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Pacific Islands Renewable Energy Project

A climate change partnership of GEF, UNDP, SPREP and the Pacific Islands

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The Secretariat of the Pacific Regional Environment Programme

Pacific Regional Energy Assessment 2004

An Assessment of the Key Energy Issues, Barriers to the Development of Renewable Energy to Mitigate Climate Change, and Capacity Development Needs for Removing the Barriers

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This report is based on data gathered by a PIREP team consisting of:

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Mr Peter Johnston, International PIREP Consultant

The international consultants visited the Solomon Islands from 23-29 January 2004. Information for the report was gathered both before and after the visit by the national consultant. The national coordinator provided considerable support and assistance throughout the mission. Because of the limited time of the mission in the Solomon Islands, and the security situation, which had only recently improved, all discussions were held in or near the national capital, Honiara. Unfortunately, the local offices of the international oil companies were unwilling to provide any information on their product sales, an omission that hindered some analysis. This report reviews the status of energy sector activities in the Solomon Islands in early 2004.

An April 2004 draft of this report was reviewed by Secretariat of the Pacific Regional Environment Programme, United Nations Development Programme, the Global Environment Facility with additional comments in October by the national PIREP committee. However, the contents are the responsibility of the undersigned and do not necessarily represent the views of the Government of the Solomon Islands, SPREP, UNDP, GEF, or the many helpful individuals who provided the information on which the study is based.

Peter Johnston

John Vos

October 2004

ACRONYMS

AAGR	Average Annual Growth Rate
AC	Alternating Current
ACP	African, Caribbean, Pacific countries
ADB	Asian Development Bank
ADO	Automotive Diesel Oil
APACE	Appropriate Technology for the Community and Environment
BP	British Petroleum
CDC	Commonwealth Development Corporation
CFL	Compact Fluorescent Light
CIF	Cost+insurance+freight
CMEA	Commodities Market Export Authority
CPI	Consumer Price Index
CROP	Council of Regional Organisations of the Pacific
DME	Direct Micro Expelling (coconut oil)
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EPC	Electric Power Corporation
ESCAP	Economic and Social Commission for Asia and the Pacific (UN)
EU	European Union
EWG	Energy Working Group of CROP
FSP	Foundation of the Peoples of the South Pacific
FY	Fiscal Year
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GMT/UTC	Greenwich Mean Time/Universal Time Coordinate
GNP	Gross National Product
GREA	Guadalcanal Rural Electrification Agency
GTZ	**De**utsche Gesellschaft für Technische Zusamenarbeit (German Technical Cooperation)
HCJ	Hocking Construction and Joinery Ltd
HF	High Frequency
HF	High Frequency (2-way radio)
Hp	Horsepower
JICA	Japan International Cooperation Agency
kV	Kilo-Volts (thousands of volts)
kVA	Kilo-Volt-Amperes (Thousands of Volt Amperes of power)
kW	Kilo-Watt (Thousands of Watts of power)
kWh	Kilo-Watt-Hour (Thousands of Watt Hours of energy)
kWp	Kilo-Watts peak power (at standard conditions) from PV panels
LPG	Liquefied Petroleum Gas
LPPL	Lever Pacific Plantations Ltd.
MDG	Millennium Development Goals
MEF	Malaita Eagle Force (paramilitary group)
MME	Ministry of Mines and Energy
MNR	Ministry of Natural Resources
NASA	US National Aeronautics and Space Administration
NBSI	National Bank of the Solomon Islands
NORAD	Norwegian Agency for International Development
OPEC	Organisation of Petroleum Exporting Countries

OTEC	Ocean Thermal Energy Conversion
PACER	Pacific Agreement on Close Economic Relations
PDF	Project Development Facility (GEF)
PEDP	Pacific Energy Development Programme (UN 1982-1993)
PIC	Pacific Island Country
PICCAP	Pacific Islands Climate Change Assistance Programme (GEF/UNDP)
PICTA	Pacific Island Countries Trade Agreement
PIEPSAP	Pacific Islands Energy Policies and Strategic Action Planning
PIFS	Pacific Islands Forum Secretariat
PIREP	Pacific Island Renewable Energy Project (GEF/UNDP)
PMU	Programme Management Unit, Ministry of National Planning
PPA	Pacific Power Association
PREA	Pacific Regional Energy Assessment (1992)
PV	Photovoltaic
RE	Renewable Energy
RET	Renewable Energy Technology
RIPEL	Russell Islands Plantation Estates Limited
SEI	Solar Energy International
SELF	Solar Electric Light Fund
SHS	Solar Home Systems
SICHE	Solomon Islands College of Higher Education
SIDT	Solomon Islands Development Trust
SIMA	Solomon Islands Manufacturer's Association
SIPL	Solomon Islands Plantations Limited
SIVEC	Solomon Islands Village Electrification Council
SOPAC	South Pacific Applied Geoscience Commission
SPC	Secretariat of the Pacific Community
SPREP	Secretariat of the Pacific Regional Environment Programme
STABEX	EU fund for ACP countries to stabilise copra export prices
STPL	Solomon Tropical Products Limited
SWH	Solar water Heater
SWOT	Strengths, Weaknesses, Opportunities and Threats
TPA	Townsville Peace Agreement
ULP	Unleaded Petrol
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organisation
US	United States
USP	University of the South Pacific
V	Volts
VBMS	Voice Belong Mere Solomons (Women's NGO)
VFEP	Village First Electrification Programme
WB	World Bank
WCO	Western Coconut Oil Company
Wh	Watt hours of energy
WPREP	Western Province Regional Renewable Energy Programme
WRI	World Resources Institute (Washington, DC)
WSSD	World Summit on Sustainable Development

Energy Conversions, CO_2 Emissions and Measurements

The following conventions are used in all volumes of the PIREP country reports unless otherwise noted.

Fuel	Unit	Typical Density kg / litre	Typical Density l / tonne	Gross Energy MJ / kg	Gross Energy MJ / litre	Oil Equiv.: toe / unit (net)	Kg CO_2 equivalent [e]	
							per GJ	per litre
Biomass Fuels:								
Fuelwood (5% mcwb)	tonne			18.0		0.42	94.0	
Coconut residues (air dry) [a]								
Shell (15% mcwb) harvested	tonne			14.6		0.34		
Husk (30% mcwb harvested	tonne			12.0		0.28		
Average (air dry) [b]	tonne			14.0		0.33		
Coconut palm (air dry)	tonne			11.5		0.27		
Charcoal	tonne			30.0		0.70		
Bagasse	tonne			9.6			96.8	
Vegetable & Mineral Fuels:								
Crude oil	tonne			42.6		1.00		
Coconut oil	tonne	0.920	1,100	38.4		0.90		
LPG	tonne	0.510	1,960	49.6	25.5	1.17	59.4	1.6
Ethanol	tonne			27.0		0.63		
Gasoline (super)	tonne	0.730	1,370	46.5	34.0	1.09	73.9	2.5
Gasoline (unleaded)	tonne	0.735	1,360	46.5	34.2	1.09	73.9	2.5
Aviation gasoline (Avgas)	tonne	0.695	1,440	47.5	33.0	1.12	69.5	2.3
Lighting Kerosene	tonne	0.790	1,270	46.4	36.6	1.09	77.4	2.8
Aviation turbine fuel (jet fuel)	tonne	0.795	1,260	46.4	36.9	1.09	70.4	2.6
Automotive diesel (ADO)	tonne	0.840	1,190	46.0	38.6	1.08	70.4	2.7
High sulphur fuel oil (IFO)	tonne	0.980	1,020	42.9	42.0	1.01	81.5	3.4
Low sulphur fuel oil (IFO)	tonne	0.900	1,110	44.5	40.1	1.04	81.5	3.4

Diesel Conversion Efficiency:

Actual efficiencies are used where known. Otherwise:	litres / kWh:	Efficiency:
Average efficiency for small diesel engine (< 100kW output)	0.46	22%
Average efficiency of large modern diesel engine(> 1000 kW output)	0.284	36%
Average efficiency of low speed, base load diesel (Pacific region)	0.30 - 0.33	28% - 32%

Area: 1.0 km^2 = 100 hectares = 0.386 $mile^2$ 1.0 acre = 0.41 hectares

Volume 1 US gallon = 0.833 Imperial (UK) gallons = 3.785 litres 1.0 Imperial gallon = 4.546 litres

Mass: 1.0 long tons = 1.016 tonnes

Energy: 1 kWh = 3.6 MJ = 860 kcal = 3,412 Btu = 0.86 kgoe (kg of oil equivalent)

1 toe = 11.83 MWh = 42.6 GJ = 10 million kcal = 39.68 million Btu

1 MJ = 238.8 kcal = 947.8 Btu = 0.024 kgoe = 0.28 kWh

GHGs 1 Gg (one gigagramme) = 1000 million grammes (10^9 grammes) = one million kg = 1,000 tonnes

CO_2 equiv CH_4 has 21 times the GHG warming potential of the same amount of CO_2; N_2O 310 times

Notes: a) Average yield of 2.93 air dry tonnes residues per tonne of copra produced (Average NCV 14.0 MJ/kg)

b) Proportion: kernel 33%, shell 23%, husk 44% (by dry weight).

c) Assumes conversion efficiency of 30% (i.e., equivalent of diesel at 30%).

d) Assumes conversion efficiency of 9% (biomass - fuelled boiler).

e) Point source emissions

Sources:

1) Petroleum values from Australian Institute of Petroleum (undated) except bagasse from AGO below

2) CO_2 emissions from AGO Factors and Methods Workbook version 3 (Australian Greenhouse Office; March 2003)

3) Diesel conversion efficiencies are mission estimates.

` 4) CO_2 greenhouse equivalent for CH_4 and N_2O from CO_2 Calculator (Natural Resources Canada,

EXECUTIVE SUMMARY

1 COUNTRY CONTEXT

Physical Description. The Solomon Islands consists of nearly 1000 islands – 350 populated – with 28 thousand km^2 of land spread over 0.8 million km^2 of sea. There are six main islands: Guadalcanal, Malaita, Makira, Santa Isabel, Choiseul and New Georgia. The climate is tropical monsoon, with few extremes of temperature and weather. The islands are mostly rugged and mountainous. The country is relatively rich in mineral, hydro and forest resources.

Population. From 1986-1999, the population grew 2.8% annually reaching 457,000 in 2003. About 94% are Melanesian, 4% Polynesian, 1% Micronesian and 0.5% European and Chinese. About 86% live in rural villages and 80% of the urban population lives in one city, the capital Honiara. At the time of the 1999 census, there were 13 people per km^2 and 6.3 persons per household. By 2019, the population may reach 716,000 with 105,000 in Honiara, where fuel wood access is already becoming a problem. Rapid urban growth could affect practical future energy use options.

Environment The Solomon Islands is party to various treaties and conventions related to environmental protection, including the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. A communication to UNFCCC, including greenhouse gas emissions and vulnerability to climate change, is expected to be submitted during 2004.

Political Development. The British Solomon Islands Protectorate became independent from Britain in 1978. The Independent State of Solomon Islands is a Westminster-style parliamentary democracy. Elections are normally held every four years, the most recent in December 2001.In recent years, the country has experienced considerable unrest and economic decline. Serious civil unrest on Guadalcanal began in late 1998, leading to a state of emergency in June 1999 and a *coup d'é·tat* in June 2000. The Townsville Peace Agreement was signed in late 2001, supported by an Australian-led intervention force, the 'Regional Assistance Mission to Solomon Islands' (RAMSI) since 2003. The economy seems to be recovering, a new constitution is being developed, and local people appear to be cautiously optimistic.

Economic Overview. The economy consists of a mixed subsistence sector on which the majority of the population is dependent, and a small monetised sector dominated by large-scale commercial enterprises. Between 1996 and 2002, gross domestic product declined in real terms by 24%, over 35% per capita. Performance was considerably worse for the monetised sector. In 2003, GDP grew by 3.8%, nearly equalling the 1992 level. The government is signatory to three regional trade and economic trade agreements and the Cotonou Agreement, which provides access to European Union development assistance. Little EU assistance was spent during the unrest; there is € 42 million available from unspent STABEX funds alone. A *National Economic Recovery, Reform and Development Plan* for 2003-2006 focuses on five areas: 1) normalising law and order; 2) strengthening democracy, human rights and governance; 3) restoring fiscal and financial stability; 4) revitalising the productive sectors; and 5) restoring basic social services. In 2004, the Central Bank expressed concern about a precarious level of foreign reserves, very high debt, relatively high inflation, excessive government deficit, and a weakened financial system. However, it notes that the country is well endowed with natural resources, and that the recovery plan provides an opportunity to address fundamental weaknesses comprehensively.

Arrangements for Energy. An Energy Division within the Department of Energy and Mines is responsible for energy policy, renewable energy development and project implementation. Its roles are extensive but staffing levels and financial allocations are inadequate to carry out these functions. Funding is very low even for basic needs (transport, travel, office expenses, communications, electricity, etc.)

Electric power is the responsibility of the government-owned Solomon Islands Electricity Authority (SIEA), which supplies Honiara, nine provincial centres and Noro in Western Province. SIEA has a long history of under-investment, insufficient resources and under-skilled staff. Shell, and a local company Markworth, import petroleum fuel. Both have storage depots in central Honiara, restricting expansion options and raising safety concerns. Petroleum and gas (LPG) prices are regulated by a Price Control Unit within the Ministry of Commerce and Employment.

Numerous draft energy policies have been developed since the 1980s with considerable donor assistance but none were endorsed by cabinet. There are no formal policies for energy overall or rural electrification. There is some legislation dealing with energy issues but most needs substantial revision: i) the *Electricity Act* of 1969 gives SIEA sole authority to provide or supply electricity to urban centres; ii) the *Consumer Protection and Price Control Act*, revised in 1995, establishes price control through an awkward, and for many products, unworkable system and imposes fines which are far too low to be effective; iii) fuel storage and handling are covered under general 1939 legislation and need major revision; and iv) the *Environmental Act* of 1998 includes environmental impact assessment requirements that could affect some future energy sector investments.

There is no national energy committee or other mechanism to coordinate energy sector issues. There is a climate change committee, which reportedly seldom meets. It acts as an informal secretariat and steering committee for PIREP.

2 Energy Supply, Demand and the GHG Inventory

Energy Supply. The Solomon Islands is overwhelmingly dependent on imported petroleum for its commercial energy needs but biomass still accounts for about 61% of gross national energy production, petroleum products for 38%, and hydropower and solar about 1%. Imports of petroleum fuel have increased less than 2% annually by volume since 1990 but constitute a fairly high percentage of total imports by value, higher than the early 1980s when high oil prices were of concern to the government.

Despite poor resources for petroleum price control, prices in Honiara (free of tax and duty) are lower than average for the PICs for key products. However, SIEA reportedly pays a high cash-on-delivery price, as it has no supply contract. For LPG, prices in Honiara are above average for the region. A longstanding constraint to efficient and safe petroleum supply has been the downtown Honiara storage facilities.

Energy Demand. There are no reliable data on sectoral energy demand. The PIREP mission estimates 2001/2002 petroleum demand of 78 million litres (ML) or 68 kilotonnes of oil equivalent (ktoe), with transport accounting for 56%, electricity 28%, commerce and industry 15% and direct household use (mostly cooking and lighting) one percent. About 89% of all households rely mainly on biomass for cooking. Fuel wood burning probably totals about 110 ktoe, with additional biomass used for copra and cocoa drying.

The 1999 census reports indicates that 16% of all households, but only 9% of those outside Honiara, had access to electricity. Sixty nine percent received power from SIEA, 28% generated their own power, and 23% had other sources. SIEA has a national tariff with

substantial cross subsidies from Honiara consumers to others. In early 2004, the charge was 17.6 US¢/kWh for households and 21.1¢ for commerce or industry. If a business generates power in an SIEA service area, it also pays half of the normal SIEA charge (except in Honiara where SIEA is unable to meet demand). In 2002, SIEA sales were 42 GWh of which domestic consumers accounted for 27%, commercial/industrial 63% and nine percent government . Honiara accounted for 76% of total demand and Noro 11 percent. For the past twenty years, peak demand in Honiara has usually exceeded firm capacity. This is expected to remain the case for several years or more.

Future Demand and GHG Emissions. To estimate future commercial energy demand, it is assumed that population increases 2.8% per year (3.8% in Honiara), GDP grows 3-4% per year, and – assuming no major investments in renewable energy or energy efficiency – petroleum imports grow 4% annually, except distillate for electricity use at 5.2 percent. With these assumptions, greenhouse gas (GHG) emissions from commercial energy would increase from 206 Gg in 2001/02 to 313 Gg a decade later, a 52% increase.

In principle, the Solomon Islands could reduce emissions by 122 Gg per year within a decade, nearly 60% of current emissions and 40% of those a decade from now. This is based on proven technologies and known resources but does not consider economic, financial, political, social, technical, environmental or other practical constraints. About 90% of potential reductions would be from renewable energy (mostly biofuels and from hydro) and 10% from improved energy efficiency. Large-scale solar PV and wind combined would account for less than four percent.

3 Potential for Renewable Energy Technologies

The technical potential for renewable energy production in the Solomon Islands is considerable but most is far from demand and cannot be readily exploited. Little of the potential has been accurately assessed.

Geothermal. There are indications of exploitable geothermal resources in at least at four locations: West Guadalcanal, Paraiso in Vella Lavella, Simbo Island, and Savo Island. There are four known thermal areas in West Guadacanal. On Vella Lavella, studies suggest a 10 MWe resource but there is no local demand.

Hydro. There is substantial hydro potential on seven islands but limited evaluation. However, dams and storage reservoirs would be technically difficult and expensive, limiting most sites to run-of-river schemes. One exception is Komarindi on Guadalcanal, where the Asian Development Bank financed a design study for a 7 MW system with storage. There is also potential for 20 MW at Lunnga on Guadalcanal. Over 20 years ago, a number of hydro systems were considered for development: 360 kW at the Fiu River to serve Auki on Malaita, 25 kW on the Rarinikera River of east Malaita, 200 kW at Puepue on San Cristobal and others. The government developed a database of over 100 sites for possible small hydro development, of which 62 have an estimated overall capacity of 11 MW. On a larger scale, Japanese experts have identified nearly 330 MW of potential on seven islands, 73% of which is on Guadalcanal, where the resource has been better investigated as the island accounts for the bulk of national electricity demand.

Ocean Based. The sea wave energy potential has apparently not been assessed. Extrapolating from results from Fiji and Vanuatu, annual average wave power could be roughly 14 kW per metre of wave front, with a wide range varying by site. If the technology to tap off sea wave energy were commercially available and economically viable, the Solomon Islands could produce much of its electricity from a few relatively small plants. There has apparently been no measurement of deep sea versus surface ocean temperatures to

enable estimates of near-shore ocean thermal energy potential or of tidal energy potential, though this is likely to be minor.

Wind. There are no data on the Solomons' wind energy potential. Nonetheless, wind would be a costly option and is unlikely to play a significant role in the near or medium term future.

Solar. As the Solomon Islands lies near the equator, there is considerable solar energy potential. Records for 1987-1989 suggest average annual insolation of 6600 MJ per m^2 of horizontal surface at the Guadalcanal airport. A 1992 Solarex world map indicates design insolation values of 5 kWh/m^2/day or higher, among the highest levels in the region.

Biomass. The Solomon Islands is heavily forested. However, considering landowner mistrust of the government and logging companies, past political interference, and a history of alienation of land from customary control for long-term crops, large-scale biomass energy (particularly involving replanting) may be difficult even where technically and economically viable; it thus not easy to delineate the available biomass energy resource. Palm oil and copra are major agricultural commodities. A large palm oil plantation closed in 1999 due to ethnic tensions. If it reopens, which may not be for some years, the oil could be used as a distillate replacement, depending on its relative value as a fuel and an export commodity. In the mid 1980s, copra output exceeded 40,000 tonnes, enough to produce about 30 ML of coconut oil, equivalent to 28 ML of distillate, sufficient to displace about half of current diesel fuel imports. Economic opportunities for biomass for power generation are very limited.

4 Experiences with Renewable Energy Technologies

Geothermal. There has been no geothermal power developed in the Solomon Islands.

Hydro. SIEA developed two small hydro schemes in 1986 and 1996, 32 kW on the Malu'u River on Malaita; and 185 kW at Buala on Santa Isabel. Three new hydro schemes with a total capacity of 0.5 MW are reportedly under consideration. An Australian development organisation, APACE, and several local NGOs (particularly SIVEC) have been active in developing village-based micro-hydro. Three schemes installed from 1983-1997 on Kolombangara (Iriri, Vavanga and Ghatere) had very limited funding, capacities of 10-12 kW, and generation of 5 kW each or less. Based on the Kolombangara experiences, there were more robust designs for four subsequent APACE schemes in Malaita (Manawai, 1997; Raeao, 2002; Nariaoa , 2004) and Bulelavata (New Georgia, 1999) typically generating 15 kW of electricity. A large number of communities that have expressed interest in similar schemes are required to make a significant financial contribution (application fee, $2500 towards pre-feasibility study, annual SIVEC membership of $100 increasing to $500 when the system becomes operational; transport, petrol and food for study teams; and chainsaw hire, fuel, etc. during construction). This is quite a different approach from most village hydro development in the region, requiring serious community input and involvement.

Ocean. There has been no development of sea wave, tidal, OTEC or other ocean-based energy.

Wind. There have apparently have been no significant installations of wind energy systems.

Solar. There were 50-100 solar water heaters in the country in 1990 and perhaps 100-150 systems now. The market is small. Solar PV has been used since the 1970s at church missions for lighting, a few PV refrigerators were installed in 1992 for vaccine cooling in health centres (but failed within a year or two), and Solomon Telekom has PV radiotelephones in most provinces, their largest unit being a repeater station on Ngella with 1.6 kW peak from twenty 80 Wp panels. The American Solar Electric Light Fund, working with local NGOs, provided over 110 solar home systems in Sukiki and Makaruka

(Guadalcanal) in 1997-1998 but the majority were damaged or stolen during the civil crisis. Although a number of companies sell solar PV equipment, only one (Willies) specialises in PV and provides training. Willies has sold, or has confirmed orders for, about 200 systems from mid 1998 to early 2004.

Biomass. In the late 1980s, 28 wood-fuelled water boilers were installed at ten boarding schools for cooking root crops. Their current status is unknown. Although nearly all rural Solomon Islanders cook with wood, most use open fires, rather than wood stoves. Voice Belong Mere Solomon, a women's NGO, has trained women to make sawdust stoves and produce fuel from coconuts to substitute for kerosene. A local joinery expects to produce sawdust briquettes during 2004, estimating that sufficient sawdust and shavings are available in Honiara to meet the fuel wood needs of 20% of the city's wood-using households.

Biomass has been used to produce electric power on a small scale and proposals to use sawmill and agro-industrial waste for power generation have been considered since the early 1980s, including a proposed power station near Honiara. For over 20 years from 1973, Solomon Islands Plantations Limited, the palm oil producer, generated steam and electricity from a small biomass system but plans for a larger 2.5 MW system never materialised. In the 1970s, small biogas digesters were built at several piggeries. In 1985, the government planned a larger biogas system at Tambea for digesting waste from 800 pigs (to be expanded to 2,000 pigs) but the cost was high and plans were abandoned. Around 1990, a biomass gasifier for power generation was tested at the Batuna sawmill, Vangunu. It produced 15 kWe from charcoal but only functioned for a year or so.

The country could potentially use coconut oil to displace 25 million litres of distillate per year. Several small-scale producers use the Indian Tinytech system (300 litres of oil per day) and the smaller Australian DME technique (30 litres). In 2003, SIEA tested coconut oil as a fuel at a remote power station (Lata in Temotu, where diesel fuel is 60% more expensive than coconut oil. There were minor technical problems and testing has stopped but SIEA remains interested in the concept. In brief, there have been a few trials of coconut oil as a diesel fuel replacement, and more are planned, but thus far it has been on a very small scale.

5 Barriers Identified in Development & Commercialisation of Renewable Energy

Fiscal. Barriers to RETs include policies biased in favour of conventional energy or against renewable energy.

- SIEA has an exemption from duty on distillate ($0.22/l), which could bias fuel choice against local biofuels. There is no fiscal incentive to import RETs, which attract the same duty as electrical equipment in general.
- There are no 'green' interest rates for RE or access to foreign capital for RE through government support.
- The lack of any analysis of the likely development impact of large-scale use of coconut and/or other vegetable oils as biofuel is real barrier to its serious consideration for development.

Financial. Financial barriers include:

- the minimal staffing (three staff) and financial resources of the Energy Division;
- serious government budgetary constraints in general;
- very low cash incomes in rural communities;
- higher initial costs of RETs compared to conventional energy systems;
- SIEA tariff policies, with heavy cross-subsidies and penalties for self-generation;
- lack of donor funding for coconut oil biofuel;and
- the inability of banks to use customary land as security or equity for loans;

Legislative, Regulatory and Policy.

- lack of any formal, cabinet-endorsed energy policy overall or for rural electrification or RE;
- there are no formal energy plans, and few standards or regulations regarding energy use and development;
- inadequate legislation for consumer protection, price control, fuel storage and handling, and power sector regulation; and
- lack of legislation for Renewable Energy Service Companies (RESCOs).

Institutional. There are serious institutional weaknesses at all government levels (except local communities in some provinces). Government institutions generally lack the expertise to foster or effectively develop RE projects. There is no energy sector coordination mechanism. Other barriers:

- the Energy Division has not developed any RET projects for years, and is seen by many as a serious barrier to RET (which may change with a new Director);
- despite a formal MOU between the government and SIVEC, the latter's experience in community micro-hydro development has reportedly been ignored by government, although community-owned and managed micro-hydro can be a cost-effective approach;
- the government lacks capacity to effectively absorb donor assistance for energy projects;
- donors often support RE but are far too slow to act and change their priorities too frequently;and
- ineffective cooperation among regional organisations can be a barrier for RE efforts.

Technical. There are no standards for imported RETs. There is a serious shortage of technical skills and virtually no industry away from Honiara and Noro.

Market. Among the market barriers identified are the following:

- lack of affordable, reliable shipping for copra to be shipped to cities for processing into biofuel;
- the monopolistic attitudes of the government, which discourages competition;
- protection of SIEA's operations, so SIEA has no incentive to improve, and RETs cannot compete;
- projects may be technically and financially feasible but without immediate customers, it cannot be developed; and
- the Foreign Investment Board is believed by many to be strong disincentives for investment.

Knowledge and Public Awareness. In general, there is little public or government awareness of RE opportunities and technologies.

- There is limited knowledge regarding various options for producing coconut oil as a fuel.
- There is poor access to information on prior experience in the Pacific on coconut oil biofuel (and other RE initiatives), partly due to expensive and Internet access.
- Knowledge of the pros and cons of solar PV is very limited.
- There are no laboratory facilities to test biofuels or petroleum fuels.
- There is little or no appropriate RE training so the knowledge base remains low.

Other.

- Long-term access to customary land is needed for most RET development but officials and developers often find it difficult to resolve land access issues.
- Micro hydro is relatively benign environmentally but poor logging practices change water flow patterns, and this can a barrier to hydro development in logging areas.
- Too much donor funding for RE is said to go to expatriate consultants, with very little to build local expertise and capacity.
- 'Give me money' has become part of the culture and constrains rural RE development.

6 Implications of Large Scale Renewable Energy Use

Benefits and costs of RE. Large-scale solar PV for rural electrification should help improve education, health, productivity, integration into the economy, and some rural employment and training. Potential negative impacts include poor management of old batteries and failed components, increased pressure for cash to pay for appliances and services, and friction as a new technical elite develops in villages. Large-scale biofuels could improve demand for

coconuts or other oil-bearing crops and increase rural cash incomes. However there could be land access problems and transport / logistical constraints. Wind, hydro, geothermal and solar energy for grid power would reduce fuel imports arguably improving economic stability and security. There could be a substantial increase in private sector involvement in energy delivery. Negative effects include the need for SIEA to broaden its capacity to support a range of generation technologies and fuels.

Environmental Implications. The biggest impact of RETs (and GHG reductions) would come from biofuels followed by hydropower. Biofuels are unlikely to use more than 50% of the peak production of copra, and this only if the economics favour fuel use rather than export, so the impact should be similar to current coconut (or oil palm) cultivation practices. Biodiesel fuels are low in emissions and readily biodegrade if spilled. There can be numerous well-documented negative impacts of large hydro (over 10 MW) but these can be ameliorated if they are developed in accordance with recommendations of the World Commission on Dams. Small run-of-river hydro tends to be low impact. Geothermal is unlikely to be developed in the next decade but could play a significant role if minerals were found near a geothermal resource. If properly developed, geothermal has very low GHG emissions.

7 Capacity Development Needs for Removing Barriers

Fiscal. Capacity is lacking in several key areas to overcome barriers identified in chapter 5:

- inadequate capacity to develop biofuel as a practical alternative to distillate; and
- very limited capacity for analysing effects of interest rates, import duties, energy prices, taxes etc. on RET development.

Financial. The lack of capacity to effectively tap finance for rural electrification (through RETs or conventional) is a constraint for all forms of rural development:

- insufficient capacity to develop RET project proposals that are acceptable to donors or financiers; and
- lack of capacity to develop guidelines for micro hydro development (which affects a range of other issues, not just finance.)

Legislative, Regulatory and Policy. Lack of capacity within government and SIEA to develop and implement effective legislation, energy policies, guidelines and regulations for energy in general, including renewable energy.

Institutional.

- SIEA requires capacity to assess and implement biofuels if they are to be used on a large scale for power generation.
- The capacity of regional organisations and the CROP Energy Working Group require development to enable better provision of effective RET services.

Technical. There is little accessible appropriate technical information for making energy choices and capacity is needed to develop them:

- Lack of easily understandable reference materials regarding RETs accessible in the SI**.**
- Limited capacity to assess and measure local RE resources.

Market. Incentives for local people to establish businesses to provide RE services have been discussed; no additional capacity development needs are suggested.

Knowledge and Public Awareness. There is a requirement for relevant and practical training for Solomon Islanders in various aspects of RETs for designing, marketing, installing, operating, maintaining, and repair. Capacity is needed to provide such training, including information in local languages.

Other.

- Developing local energy sector consulting capacity.

- Lack of consistent hydro development procedures.

8 The Implementation of the Capacity Development Needs and Co-Financing Opportunities

Capacity Development Opportunities. The following are recommended as specific studies and co-financing opportunities for capacity development. Any study should include, where appropriate, recommendations for further practical action.

- *Biofuels***.** A study on coconut oil biofuel for both electric power and ground transport for: i) 5-30 ML per year commercial level for urban energy services; and ii) small-scale production for remote islands and communities.
- *Import duties and taxes***.** A study on taxes and exemption policies to determine and address any effective biases against RETs.
- *Energy pricing***.** A study of the national electricity tariff, surcharge on self-generation and distillate tax exemptions on RET development.
- *Green interest rates***.** An assessment of the practicality of subsidised green rates and other assistance for establishing RE services, particularly to rural areas.
- *Land access***.** A study of opportunities to involve landowners as partners in large-scale RE development.
- *Rural development RE trust fund***.** An assessment of the practicality of a trust fund for rural RE development.
- *Energy policy development***.** A review of draft national and rural energy policies, and preparation of new, practical policy documents for consideration by cabinet.
- *Energy legislation***.** A review of existing legislation and regulations with revisions to aid in rational energy choices for electric power, liquid fuels, fuel pricing, and RET development.
- *Energy Division*. A review of the functions, authority, responsibilities and resource needs of the Energy Division.
- *Public information resource for RETs*. Financing to develop a library of RET information materials specifically selected and developed for the Solomon Islands.
- *Guidelines for village scale hydro development*. Development of guidelines for site technical assessment, environmental impact assessment, economic analysis, technical design, operational requirements and maintenance requirements for micro-hydro.

Hardware Investment Opportunities. The team did not identify any projects immediately available for co-financing, although there could be opportunities for hydro development soon if a decision is made to re-open the gold mine. If GHG reduction is a priority, the investments should be considered for biofuels and hydropower. However, the development impacts of RETs for the Solomon Islands are likely to be much greater through a large-scale programme of community-scale solar PV investments, including the development of appropriate institutions for their finance and operation.

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Map of the Solomon Islands

1 THE COUNTRY CONTEXT

1.1 Physical Description

There are about 996 islands in the Solomon Islands (SI), totalling 28,450 square kilometres (km^2), of which land accounts for 27,540 km^2, dispersed over 800,000 km^2 of sea. Approximately 350 islands are inhabited including the six main islands of Guadalcanal (the largest, where the capital Honiara is located), Malaita, Makira, Isabel, Choiseul and New Georgia. The group lies between 155° 30' and 170° 30' East longitude and between 5° 10' and 12° 45' South latitude, northeast of Australia as shown in the map on the previous page. The climate is tropical monsoon, with few extremes of temperature and weather. The islands are mostly rugged and mountainous with some low coral atolls. The Exclusive Economic Zone extends to 200 nautical miles (370 km) with an area of 1.34 million km^2. Table 1-1 summarises some key physical characteristics for the main islands.

Table 1-1 – Physical Features of the Solomon Islands

Island	Land area and agricultural utilisation	Landforms	Soil type
Guadalcanal	5320 km^2 8.5 %	Ridge volcanic mountains, karst, moderately, narrow and lightly dissected ridges, low terraces, flood plains and colluvial fans	Mixture of volcanic and sedimentary rocks, humus-rich, base- poor, shallow loams and clays at high altitudes and young loams, clays and peats in valleys and coastal plains
Malaita	4200 km^2 n/a	Volcanic cones, steep, dissected narrow ridges, fluvial plains, karst, valleys, swamps and coastal landforms	Strongly weathered and leached soils with low base status to slightly and moderately weathered leached soils, organic with decomposed peat.
Santa Isabel (Bugotu)	4121 km^2 2.3 %	Low amplitude rounded hills and ridges with steep sides and crests, small areas of karst and some cuestas	Moderately to strongly weathered and leached soils with low base status, organic with well decomposed peat
Makira	3090 km^2 2.5 %	High to irregular rounded ridges, rolling hills, fluvial plains, fans and beaches	Moderately to strongly weathered and leached soils with low base status, slightly weathered with little horizon development and organic with well decomposed peat
Choiseul	3837 km^2 n/a	Hills and mountains with steep sided ridges and stable to unstable slopes and stable narrow crests, some being former volcanic centres	Slightly to strongly weathered leached soils with little horizon development to leached with low base status
New Georgia	2145 km^2 3.1 %	Volcanic centres, out wash fans, ridge plateaux, karst, fluvial plains and swamps and extensive reef lagoon complexes	Organic, young and slightly to strongly weathered and leached soils with low base status

Notes: Source is Hansell and Wall, 1970 except agricultural utilisation is Cheatle, 1987. n/a is not available

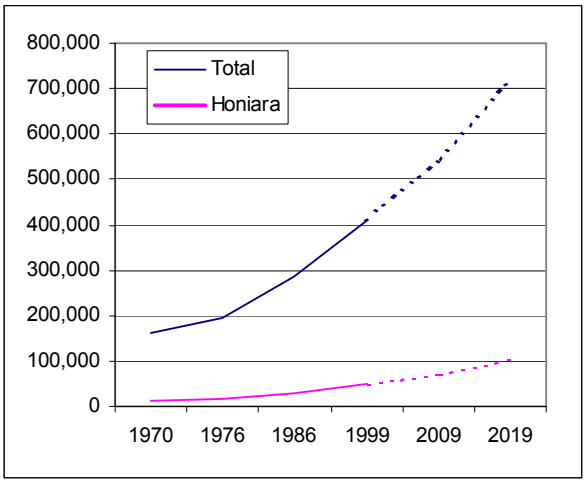
1.2 Population

By late 2003, the population of the Solomon Islands was about 457,000. In 1999, the most recent national census, it was 409,042 (94.2% Melanesian, 4.0% Polynesian, 1.4% Micronesian, 0.4% European and 0.1% Chinese). Males were 51.7% of the total, outnumbering females by 211,381 to 197,661. About 86% of the population (65,000 households) lived in rural villages and 14% were considered urban. Overall, there were 13 people per km^2 and the average household size was 6.3 persons. Urban and rural population by island is shown in Table 1-2.

About 77% of the 1999 urban population lived in Honiara, accounting for only 12% of the national total. From 1986-1999, the overall population (Figure 1-2) increased rapidly at an average annual growth rate (AAGR) of 2.8% per annum. The urban population (Figure 1-1

and Table 1-3) grew even more rapidly with an AAGR of 3.8 percent. The Ministry of National Planning (MNP), assuming that these AAGRs will continue, estimates a national population of 716,000 by 2019 with Honiara reaching 105,000, more than double that of 1999. From 1970-1986, Honiara (Table 1-4) grew by 6.0% annually, with the recent decline in AAGR reflecting to some extent the temporary movement of people out of Honiara in 1999 due to civil unrest (discussed briefly in Section 1.4). With the end of hostilities, Honiara's growth could again increase more rapidly than the projection suggests. The rapid total population growth and the urban increase (particularly in Honiara where fuel wood is becoming increasingly scarce), could affect future energy use options and the patterns of energy use.

Figure 1-1 – Population 1970-1999 and Projections to 2014



Source: Data from Ministry of National Planning (Jan. 2004)
Note that the intervals shown between years are not constant.

Table 1-2 – Population of Solomon Islands (1999)

Island or group	Total	Urban	Rural
Choiseul	20,008	440	19,568
Western	62,739	6,442	56,277
Isabel	20,421	451	19,970
Central	21,577	1,333	20,244
Rennell-Belona	2,377	0	2,377
Guadalcanal *	60,275	3,013	57,262
Honiara	49,107	49,107	0
Malaita	122,620	1,606	21,2014
Makira	31,006	979	30,027
Temotu	18,912	361	18,551
National Total	*409,042*	*63,732*	*345,310*

Note: * Excluding city of Honiara
Source: 1999 Census of Population and Housing (2001)

Table 1-3 – Growth of Urban Population, 1976-1999

Province	Urban centre	1976	1986	1999
Western	Gizo	2,707	3,710	6,882
Isabel	Buala	1,414	1,901	451
Central	Tulagi	808	1,622	1,333
Malaita	Auki	1,926	3,252	1,606
Honiara	–	14,942	30,413	49,107
Makira	Kirakira	1,767	2,588	979
Temotu	Lata	795	1,295	361
Total		*24,359*	*44,781*	*63,732*

Source: SI Statistic Office, 1988 andSI Census, 2001

Table 1-4 – Honiara Population, Growth and Persons per Household, 1970-1999

Year	1970	1976	1986	1999
Population	12,006	14,942	30,413	49,107
AAGR, % (years)	-	3.7 (1970-76)	6.8 (1976-86)	3.8 (1986-99)
Persons / hh	5.4	5.5	7.0	7.1

Source: As for Table 1-3

1.3 Environmental Commitments

The Solomon Islands is party to various treaties and conventions related to environmental protection, including the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, the Convention to Combat Desertification, Law of the Sea, and the Convention on Biological Diversity. An initial national communication to the UNFCCC, indicating greenhouse gas emissions, and vulnerability and adaptation to climate change, has been prepared and is expected to be submitted during 2004. Table 1-5 summarises the status and date of signing of some key environmental conventions.

Table 1-5 – Status of Ratification of Environmental Treaties and Conventions by Solomon Islands						
Status in Solomon Islands	**?** (SPREP Convention)	**Conservation of nature** (Apia Convention)	**Hazardous wastes** (Waigani Convention)	**Nuclear free Pacific** (Rarotonga Treaty)	**GHG reductions** (Kyoto Protocol)	**Ozone depleting substances** (Montreal Protocol, et al.)
Signed	–	No	16 Sep 95	29 May 87	29 Sep 98	Acceded to Vienna Convention, 17 June 93
Ratified	10 Aug 89	No	07 Oct 98	27 Jan 89	13 Mar 03	
Entered into force	22 Aug 90	26 Jun 90	21 Oct 01	27 Jan 89	n/a *	
Notes:	Treaties and conventions are briefly described in Volume 1, the PIREP Regional Overview report * The Kyoto Protocol is in force from 15 February 2004 for European Union members only.					
Sources:	Websites for conventions, Forum Secretariat, and SPREP (January – March 2004)					

1.4 Political Development

The former 'British Solomon Islands Protectorate' achieved independence from Britain on 7 July 1978 and became the Independent State of Solomon Islands On the surface it is a Westminster-style parliamentary democracy. The Head of State is Queen Elizabeth II, represented by the Governor General, Sir John Ini Lapli. The Prime Minister is Sir Allan Kemakeza, who appoints a cabinet composed of members of an elected parliament, which comprises a speaker, and 50 members representing 50 constituencies. Elections are normally held every four years, the most recent in December 2001. The next elections are planned for early 2006. Key changes in the government from 1989 to early 2004 are summarised in Table 1-6.

Table 1-6 – Changes in Solomon Islands Government from 1989 – early 2004						
Term in Office	**Mamaloni 1989 - 1993**	**Hilly 1993 - 1994**	**Mamaloni 1994 - 1996**	**Ulufa'alu 1997 - 2000**	**Sogavare 2000 - 2001**	**Kemakeza Dec. 2001 - 2004**
Governor General	Sir Moses Pitakaka	Sir Moses Pitakaka	Sir George Lepping	Sir George Lepping	Sir John Ini Lapli	Sir John Ini Lapli
Prime Minister	Solomon Mamaloni	Francis Billy Hilly	Solomon Mamaloni	Batholomew Ulufa'alu	Manaseh Sogavare	Sir Allan Kemakeza
Ruling party or Parties	Peoples Alliance Party (PAP)	National Coalition	Solomon Islands Govt for National Unity	Solomon Islands Alliance for Change (SIAC)	Solomon Islands government for National Unity, Reconciliation and Peace (SIGNUR)	National Coalition Partnership (NCP)
Minister responsible for Energy	Allan Paul	Hilda Kari	Eric Seri; then David Vouza	Walton Naezon	Walton Naezon	Walton Naezon (2002) Stephen Paeni (2003-present)
Comments	PAP won majority seats and form the government	Coalition of several parties; was taken over by an opposition group	Mamaloni took over from Hilly in vote of no confidence	Coalition of small political parties (i.e. Liberal, Labour, independents)	Unscheduled election after the SIAC was overthrew by MEF / joint paramilitary group in June 5th 2000 coup	Coalition between PAP and Association of Independent Members
Note: MEF = Malaita Eagle Force						

In recent years, the Solomon Islands has experienced considerable unrest and economic decline, the roots of which stretch back to colonial days. Projections for energy use, and real opportunities for replacing conventional energy with renewable energy, depend very much on economic developments and political stability. Serious civil unrest on the largest island of Guadalcanal, which has a large migrant population from the most populated but poorly developed island, Malaita (see Table 1-2), began with armed conflict in late 1998, leading to a state of emergency in June 1999 and a coup led by Malaitans in June 2000. The Townsville Peace Agreement (TPA) was signed in October 2001, and unrest has ended for the present following the arrival in July 2003 of the Australian-led 'Regional Assistance Mission to Solomon Islands' (RAMSI). RAMSI is an intervention force of over 2000 military and police supported by administrative staff working within the Government of the Solomon Islands

(GoSI). The following points, excerpted and edited from the UN's *Common Country Assessment for the Solomon Islands* (CCA; 2002), provide an excellent context for considering national development issues and prospects:

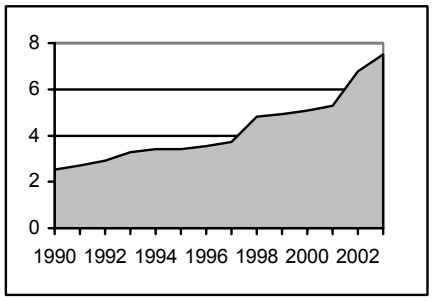
- the Solomon Islands faces a crucial test of sustainability as a nation. Its component provinces resent the rule of its centralist government. The economy, weakened through a decade of poor economic management and poor governance, has been pushed to the brink of collapse by a civil uprising between militia of two of the country's main islands. Post-Independence gains in health, education and infrastructure are being eroded. The commercial timbers of the nation's natural forest resources are almost spent;
- the Solomon Islands is economically under enormous pressure, with negative economic growth, very low government revenue, increasing public debt, and low levels of foreign reserves. The national development goals and objectives of all governments since Independence in 1978 have consistently favoured … large-scale, export-oriented resource development projects. The current government has stated its intention to *"reverse the decline in our country's production, exports and income, reform the management of the government's finances, reduce expenditure, increase revenue and improve debt management, initiate a new deal for provinces and allocate resources more equitably, repair, upgrade and maintain our physical infrastructure, and revive programmes in our social sectors, particularly in health and education.";*
- the Solomon Islands ranks 13th of 15 Pacific island countries and 121st in the world in the UNDP's Human Development Index. Women's participation in decision-making is improving but remains relatively low;
- the Solomon Islands has failed to achieve a level of political maturity sufficient to permit the formation of stable governments. There has been a high turnover of governments – ten in twenty-three years – and seven prime ministers. Despite this instability it is reassuring that, except for the change of government brought about by a coup in June 2000, all other changes have been constitutional. The Solomon Islands judiciary has admirably retained its independence throughout the recent troubled times;
- civil unrest on Guadalcanal led to the closure of Solomon Islands Plantations Limited (SIPL) in mid-1999 (the only palm oil producer in the country and also a producer of cocoa), the closure of the Gold Ridge gold mine in mid-2000 (the only mining operation), and the cessation of timber log production and sawmilling on Guadalcanal. Production of copra and cocoa on Guadalcanal by other commercial enterprises and by smallholders also ceased in 1999. The civil unrest also adversely affected the operations of manufacturing and service industries in Honiara. The export production base has been badly damaged; and
- 87% of the land area of the Solomon Islands is under customary resource tenure. The traditional land and sea resource management regimes of the Solomon Islands are community based, and participatory. In essence, a "corporation" owns an area and its resources, the directors of which are "primary rights holders" who collectively have the authority to allocate use rights (through the chairman, the spokesman for the line). Ordinary members are those who hold "secondary" rights. Customary land and sea tenure systems, although ancient in origin and constant in principle, have changed. Much of this change is positive since it demonstrates a capacity to adapt to new circumstances. Development on customary land and in customary sea is achievable through carefully developed adaptive management regimes that ensure that benefits are equitably shared among stakeholders.

Since the CCA was completed in March 2002, violence has ended, the economy seems to be recovering slowly (see next section), a new constitution is being developed which is expected to increase power within the provinces, and local people and business appear to be cautiously optimistic. However, the gold mine is not expected to re-open soon, oil palm may be years from recovery, and the economy remains fragile. Public servants and investors still often view customary land tenure as a constraint to the development of local resources (including biomass and hydro-based energy) but the CCA suggests that it also offers opportunities, if management mechanisms are carefully considered.

1.5 Economic Overview

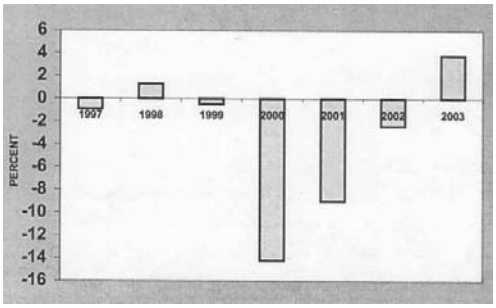
The economy of the Solomon Islands is made up of a mixed subsistence sector on which the majority of the population is dependent, and a small monetised sector dominated by large-scale commercial enterprises. These sectors straddle both rural and urban space. Production in the mixed subsistence sector includes household production for self-consumption and surpluses for sale to local and urban markets as well as household production of cash crops for the export market. The monetised sector comprises commercial enterprises and organisations involved in primary production, manufacturing and the service industries. This includes the provision of public goods and services by the government and goods and services provided by statutory bodies.

Figure 1-2 – Exchange Rate: SI$ to US$1.00



Source: CBSI reports

Figure 1-3 – Change in Real GDP (1997-2003)



Source: *Economic Overview* (CBSI; 2004)

The Solomon Islands dollar has weakened steadily for well over a decade (Figure 1-2). Recent trends in Gross Domestic Product (GDP) in real terms, including traditional non-monetised output, are summarised in Figure 1-3. Between 1996 and 2002, GDP in real (constant dollar) terms declined by 24%, or over 35% per capita. In 2003, provisional data suggest 3.8% real growth, no doubt bolstered by RAMSI's presence and expenditures, increasing total GDP to nearly the 1992 level. Performance has been considerably worse for the modern monetised sectors of the Solomon Islands economy.

Table 1-7 shows economic growth – or contraction – by sector. Some key indicators of commodity production are provided in Table 1-8.

Table 1-7 – Real Gross Domestic Product, 1990-2002 (indexed; 1985 = 100)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003*
Agriculture	103.8	97.1	113.7	113.1	116.5	125.5	125.1	138.0	132.7	103.5	83.0	70.9	77.3	
Forestry, Logging, Sawmilling	113.3	82.7	142.4	156.7	170.6	196.1	209.9	195.8	134.9	153.0	132.2	131.7	135.6	
Fishing	101.8	165.9	150.6	125.9	148.2	205.1	151.4	156.7	176.6	170.9	85.3	72.3	76.8	
Mining & Exploration	118.3	78.1	57.6	53.9	53.1	58.1	74.9	11.5	-449.7	-1,262.5	-613.1	38.2	36.7	
Manufacturing	134.6	135.1	146.0	156.8	215.3	227.7	235.1	237.8	245.7	246.0	197.2	158.1	149.8	
Electricity and Water	157.4	168.6	178.6	192.2	211.8	235.2	232.4	249.7	263.4	276.4	231.0	183.4	214.4	
Construction	96.0	75.7	77.9	80.2	90.7	218.3	289.8	189.5	103.9	75.1	40.1	21.8	26.1	
Retail and Wholesale Trade	103.4	109.2	120.4	127.1	129.5	135.9	146.9	146.6	159.8	149.7	134.5	119.9	131.7	
Transport and Communications	109.6	111.6	119.3	137.0	155.9	163.8	164.0	152.0	170.7	179.3	143.4	114.7	129.8	
Finance	157.5	174.7	184.4	201.8	227.0	249.5	303.2	281.6	243.9	247.6	239.4	231.4	228.3	
Other Services	136.0	141.9	153.5	155.6	169.6	169.6	170.7	171.2	182.2	175.9	172.8	172.4	138.5	
Index of Monetary GDP Production	117.0	120.5	133.8	138.4	151.9	169.4	171.8	167.3	170.9	169.2	139.1	122.0	118.0	
Annual % movement	1.5	3.0	11.1	3.4	9.3	11.5	1.4	-1.6	1.2	-1.0	-17.8	-12.3	-3.6	
Index of Primary Production	105.4	109.4	128.0	125.2	135.1	158.5	149.0	154.5	143.0	129.1	94.0	84.1	89.6	
Annual % movement	1.5	3.8	17.0	-2.2	7.7	17.3	-6.0	3.7	-7.4	-9.7	-27.2	-10.4	6.4	
Non-Monetary: Food	113.5	116.5	119.6	122.8	126.0	129.4	132.8	136.3	139.9	143.6	147.4	151.9	155.9	
Non-Monetary: Construction	114.8	117.0	119.3	121.5	123.9	126.3	128.7	131.1	133.7	136.2	141.6	147.2	150.1	
Non-Monetary GDP Index	113.6	116.5	119.6	122.7	125.8	129.1	132.4	135.9	139.4	143.0	147.0	151.5	155.4	
Index of Total GDP Production	*118.5*	*122.0*	*133.6*	*135.3*	*146.7*	*161.5*	*164.1*	*161.8*	*164.7*	*163.9*	*140.5*	*127.9*	*125.3*	
Annual % movement	*1.9*	*3.0*	*9.5*	*1.3*	*8.1*	*10.1*	*1.6*	*-0.8*	*1.3*	*-0.5*	*-14.3*	*-9.0*	*-2.4*	*3.8*

Source: CBSI Annual Reports; Quarterly Reports and Economic Overviews Note: * 2003 provisional

Table 1-8 – Production by Major Commodity, 1990-2003 (metric tonnes except logs)

Commodity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003 (6m)
Copra	34306	25133	29073	29057	22500	26148	21989	28679	26971	23242	19004	1701	1702	4344
Oil	2693	2717	3879	4286	2827	4372	3520	5399	8339	10345	8553	117	--	--
Palm Oil	22104	22518	30854	30986	29737	29562	28680	28863	29077	12877	--	--	--	--
Palm Kernel	5051	4992	6781	7043	7183	6861	6834	7005	6821	3182	--	--	--	--
Cocoa	3895	4615	4159	3297	3337	2482	2464	3907	844	2395	2316	2038	2907	1800
Fish *	25986	50859	39996	32486	39005	56133	41199	40654	49390	47961	21163	17699	18508	13856
Logs ('ooo m^3)	442	336	640	547	267	--	791	650**	604**	622**	536**	534**	550**	403**

Source: CBSI Quarterly Reviews (March 2001 - June 2003) -- = data unavailable or unreliable; 2003 is for January - June

Notes: * Fish catches are those of Solomon Taiyo Ltd. and National Fisheries Development only.
** Since 1997, there are no log production data so log exports are used as a proxy.

In 2000, the GDP in nominal (current dollar) terms was $1412 million or $3358 per capita (US$450). Earlier household income and expenditure studies suggest that incomes and expenditures vary considerably by province. As Table 1-9 shows, Honiara incomes (1998) and expenditure (1983) were well above those of other locations. In 1998, Honiara residents had annual gross earnings of about US$2808 per household or US$395 per capita.

As shown in Table 1-10, the GoSI is signatory to the three Pacific regional trade and economic trade agreements, the most important of which are the Pacific Island Countries Trade Agreement (PICTA) and the Pacific Agreement on Closer Economic Relations (PACER; between PICTA signatories and Australia and New Zealand). The GoSI has also signed the Cotonou Agreement, providing membership in the African, Caribbean and Pacific (ACP) group of countries, and thus access to further development assistance from the European Union. Because very little EU assistance was spent during the period of unrest, there is considerable funding available from the EU for development assistance, including about Euro 42 million from the STABEX fund.

Table 1-9 – Household Income and Expenditure (1993 & 1998)

Province	Average gross rural expenditure 1993	Ave. monthly earning 1998 SI $	US$
Choiseul	$88.70	$560	$115
Western	$150.60	$572	$119
Isabel	$122.00	$611	$127
Central	$87.70	$322	$67
Guadalcanal	$184.90	$491	$102
Malaita	$178.50	$545	$113
Rennelll–Bellona	n/a	$540	$112
Makira–Ulawa	$70.90	$627	$130
Temotu	$79.70	$686	$142
Honiara	–	$1,129	$234

Source: Solomon Islands Human Development Report (UNDP, 2002)

The National Coalition Partnership Government led by Prime Minister Kemakeza, was elected into power in December 2001 (Table 1-6). Amid continuing deterioration of law and order, the GoSI was unable to develop or implement a comprehensive recovery plan. The government requested assistance from the Australian Government, which resulted in the deployment of RAMSI. Subsequently, the government has developed a *National Economic Recovery, Reform and Development Plan* (NERRP; 2003-2006), which identifies and focuses on five key strategic areas. It is too early to assess the extent to which the NERRP is succeeding in: 1) normalising the law and order and security situation; 2) strengthening democracy, human rights and good governance; 3) restoring fiscal and financial stability and reforming the public sector; 4) revitalising the productive sectors and rebuilding supporting infrastructure; and 5) restoring basic social services and fostering social development.

Table 1-10 –The Solomon Islands and Regional Economic Treaties

Status	SPARTECA	PACER	PICTA
Signed	14 July 1980	18 Aug 2001	06 Aug 2002
Ratified	24 Feb 1981	02 June 2003	02 June 2003
Entered into force	26 Mar 1981	03 Oct 2002	13 April 2003

Source: Note from Pacific Islands Forum Secretariat (January 2004)

1.5.1 The Millennium Development Goals

In September 2000, 147 countries adopted the Millennium Development Goals (MDGs), a set of targets with quantifiable indicators, now widely used to assess development progress. In 2003, the Asian Development Bank (ADB) reported on the progress of its Pacific Developing Member Countries (PDMCs) toward meeting the MDGs. Unsurprisingly, the ADB reported:

> *"The Solomon Islands is far behind in meeting the MDGs by 2015. Existing data are outdated and updating them extremely difficult under current circumstances. There are indications that the poverty situation has been exacerbated by law and order problems, the ongoing financial crisis, the contraction of economic activities and rising unemployment, compounded by high population growth rates. Many people have been displaced by the inter-communal conflict that is still simmering. Funding for essential social services has diminished impacting upon the health and education indicators, particularly in remote areas. Education indicators are very low. Primary enrolment rates are the lowest of all PDMC. The gender gap has narrowed but remains noticeable in school enrolment and literacy rates. Health indicators are*

poor. Available data suggest that child mortality rates and malaria prevalence have decreased slightly. Maternal mortality rates are very high. Access to water and sanitation has improved slightly but urban-rural disparities are extremely high. For all indicators there are great variations between the different provinces / islands.'

Clearly the Solomon Islands faces many development challenges, among which access to affordable modern forms of energy may not be a high government priority. The Central Bank of the Solomon Islands (CBSI, 2004) adds a precarious level of foreign reserves, very high debt, relatively high inflation, excessive government deficit, and a weakened financial system to the list of weak economic fundamentals. It notes that the Solomon Islands is relatively well endowed with natural resources, and that the NERDP provides an important opportunity to address the fundamental weaknesses in a comprehensive and coordinated manner. The CBSI, which has been an effective and critical economic watchdog for some years, concludes that the outlook for stronger growth is good.

Considering the experiences of the post-colonial period, and especially recent years, commercial and development bank staff, and private businessmen, seem to be surprisingly optimistic. Table 1-11 shows the wide range of interest rates charged on loans and overdrafts since 1990. Although several banking representatives suggested current rates of 13-15% for business loans, one said his bank could offer loans as low as 9% for a good project (e.g. hydro development) and a good investor. Apparently no loans have been made for energy projects thus far. Table 1-12 shows the distribution of outstanding loans since 1990 by sector for the Development Bank of the Solomon Islands, most of which have been for services and commerce.

Table 1-11 – Commercial Bank Interest Rates on Loans and Overdrafts

Year	Personal loans	Other loans *	Overdraft	Weighted average **
1990	16.32 - 18.00	14.00 - 18.00	15.00 – 18.00	16.39
1991	16.32 - 19.75	14.00 - 19.75	15.00 – 19.75	17.25
1992	16.32 - 21.00	14.00 - 21.00	16.50 – 21.00	18.32
1993	14.75 - 21.00	12.50 - 21.00	14.50 – 21.00	17.50
1994	14.75 - 19.00	12.50 - 18.75	14.50 – 18.25	16.23
1995	14.50 - 20.00	12.50 - 20.00	14.50 – 20.00	16.94
1996	14.50 - 20.00	11.00 - 20.00	14.50 – 20.00	16.66
1997	15.00 - 19.50	10.00 - 18.50	14.00 – 18.70	15.71
1998	14.00 - 15.00	10.00 - 16.25	14.00 – 15.75	14.12
1999	14.00 - 15.00	10.00 - 16.25	14.00 – 15.75	14.12
2000	14.00 - 17.50	10.00 - 21.50	10.00 – 18.00	15.09

Sources: CBSI Quarterly Review December 1999, Vol. 11. No.4 and CBS Quarterly Review March 2001, Vol. 13, No.1

Notes: * includes business loans ** of loans and overdrafts

Table 1-12 – Distribution of Outstanding Loans (Development Bank of Sol Islands; $'000)

Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Agriculture	5968	7501	5016	5669	6088	6294	7116	8071	8004	10,106	8118
Industry	2000	2372	4570	2697	2846	4088	3462	4714	4452	4984	5093
Commerce	3311	3323	5643	6455	4283	4557	6521	10,259	10,061	14,632	13,935
Services	2990	4613	4409	8167	10,108	12,970	16,516	21,149	21,012	25,763	28,074
RTC *	26	19	7	13	51	-	407	422	396	845	1102
Others **	945	1252	3105	3490	2853	3585	4879	3843	11683	4310	5220
Total	*15,240*	*19,080*	*22,750*	*26,491*	*26,229*	*31,494*	*38,901*	*48,458*	*55,608*	*60,640*	*61,542*

Notes: * RTC = Rural Training Centres: ** Includes micro loans and DBSI staff loans

Source: *CBSI Quarterly Review December 1999, Vol. 11. No. 4 and CBSI Quarterly Review March 2001, Vol. 13, No .1*

1.5.2 Investment climate

In an investment study several years ago (PIFS, 2001) the Forum Secretariat (slightly edited) says:

"The GoSI recognises the importance of overseas investment in broadening the country's economic base. The assessment process emphasises: i) strengthening the technical and marketing expertise of the private sector; ii) use of local raw materials; iii) net export income; iv) import cost savings; and v) employment and training, especially in regional areas. ... Foreign investment proposals are screened under the 1999 Investment Act, which provides for investment guarantees where transfer or proceeds of sales, dividends, profits, payments under approved technology agreement etc, is required. An Investment Board is responsible for approving all foreign investment applications and has the following functions: i) approval of foreign investments and technology agreements; ii) monitoring and enforcing compliance with the terms and conditions of approvals granted under the Act; and iii) reviewing and advising the GoSI on policies and procedures relating to the promotion and regulation of foreign investments."

Proposals may be approved in 30 days but can take considerably longer depending on the project's complexity, its location and land related issues. Approvals are also subject to exchange control approval. There are several economic sectors reserved for Solomon Islanders but the policy has not been strictly applied.

Land is a complex and integral part of the Solomon Islands way of life and generally communally owned by clans or tribes. Children inherit land rights through either the father or mother depending on the lineal system practised by the particular clan. Title to land is either customary or registered and means that:

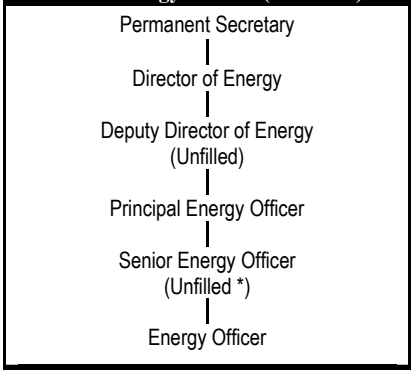
- the government recognises that all customary land is owned, usually in a lineage group;
- registered land has its ownership and boundaries recorded in a land registry in Honiara and these are guaranteed by law rather than by custom. The registered system is attractive to investors but permits to own a perpetual estate (freehold interest) in registered land are limited to indigenous Solomon Islanders. Others may only lease registered land; and
- about 88% of land is customary and 12% registered. In 1977, an Amendment Bill to the Lands and Titles Ordinance converted perpetual estates owned by non-Solomon Islanders into 75 year fixed term estates (leases from government) with development conditions.

During the mission, several people referred to the Investment Board as a "Non-Investment Board". Others, however, felt that there have been recent improvements.

1.6 Institutional and Legal Arrangements for Energy

The Energy Division of the Department of Energy and Mines within the Ministry of Natural Resources is responsible for energy policy and renewable energy project development and project implementation. The roles of the Energy Division, as described in Box 1-1, are quite extensive. However, the approved staffing structure and numbers (only three at present as shown in Figure 1-4) are inadequate to carry out these functions effectively.

Figure 1-4 – Structure of the Energy Section (Jan 2004)



* Incumbent resigned in early 2004

The Director of Energy is responsible to the Permanent Secretary, a political appointee, who in turn is responsible

to the minister. It is likely that most or all divisional staff report in practice to the director, rather than the unwieldy arrangements shown but no job descriptions or detailed responsibilities have been seen. For the Energy Division, as for government offices in general, it has been extremely difficult to function effectively in recent years, although there has been some improvement since the arrival of RAMSI. Access to transport, funds for travel and basic office expenses, telephone service, and basic e-mail communications have been intermittent or non-existent. Electric power supply has been erratic. Most civil servants were often not paid for weeks at a time during the past several years, and could not always afford bus fare to get to work.

Box 1-1 – Informal Roles and Responsibilities of the Energy Division

The roles of the Energy Division is to:

- formulate and implement national energy policy, and monitor and evaluate its impact;
- plan, coordinate and assist in the implementation of energy projects and programme across the energy sector and between ministries and related agencies;
- provide the government and energy related agencies with expert advise and analysis on energy matters;
- act as the focal point for all petroleum matters (including price control supply, storage and distribution); and
- act as the convener and facilitator of the national energy coordinating committee

The responsibilities are to:

- develop, implement and monitor a national energy work programme(s) by which energy policies will be achieved;
- coordinate activities and programmes (including the rural electrification programme) of the energy sector participants;
- develop and maintain a comprehensive energy sector database for policy formulation, planning and monitoring, through the collection and collation of information on energy supply, demand, etc;
- monitor, review and provide recommendations on fuel pricing electricity tariffs, and government charges and subsidies, to ensure that the full and correct price signals are conveyed to consumers wherever possible;
- develop and maintain the capacity to monitor and evaluate the landed price of petroleum, the petroleum company cost elements, the pricing formula, and government charges so as to negotiate and maintain equitable pricing and proper contractual arrangement for petroleum products;
- monitor, review and provide recommendations on future developments in public and private energy sector infrastructure. In particular, encourage public sector agencies to adopt a list cost, financially and environmentally sustainable strategy to meeting energy demand;
- formulate and secure proposals for donor assistance where appropriate, and screen out those lucking in technical maturity economic viability or environmental sustainability;
- provide advise to government and its agencies concerning energy investment budgets and / or specific project funding;
- in conjunction with other ministries and agencies, develop, implement and monitor regulations and standards governing the energy sector, particularly concerning the safety of petroleum handling/storage facilities and environmental guidelines for the petroleum sector, such as oil spill contingency plans and waste oil disposal;
- work closely with the relevant government and non-government organisations on the environmental aspects of energy projects and programmes;
- develop and assist in implementing energy conservation and efficiency programmes for the government, commercial sector and the public, including education campaigns and the evaluation of energy efficient appliances and technology;
- develop and facilitate education/awareness programmes to highlight fuel substitution options;
- monitor and review the development of new and renewable energy resources and technologies particularly with regard to photovoltaics, solar thermal technology and biomass; and
- train local staff.

Source: *Energy Policy and Guidelines* (GoSI, 1994); informal as these were never endorsed by cabinet

It is not clear how the roles and responsibilities of the Energy Division duplicate or overlap with similar responsibilities of those other departments, e.g. the fuel pricing function of the Commerce Ministry. However, the Energy Division has very limited financial resources and its actual powers are both unclear and weak. It reportedly focuses primarily on small-scale renewable energy technologies (RETs). *De facto* responsibilities for various aspects of energy, although this is no doubt incomplete, are indicated in Figure 1-5.

Figure 1-5 – *De Facto* Responsibilities for Energy Matters in the Solomon islands (January 2004)				
Ministry of Commerce and Employment	**Ministry of Natural Resources**		**Ministry of National Planning**	**Solomon Islands Meteorological Services**
Price Control Unit	**Department of Mines and Energy**	**Department of Forests and Environmental Conservation**		
	Energy Division	**Environment Division**		
• Fuel price control • Petroleum storage and handling	• Energy studies, legislation and policies • Rural electrification through RETs • Reviewing fuel and electricity pricing • Solomon Islands Electricity Authority	• Environmental impact assessments (including energy sector)	• Overall policy coordination • Reform Programme	• Climate change policy (including greenhouse gases)
Source: mission discussions				

1.6.1 Electric power

The Solomon Islands Electricity Authority (SIEA) is responsible for electric power supply and distribution to all urban and provincial centres, i.e. Honiara, nine provincial centres, and Noro Township in the Western Province. The SIEA is a government-owned statutory body. Although it has been commercialised, and operates as a business with the goal of making a profit, there is a long history of under-investment, insufficient resources and under-skilled staff. The Minister responsible for energy, i.e. the Minister of Natural Resources appoints a board consisting of six members and a chair. Although the Director of Energy sits on the SIEA board,[1] SIEA would reportedly prefer the Energy Division member to be replaced by a representative of the Chamber of Commerce.

SIEA provides power to urban centres through diesel generators, except for Buala town on Isabel Province and Malu'u substation in Malaita with small hydro. Various boarding schools, rural training centres, health centres, rural fisheries centres, tourist resorts, private shops and residents use their own diesel generators for electricity.

1.6.2 Petroleum

Petroleum products are imported into the SI by Shell Oil and Markworth Oil, a Solomon Islands' based company that bought the local assets of Mobil Oil in 2003. Mobil had operated in the Solomons since the 1960s. The storage depots of both companies are at the main port in central Honiara, a location that does not allow for expansion because of serious safety issues and limited land area. Origin Gas Ltd. of Australia is the sole importer and distributor of liquid petroleum gas (LPG). LPG was first sold in the SI in the early 1970s by Melanesian Traders, acting as agent for Boral Gas Ltd. of Australia. In 1985, Boral acquired a majority shareholding in Melanesian Traders and assumed overall management of Boral Gas in the country. In 2000, Boral was re-structured, with Origin formed to handle energy while Boral

[1] As the current Director is acting (April 2004), his predecessor remains on the SIEA board until a substantive Director is appointed. The position was advertised in early 2004.

continued with building and construction. Origin's main LPG storage is also in Honiara. Origin sells only in Honiara to private outlets, some of which distribute to other locations.

1.7 Petroleum price control

LPG and petroleum fuel prices are regulated at both wholesale and retail level by the GoSI through an under-resourced (one person) Price Control Unit within the Ministry of Commerce and Employment, which also has responsibility for all other price control issues throughout the Solomons. Although the price controller may soon be allocated a RAMSI technical assistant, and sufficient funds to travel beyond Honiara, it is understood that his duties will be considerably expanded to include administration of the Trade Practices Act.

1.7.1 Energy policy

There have been numerous drafts of national energy policies in the past two decades. The most recent is a 1995 set of two documents, *National Energy Policy Guidelines* and *National Energy Policy Statement* prepared by the Pacific Islands Forum Secretariat (PIFS/GoSI, 1995) in conjunction with the GoSI. However, these were rather generic documents similar to those of other Pacific Island Countries (PICs), were never endorsed by cabinet and have no formal status. They were reviewed by the Energy Division in 1996 and are still sometimes used to guide some Energy Division activities. A draft *Solomon Islands Rural Electrification Policy* was prepared in 1996 through the German Deutsche Gesellschaft für Technische Zusamenarbeit (GTZ/GoSI, 1996), related to then-planned rural micro-hydropower development. It contains guidelines on management, price recovery, tariff polices, etc. It, too, was never endorsed by cabinet and has no formal status. In 2000, power sector analysts provided through the Japan International Cooperation Agency (JICA, 2000) recommended the development of a rural electrification policy and the establishment of a Rural Electrification Advisory Committee to guide implementation of rural hydro and solar photovoltaic (PV) power systems. This has not eventuated.

In 1993, the Provincial Assembly of the Western Province signed a Memorandum of Understanding (MOU) with an Australian rural development agency, Appropriate Technology for the Community and Environment (APACE; see (Annex D) to design a provincial village electrification policy and programme based on earlier APACE experiences in the province. Its status is unknown.

In 2001, the Energy Working Group (EWG) of the Council of Regional Organisations of the Pacific (CROP) developed a *Pacific Islands Energy Policy and Plan* (PIEPP), primarily to guide the activities of the CROP EWG. It has been used in modified form for several PIC national energy policies. The Energy Division is considering adapting PIEEP, which covers a wide range of policy issues, for the Solomon Islands and reportedly hopes to have it completed and endorsed by cabinet during 2004.

1.7.2 Energy Legislation

There are several acts of the parliament of the Solomon Islands that deal directly or indirectly with energy issues. Most require substantial revision if they are to be effective. These are briefly discussed below.

- *The Electricity Act (1969)* (Chapter 128 of the Laws of the Solomon Islands) establishes the responsibility of the SIEA for providing electricity to urban and provincial centres. The SIEA has sole authority to provide and/or supply electricity to urban centres under the Act. Any private generation in areas where SIEA operates must be licensed by SIEA.

- The *Consumer Protection and Price Control Act* (revised in 1995, entered into force on 16th October 1995; Chapter 64 of the Laws of the Solomon Islands) establishes price control rules throughout the country. In effect, of sixteen products specifically mentioned in the Act, only petroleum products and LPG are currently systematically price controlled. Other products are dealt with if and when there are consumer complaints. The legislation is outdated and difficult to enforce in its current form (based on a percentage mark-up of import cost, which varies from supplier to supplier). It also refers to specific brand-named products and specific package sizes, many of which are either not found in the market or are sold alongside new brands and package sizes that are apparently not price controlled. Fines for non-compliance are small, generally $300-500 (i.e. under US$67) per offence. It is not worthwhile pursuing offenders, given the current state of the legal system and costs related to pursuing any action. The Prices Advisory Committee (PAC), an extra-government body established under the Act and chaired by the price controller, advises the Minister on price regulation issues. The PAC has advised the GoSI that the Act should be updated and revised.
- Fuel storage and handling are covered by Chapter 109 of the Laws of the Solomon Islands. This was written in 1939 and needs major revision and updating.
- The *Environmental Act* (1998) was gazetted in September 2003 and its relevant regulations are not yet in place. Under the Act there are formal requirements for environmental impact assessments (EIAs), but no specific requirements for energy sector investments such as power stations or oil storage. No EIAs have been conducted since the Act was gazetted but they would be required for such projects as major hydro development.

1.7.3 Inter-ministerial Energy Committees

The establishment of a national energy committee was proposed in the mid 1990s but never established. Under the UNDP/GEF/SPREP Pacific Islands Climate Change Project (PICCAP), which was established to deal with greenhouse gas (GHG) emissions and a national GHG inventory, a PICCAP committee was established. The committee considered energy issues, as it must to deal with GHGs, and the Energy Division was represented. Although PICCAP formally ended in 1999, the Solomon Islands Meteorological Services (SIMS) continues to deal with climate change/GHG issues and consults with the Energy Division through a Climate Change Country team. The team consists of representatives from government departments, non-governmental organisations (NGOs), and the private sector but reportedly has not met since October 2002.

Informally, it seems that more-or-less the same group that dealt with PICCAP / climate now forms a an informal secretariat (and *de facto* committee) for PIREP and presumably for a new Danish funded, UNDP-managed and SOPAC-executed regional project called Pacific Islands Energy Policy and Strategic Action Planning (PIEPSAP). However, formally, there is no committee or interministerial advisory group on energy. There is no formal mechanism to include the many NGOs involved in rural energy in developing a practical national energy policy, especially as the climate change country team is apparently inactive.

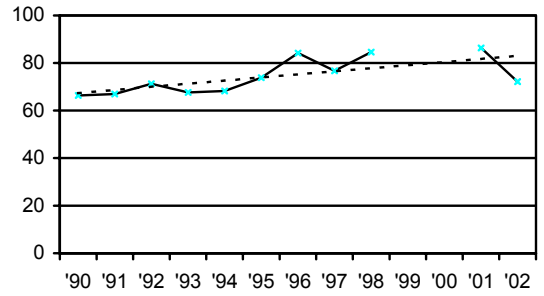
2.1 Energy Supply

The Solomon Islands are overwhelmingly dependent on imported refined petroleum fuels for national energy needs for electricity generation, for transport by land, sea and air and for lighting. Biomass provides more than 61% of gross national energy production, petroleum products for about 38%, and hydropower and solar perhaps one percent.

2.1.1 Petroleum

Imports of refined petroleum fuel to the Solomon Islands have increased only slightly by volume since 1990 (Figure 2-1 and Table 2-1; no GoSI data available for 1999 and 2000) but have generally been a very high percentage of total imports by value, averaging nearly 18% since 2000 (Figure 2-2), higher than the early 1980s when high prices were of serious concern to the government.

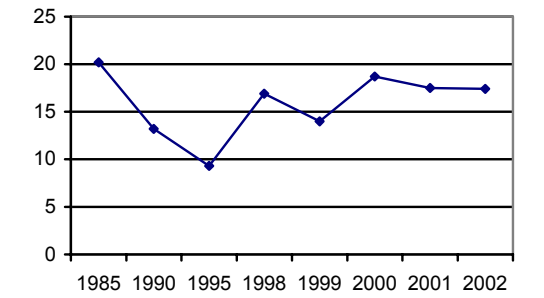
Figure 2-1 – Imports of Petroleum Fuels, 1990-2002



Source: SI Statistics office, 2003 Vol. In ML; dashed line is trend line

The *Pacific Regional Energy Assessment* (PREA, WB et. al., 1992) predicted that petroleum fuel imports would grow between 1989 and 2000 at an AAGR of 2.2% per year overall, with distillate imports growing more slowly (1.6%), assuming that the then-planned Komarindi (Guadalcanal) hydroelectric project would proceed. Statistics Office data for 2000 were lost due to the conflicts. Trend lines (not shown for distillate) suggest that the actual AAGR for the period has been 1.8% overall but 0.9% for distillate. Komarindi hydro was not constructed, and of course the economy is much smaller than the World Bank (WB) would have anticipated.

Figure 2-2 – Petroleum as % of Total Imports, 1985-2002



Source: Key Indicators for Solomon islands (ADB, 2003)

As the PREA noted over a decade ago, small quantities, long transportation routes, and frequent trans-shipment result in high landed costs of petroleum products in many Pacific Island Countries (PICs). Recent wholesale prices of gasoline and distillate (i.e. automotive diesel oil, ADO; excluding taxes and duties) are shown in Figure 2-3. Despite the inadequate resources for price control, and the reportedly poor formulas for price calculations, prices in Honiara are considerably lower than average for Pacific Island countries. For kerosene (not illustrated), retail prices (free of taxes and duties) are average but wholesale prices are below average, suggesting a high mark-up compared to other neighbouring countries. The SIEA presumably pays a relatively high price for distillate, as it has no fuel supply contract. SIEA currently (early 2004) purchases its fuel from Markworth Oil on a cash-on-delivery basis, at prices reportedly higher than those of the previous supplier, Mobil.

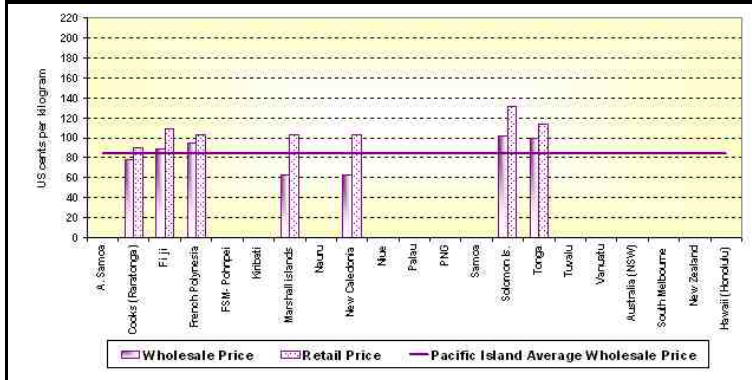
Table 2-1 – Petroleum Fuel Imports to the Solomon islands, 1990 – 2002 (thousand litres)											
Fuel	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**2001**	**2002**
Aviation Gasoline	486	610	2237	887	841	2,082	884	578	224	211	483
Jet fuel	846	1443	1579	1742	1025	1452	2881	3059	2465	4190	3972
Motor Spirit	12,215	12,258	11,976	11,974	14,803	17,061	21,153	15,799	15,069	20,400	14,799
Kerosene	1586	2723	2213	2877	2825	2883	2751	3442	2481	3397	3315
Distillate Fuel	49,780	48,385	51,287	47,646	46,545	48,142	54,730	51,995	62,435	55,974	47,696
Lubricating oil	1291	1093	1425	1736	1609	1,465	953	952	1025	1006	1021
LP Gas	82	504	583	783	533	665	803	898	945	1,079	870
Total (KL)	*72,269*	*73,000*	*77,285*	*73,631*	*74,168*	*79,738*	*90,144*	*82,713*	*90,635*	*92,251*	*78,151*
Value (SI$ millions)	144,538	146,000	154,570	147,262	148,336	159,476	180,288	165,426	181,270	184,502	156,302
Source: SI Statistics Office, 2003 Note: Data are not available for 1999 and 2000											

Liquid Petroleum Gas (LPG) imports have grown fairly rapidly (Table 2-1). A limited sample of prices in other PICs (Figure 2-4) suggest that both wholesale and retail LPG prices in Honiara, excluding import levies and taxes, are somewhat above average for the region.

Figure 2-3 – PIC Wholesale Petroleum Fuel Prices
(excluding import duties and taxes; late 2003)

Source: Pacific Fuel Price Monitor, Edition 6 (PIFS; 25 Feb. 2004)

Figure 2-4 – PIC Wholesale LPG Prices
(excluding import duties and taxes; late 2003)



Source: as for Figure 2-3

A constraint to petroleum fuel supply (and safety) for well over a decade has been the size and downtown Honiara location of rather old petroleum fuel storage facilities. The PAC (Section 1.6) is advising that the GoSI re-activate previous plans to consider the establishment of an independently owned fuel terminal to replace the two current terminals in the middle of Honiara. The new terminal would be built away from town and could be tendered out along the lines adopted by the Government of Samoa.

2.2 Energy Demand

2.2.1 Petroleum

There are no readily accessible data or surveys to indicate the demand for petroleum products among various categories such as government, commerce and industry, domestic households

or transport. Shell was unwilling to provide sales data by product or type of customer. Markworth felt that their data, covering only several months, were not indicative of a year's sales. Jet fuel and aviation gas are obviously used for air transport and gasoline for ground transport. For other fuels, demand by sector must be estimated, sometimes crudely. As sales data are unavailable, imports have been used as a proxy for consumption. Imports and sales can differ substantially for any year, depending on the frequency of imports and changes in stock levels at year-end. Therefore, petroleum fuel demand has been estimated in tonnes of oil equivalent (ToE) for 2001/2002 using an average of the 2001 and 2002 import data of Table 2-1.

Table 2-2 – Consumption of Petroleum Products by Sector (ToE; 2001/2002)

Product	Imports		——— Consumption by Sector in Tonnes of Oil Equivalent ———				
	KL	tonnes	Transport	Electricity	House holds	Commercial & industry	Total ToE
Motor spirit	17,600	12,847	14,003				14,003
Aviation gasoline	347	241	270				270
Jet fuel	4081	3239	3531				3531
Other kerosene	3356	2643			576	2305	2881
LPG	975	497			290	291	581
Distillate	51,835	43,559	20,000	19,400		7,644	47,044
Total	*78,194*	*63,026*	*20,000*	*19,400*	*866*	*10,240*	*68,310*
% of total ToE	*n/a*	*n/a*	*56%*	*28%*	*1%*	*15%*	*100%*

Source: Imports are from GoSI as reported in Table 2-1 omitting 'lubricating oils'

Notes: Imports in KL are average of 2001 and 2002 data of Table 2-1. Tonnes andToE calculated from data of conversions table. Total adds up to 101% due to rounding errors; n/a = not applicable

The sectoral breakdown shown in Table 2-2 is imprecise as the assumptions used are no doubt questionable. In addition, 2001and2002 were not typical periods for consumption of energy, due to serious disruptions and social tensions, particularly in and around Honiara.

- Distillate used for electricity generation is estimated from the power sector data presented later in this section plus crude estimates for self-generation.[2] The remaining distillate has been allocated between transport (72%) and commerce/industry (28%).
- Less than 2% of households use kerosene as their main cooking fuel (Table 2-3) but it is widely used for lighting. It is assumed that 20% of kerosene is for household use and the rest for commercial and industrial use.
- Only 10% of households cook primarily with LPG (Table 2-3); it is assumed that about half of LPG is used for commercial and industrial purposes.

[2] In 2001, SIEA sold about 52.4 GWh from diesel. Generation was probably about 1.16 x 52.4 GWh = 61 GWh. Assuming 0.27 l/kWh, fuel use was 16.4 ML of ADO. It is assumed that private generation probably added another 5 ML for 21.4 ML total. This is about 19,400 ToE.

2.2.2 Biomass

Fuel wood is by far the most common cooking fuel in the Solomon Islands, used (Table 2-4) by 89% of the population as their main fuel, increasing to 95% if Honiara is ignored. Even in Honiara, a quarter of households primarily use wood for cooking. The capital and its surroundings have lost considerable tree cover (Figure 2-5). Malaitans,[3] who make up nearly half of Honiara's population, have no traditional access to land on Guadalcanal and therefore reportedly often have little recourse except illegal cutting.

Figure 2-5 – Denuded Hillside, Honiara

Photo: Peter Johnston, 2004

A commercialised fuel wood market is gradually developing in Honiara. It began in the early 1990s but was stopped during the height of the ethnic tension in 1999 and started again in 2001. In early 2004, fuel wood prices ranges from $15-30.00 per bundle depending on size (about 15-25 kg respectively). Supplies come mainly from secondary forest and logged over areas of Tenaru and Mt Austin, about 10 km from Honiara. Suppliers sell at all market outlets in Honiara including KGVI, Fishing Village and White River but the bulk is sold at the Central Market (Figure 2-6), where sales can reach 70-80 bundles per day. Average daily use of fuel wood per household was reportedly estimated in the census report at 15 kg, yielding a fuel wood consumption of about 311 million kilograms in 2000 (about 110,000 ToE assuming 15% moisture content). This excludes wood and other biomass used for copra and cocoa drying and household uses during festive seasons, when use can be high.

Figure 2-6 – Fuel wood Sales, Honiara Market

Photo: John Vos, 2004

Table 2-3 – Cooking Fuel Most Commonly Used, by Households and by Province (1999)

Location	Households (Number)	Most Commonly Used Fuel						
		Fuel wood HH	%	Electricity	LPG	Kerosene	Other	Not stated
Choiseul	3,142	3,072	97.8%	1	29	31	3	6
Western	9,992	8,961	89.7%	42	489	373	90	37
Isabel	3,556	3,353	94.3%	0	112	78	4	9
Central	3,625	3,313	91.4%	10	193	106	0	3
Ren-Bellona	432	408	94.4%	0	16	6	0	2
Guadalcanal	10,399	9,737	93.6%	19	564	53	1	25
Malaita	18,606	17,993	96.7%	13	384	144	9	63
Makira	4,926	4,798	97.4%	5	68	43	0	12
Temotu	3,415	3,346	98.0%	5	31	30	1	2
Honiara	6,921	1,755	25.4%	106	4,614	401	26	19
Sol Islands	*65,014*	*56,736*	*88.8%*	*201*	*6,500*	*1,265*	*134*	*178*

Source: Report of the 1999 Census

[3] The United Nations (*Solomon Island Common Country Assessment,* 2002) estimates that almost 48% of the Honiara population were of Malaitan origin in 1999.

2.2.3 Electricity

As Table 2-4 shows, only 16% of households in the Solomon Islands had access to electricity in 1999, ranging from well under 1% in Rennell-Bellona to 73% in Honiara. Excluding Honiara, the electrification rate nationally was under nine percent; it is unlikely that this has since increased. Overall, 69% of those households electrified received power from SIEA. Away from Honiara, only 41% of electrified households had SIEA service, 28% had their own source, and 23% reported that they received electricity from a private company. SIEA's 9,200 customers are shown by type in Table 2-5.

Table 2-4 – Households by Source of Electricity and by Province (1999)

Location	Total number of Households	Households with electricity		Source of Electricity					
		Number	Percent	From SIEA	Private Company	Own Source	Other Source	No Electricity	Not Stated
Choiseul	3142	249	8%	1	85	77	86	2884	9
Western	9992	1993	20%	877	531	481	104	7961	38
Isabel	3556	423	12%	86	106	142	89	3127	6
Central	3625	524	14%	113	322	89	0	3095	6
Ren-Bellona	432	6	0.1%	0	0	0	6	423	3
Guadalcanal	10,399	862	8%	369	50	386	57	9501	36
Malaita	18,606	778	4%	441	40	152	145	17,695	133
Makira	4926	247	5%	140	43	19	45	4662	17
Temotu	3415	110	3%	80	4	26	0	3302	3
Honiara	6921	5018	73%	4897	9	100	12	1887	16
Sol Islands	*65,014*	*10,210*	*16%*	*7004*	*1190*	*1478*	*538*	*54,537*	*267*

Source: report of the 1999 census (GoSI, 2001) Note: rounded off to nearest whole number (except Rennell-Bellona)

SIEA has a national tariff (Table 2-6), with substantial cross subsidies from Honiara consumers to others. In early 2004, the cost of electricity was about 17.6 US¢/kWh for domestic consumers and 21.1 US¢/kWh for commercial or industrial consumers. There is an 'automatic fuel price adjustment' (AFPA), varying with the cost of diesel fuel. From October 2003 to early 2004, it has been 76 SI¢/kWh, an 8¢ reduction from the previous AFPA. Many businesses have their own generator due to frequent SIEA outages. If a business generates its own power in an SIEA service area, it is charged at a rate of half of the normal SIEA charge per kWh (except in Honiara where SIEA is unable to meet demand). Tariffs were last independently reviewed by AusAid in

Table 2-.5 – SIEA Customers by Type, 1990 to 2002

Year	Domestic	Comm.	Indust.	Govt.	Other	Total
1990	4941	335	149	737	137	6299
1991	5034	871	225	197	136	6463
1992	5181	954	212	182	123	6652
1993	5463	924	158	233	115	6893
1994	5523	1061	160	204	119	7067
1995	5854	1196	128	194	124	7496
1996	6114	1295	191	212	132	7944
1997	6198	1256	171	187	141	7953
1998	6313	1282	174	186	149	8104
1999	7012	1384	152	209	168	8825
2000	6823	1409	141	194	142	8709
2001	6896	1475	147	226	181	8925
2002	7029	1598	153	274	191	9245
2002 (%)	*76%*	*17%*	*2%*	*3%*	*2%*	*100%*

Source: SIEA

February 2003. All tariff changes require cabinet endorsement. It is understood that the tariff structure is to be reviewed in early 2004 with the AFPA integrated into the basic charge.

As Table 2-7 shows, in 2002, total consumption was about 42 GWh of which domestic consumers accounted for 27%, commercial/industrial use 63% and nine percent government utilisation. The Honiara system accounted for 76% of total demand, Noro 11% and eight others less than 4% each. Table 2-8 summarises the SIEA system and demand forecasts carried out by Japanese power sector consultants in late 1999.

Table 2-6 – SIEA Tariff (early 2004)

Category	Charge (SI$/kWh)
Domestic	1.3175
Commercial and Industrial	1.5850
High Voltage Tariffs	1.4850
Minimum Charge ($/m)	$20.00

Note: Costs incl. AFPA, SI$ 0.76/KWh

Table 2-7 – SIEA Consumption by Consumers, 2002 (MWh)

Category	Honiara	Noro	Munda	Gizo	Auki	Malu'u	Buala	Kira	Lata	Tulagi	Total	% of total
Domestic	8,938,	511	128	487	455	18	109	202	128	125	*11,101*	*27%*
Commercial	15,454	921	230	468	515	10	57	117	30	231	*18,033*	*43%*
Industrial	3,988	3,208	802	9	230	0	1	3	8	58	*8,307*	*20%*
Govt	2,830	66	17	273	228	4	57	62	4	1	*3,542*	*9%*
Min. Charge	36	7	2	11	9	7	3	6	3	4	*88*	*<<1%*
Others	348	35	9	149	61	0	13	2	26	23	*666*	*2%*
Total	*31,594*	*4,748*	*1,187*	*1,397*	*1,498*	*40*	*338*	*393*	*199*	*443*	*41,837*	*100%*
% of total	*76%*	*11%*	*3%*	*3%*	*4%*	*<<1%*	*1%*	*1%*	*<1%*	*1%*	*100%*	-

Source: *Historical Consumption by Category* (SIEA 2004)
Notes: MWh = '000 KWh Totals rounded; < = less than; << = much less than

Table 2-8 – SIEA System Characteristics and Demand Forecasts

System	Location	Type	Capacity KW (Oct. 1999)	Peak KW (Oct. 1999)	Forecast Demand (MWh)		Forecast Peak (kW)		Began
					2002	2018	2002	2018	
Honiara - Lungga	Guadalcanal	diesel	18,000	10,550	56,289	125,000	12,477	27,400	
Noro – Munda *	Western	diesel	2,700	1790	14,513	54,600	2,673	11,330	1987
Gizo	Western	diesel	510	280	2,939	4900	571	1,030	1991
Auki	Malaita	diesel	624	280	11,499	33,900	2,387	5,950	1991
Malu'u	Malaita	hydro	30	33					1984
Buala	Santa Isabel	hydro diesel	150 62	70	458	1700	108	360	1996
Kirakira	San Cristobel	diesel	170	61	413	1500	92	330	1992
Lata	Temotu	diesel	160	65	387	900	80	190	1993
Tulagi	Florida Isl	diesel	?	?	255	560	71	143	1998**
	Choiseul				101	390	25	86	
	R-Bellona				31	76	6	17	
Total					*86,887*	*223,500*	-	-	

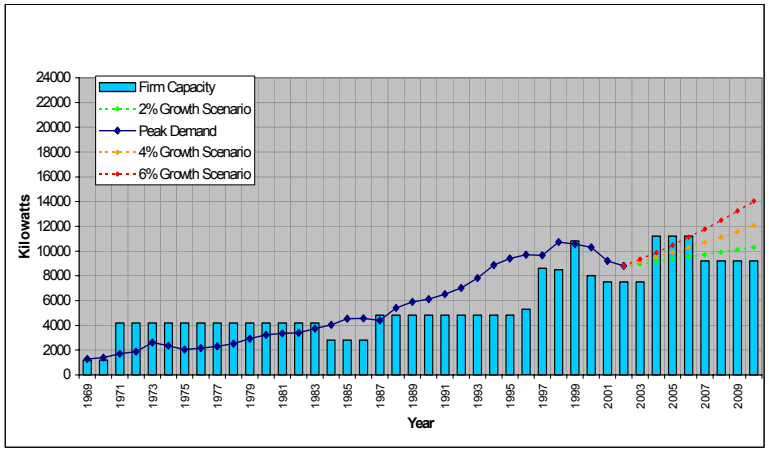
Source: Master Plan Study of Power Development in Solomon Islands: Draft Final Report; Volume 1, Summary (JICA, Aug. 2000)
Notes: * Munda connected by 11kV line to Noro in 1996 ** Taken over by SIEA in 1998

Table 2-7 provides consumption whereas Table 2-8 shows generation, which could be 14-20% higher than consumption depending on individual system losses. Considering the economic collapse during and following the study, and a large decline in Honiara consumption during the disruptions (1999: 45.6 GWh, 2000: 41.8 GWh, 2001: 42.8 GWh,

2002: 31.6 GWh), it is not surprising that the short-term 2002 forecasts were too high, illustrating some difficulties in preparing accurate forecasts.[4]

Figure 2-7 shows firm capacity and demand (in KW) in SIEA's Honiara system from 1969 through 2003. For the past twenty years, peak demand has usually exceeded firm capacity. (There were outages in Honiara several times daily during the PIREP mission.) Without investment in capacity, this is likely to remain an issue during the next few years, regardless of a range of assumptions shown in the figure regarding growth in peak demand.

Figure 2-7: Honiara Firm Generating Capacity and Demand Growth



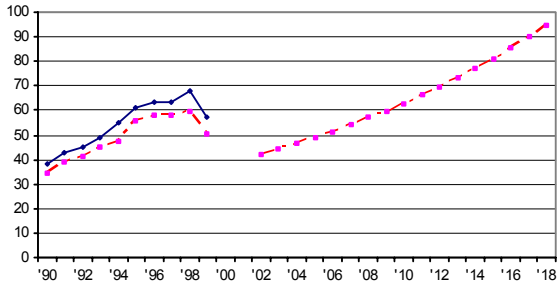
Source: SIEA 2004

2.3 Future Growth in Commercial Energy Demand and GHG Emissions

Figure 2-8 shows historic generation and sales of electricity by SIEA and forecasts for 1998-2018. The forecasts assume JICA's projected average annual growth rate of 5.2% for generation and sales, but not (because of the recent economic decline) their calculated MWh and peak demand. Considering the data inconsistencies, forecasts are no more than roughly indicative but provide a basis for estimating future petroleum use for power generation if there is no development of hydropower or other renewable energy (RE) resources.

The Solomon Islands had extremely variable economic growth in the period 1989-1998, i.e. before open conflicts erupted, with an AAGR during that period of about 3.1% in real terms. The population has grown at 2.8% per year (3.8% in Honiara) and this is expected to continue. It is difficult to accurately judge likely future economic growth in a small country in which many issues remain unresolved and political stability is uncertain. For the purposes of this report, it is assumed that donors and RAMSI will continue to support a return to normalcy and that the economy will continue to grow, or resume growing, at a slightly faster rate than population, on the order of 3-4% per year. From 1990-1998, petroleum fuel imports grew at an AAGR of about 4% (falling considerably afterwards).

Figure 2-8 –
Generation & Sales Historic and Projected (GWh)



Sources: Historic from SIEA 2004; proj. from AAGR of JICA 2000
Note: Solid line is generation; dashed line is sales.
Data from 1990-1999 are historic;
2002-2018 = sales projections.

[4] The differences in the data of Tables 2-7 and 2-8 are higher than one would expect, for unknown reasons. The historical data of Figure 2-8 differ from both tables but is nonetheless sufficiently accurate for indicative forecasts.

Before estimating the SI's current greenhouse gas (GHG) emissions and projections over the coming decade, past emissions from petroleum fuels are briefly considered. A GoSI report has been drafted on 1994 emissions of carbon dioxide (CO_2). Results, summarised in Table 2-9, show 323 Gg (the standard international GHG unit) of emissions. Using the same fuel imports as those of Table 2-9, the PIREP team calculates 330 Gg. This minor 2% difference suggests that the methodologies used by PIREP and the earlier PICCAP team give comparable results.[5]

Table 2-9 – CO_2 Emissions from Petroleum Fuels (1994)

Fuel Type	Fuel Imported (Kilotons)	Apparent Consumption (Kilotons)	Apparent Consumption (Terajoules)	Actual CO_2 Emissions (Gg CO_2)	Percent of total (%)
Gasoline	16.25	16.25	728	49.95	15.48
Jet A1	4.8	3.3	147.15	10.42	3.23
Other Kero	3.62	3.62	162	11.53	3.57
Diesel Oil	76	76	3293.08	241.47	74.86
Lubricants	2.2	2.2	88.42	6.45	2
LP Gas	0.94	0.94	44.47	2.78	0.86
Total	*103.81*	*102.31*	*4463.12*	*322.6*	*100.0*

Source: *First Solomon Islands Communication to* UNFCCC (draft; to be submitted, undated)

Notes: Based on UNFCCC top down approach Gg = gigagramme = 1,000 t

Assuming no major investments in the next decade in energy efficiency or indigenous energy, petroleum fuel imports to the Solomon Islands are estimated to grow at an AAGR of about four percent, except for distillate for electricity use, which is assumed to increase at 5.2% (consistent with JICA demand projections for SIEA). The 1992 PREA exercise, with an order of magnitude more resources than PIREP, was not able to predict growth in energy use particularly well and it is unlikely that this exercise will be more accurate; projections which follow are thus meant to be indicative only.

Table 2-10 – Petroleum Demand and GHG Emissions in 2001/02 and Projections for 2011/12

Product	2001/2002			2011/2012			
	KL imports (estimate)	**Share** (%)	**GHGs** (Gg CO_2)	**KL sold** (projected))	**Share** (%)	**AAGR** (%)	**GHGs** (Gg CO_2)
Gasoline (Motor spirit)	17,600	21.3	44.0	25,050	21.2	4	62.6
Jet fuel	4,081	5.1	10.6	6,040	5.1	4	15.7
Kerosene	3,356	4.6	9.4	4,970	4.2	4	13.9
Distillate (ADO	51,835	67.8	140	80,880	68.4	4.55	218.4
Aviation gasoline	347	0.4	0.8	364	0.3	4	0.8
Liquid Petroleum Gas	975	0.8	1.6	1,022	0.8	4	1.6
Total	*78,194*		*206.4*	*118,326*		*4.23*	*313.0*

Source: 2001/02 imports from Table 2-2 (Statistics Office, GoSI, 2003); 2011/12 imports are mission estimates

Notes: CO_2-equivalent emissions for various fuels and conversion of LPG from T to KL are from data of conversion table.
Distillate growth (45% for electric power; 55% other) is 4.55% growth
GHG emissions assume that all fuels imported during a year were consumed during the year; ignores lubes.

Because of data gaps, considerable inconsistency in existing fuel and power sector data, and the difficulty in choosing a representative recent base year during a period of conflict and economic collapse, in Section 2.2 an average of 2001 and 2002 fuel imports were used to estimate patterns of energy consumption by sector. The same baseline is used in Table 2-10.

[5] This was checked primarily because the draft UNFCCC communication from the Solomon Islands (Table 2-9; GoSI, undated) shows 1994 imports of petroleum fuels (minus re-exports) of 102 KT which is nearly double those provided to the mission by the GoSI (Table 2-1; Statistics Office, 2003): 68.2 KL (55.4 KT). The lower level of imports would reduce 1994 CO_2 emissions to about 180 Gg.

Under the assumptions used, CO_2 emissions would increase from 206 Gg in 2001/02 to 313 Gg a decade later, a 52% increase.

As discussed in the next chapter, the Solomon Islands has very significant potential for commercial energy production from renewable indigenous resources, primarily the development of its hydropower and biofuels to displace diesel fuel. Ignoring promising technologies that are very unlikely to be commercialised in the next decade or so -such as sea wave or ocean thermal energy -Table 2-11 provides indicative estimates of the potential and their associated GHG reductions.

Table 2-11 suggests that in principle, the Solomon Islands could reduce CO_2 equivalent GHG emissions by 122 Gg per year within a decade, about 58% of current emissions or 39% of projected emissions by 2011/12. About 91% of GHG reductions ate from renewable energy and 9% from energy efficiency measures. This indicative estimate is based on proven technologies and known resources but does not consider economic, financial, political, social, technical, environmental or other practical constraints. The bulk of the potential reductions would come from biofuel and a small amount of the available hydro resource. Even a large solar PV or wind energy programme would provide very little in GHG reductions. The basis for the above estimates is discussed in the next chapter.

Table 2-11 – Indicative Energy Production in Solomon Islands from Renewable Technologies

Technology	Potential power or energy savings	GHG reductions (Gg) [1]	% of total savings	Comments
Hydro (>1 MW) [2]	About 25 MW	31 Gg for all hydro	25	Less than 10% of hydro potential. See note 2
Hydro (0.1-1.0 MW [3]	About 6 MW			See note 3
Hydro (< 100kW)	About 0.6 MW			See note 3
Geothermal	Over 10 MW	n/a	0	Potential is far from centres of demand
Biofuel	28 ML diesel equivalent	75	61	Coconut oil (assumed to be for transport)
Other biomass [4]	Assume 1 MW	< 2	< 2	Could be much higher
Solar PV [5]	30,000 SHS; 500 others	≈3	≈ 2	Generally good solar resource
Wind [6]	1 x 250 kW minimum	<< 1	<< 1	Wind speeds appear to be low in Solomon Isl
Efficiency (electrical) [7]	2,350 KL of ADO	6.3	5	10% of ADO used for electricity
Efficiency (transport) [8]	1,250 KL of motor spirit and 465 KL of ADO	4.4	4	5% of ground transport fuel use by 2013
Total		*≈ 122*	*100*	

Notes on assumptions used:

1) **General**. 1 Gg of GHG emissions = 1,000 tonnes. < = 'less than' << = 'much less than' ≈ = approximately

2) **Hydro**. Honiara peak demand (Figure 2-7) is unlikely to exceed 16 MW in next decade. Assumes SIEA and others can absorb 25 MW

3) **Small hydro**. Assumes about half of mini potential identified by JICA (Table 3-2) is developed and all of the micro potential. Assumes hydro (not base load except Komarindi) replaces 60% of fuel currently used for power generation for electricity generation: 60% of 19.4 ML = 11.6 ML or 31 Gg of CO_2.

4) **Biomass**. Assumes), 0.93 kg CO_2 / MWh. At 2,000 MWh/yr, this is 1.86 t of CO_2 equiv. Most is CO_2 reduction.

5) **PV**. About 60,000 rural households. Assume 30,000 systems of 100 Wp & 0.25 kWh/day plus 500 larger (school, health, etc.) systems at 1.0 kWh/day. Assume 300 days/yr operation = 2.55 million kWh/year. At 0.5 l/kWh for small diesel systems, this would displace 1.28 ML of fuel, equivalent to only 3.4 Gg per year.

6) **Wind**. Assume average output of 50 kW for 2,000 hour/year or 100,000 kWh. If this replaced small diesel system (0.5 l/kWh), fuel savings are 50,000 l/year or 135 tonnes of CO_2 displacement, less than 0.14 Gg per year.

7) **Efficiency** (elec.). There are large supply side inefficiencies in electricity production and some demand-side opportunities. From Table 2-2, 44% of ADO is for electricity: 44% x 80,880 = 35,588 KL so 10% is 3,559 KL. However, hydro and biomass displaces 34% of ADO used for electricity (33 Gg /[44 x 218.4]) so only 66% of this fuel saving will reduce GHGs. 66% of 3,559 = 2,350 KL

8) **Efficiency** (transport). Vehicles in the Sol Islands are badly maintained and inefficient to operate. 5% of motor spirit = 0.05 x 25,050 = 1250 KL, equivalent to 3.1 Gg Transport accounts for 46% of ADO use. 46% x 80,800 = 37,200 KL. If all biofuel (28,000 KL) is used for transport, then only 25% of the fuel savings would result in GHG reductions.). The fuel savings are 5% x 37,200 KL = 1860 KL of ADO. 25% of this, or 465 KL, would result in reduced GHGs of 1.3 Gg. Total GHG reductions are 3.1 (motor spirit) + 1.3 (distillate) = 4.4 Gg

3 POTENTIAL FOR RENEWABLE ENERGY TECHNOLOGIES

The technical potential for energy production from renewable energy technologies (RETs) from local renewable resources in the Solomon Islands is considerable. However, in practice much of this potential is far from demand and cannot be readily exploited. Much has not been accurately assessed. Indications of technical potential are nearly meaningless as estimates of short-term practical options. Nonetheless, there is considerable value in estimating the potential resources and associated technologies for geothermal, hydro, ocean based energy, wind, solar and biomass for liquid fuels (coconut oil) and combustion (forest resources). These are discussed below.

3.1 Geothermal

The Solomon Islands has many hot springs and there are indications of possibly exploitable geothermal resources in a number of locations. Although no systematic assessment of geothermal energy potential has been carried out, there are surface geothermal manifestations in at least at four locations the Solomon's archipelago: West Guadalcanal, the Paraiso field in the Ngokosoli river valley of Vella Lavella, Simbo Island, and Savo Island.

On West Guadacanal, 40 km north-east of Honiara and 5 km island from the sea, there are four known thermal areas: Nggurara, Kunjuku, Saikotulu and Koheka. Another resource in Paraiso Bay on Vella Lavella Island, with surface temperature up to 99^{o}C, considerable outflow and a geothermometrically calculated equilibrium temperature of 160^{o}C, appears to be suitable for power generation. A shallow temperature survey by the UK Institute for Geological Studies in 1979 indicated power potential at Paraiso field of about 10 MW (WB & UNDP 1983; WB et al, 1992 and SOPAC 2002). However, the absence of a nearby market for electricity, with the exception of the capital city of Honiara, means that exploitation of geothermal resources is unlikely to be practical for some time.

In 2002 SOPAC, in collaboration with the US Geothermal Industries Corporation (USGIC) prepared a funding proposal for carrying out further assessment of the geothermal resource in five Pacific Island Countries (SOPAC, 2002), including the Solomon Islands.

3.2 Hydro

Many of the islands of the Solomons are large, high, and volcanic and have heavy rainfall. There is substantial potential for electricity from hydro resources on at least seven islands but efforts to evaluate the resource have been limited. However, adverse geological conditions make the construction of dams and the impoundment of water in storage reservoirs technically difficult and expensive. The most practical option is generally run-of-river hydro. As the firm capacity of run-of-river schemes is determined by minimum dry-season river flows, their main benefit is saving diesel fuel rather than providing firm generating capacity (WB et. al., 1992). A key exception is the Komarindi scheme on Guadalcanal, which SIEA would like to develop with a storage reservoir for base load operations.

Plans to develop hydropower to supply Honiara date to 1966 with a proposed Lungga river scheme. The site was investigated in detail but planned development ceased in 1981 when it was found that the 20 MW planned project would be too expensive. Numerous alternative hydro sites to serve Honiara have since been explored, including the Matiniko, Choroa, and Itina rivers, and most recently the Komarindi. In 1990, the ADB provided US$1.3 million in technical assistance toward a detailed design study for a 6.6 MW Komarindi hydro scheme but the project was never developed. There have been recent discussions regarding a 20 MW

hydro scheme at Lunnga, in part to serve the needs of the Gold Ridge gold mine, if and when a decision is made to re-open it.

In the 1970s and early 1980s, hydro schemes were also considered for other locations including a 360 kW Fiu river project serving Auki on Malaita, a 25 kW Manawi scheme on the Rarinikera river in east Malaita, and a 200 kW Puepue scheme on San Cristobal. Mini-hydro[6] schemes were considered near Poitete (Kolombangara), Graciosa Bay (Nendo) and on the Malin, Manakwai and Kwaitoa rivers of Malaita (WB, 1983). Noting the host of hydro sites under consideration, the 1983 WB mission recommended a comprehensive hydro survey to more accurately establish the potential. The GoSI accepted the recommendation and a UNDP-funded hydropower advisor was engaged from mid 1987 to compile a hydro potential database at the Ministry of Natural Resources (MNR). Hydrological (stream gauging and rainfall) data collection equipment supplied under the Lomé II regional energy programme supported the database work. The equipment, supplied in early 1985, performed poorly and was subsequently severely damaged by cyclone Namu in 1986 but new and improved equipment, installed in 1988, provided valuable hydrological data.

The GoSI database, which has been used in more recent studies, included limited technical data on about 100 sites that had been reviewed by various agencies. Table 3-1 summarises information on 62 selected sites with an estimated capacity exceeding 11 MW. The JICA-funded *Master Plan Study for Power Development in Solomon Islands*, carried out in 1999-2000 (with some reporting delayed until 2001), identified nearly 330 MW of hydroelectric potential on seven islands. This is summarised in Table 3-2 below. Note that 73% of the total potential is reportedly on Guadalcanal, possibly because the resource has been more thoroughly investigated on the island with the bulk of national electricity demand.

Table 3-1 – GoSI Hydro Database (1990)

Province	Number Of sites	Estimated capacity (kW)
Malaita	24	4,300
Western	8	200
Temotu	2	n/a
Makira	7	750
Central Islands	1	n/a
Choiseul	3	n/a
Guadacanal	10	> 5,000
Isabel	7	800
Total	*62*	*> 11,050*

Source: Paul Fairbairn, SOPAC, March 2004

Table 3-2 – Potential Hydroelectric Power Identified by JICA (2000)

Island	Number of Sites	Output in kilowatts:			Total (kW)	% of total
		Micro	Mini	Small		
Guadalcanal	49		1,210	236,100	237,310	73%
Malaita	23	90	2,700	28,000	30,813	9%
Santa Isabel	6		610	4,100	4,710	1%
New Georgia	23	320	4,840		5,183	2%
San Cristobal	12	20	371	25,500	25,903	8%
Choiseul	15	140	2,030	20,030	22,215	7%
Santa Cruz	2	50	260		310	<< 1%
Total	130	620	12,021	45,530	326,444	100

Source: Table 5-1: Result of Hydropower Map Study (JICA, 2000)
Note: Micro <100 kW; Mini 100-1,000 kW; Small > 1,000 kW; << = 'much less than'

[6] Although classification can be vague and sometimes seems arbitrary, the following range is often used: picohydro for output below 1 kW, microhydro for output below 300 kW, and minihydro for output greater than 300 kW but less than 2 MW. Note that this differs from the JICA definitions in Table 3.1.

3.3 Ocean Based

Although the Solomon Islands is surrounded by oceans, no use is made of ocean based energy technologies (OTEC, tidal or wave energy) and there is limited knowledge of its potential. This is unsurprising as ocean energy technologies are yet not commercially available, proven technologies.

Although the sea wave energy potential of the Solomon Islands has apparently not been assessed, Oceanor of Norway monitored nearby Fiji and Vanuatu in the early 1990s, through a Norwegian Agency for International Development (NORAD) funded regional wave energy resource assessment (SOPAC, 1993). The aim was to map the resource (wave height, wave periods and wave energy), through data buoys moored off the shores of various islands. Table 3-3 shows some results. For Vanuatu, for example, the estimated annual average wave power is 14.4 kW per metre of wave front from buoy measurements and a range of 9-20 kW/m based on Geosat satellite altimeter calculations. Presumably, the results for the Solomon Islands would be similar. For a location producing 10 kW/m, assuming 25% conversion efficiency, it would require 0.4 km of wave front for an average annual output of 1 MW. If the technology to tap the energy of sea waves were commercially available and economically viable, the Solomon Islands could produce much of its electricity from a few relatively small plants.

Table 3-3 – Estimated Sea wave Potential in Melanesia (kW/m)

Technique	Fiji	Vanuatu
Buoy	22.9	14.4
Satellite	6-24	9-20

As far as the mission could determine, there has been no measurement of deep sea versus surface ocean temperatures to enable estimates of near-shore ocean thermal energy (OTEC) potential. Despite frequent announcements of new sea wave and OTEC prototype projects, it is highly unlikely that the Solomons or other PICs will deploy ocean energy technologies for the next decade or so.

3.4 Wind

There are no data available which would allow an assessment of the likely wind energy potential of the Solomon Islands. The Forum Secretariat's Southern Pacific Wind and Solar Monitoring Project, which measured wind speeds in a number of PICs in the mid-1990s, did not include the Solomon Islands. It is nonetheless evident that the variable wind regime of the Solomons, together with the need to design equipment for typhoon conditions, will make wind energy a relatively costly option. Given the low level of demand for electric power outside Honiara and the provincial centres, there is unlikely to be a significant role for wind energy in the near or medium term future (WB et al, 1992).

3.5 Solar

Since the Solomon Islands lies near the equator, it is in a favourable geographical location for year-round solar energy application. Insolation is relatively high. Records for the period 1987-1989 give an average annual total insolation of 6,600 MJ per m^2 of horizontal surface for the Henderson Airfield site on Guadalcanal. Comparable insolation data were not available for any other island a decade ago (WB et al, 1992) and are not available today. A 1992 Solarex world map gives design insolation values of 5 kWh/m^2/day and higher for the Solomon Islands, among the highest in the South Pacific (Solarex, 1992).

3.6 Biomass

The Solomon Islands, is heavily forested. Until the period of unrest, timber sales provided 50% of government export revenues and 20-30% of total government revenues. The forest and timber sector, which included 19 logging companies, was the nation's biggest employer.

Despite an obligation for logging companies to process and sell 20% of their licensed volume as sawn timber or processed products (locally or for export), the level of downstream processing has been very small. Uncontrolled and destructive logging has been a longstanding problem, which contributed to the tensions. As documented by the United Nations (CCA, UN, 2002), landowner mistrust of the government and logging companies, political interference, and a history of alienation of land from customary control (in practice if not in law) for the planting of long-term crops such as coconut, suggest that large scale use of biomass for energy, particularly involving replanting, may be difficult even where apparently technically and economically viable. In this context, it is not easy to delineate the available biomass energy resource.

Timber production (round wood logs exported and converted locally) remained at around 350,000 m^3 during the 1980s but accelerated in the early 1990s. Log production peaked in 1996 and 1997, with extraction rates estimated to be at least 730,000 m^3 and perhaps over 800,000 m^3. The ADB estimated that the 1997 level of log harvesting was two to three times the sustainable yield from the remaining natural forest (Fleming and Blowes, 2003).

Palm oil and copra are major agricultural commodities. Solomon Islands Plantations Limited (SIPL; formerly part of the Commonwealth Development Corporation, CDC) operated a palm oil plantation between 1973 and June 1999, when it closed down due to the tensions. Lever Pacific Plantations Limited (LPPL) operated coconut plantations on Gua and on Russell Island but sold its plantations and withdrew from the SI in 1996.

Copra production accounted for half of the value of total exports in 1970 but by the 1990s, its contribution to export earnings dropped as timber, fish, palm oil and cocoa exports became more important. By 1999 copra's role as an export commodity had reduced to three percent. Nonetheless, copra remains important to the village economy. As Table 3-4 shows, nearly half of households outside Honiara continued to trade in coconuts in 1999.

Table 3-4 – Households trading in Coconuts (1999)

Province	%
Choisel	65
Western	56
Isabel	55
Central	47
Rennell-Bellona	40
Guadalcanal	46
Malaita	35
Makira-Ulawa	59
Temotu	56
Solomon Islands:	
including Honiara	*43*
excluding Honiara	*47*

Source: report of 1999 census

Total household copra production achieved an historic high in 1985/86 of 42,000 metric tonnes (MT), declining to between 20,000 and 30,000 MT during the 1990s. In 1996 the government-owned Commodities Export Marketing Authority (CEMA) purchased Lever Solomons Ltd. and established a subsidiary, Russell Islands Plantation Estates Limited (RIPEL), investing in new equipment for coconut oil. In 1998 CEMA established six small mills nation-wide in joint ventures with provincial governments of Temotu, Makira, Malaita, Western, Guadalcanal and Choiseul (UNDP, 2002). This led to an increase in coconut oil production, which nearly quadrupled between 1990 and 2000, peaking at 10,345 tonnes in 1999, as can be seen from Table 3-5.

Table 3-.5 – Copra and Coconut Oil Production, 1990-2000 (tonnes)

Product	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Copra	34,306	25,133	29,073	29,057	22,500	26,148	21,989	28,679	26,971	23,242	19,004
Oil	2,693	2,717	3,879	4,286	2,827	4,372	3,520	5,399	8,339	10,345	8,553

Source: National Economic Recovery, Reform and Development Plan
Note: Copra production apparently additional to that used to produce oil

During the period of unrest, copra and coconut oil production and export volumes dropped dramatically, copra declining to approximately 4,000 tonnes per year. Financial problems forced CEMA to effectively stop functioning and the CEMA mills stopped oil production in 2001.

There is limited experience in the Solomon Islands, discussed in Chapter 4, with the use of coconut oil on a small-scale as a 'biofuel' which can substitute, alone or as a blend, for distillate for power generation and transport. As noted above, in the mid 1980s, copra output exceeded 40,000 tonnes, sufficient to produce about 27,000 tonnes of coconut oil (29.7 million litres or ML). This is equivalent in energy terms to about 28 ML of distillate. During the past decade, distillate imports to Solomon Islands have generally ranged from about 45-55 ML. In principle, if it returned to mid-1980s copra production levels, the Solomon Islands could displace about half of diesel fuel imports with coconut oil-derived biofuel. This, of course, is unlikely to be practical for a range of technical, economic and social reasons. If palm oil production resumes, this could also be significant source of biofuel, depending on relative value as a fuel and export commodity.

A number of efforts have been made in the Solomons to use biomass to produce electric power, and proposals to use sawmill and agro-industrial waste for power generation have been under discussion since the early 1980s. However, opportunities for economically justifiable uses of biomass fuels for power generation are very limited. The use of palm oil residue, copra, other biomass as sources of fuel for process heat and for electricity production is discussed in the next chapter.

4 EXPERIENCE WITH RENEWABLE ENERGY TECHNOLOGIES

4.1 Geothermal

As described in Chapter 3, there has been limited study of the geothermal resource on Guadalcanal and elsewhere, but no geothermal power has been developed in the Solomon Islands.

4.2 Hydro

The Australian organisation APACE has been a driving force behind micro-hydro development in the Solomon Islands for over twenty years. APACE, its development, and the establishment of the Village First Electrification Programme (VFEP) and the Solomon Islands Village Electrification Council (SIVEC) are briefly described in Annex D.

4.2.1 Government hydro development

SIEA developed and implemented two hydro schemes in 1986 and 1996 respectively. The first, supplying a health centre, a store and several houses was funded by New Zealand Aid and installed on the Malu'u River on Malaita. It has a rated turbine capacity of about 32 kW, a maximum load of about 15 kW, and was closed for some time due to local land disputes. The current status is not known. The second SIEA hydro scheme was constructed in Buala on Santa Isabel in 1996. The 185 kW turbine supplies some 150 kW to a hospital, a school, a store, a fish storage facility and houses. The Buala hydro system was part of a GTZ-funded PIFS- managed project. Experts from the German firm Project-Consult advised GoSI and SIEA on urban and rural power supply, on the siting and planning of small hydro plants, and on the formulation of a rural electrification policy.

Three hydro schemes with a total capacity of approximately 0.5 MW are reportedly currently under consideration, as shown in Table 4-1. A 230 kW hydro scheme under consideration by the GoSI would provide power to the Stuivenberg Rural Training Centre at East Makira to replace existing diesel power generation (Nori, 2004).

Table 4-1 – SEIA Hydro Projects Under Consideration

Island	Makira	Choiseul	Malaita
River	Huro	Sorave	Rori
Capacity	120 kW	70 kW	300 kW

Source: Morgan Wairiu discussions with SIEA, 2004

4.2.2 Non-government hydro development

Religious missions have a history of using small hydro for electrification in the Solomons, as in PNG and Fiji, and their installations pre-date those for village or grid electrification. An example is a micro hydro (pelton turbine) plant installed in 1976 serving a church mission and health centre at Atolifi on Malita. The turbine has a rated capacity of 75 kW and generates about 32 kW. The PIREP team has no information on its status or the extent to which other church organisations have installed hydro plants. It seems likely, however, that others have been built.

The first village-based micro-hydro system was installed in Iriri settlement on Kolombangara Island. The project started with a request to APACE by the community in 1978. Iriri was subsequently surveyed through a small donation from an Australian entrepreneur. The United Nations Industrial Development Organisation (UNIDO) funded design and installation as a pilot project to test the viability of small hydro for stand-alone, community based, energy supply (Silas and Tutua, 2004). APACE managed project funds, designed the system and provided technical advice but the community made the decisions. The 10 kW hydro scheme was completed in 1983 (Bryce, 2004). There were criticisms of the original design (e.g. a

high-maintenance wooden dam and a penstock supported by trees; Figure 4-1) but the Iriri project was perceived locally as being successful, was an inspiration to other villages, and led to micro-hydro electrification in the nearby Vavanga and Ghatere communities on Kolombangara in 1994 and 1997 respectively. All three systems were built with limited funding, have turbines of 10-12 kW capacity and generate 5 kW or less.

Figure 4-1 – Iriri Hydro Penstock

Source: www.apace.uts.edu.au

The Iriri scheme (Figure 4-1) reportedly operated for 20 years, with some lengthy periods of downtime (which is common for village micro-hydro), with minimal outside financial assistance. It is claimed by APACE to have contributed to village development (timber milling, copra processing, plant nursery, community farm, electric tool "lending library" and women's electric bakery). It has required significant penstock maintenance, due to the open plastic penstock being damaged by tree falls and to the need for frequent replacement of the wooden penstock supports. Iriri has not operated since early 2003 following breakage the penstock with no more spares available from the 1983 stock. An upgrade that includes replacing the weir, completely burying the 0.9 km long penstock, and expanding system capacity is expected to be completed by the end of 2004 (Bryce, April 2004; Silas and Tutua, 2004).

The Vavanga scheme has often lacked sufficient water to operate continuously. The turbine tended to wear out belts rapidly, and the design did not allow proper alignment adjustment for the new alternator installed in the late 1990s. It has been down several times when belts were broken and once due to alternator rotor damage. The system has not operated since late 2003. An upgrade, planned for 2004 completion, should double the output.[7]

Figure 4-2
Villagers Constructing Manawai Dam

Source: www.apace.uts.edu.au

The Ghatere scheme has experienced internal and external problems, including inadequate funding, sabotage during the ethnic tensions and a Tsunami that destroyed some of the infrastructure. The 10 kW system has yet to be commissioned (Bryce, April 2004 and APACE, January 2004).

The experiences gained with the first three APACE micro-hydro systems has resulted in more robust and costly designs for four subsequent schemes in Manawai Harbour (Figure 4-2; Malaita, 1997), Bulelavata (New Georgia, 1999), Raeao (Malaita, 2002) and Nariaoa (Malaita, pending 2004). Budgets have been higher, turbo-machinery is better, village representatives were intensively trained for three months and a more rigorous project cycle was developed. As a result, the newer systems have reportedly operated without

[7] The terrain around Vavanga was altered by clear felling by Levers Pacific during the 1970s. The river flows progressively changed during the 1990s, reducing the flow of one river while increasing that of a neighbouring river. The upgrade involves changing rivers, changing turbines, and some penstock and minor electrical change (Bryce, April 2004).

significant problems and produce more electrical output (about 15 kW_e compared to less than 5 kW_e for the early systems). The power available at Manawai has been lower than expected but sufficient for coconut milling, a trade store, a provincial health clinic and school facilities. Bulelavata sells power to a large secondary high school and runs a fish freezer. Raeao is planning an electric copra mill (APACE, 2004). The hydro systems installed with APACE support, all in Western Province or Malaita, are summarised in Table 4-2.

Other communities from throughout the country have expressed their interest in electrification through hydropower with APACE assistance. Those currently under consideration are indicated in Table 4-3 (Adams, Solomon Islands Village Electrification Council, SIVEC; 27 January 2004).

Table 4-2 – APACE-Supported Hydro Development in the Solomon Islands

Location	Year Installed	Turbine capacity	Generation	Funded by	Comments
Iriri settlement (Kolombangara)	1983	10 kW	3-4 kW	UNIDO	Currently (April 2004) being upgraded and extended. Power remains off until upgrade is completed
Vavanga (Kolombangara)	1994	12 kVA	4-5 kW	AusAID + Austr. Citizens	Currently (April 2004) being upgraded and extended. Generation will double.
Ghatere (Kolombangara)	1997	12 kW		AusAID + Austr. Citizens	Not properly installed. Wiring damaged in *tsunami*. Completion awaits local fund raising
Manawai Harbour (Malaita)	1997	50 kW	15-25 kW	ROC	Various economic and rural development spin-offs
Bulelavata (New Georgia)	1999	29 kW	14 kW	AusAID	Only four days of downtime during first four year. Power supply extended to Beulah PSS
Raeao (Malaita)	2002	25 kW	14 kW	ROC	
Nariaoa (Malaita)	Feb. 2004	25 kW		ROC	Not completed

Source: Note: ROC is Republic of China (Taiwan)

4.2.3 Paying for village hydro systems

Communities that seek hydro electrification with APACE support are now required to make a significant financial contribution. There is an initial application fee ($25 but increasing to perhaps $50), a contribution towards a pre-feasibility study[8] ($2,500, about US$388 at the March 2004 exchange rate), and from 2004 an annual SIVEC membership fee of $100 per year increasing to $500 per year when the hydro system becomes operational. They also pay for canoe transport, petrol, food, etc for both pre-feasibility and feasibility study teams and the travel costs for a representative to go to Honiara throughout the process. Finally, they pay for chainsaw hire, fuel, etc. during construction. These are generally major cash purchases that dwarf the initial pre-feasibility contribution.

After completion, the schemes are formally handed-over to the community that then becomes owner and manager and is responsible for establishing and collecting monthly payments towards system upkeep. Monthly tariffs imposed by the various village hydro management committees vary but are always lower than the average cost of kerosene usage locally. In Manawai Harbour and Raeao, the fee is $2 per light per household per month. In Bulelavata, the average charge is about $10 per household per month, more for business users.

4.2.4 Localisation of micro-hydro development

[8] In the 1990s, feasibility studies were supported by a Western Province renewable energy programme, which was free to communities. If the study was in another province, APACE financed the studies. This arrangement changed when the formal status of APACE changed (Annex 5).

The role and contribution of APACE to village electrification in the Solomon Islands has changed over the years. APACE helped establish the Solomon Islands Village Electrification Council (SIVEC), established under an MOU with the GoSI in 1997. SIVEC brings together representatives from communities, NGOs and the GoSI, and has an office in the Ministry of Commerce, Industries & Employment. APACE was renamed APACE VFEG (Village First Electrification Group) in 2000 in order to focus on rural renewable energy, devolve considerable management and decisions to local partners, and transfer fund raising and project submission efforts largely to local entities, such as SIVEC. It assists communities with planning, institutional strengthening and advocacy and provides formal and informal training in micro-hydro systems.

Table 4-3 – Micro-hydro Projects Under Consideration

Province	Location
Malaita	Ladeabu
Malaita	Henbotasi
Choiseul	Kuma
Choiseul	Sorana
Choiseul	Panarui
Choiseul	Bangaraseqa
Choiseul	Lute
Choiseul	Boe
Choiseul	Papara
Choiseul	Posarae
Choiseul	Katurasele
Guadacanal	Komuvaoiu
Guadacanal	Auvavu
Guadacanal	Manekaraku I Kofiu
Guadacanal	Belanimanu
Guadacanal	Vatukulau
Guadacanal	Duidui
Guadacanal	Talise

SIVEC has gradually taken over the earlier steps in the project cycle. It helped manage the Bulelavata hydro project, managed both the Raeao and Nariaoa hydro projects, has developed and adopted guidelines and criteria for community participation, and is advising the GoSI on a village electrification policy, based on community ownership and management. Whether SIVEC can fulfil this function depends in part on funding. It has never received any official budgetary support, struggles to remain in operation and introduced membership fees in February 2004.

4.3 Ocean Based

There has been no experience in the Solomon Islands with sea wave, tidal, OTEC or other ocean-based energy demonstrations.

4.4 Wind

As far as the mission could determine, there have been no installations of wind energy systems in the Solomon Islands.

4.5 Solar

4.5.1 Solar Thermal

Solar water heaters (SWH) have been used in the Solomons for over twenty years. By 1983, several dozen imported SWHs had been installed in residences in Honiara, and in plantations in the central and western provinces. The Solahart distributor (Guadalcanal Electric Co. Ltd.) installed at least 25 units in Honiara; Levers Pacific Timbers installed 10 units at staff residences in Kolombangara and New Georgia. The Honiara Central Hospital, several provincial hospitals and the Mendana Hotel also had SWHs and Solomon Taiyo Limited planned solar water preheating for a steam boiler for a new fish cannery at Noro (WB et al, 1992). In the late 1980s, the Lomé II Pacific Regional Energy Programme funded SWHs for five provincial hospitals (Auki, Buala, Kira Kira, Lata and Gizo). Installations began in 1990, with four systems installed by 1992. Both the equipment and the installations were problematical for a variety of reasons related to quality (Johnston, 1994).

There were problems with the durability of the early SWH units (WB et al, 1992) and by the 1990s interest seemed to have waned. Today SWH is confined to hotels, institutions and

upper income households, mainly in Honiara. At least two companies, (C&I Distributors and Island Enterprises) still sell, install and repair SWHs, the latter selling about 5 units per year. The approximate price for a home SWH system is $18,000 (Stevenson, 2004 and Bradford, 2004).

The PREA estimated that there were 50-100 SWH installations in the Honiara area in 1990 at. The PIREP mission estimates that in early 2004, there are about 100-150 systems. It is not known how many are in working order. A 1987 Honiara household energy survey, undertaken by the UNDP/ESCAP Pacific Energy Development Programme (PEDP), showed that less than 10% of households used more than 18 litres of hot water per day for non-cooking purposes. This low level of hot water use suggests that the market for solar hot water heaters in the residential area may be limited (Wairiu, 2004).

4.5.2 Solar Photovoltaics

In the 1970s and 1980s, some church missions switched from diesel generators to photovoltaic (PV) lighting with kits purchased from Guadalcanal Electric Co. Solomon Telekom began using solar PV to power radio transceivers and repeater stations in the then-expanding rural telephone network (WB et al, 1992). The 1984-1994 Lomé II regional energy programme financed six Electrolux PV refrigeration systems for provincial health clinics. The refrigerators were supplied in the late 1980s but the first four units were not installed until late 1992, due to the late withdrawal of the Ministry of Health from the project, which left the Ministry of Natural Resources (MNR) responsible for installation and maintenance although no local funds for installation had been allocated. One system was kept at MNR and one was never installed due to a continuing lack of local funds. The four PV refrigerators that were installed apparently broke down shortly after installation and were not repaired (Johnston, 1994).

In 1997 and 1998, the Solar Electric Light Fund (SELF) of the USA and its local NGO partner, the Guadalcanal Rural Electrification Agency (GREA) provided solar home systems (SHS) to 46 homes and a school in Sukiki, Guadalcanal and to 65 homes, a school and several churches in Makaruka, also in Guadalcanal. During the unrest, the GREA office was burned down and many of the SHS were destroyed. In Sukiki about half the systems are estimated to be still operating. In Makaruka perhaps 20% remain in working order. Solar systems were also installed by SELF at seven rural houses in Gatokiae, Western Province and at four rural health clinics on the island of Santa Isabel. Now that ethnic tensions have eased, SELF and GREA plan to refurbish the Sukiki and Makaruka projects and expand solar electrification to rural health clinics in Temotu Province. Annex 5 provides more details on SELF's PV efforts in the Solomon Islands.

Discussions with private entrepreneurs in early 2004 showed that the share of solar energy equipment sales in their business is typically very small. The primary business of C&I Distributors and Island Enterprises is the sale of general electrical goods, hand tools, furniture and chemicals. C&I stopped selling PV systems in 1986. Island Enterprises saw a drop in sales from approximately 15 PV systems per year in the late 1980s and early 1990s to only three systems per year now. Cruz Communication sells solar equipment only as components of HF radio kits (Bradford, 2004; Stevenson, 2004; Richardson, 2004).

One company, however, deals solely with solar PV. Willies Electrical and Solar Power offers four brands of PV modules (Sharp, BP, Photowatt, Unisolar) from two Australian suppliers (Rainbow Power Company, NSW and Choice Electronic, Brisbane, Queensland). Willies has sold, or has confirmed orders for, approximately 200 systems since starting business in July 1998. Customers include churches, health clinics, schools, marine users for navigational aids, and a few private persons such as private resort operators. The equipment is usually funded by aid agencies. Through AusAid, the Ministry of Health bought about 50 PV systems from Willies for installation at rural health centres. Consisting of a light, a dryer, and a microscope (all converted to 12 volt DC operation), they are used to test blood samples for malaria infection and were installed in the third quarter of 2003 (David Iro, 2004; Stacey Greene, 2004). With funding from the European Union (EU) Micro Projects Programme, solar powered water pumps were installed by Willies at Vatu Rural Training College and Biakapu village in 2002 and 2003 respectively (Vaisekavea, 2004). The Willies director, David Iro, also provides training in technical aspects for PV. For a short time in 2004, he was assisted by a British Executive Service Overseas (BESO) volunteer for development of training materials.

Figure 4-3 – David Iro in his Willies PV workshop

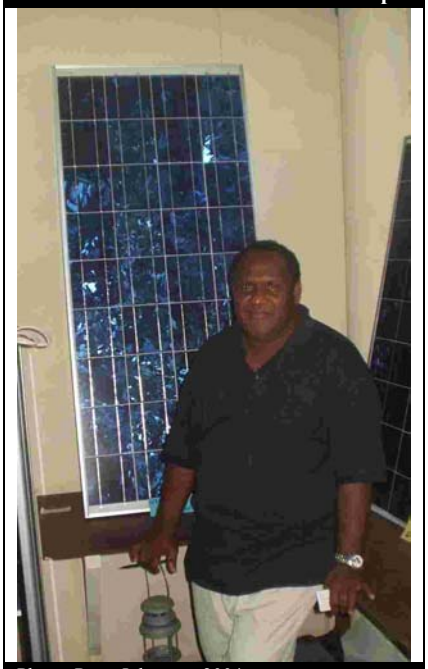


Photo: Peter Johnston, 2004

Solomon Telekom has solar PV operated radiotelephones in almost all provinces, with most systems located in Western and Choiseul provinces. They use equipment imported from Australia. Its largest solar powered unit is a repeater station on Ngella Islands having 1,600 peak watts (Wp), using twenty 80 Wp panels (Robinson, 2004).

4.6 Biomass

4.6.1 Fuel wood

As noted in Section 2.2, estimates derived from the 1999 census suggest that the great majority of Solomon islanders cook with wood (Figure 4-4), consuming about 311 million kg in 2000. There are no records of fuel wood sales in the urban areas of Honiara, Auki and heavily populated parts of North Malaita and some atolls. Elsewhere people gather wood from their own lands or nearby forests where resources are plentiful. On Malaita, mangroves are being destroyed as wood is used for cooking. There is reportedly no replanting at present (Wairiu, 2004; Waleanisia, 2004).

Figure 4-4 – Typical Wood burning Oven, Honiara with PIREP national consultant & coordinator

Photo: Peter Johnston, 2004

There is little good-quality fuel wood remaining in the vicinity of Honiara, which has forced prices up. Over the last six-twelve months, the price of firewood in Honiara has tripled, making the fuel too expensive for many Honiara residents, often restricting wood use to weekend meals.

A few[9] Honiara residents have turned to sawdust, which can be gathered at no or little cost from sawmills, as an alternative. Sawdust stoves can be bought for $60 (small model) or $100 (large model). Voice Belong Mere Solomon (VBMS; a women's NGO) trains women to make sawdust stoves and produce fuel from coconuts to substitute for expensive kerosene. In the past, VBMS and other NGOs (Foundation of the Peoples of the South Pacific, FSP) and the Solomon Islands Development Trust, SIDT) trained woman in charcoal production in earth kilns (Teakeni, 2004). VBMS plans to develop a new charcoal stove, although past charcoal and charcoal stove programmes in the Pacific Islands region have not proved to be sustainable or popular.

In the late 1980s, the Lomé II Pacific Regional Energy Programme funded the installation of 28 imported wood-fuelled stoves (large water boilers suitable for cooking root crops at institutions) for reducing fuel wood consumption at ten boarding schools. Although the stoves arrived in Honiara in October 1990, an MOU wasn't signed by the GoSI until October 1991. Most stoves were installed during 1992 and used successfully for some time. Their current status is unknown.

In the Ranadi industrial estate near Honiara, at least four sawmills and furniture factories (Timol Enterprises Limited, Hocking Construction Limited, Fletcher Kwaimani Construction and Cruz Marketing) generate a considerable volume of wood waste that is, or can be, used as household fuel. At the Ranadi rubbish dump, and along the roadside, large piles of sawdust were seen smouldering or left to rot. This could indicate that there is little interest in using sawdust (for fuel, as floor mats, for chicken production or as garden mulch) but may also indicate that it is offered for sale at a price which is considered too high by prospective buyers, or that disposing of it in an orderly manner is considered too expensive. This issue was not explored further.

Hocking Construction and Joinery (HCJ) Ltd. plans to produce sawdust briquettes, using an Italian briquetting machine, for sale as fuel in local or export markets. HCJ estimates that 6,000 m^3 per year of sawdust and shavings is available in the Honiara area (HCJ, 2004), sufficient to provide the fuel wood needs of about 20% of Honiara's wood-using households.[10]

Village plantations or family forests, often less than one hectare, are developing rapidly in the Solomons with annual plantings exceeding 2000 ha in 2002 and projected to continue at 1,000 ha per year. Future wood flows from village plantations, industrial plantations and re-growth forest are each projected to contribute about a third of the national log harvest. Industrial plantations are reaching maturity and will increase timber production from 120,000 m^3 currently to 200,000 m^3 by 2020 (National Economic Recovery, Reform and Development Plan, GoSI, 2003). The increase in plantation forestry should increase rural income with less use of virgin forest for log extraction. The off-cuts from forest plantation harvest could provide a good source for fuel wood (Wairiu, 2004).

4.6.2 Biomass power

Although opportunities for economically justifiable uses of biomass fuels for power generation are very limited, biomass has been used to produce electric power on a small scale and proposals to use sawmill and agro-industrial waste for power generation have been under

[9] The mission has no data on the number of sawdust users but estimates that not more than 50-100 households use sawdust as their main cooking fuel.

[10] Assuming a specific density of 300 kg/m^3, 6000 m^3 equals 1800 tonnes. If a household uses 15 kg per day, or 5.5 tonnes per year, this would suffice for 329 households or 19% of Honiara households that use wood as their main cooking fuel.

discussion since the early 1980s. These include a proposed biomass power station near Honiara, and a prototype gasifier using charcoal from sawmill wastes in Batuna.

In 1983, a study recommended constructing a 4 MW biomass power station at the Lever Brothers coconut plantation at Tenaru, 15 km east of Honiara. It was to use oil palm residues, coconut shells and husks, logging wastes from forests, sawmill wastes, etc. Changing circumstances led to a project revision and abandonment in 1987. In 1991, SIPL considered constructing a 2.5 MW steam power plant, which would feed surplus into the SIEA grid, fuelled by the palm oil shells and husks. Since 1973, SIPL had generated steam and electricity from a smaller biomass system. The larger project never materialised.

As part of the Lomé II regional energy programme, a biomass gasifier for power generation was tested at the Batuna sawmill on Vangunu Island in Western Province. It had a nominal electrical output of 15 kW using charcoal as fuel (WB, 1992). Operating results were poor and it is understood that the unit did not function for more than a year or so. The use of gasifiers in combination with combustion systems such as boilers, kilns, dryers, and heaters (staged combustion burners) for heat generation, commonly used on estates in Papua New Guinea, has never taken off in the Solomon Islands.

4.6.3 Biogas

Biogas, a gaseous fuel mixture of methane (CH_4) and carbon dioxide (CO_2) produced as organic matter decays in the absence of air, can be produced from animal dung. In the 1970s, a number of small anaerobic biogas digesters were built in the Solomons at small piggeries, with the assistance of the Secretariat of the Pacific Community (SPC). Under the Lomé II regional energy programme, a larger biogas demonstration system planned at Tambea piggery, initially to use the waste from 800 pigs, then 1300 pigs and enlarged again to 2000 pigs. Despite high costs and possible design deficiencies, the GoSI decided in 1985 to proceed. However, all tenders were well above the budget (Euro 136,000) and the project was cancelled in 1988 (Johnston, 1994). Biogas can also be produced from municipal waste landfills, but the modest volumes of waste per capita, and the poor state of the Honiara landfill, make it unlikely that a landfill-based energy generation project would be economic.

Most livestock in the Solomons are pigs and poultry, with cattle a recent introduction into the subsistence sector. The collection of manure from these animals for biogas is generally impracticable without stall-feeding. Biogas technology is therefore not a realistic option in the Solomon Islands at any appreciable scale, in the near or medium term future.

4.6.4 Biofuel derived from coconut oil

In Section 3.6, it was noted that the Solomon Islands could potentially produce enough coconut oil as a fuel to displace over 25 million litres of distillate. In addition to CEMA there are other small-scale coconut oil producers including the Western Coconut Oil Company (WCO), Solomon Tropical Products Limited (STPL) and others using Tinytech expelling technology, and village communities using Direct Micro Expelling (DME^{TM}) technology.

SIEA, with financial support from AusAid and New Zealand Aid, tested pure coconut oil in an old 80 kVA high-speed Perkins diesel engine at its Lata power station in Temotu Province in 2002 and 2003. By early 2004, SIEA had not yet formally reported results. However, SIEA informally reported on two test runs. During the first, the fuel flow rate was problematic due to insufficient pre-heating. During the second run, conducted over a two-week period in October-November 2003, problems were experienced with clogging filters, which led to engine shutdown every 4-5 hours. Testing was stopped when SIEA ran out of filters (Wairiu, 2004; Daka, 2004; Greene, 2004) but SIEA feels that the problems were not serious and

could easily be overcome. SIEA remains interested in coconut oil as a fuel for remote sites, noting that coconut oil at Lata cost $2.5 per litre compared to $4.0 for diesel fuel.

Figure 4 -5 –
Tinytech Coconut Oil Expeller

Photo: Peter Johnston, Honiara, 2004

Tinytech (Rajkot, India) produces small ("tiny") oil mills suitable for crushing all types of oilseeds whether edible or non-edible, producing some 300 litres of oil per day, typically powered by a 10 hp electric motor or a 12 hp diesel engine. Tinytech has sold more than a thousand units across the world, including thirteen to Pacific Island Countries, for copra. Six units have been installed in the Solomon Islands in the last two years or so (Tinytech website, undated). The first unit in the Solomons was imported by Pattson Arish of Mane Brothers, installed and commissioned by a Tinytech technician from India. Two were purchased by a GoSI-owned company and five by STPL, Tinytech's sole distributor in the country (Gopal Desai, Tinytech, 19 March 2004). STPL started operating its first Tinytech oil mill in mid 2003, initially producing up to 300 litres of oil per day, now (with multiple units) up to 3 tonnes of oil per twelve-hour shift. Some oil is used for fragrance, most is sold to a nearby soap factory, and some used as fuel in seven STPL vehicles and in the hydraulic motor that powers the oil expeller. STPL plans to produce 40 tonnes of oil daily by the end of 2004. Over half, the lower quality output, could be used to produce "cocoleen", a diesel-substitute consisting of coconut oil and an additive containing kerosene and other ingredients.

DME technology was developed, and has been promoted, by Dan Etherington, initially with the Research School of Pacific and Asian Studies of the Australia National University in Canberra but, since his retirement, with Kokonut Pacific Pty Ltd. The DME process is designed for very small-scale village producers. It squeezes coconut oil from semi-dried and grated coconuts in a hand-operated press. (The nut drying stage is reduced from several days for copra to about 90 minutes and fuel wood for drying is also reduced dramatically.) No electric power is needed and the capacity is some 30 litres per unit per day, about 10% of the capacity of a Tinytech system. The oil produced is very high grade and suitable for use in cosmetics, cooking or as a diesel substitute (Kokonut Pacific website, undated).

DME was first tested in the Solomon Islands at the rural training centre at Vanga Point, Western Province in the 1980s. Three more units were later installed in outer islands. A proposal for a $2.4 million (about US$320,000) project to install another 25 units in five communities has been submitted to the EU Micro Projects Programme for funding from Sytobex 98 funds. Although initially rejected by the EU as non-viable, the programme may still proceed depending on the outcome of a study underway in early 2004 (Vaisekavea, 2004 and EU, 2003). It is not known how much of the output would be used as a local fuel to replace distillate, which is quite costly and often unavailable in remote communities.

In brief, there have been a few trials of coconut oil, and coconut oil blends, as a diesel fuel replacement in the Solomon Islands, and more are planned but thus far it has been on a small scale.

5 BARRIERS IDENTIFIED IN DEVELOPMENT AND COMMERCIALISATION OF RENEWABLE ENERGY TECHNOLOGIES

This chapter identifies barriers to the development and use of renewable energy technologies (RETs) in The Solomon islands. During the mission, interviews were held with nearly fifty people in and near Honiara, of who over 70% were Solomon Islanders, and the rest foreign businessmen, aid workers, diplomatic personnel or NGO workers based in the country. Twenty-two individuals participated in a half-day workshop to discuss 'strengths, weaknesses, opportunities and threats' (SWOT) regarding the use and development of RETs in the country. The results of the SWOT workshop, at which participants openly expressed a wide variety of opinions, are reported in Annex 3.

The views in this section of the report are paraphrased but come from people in the Solomon Islands, not the outside consultants. Nonetheless the summaries of sections 5.1 through 5.8, which emphasise barriers, also constitute the mission's own conclusions.

It was widely agreed that the Solomon Islands has abundant resources in nearly all provinces which could be developed for small-scale and large scale energy use: hydro, geothermal, biomass and solar in the short-to-medium term, and ocean energy in the long term. There is also considerable enthusiasm for RE and perhaps a surprising degree of optimism for the future. Nonetheless, the main barrier was felt to be the overall prevailing environment: low economic growth coupled with rapid population growth, important national issues remaining unresolved, and a government which is poorly resourced and generally weak.

Some strengths expressed by some individuals were considered to be weaknesses by others. At times, the distinctions between strengths and opportunities, or between weaknesses and threats, were vague. In practice, barriers to RE tend to extend across several classifications. Therefore, the assignments to specific groupings below are to some extent subjective.

5.1 Fiscal

Fiscal barriers to RETs include those for which government fiscal policies (import duties, taxes, charges) raised for public finance are biased in favour of conventional energy or biased against renewable energy.

- The fiscal regime in the Solomon Islands is arguably biased against RETs. Fuel for rural electrification is apparently not exempt from import duty. However, SIEA has received an 18 month exemption from January 2004 from paying duty on distillate, previously $0.22 per litre, which could bias fuel choice against coconut oil or other locally produced biofuels. There is little fiscal incentive to import RETs (e.g. solar PV; 12 volt lights for PV use), which attract an import duty of 20%, the same as electrical equipment in general.
- There are no incentives to promote RE investments through 'green' interest rates, or access to foreign capital for RE through government support.
- There is little knowledge of the impact of large-scale production of coconut oil or other vegetable oils as a biofuel on government revenue (e.g. lost import duty on distillate fuel, loss of potential produce exports, employment and tax revenues, etc.).

5.2 Financial

In early 2004, the GoSI's Energy Division had only three staff, and only five approved positions. Government support was minimal, as is the case for most government offices. During the PIREP team's visit, the power was often off, the phone/e-mail system was not

functioning, and the staff had no transport. The poorly resourced energy office is a barrier to successful RE. In general, however, people felt that sufficient funds were available from donors and others, if they could be channelled where needed and where they could be effective. Lack of finance at a national issue was not identified as a key issue for RE per se. However, in a country with only 9% electrification away from the capital, widespread rural electrification is neither a development priority nor a priority for use of government funds. Financial barriers identified include:

- serious GoSI budgetary constraints affect the implementation of any planned RE project to which the government makes any financial commitment;
- a general financial barrier to RETs is believed to be their higher initial costs compared to conventional fossil fuel energy;
- at the community level, lack of finance has slowed or curtailed micro hydro development in a number of cases;
- where reticulated power is available, self-generators (businesses) have to pay SIEA 50% of the SIEA tariff for each kWh self-generators produce, reducing any financial incentive (to SIEA or private companies) to invest in other energy sources;
- donor funding has been available for various RETs but (reportedly) not for coconut oil as a fuel, despite its potential for both large scale urban distillate replacement and small-scale rural systems; and
- some banks and officials suggest that the land tenure system, with traditional ownership of land that cannot be sold, can act as a serious financial barrier as landowners cannot use land as equity for loans.

5.3 Legislative, Regulatory and Policy

The GoSI has developed drafts of national energy policies and rural energy policies over the past twenty years with assistance from several donors (UNDP, GTZ, JICA) and agencies (PIFS). However, the GoSI has formally endorsed none of these. The lack of appropriate legislation, approved energy policies, guidelines and regulations form a significant barrier to the development of RE.

- There were several drafts of a national energy policy developed since the mid -1980s. The GoSI has formally endorsed none of these; there is no formal energy policy.
- There are no policies and guidelines regarding RE, only drafts.
- The power utility, SIEA, is monopolist in areas that are close to the grid so others complain that they cannot generate electricity even if SIEA is unable to provide it.
- Consumer protection, price control, and fuel storage and handling legislation are out-of-date and ineffective.

5.4 Institutional

Even before the recent period of conflict, there were serious institutional weaknesses at all government levels in the Solomon Islands (except local communities in some provinces). Government institutions generally lack the expertise to foster or develop RE projects. There is no national coordination mechanism regarding energy issues and departments tend not to share information.

- The GoSI Energy Division is seen by many as uncooperative, has not developed any RET projects for years, and has been a serious barrier to RET (which they hope will change with the expected appointment soon of a new Director).
- Despite a formal MOU between the GoSI and SIVEC, the latter's experience and expertise in community micro-hydro development, and the fact that most RET development in the SI has been through NGO efforts, the ministry responsible for energy has reportedly ignored the work of SIVEC and other NGOs.
- According to several NGOs, the GoSI does not understand that community-owned and managed micro-hydro can be more cost-effective than government-supplied rural diesel generation.
- SIEA struggles to survive and fights daily to keep the power system operating. Resources are inadequate and transmission, distribution and regulation are all neglected.
- The GoSI lack the capacity to effectively absorb donor assistance for assistance projects, energy or otherwise.
- The donors are said to (sometimes) have good ideas and willingness to support RE but are far too slow to act and change their priorities too often.
- In some GoSI agencies, regional organisations are seen as unsupportive to the Solomon Islands' energy efforts, inconsistent in their support and genuine barriers for some specific RET efforts.

5.5 Technical

There are no standards to assure that RETs imported into the Solomons are suitable for local conditions. There is a serious overall shortage of technical skills and virtually no industry away from Honiara and Noro. For hydro, geothermal, biomass and solar options, technical issues were not identified as the main barriers in the Solomon Islands, although poor knowledge of the extent of the various resources was cited as a barrier.

5.6 Market

Among the market barriers identified are the following:

- the need for regular, affordable and reliable shipping so copra can be shipped to mills for processing into biofuel;
- a change in the monopolistic attitudes of the GoSI, in order to encourage more competition;
- too much protection for diesel power generation (e.g. SIEA has no incentive to improve, so how can REs compete);
- feasibility studies which sometimes show that a project is technically and financially feasible but with no immediate customers, the project does not develop;
- the 'Foreign Investment Board' is believed by many to provide strong disincentives for anyone to invest;

5.7 Knowledge and Public Awareness

There was no evidence of public awareness campaigns on energy or climate change. These may exist but none of those interviewed mentioned them and none were observed during the short mission.

- There is considerable knowledge on how to produce copra, but limited knowledge on the options for producing coconut oil as a fuel.
- There is reportedly poor access to reports on prior experience in the Pacific region on coconut oil as a fuel (in part because few people in government or outside have reliable Internet access).
- In general, there is little public awareness of RE opportunities and technologies.
- Knowledge of pros and cons of solar PV is very limited in the Solomon Islands.
- No laboratory facilities exist to test quality of biofuels (or petroleum fuels).
- Even where there is a clear government policy, appropriate training does not follow so the knowledge base remains low.

5.8 Other

For those who wish to develop RETs, long-term access to land was considered to be a serious barrier. As elsewhere in the region, traditional landowners are very protective of their rights and it can be very difficult to get access to land for RE, especially if it is believed to benefit government, outsiders, or only a few landowners, or others. In some cases, a few dissident landowners (or those who claim to have land rights) have stymied developments. Public servants tend to be poor at resolving land issues and negotiating arrangements for access to land that are seen to be fair by the owners. Other barriers:

- micro/small hydro projects, if well designed, tend to be relatively benign environmentally. However, at least one hydro project in the Solomons is being redesigned due to changed water flows due to logging practices. If logging remains poorly controlled, this could be a barrier to development of both small hydro resources and biomass energy projects.
- a large share of donor support funds for RE is said to go to expatriate consultants, with very little allocated towards building-up local expertise and capacity; and
- the attitude of ‘give me money’ has become part of the culture and needs to change.

6 IMPLICATIONS OF LARGE SCALE RENEWABLE ENERGY USE

6.1 General Benefits of RE

The large-scale development of SHS for rural electrification should have the positive effects of improved education, health, productivity and better integration of rural areas into the national economy. There would also be some increases in rural employment and training benefits for rural persons. Negative impacts could include problems with management of spent batteries and other failed components, increased pressure on the rural economy for cash to pay for appliances and services and social friction arising from the development of a new 'technical elite' in the villages.

Large-scale development of biofuels could have a very positive economic benefit for rural areas by improving demand for coconuts or other oil-bearing crops and increasing cash incomes in rural areas. However there could be land access problems and constraints due to transport and logistics. There could arguably be increased economic stability due less dependence on imported oil and the variations of world oil prices, and large-scale development of a biofuel processing industry.

The use of wind, hydro, geothermal and solar energy for grid power would have the positive effects of reduced fuel imports that would increase national economic stability and security, broaden the base of energy inputs to the grid. These RETs could also increase the involvement of the private sector in energy delivery. Negative effects would include the need for SIEA, already struggling, to greatly broaden its technical support capacity to include a range of generation technologies.

6.2 Environmental Implications of Widespread Use of Renewable Energy

For GHG emissions and energy production from RETs, Table 2-11 suggests that the biggest impact in the Solomon Islands would come from investment in coconut oil-based biofuels, followed by large-scale hydropower (even tapping only 10% of the estimated hydro potential), followed by small hydro development. Any of these, if poorly planned, could have significant environmental impacts, as discussed below.

6.2.1 Environmental issues and biofuels

It has been assumed that less than half of coconut oil production in the Solomons might potentially be used for fuel, probably far less, so the impact should be no more severe than current coconut cultivation (or oil palm) practices. In terms of use, biodiesel fuels from coconut, oil palm or other vegetable oils are very low in emissions, as they contain almost no sulphur or hazardous materials. In case of spillage to the ground or marine environment, they biodegrade readily and do not cause contamination.

6.2.2 Environmental issues and large hydro (over 10 MW)

The International Rivers Network (IRN), an NGO which lobbies strongly against hydro projects above 10 MW, alleges that major hydro expansion harms: i) efforts to move toward sustainable development, ii) people and ecosystems, and iii) energy security. Among other dangers, they list increased vulnerability to climate change (due to changes in rainfall patterns

and quantities) and the emission of significant amounts of GHG from large reservoirs (due to rotting organic matter)[11] (IRN, 2003).

While some feel that IRN is alarmist, there has been a history of poorly designed and implemented large hydropower developments throughout they world. There can be significant and irreversible effects on surface water, groundwater and other aspects of water transfer within the hydrological cycle during project construction, project operation and maintenance, and decommissioning. In some cases, there are impacts during the planning phase, probably indirect off-site effects as materials are mined or fabricated in preparation for plant construction. For hydropower, the area of influence is very wide, extending from the upper limits of the watershed catchments to the valley below the dam and as far downstream as the estuary and off-shore zones. The most severe direct hydrological impacts are likely to result from the impoundment of water, flooding of land to form a reservoir, and the reduction of water flow downstream. Potential indirect effects can be caused by construction and operation of work camps, access roads, and power transmission facilities, for example soil erosion affecting surface and ground water. The potential hydrological effects of the environment on the dam depend on land and water use in the watershed area upstream of the reservoir. Often relocations of population from the inundated reservoir area can increase pressures within the watershed resulting in changed land use patterns, which increase erosion and subsequently sedimentation in the reservoir. The main hazard risk is a failure of the dam resulting in a sudden and massive flow of water downstream (Johnston, 1994).

The World Bank (1991) lists the following potential, and often real, hydrological impacts of large hydro dams:

- decomposition of trees in flooded land, causing nutrient enrichment in the reservoir and increased water loss through transpiration;
- creation of reservoir dramatically changing water flow (quantity and timing), water quality, and sedimentation within river basin; disrupted water flow to downstream communities, initially with greatly increased sedimentation and later reduced quantities of water;
- loss of wetlands downstream of reservoir;
- sedimentation in reservoir reducing storage capacity and lifetime, reducing nutrient-rich silt downstream, increasing riverbed scouring downstream;
- altered water table upstream and downstream plus resulting salinisation;
- reduced flow of water at times to communities downstream; and
- reduction in fish production (and catches) downstream;

[11] IRN lists 12 reasons to avoid large hydro in three categories. A) A major expansion of large hydro will harm sustainable development: 1. Large hydro does not have the poverty reduction benefits of decentralized renewables; 2. Including large hydro in renewables; initiatives would crowd out funds for new renewables; 3. Promoters of large hydro regularly underestimate costs and exaggerate benefits; 4. Large hydro will increase vulnerability to climate change; and 5. There is no technology transfer benefit from large hydro. B) A major expansion of large hydro will harm people and ecosystems: 6. Large hydro projects have major negative; social and ecological impacts 7. Efforts to mitigate the impacts of large hydro typically fail; 8. Most large hydro developers and funders oppose measures to prevent the construction of destructive projects and 9. Large reservoirs can emit significant amounts of greenhouse gases. C) A major expansion of large hydro will harm energy security: 10. Large hydro is slow, lumpy, inflexible and getting more expensive; 11. Many countries are already over dependent on hydropower; and 12. Large hydro reservoirs are often rendered non-renewable by sedimentation. The source is IRN (with Oxfam and other NGOs, 2003).

- increased pressure on upstream land due to resettlement followed by poor watershed control (agriculture in steep areas, grazing, deforestation,) causing erosion and increased sedimentation in the reservoir;
- deterioration of water quality in reservoir;
- sedimentation at reservoir entrance causing waterlogging and flooding upstream;
- decrease in water for floodplain agriculture. Flood plain salinisation;
- chemical contamination of water during maintenance of transmission lines and towers;
- released water from lower portion of reservoir for power is high in pH, low in oxygen, high in hydrogen sulphide and is cold, all affecting animal and plant communities downstream;
- seismic events causing catastrophic dam collapse with sudden massive water flow downstream; and
- conflicting demands for water uses.

Only one or two sites have been suggested for possible large hydro development in Guadalcanal with reservoir storage; most would, be developed as run-of-river systems, greatly reducing potential impacts. In general, any large hydro developments in the Solomon Islands should be planned, built and operated in accordance with the recommendations of the World Commission on Dams (WCD; available from *www.dams.org* explained in a *Citizen's Guide to the World Commission on Dams*, available from *www.irn.org*).

6.2.3 Environmental issues and small hydro (under 10 MW)

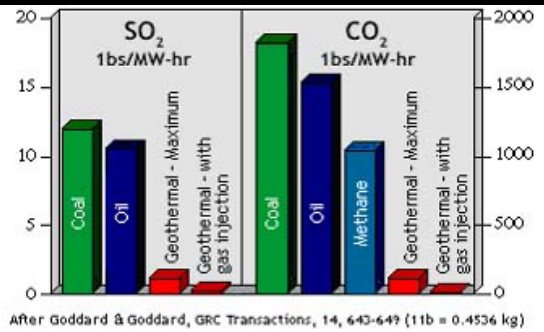
The International Association for Small Hydro, the European Small Hydro Association and the International Energy Agency's Renewable Energy Working Party all define small hydro as less than 10 MW. The IRN says, *"small hydro can, if responsibly implemented, be environmentally and socially low-impact. … To ensure that small hydro projects have low impacts and meet community priorities it is imperative that all small hydro schemes are planned, built and operated in line with the recommendations of the World Bank/IUCN-sponsored World Commission on Dams."* (IRN, 2003).

6.2.4 Environmental issues and geothermal

Geothermal is unlikely to be developed in the next decade in the Solomon Islands as sources are distant from demand. However, this could change through a mineral discovery near a geothermal resource. Also there appears to be a substantial resource that could eventually be harnessed. Although geothermal has not traditionally always been considered renewable (as reservoirs eventually deplete, at least temporarily) or benign (due to hydrogen sulphide – H_2S – and other toxic emissions), it is now considered to be relatively environmentally friendly. Typical emission levels of geothermal compared to other energy sources are shown in Figure 6-1.

According to the U.S Department of Energy *"geothermal power plants easily meet the most stringent clean air standards because they emit little carbon dioxide (fossil-fuel power plants produce roughly 1000 to 2000 times as much), no nitrogen oxides, and very low amounts of sulphur dioxide (SO_2). Steam and flash plants emit mostly water vapour. Binary power plants run on a closed-loop system, so no gases are emitted."* For [plants containing H_2S], the sulphur can be *"separated, dewatered, and recycled as feedstock for sulphuric acid production. Future technology will use microbial processes to extract metals contained in the sulphur, allowing further reuse. At most geothermal hot-water power plants, H_2S is present in such low concentrations that it requires no special controls to comply with environmental regulations. ... A typical geothermal plant requires several wells. Although drilling these wells has an impact on the land, using advanced directional or slant drilling minimizes that impact. Several wells can be drilled from one pad, so less land is needed for access roads and fluid piping."* (US DoE website, undated).

Figure 6-1 – Geothermal Power Emissions of SO_2 & CO_2



Source: www.eere.energy.gov/geothermal/environ_impacts.htm

7 CAPACITY DEVELOP NEEDS FOR REMOVING THE BARRIERS

This chapter examines the capacity development needs of the Solomon Islands. Addressing these may help to remove or reduce key barriers identified in Chapter 5. These are not prioritised. It is not suggested that those listed are necessarily all appropriate for addressing though further GEF support. Many suggestions below do not fit exclusively within one category; issues addressed under, for example, fiscal barriers may be applicable to others. There is also some repetition with similar issues covered under more than one heading.

7.1 Fiscal

Section 5.1 identified several fiscal barriers to the development and commercialisation of RETs including anomalies in rates of import duty, lack of knowledge of the fiscal impact of producing coconut oil biofuels locally, and lack of 'green' interest rates or incentives. Capacity is lacking in several key areas to overcome them.[12]

- **Biofuels**. There is inadequate capacity within government and to a lesser extent the private sector to develop biofuel as a practical alternative to distillate. There is need to develop capacity for technical development, to analyse the effects of large scale biofuel production on government revenue and other financial issues and of the logistics required to develop large scale production and delivery to urban centres for end use.
- **Import duties taxes and energy pricing**. The capacity within the government is limited for analysing the effects of interest rates, import duties, energy prices and taxes on the development of RET measures.

7.2 Financial

Finance capacity does not appear to be a major barrier to RET development in the Solomon Islands except to the important extent that low government budgets are a serious constraint to rural electrification overall – in a country with under 9% electrification excluding Honiara – where rugged terrain in isolated islands means that electrification (and rural services in general) are very expensive to provide. The capacity to develop available – or potentially available – finance for rural electrification is a constraint for all forms of rural development. Some of the capacity barriers identified under 'finance' are discussed in this section, others under other headings.

- **Insufficient capacity to fully develop acceptable project proposals.** Donor organisations today require high quality project documents with clear justification and economic analyses. The requirements for preparation of acceptable project documents for GEF and ADB are complex and demanding. The capacity of both the private sector and government to develop clear, logical and adequate project documents is limited.
- **Micro hydro development.** At the community level some micro hydro projects have been delayed or implemented with mediocre results in part due to a shortage of financial resources within the community. As part of the recommended rural energy policy (see section 7.3 below) there should be clear guidelines on the role of micro hydro, the role of the GoSI in providing financial support or encouraging donor support, and the relationship between the Energy Division, NGOs and the private sector for small hydro development.

[12] Some similar capacity development requirements were found in other national reports. It may be appropriate to develop capacity building projects concurrently in several countries through a regional effort.

7.3 Legislative, Regulatory and Policy

Section 5.3 concluded that the lack of legislation, approved energy policies, guidelines and regulations form a significant barrier to the development of RE. Donors and lending agencies typically expect a clear policy/legislative/regulatory framework to be in place before approving new energy assistance, or sometimes developed as part of this assistance.

- **Energy policy and energy legislation development**. The Energy Division, the Ministry of National Planning and the NGO community does not have the capacity to develop a comprehensive national energy policy and legislation regarding energy, and supporting regulations, that covers the wide range of issues facing the Solomon Islands.

7.4 Institutional

Some institutional issues have been considered in sections above. Others include the following:

- **Electric power sector**. Capacity development should be provided to SIEA staff so it can be directly involved in biofuel capacity development. The development of capacity to develop energy policies (covering both rural electrification policy and the role of RETs) should also include SIEA.
- **Regional Organisations' Capacity Development.** The capacity of the regional organisations and CROP Energy Working Group requires development to enable better provision of effective RET services for the Solomon Islands and the region.

7.5 Technical

Technical barriers were not identified as serious in the Solomon Islands. Nonetheless, there is an absence of accessible and appropriate technical information on which to make energy choices. Some technical matters relate to the suitability of various technologies for use in PICs in general, and can perhaps best be addressed on a regional level.

- **Lack of easily understandable reference materials regarding RETs available in the SI.** Although the Internet has many technical resources for persons wishing to understand RETs, the access to the Internet in the Solomon Islands is not widespread, tends to be very slow and computer literacy is low. Also, the wide range and highly variable quality of information available on the Internet makes it is very difficult for the novice to know which is appropriate to the Solomon Islands. There needs to be developed a local repository of information that can be accessed by anyone wishing to gain knowledge about RETs appropriate to the Solomon Islands, their cost, applicability, operation, maintenance and opportunities for use. The capacity to develop such information at regional and national level needs to be developed.
- **Measuring the RE resource**. The capacity for determining the magnitude of the solar, wind, biomass and small hydro resource is limited. Over the years, the GoSI, NGOs and JICA have examined dozens of potential small hydro sites and should seek donor funds to develop local capacity to assess additional sites that appear to have promise. Capacity for wind resource assessment needs to be developed, perhaps primarily at a regional level. If there are regional efforts to build capacity to assess ocean energy potential, the Solomons should participate but not put its own financial resources into this.

7.6 Market

Market barriers identified as constraints include the lack of regular shipping to most islands and the monopolistic attitude of the GoSI. Incentives for local people to establish businesses

to provide RE services have been discussed and no additional capacity development needs are suggested here.

7.7 Knowledge and Public Awareness

There is a requirement for relevant and practical training for Solomon Islanders in various aspects of RETs for designing, marketing, installing, operating, maintaining, and repair. However, there was no opportunity to assess the extent and effectiveness of the extensive range of RE training already carried out by regional agencies, donors, NGOs others. During 2004, the UN's Economic Social Commission for Asia and the Pacific (ESCAP) is developing an RE training programme, in cooperation with regional organisations, specifically for PICs. No specific suggestions are offered here, except that private sector and NGO staff should be included in RE training. Thus far it has been overwhelmingly concentrated on government officials, who are often not the driving force in RE development.

No studies have been carried out in the region on the effectiveness of awareness campaigns on energy efficiency or renewable energy but studies in developed countries suggest that impacts are generally both very limited and temporary. In the Solomon Islands, it may be appropriate to include materials on energy efficiency and RETs in school curricula but it is probably not an effective use of public funds to prepare public awareness materials on RE unless in association with a specific development project. Capacity development is needed in the following area:

- **lack of information in local languages**. For any RET system installed in rural areas, there should be materials (training, operations, maintenance at least in summary) available in Pidgin but especially in appropriate local languages.

7.8 Other

One of the barriers to RETs most frequently mentioned in the Solomon Islands, and often described as very serious, is access to land initially, and with secure arrangements for the long term. Others included environmental damage caused by poor logging practices and the tendency to provide support for foreign consultants, rather than to build up local capacity.

- **Developing local energy consulting capacity**. The current project, PIREP, included funds specifically to engage local consultants in each country to work with international consultants with mixed results. This is also planned for work undertaken within the PIEPSAP project at SOPAC. This may not be effective unless the government insists on the use of only competent Solomon Islanders as local consultants and pre-consultancy training is provided that focuses on methodology and professionalism.[13]
- **Lack of consistent hydro development procedures**. The Solomon Islands has hundreds of site for potential for small-scale development of hydro but there are no guidelines for assessing their environmental impact or for preparing technical designs that are appropriate for the small size of these installations.

[13] This is *not* meant as a criticism of the local PIREP consultant who performed quite competently.

8 Implementation of the Capacity Development Needs and Co-financing Opportunities

8.1 Capacity Development Opportunities

The following are recommended as specific studies and co-financing opportunities for capacity development.

- **Biofuels.** A study of the impact of the production of coconut oil-based biofuel in the Solomon Islands should be carried out on two scales for displacing distillate for electric power and ground transport: i) 5-30 ML per year commercial level for urban services; and ii) small-scale production for remote islands and communities. The study would consider technical, economic, financial, political, and social issues. It would estimate the effects of various scales of biofuel production on government revenue, including the effect of direct and indirect employment, tax revenues, etc. The report would consider whether it is in the interest of the SI to produce biofuels at various scales and, if so, recommend a strategy to support this development.
- **Import duties and taxes.** In association with local consultants, a study should be undertaken of the rates of import duties and related taxes, exemption policies, and procedures for establishing duties to determine the extent to which there is a bias for or against the development and use of RETs at small scale (rural, small community) and national scale. It would also consider duties and taxes on petroleum fuels and electricity production. The study would recommend changes which encourage the import, possibly assembly, and use of RET, including tools, appliances, monitoring equipment, etc. associated with RETs. It would consider the pros and cons (and legality under treaties, conventions and international obligations) of differential import duties on devices that are energy efficient or use indigenous resources.
- **Energy pricing.** Assisting local officials and the SIEA in the assessment of the extent to which energy pricing biases decision-making for or against RE would be useful. Among the issues to be addressed: i) should SIEA charge a national tariff, or different tariffs depending on local costs, rather than subsidise other consumers through higher charges in Honiara; ii) should a lifeline tariff be introduced (where the first 30 or 50 kWh/m for domestic consumers is cheaper than subsequent usage to benefit low-income users); iii) is it justified for SIEA to impose an extra charge (50% of the tariff) on consumers who self-generate in SIEA's areas of operation; iv) should distillate for power generation (whether used by SIEA, communities or individuals) be exempt from import duties; and v) are there other pricing practices which bias decisions in favour of, or against, RE. The study should, if appropriate, recommend pricing mechanisms that are not biased in favour of conventional energy.
- **Green interest rates.** In association with local consultants, an assessment should be made of the need for, and practicality of, special interest rates, subsidised by the government, for (majority) locally-owned businesses for the establishment of RE services, including design and installation, operation and maintenance, repair and refurbishing, training Solomon Islanders in use of RETs, production of training materials in pidgin and other local languages, etc. If it appears that "green" rates could be a useful incentive, an interest subsidy fund or special government loan arrangements for private RET and EET development should be developed.
- **Land access.** Assistance should be provided to consider options and opportunities for involving landowners as potential partners rather than opponents in the development of RETs, both small scale (for community, health centre, school, etc. applications) and

larger scale (feeding to a grid). There may be a specific opportunity in the Solomon Islands to develop institutional arrangements for hydro that would benefit Guadalcanal landowners, SIEA and operators of a re-opened gold mine.[14]

- **Rural development RE trust fund.** One problem faced by the GoSI, with its limited financial capacity, is the conflicting requirement of addressing serious both urban problems and rural development. There is a tendency to place urban development at a higher priority for the limited available funds. To ensure that funds are indeed allocated for rural development, in particular rural hydro and other RETs, a trust fund specifically for rural development would provide a source of funding that could not be re-allocated for urban development use. The practicality should be assessed and, if viable, funds sought for development.
- **Energy policy development.** Externally funded advisers, working closely with the Energy Division, National Planning and the NGO community, should assist the government to review its drafts of national and rural energy policies, and prepare practical policy documents for consideration by cabinet. These should include strategic plans with activities, timeframes, priorities, and budgetary requirements. [15]
- **Energy legislation.** A range of legislative tools are required: i) Electricity. The *Electricity Act* may need to be reviewed and revised as appropriate. ii) Fuel quality. Legislation should be drafted, as required, on quality and standards of petroleum fuel imports; petroleum product storage, blending, handling and transport; control of emissions and spillage; and disposal of wastes. [16] iii) Fuel pricing. The *Consumer Protection and Price Control Act* should be reviewed and updated to be consistent with current needs. iv) RETs. The desirability of legislation specifically for guiding and monitoring rural RET development should be assessed. There may be a need for legislation to promote, establish and control Renewable Energy Service Companies (RESCOs).
- **Energy Division**. Assistance needs to be provided to the GoSI in clearly establishing the functions, authority, and responsibilities of the Energy Division. If not already done, an up-to-date staffing structure and job descriptions should be prepared and approved at the appropriate level. Where there are MOUs between the GoSI and others (NGOs; private sector) regarding cooperation in energy services, the MOU should be consistent with government policy and the Energy Division should work within the GoSI's policy framework and agreements. Any responsibilities of the Division for coordinating energy sector activities overall, providing information to the public, and acting as Secretariat to a national energy committee, if appropriate, and its relationship to other committees or advisory groups with an energy mandate (e.g. climate change, PIREP, PIEPSAP, etc.) should be assessed. Once these functions, authority and responsibilities are clearly defined, a focused capacity building effort needs to be launched.
- **Development of a public information resource for RETs and EETs**. Financing to develop a library of RET information materials specifically selected and developed for SI

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[14] A design study was carried out some years ago for a 6.6 MW hydro project at Komorindi but landowners reportedly distrust the government, SIEA and the mining company. There are opportunities for all players to win but there is a need for neutral, outside advice to the parties.

[15] The CROP Energy Working Group's Regional Energy Policy and Plan provides a possible template. The DANIDA/UNDP/SOPAC Pacific Islands Energy Policy and Strategic Action Planning project (PIEPSAP), expected to run from August 2004 for three years, is designed to provide this sort of service but may need co-financing to meet specific capacity development needs.

[16] The Forum Secretariat has advised for some years on petroleum legislation. SPREP has offered advisory services on handling petroleum-related emissions and waste products

government, NGO and private users is needed as is selection of a suitable repository for that library. The recent tendency by the donor community to develop such materials for Internet delivery while ignoring the development of traditional library materials is not suitable for the Solomon Islands due to the low level of Internet connectivity and the slow data rates generally encountered. Without an information resource covering past experience in the Solomon Islands, other Pacific experiences and general issues of economics, technology, management, etc. organisations wishing to develop RETs in the SI may have difficulty developing the technology without a long trial and error period resulting in repeating the errors already made in other parts of the Pacific and around the world.

- **Preparation of guidelines for village scale hydro development**. Existing international guidelines for hydro development are for much larger scale implementations than useful for village hydro development in the 5-20 kW range for which there are a large number of opportunities in the Solomon Islands (and Melanesia in general). Financing is needed for the development of guidelines for site technical assessment, environmental impact assessment, economic analysis, technical design, operational requirements and maintenance requirements.

8.2 Hardware Investment Opportunities

The team did not identify any projects immediately available for co-financing. Biofuel from coconut oil and hydropower offer the most likely immediate opportunities for indigenous energy development in the Solomon Islands with the potential for substantially reducing GHG emissions from modern sector energy use. To the extent that GHG reduction is a priority, the following investments should be considered:

- **Biofuel**. By far the largest potential impact on GHG emissions of new RE investments based on known resources in the Solomon islands would be from large scale use of coconut oil as a biofuel. This could potentially eliminate up to 70% of the 2001/2002 national CO_2 emissions from petroleum fuel use.
- **Hydro.** The second largest impact would be from mini and micro hydro, which could displace 15% of current CO_2 emissions from petroleum if 10% of the potential were developed.

If funding is available on suitable terms to the Solomon Islands to develop relatively large scale RETs, the above should be considered for support. However, choices regarding RET development should not be made solely on the basis of their potential impact on GHG emissions, which in any case are nearly inconsequential on a global scale or comparative per-capita basis.[17]

- **Solar PV.** For the Solomon Islands, the development impacts of RETs are likely to be greater through a large-scale programme of community scale solar PV investments, including the development of appropriate institutions for their finance and operation, than biofuel (except to the extent that biofuel stimulated a copra recovery or fuels were made largely at village level). A major PV programme should be seriously considered if donor funding is available. Annex 5 is a proposal prepared the GoSI for a study on the use of PV in place of diesel generation for small-scale locally-owned tourist resort development in remote areas.

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[17] The Solomon Islands has no legal obligations to reduce GHGs and is an insignificant producer on a global or even regional scale. The *Climate Analysis Indicators Tool* (CAIT) of the World Resources Institute (WRI, 2003) calculates national emissions to the nearest 1/100 of 1% of the global total. The Solomon Islands emissions are shown as 0.00%.

9 ANNEXES

Annex 1 - Persons interviewed

1) PIREP:

Mr John Korinihona	Acting Director of Energy and PIREP National Coordinator, P.O. Box G37, Honiara, jkorinihona@solomon.com.sb; john@mines.gov.sb
Dr Morgan Wairiu	PIREP National Consultant, Box 378, Honiara, mwairiu@solomon.com.sb

2) Government of the Solomon Islands (including government-owned enterprises):

Ministry of Natural Resources

Mr Barnabas Anga	Permanent Secretary; b_anga@solomon.com.sb
Mr William Garema	Renewable Energy Officer
Mr Donn Tolia	Director of Mines and Geology

Ministry of National Planning (Panatina Plaza, Honiara)

Hon Mr Nollen Leni	Minister for National Planning
Mr Donald Kudu	Permanent Secretary
Mr Milton Chite	Chief Planning Officer – Natural Resources
Ms Pauline Boseto	Chief Planning Officer – Health and Population Unit
Mr Lottie Vaisekavea	Project Manager, EU Micro Projects Programme; tel: (677) 25770; fax: 25773; vaisekavea@solomon.com.sb

Ministry of Commerce and Employment (P.O Box G26, Honiara*)*

Mr Allan Arafoa	Permanent Secretary
Mr Joseph Heroau	Director, Business and Commerce, business@commerce.gov.sb
Mr Andrew Nemaia	Director of Tourism, tourism@commerce.gov.sb
Mr James Apato	Director, Industrial Development Division, idd@commerce.gov.sb
Mr Benjamin Inukoru	Cooperatives Division
Mr Francis Luza	Chair, Trade Disputes Panel
Ms Faye Mose	Deputy Director of Trade
Mr Robert Fa'aroa	Deputy Director of Immigration
Mr Derick Aiharu	Director of Investment, investment@commerce.gov.sb

Ministry of Agriculture

Mr. Jimmy Saelea	Director of Research (Agriculture), Department of Agriculture, Box G13, Honiara
Mr Michael M. Oliouou	Deputy Director of Research, Department of Agriculture, Box G13, Honiara

Ministry of Infrastructure Development

Mr Francis Nori	Civil Engineer P.O. Box G8, Honiara; fnori@solomon.com.sb
Mr Denton Rarawa	Deputy Governor, Central Bank of the Solomon Islands; drarawa@cbsi.com.sb

Ministry of Lands and Housing (P.O. Box G13, Honiara)

Mr Gilmor Pio	Manager, GIS Unit, SISLAP Project

Central Bank of Solomon Islands

Mr Denton Rarawa	Deputy Governor, Central Bank of the Solomon Islands; drarawa@cbsi.com.sb

Solomon Islands Electricity Authority

Mr Andrew Daka	Deputy General Manager (Engineering) and Acting General Manager, Solomon Islands Electricity Authority, Box 6, Honiara; Tel: (677) 30533; fax: 39472; adaka@siea.com.sb

3) Private Sector:

Mr Peter Hocking	Managing Director Hocking Construction and Joinery Ltd., P.O. Box R165, Honiara, Tel: (677) 39337; fax: 39357; hocking@solomon.com.sb
Dr. Paul Roughan	Consultant, c/- SIDT Honiara, phone: 22075 22571; pdr32@canterbury.ac.nz; proughan2004@yahoo.com
David Iro Fulaga	Director, Willies Holding Company, P.O. Box R169, Honiara, Tel/fax: (677) 30477; dif@solomon.com.sb
Mr John Vollrath	General Manager, Solomons Tropical Products (STP) and President of Solomon Islands Manufacturer's Association (SIMA), stp@solomon.com.sb
Mr Trevor Whitta	Manager, STP
Mr Anthony Hughes	Economic Planning and Banking Consultant, P.O. Box 59, Gizo; Tel: (677) 70899; avhughes@solomon.com.sb
Mr Peter Goodwin	General Manager, National Bank of the Solomon Islands, P.O. Box 37 Honiara Tel: (677) 22080; fax: 28510; pgoodwin@nbsi.com.sb
Mr Fritz Markworth	General Manager, Markworth Oil, Honiara

4) Civil Society / NGOs:

Mr John Roughan	Adviser, Solomon Islands Development Trust, P.O. Box 147, Honiara, jroughan@solomon.com.sb
Mr Adams Andres Sugalonga	Project Officer, Solomon Islands Village Electrification Council (SIVEC), P.O. Box 867, Honiara; asugalonga@yahoo.co.uk
Hon. Edward Huniehu	Member of Parliament, East 'Are'Are Constituency SIVEC member Mr Cherry Tanito Liason Officer, Solomon Islands Village Electrification Council (SIVEC)
Dr. Silent Tovosia	Chairman, Guadalcanal Rural Electrification Association of the Solar Electric Light Fund, P.O. Box 349, Honiara; msnrh@solomon.com.sb
Ms Josephine Teakeni	Director, Vois Blong Mere Solomon VBMS; P.O. Box 602, Honiara: vbms@welkam.solomon.com.sb
Ms Bernadette Usua	VBMS
Ms Jennifer Wate	VBMS andSIDT (Domestic fuel)

5) Donor / Lending Agencies and Diplomatic Missions:

Mr Joseph Waleanisia	Officer-in-Charge, United Nations Development Programme, UNDP Sub-office, City Centre Building, Honiara; Tel: (677) 27446; joseph.waleanisia@undp.org
Mr Tadashi Ikeshiro	Resident Representative of Japan International Cooperation Agency (JICA) Panatina Plaza, Honiara; tel: (677) 30410; fax: 30411; Ikeshiro.tadashi@jica.go.jp
Dr Hendrik Smets	Chargé d'Affaires a.i., European Union Delegation, P.O. Box 844, Honiara; Tel: (677) 22765; fax: 23318; smetsh@solomon.com.sb
Tom Wilson	EU consultant, Programme Management Unit, Ministry of National Planning (micro-projects)
Stacey Greene	Second Secretary Development Cooperation, Australian High Commission. P.O. Box 589, Honiara; Stacey.greeene@dfat.gov.au

6) People contacted by e-mail but not met:

Dr Graham Baines	CTA UNDP Village Sustainable Management Project, Isabel, gramb@optusnet.com.au
Dr Paul Bryce	APACE Sydney paulb@eng.uts.edu.au

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Organisation:	**URL address:**	**Topics:**
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Forum Secretariat	www.forumsec.org.fj	Economic data; investment climate
Food & Agriculture Organization	www.fao.org/DOCREP/003/X6900E/x6900e0t.htm#26.%20Solomon%20Islands	Asia and Pacific National Forestry Programme updates for Solomon Islands
Kokonut Pacific	www.kokonutpacific.com.au	Coconut oil expelling technology
Solar Electric Light Fund	www.self.org/sol_islands2.asp	Solar projects
Tinytech	www.tinytechindia.com	(Coconut) Oil expelling technology

Annex 3 – Report on Solomon Islands SWOT Workshop

A SWOT workshop attended by 22 participants was arranged by John Korinihona (Acting Director of Energy and National PIREP Coordinator), and conducted by the international consultants, on 26 January 2004. The purpose was to determine the views of Solomon Islanders and other long-term local residents regarding the 'strengths, weaknesses, opportunities and threats' for renewable energy development and commercialisation. In most PICs that held similar workshops, the bulk of time was spent in small groups or alone listing perceptions of various strengths, weaknesses, opportunities and threats. In the Solomon Islands, about two-thirds of the time was spent in plenary discussions and one-third in small working groups. Two participants made brief presentations: a) the Hon. Edward Huniehu (Member of Parliament for East Are'Are) who spoke on SIVEC/APACE village community electrification activities; and b) Mr Peter Hocking, who outlined a proposal for producing briquettes from sawdust and wood shaving waste for urban household cooking fuel. Discussions were lively and a good deal of information was exchanged.

The table below summarises comments made by participants during plenary discussions and the small group considerations (as reported back to the plenary).

Category	Strengths
General and miscellaneous	Abundant natural resources: hydro, solar and copra (as a source for coconut oil). There are also opportunities for geothermal and wind energy By using solar PV lights, the number of available working hours increases. There is considerable enthusiasm for RE and optimism in post-conflict Solomons.
Fiscal, Financial and Economic	Micro-hydro is more cost-effective than diesel generation in rural areas
Institutional	NGOs such as SIVEC have considerable expertise at village level and in developing sustainable energy projects. Although GEF can be very slow, it also offers a facility for quick support for prefeasability studies (maximum. budget of about US$25,000). Donors complain about the lack of local absorption capacity for donor money Donors themselves and the regional organisations are part of the problem
Technical	Considerable human resources are available
Knowledge and Public Awareness	Family-based RE units tend to have a high degree of ownership and can be effective (compared to community-based systems)

Category	Weaknesses
General and miscellaneous	The land tenure system (i.e. tendency of some landowners to exploit land issues) is a serious weakness restricting RETs
Fiscal, Financial and Economic	Processes and procedures of the aid system are too long and too cumbersome; we need help now, not (e.g. GEF) in several years time. Feasibility studies sometimes show that a project is technically and financially feasible but when there are no immediate customers, the project is still put off. Serious GoSI budgetary constraints affect the implementation of planned RE projects Banks and donors insist on feasibility studies. We do not need funding for another feasibility study that is just talk-talk, we need soft loans "where the rubber hits the road".
Institutional	Weak institutions at all levels in the Solomon Islands Government institutions do not have the expertise to develop RE projects There is no proper national coordination of energy matters; departments do not share information. The Department of Energy has not initiated any micro hydro projects; these are all carried out by NGOs. Co-operation with the Government is a problem. The donors have good ideas sometimes but are far too slow. We need action now (e.g. one entrepreneur had 5 meetings with the EU which has abundant funds and expressed interest in coconut oil but he claims he cannot tap into EU funds).
Legislative, Regulatory and Policy	There are no appropriate policies and guidelines regarding RE Power sector legislation and regulation are inadequate. Labour and immigration legislation restrict RE development The power utility, SIEA, is monopolist in areas that are close to the grid so others cannot generate electricity even if SIEA does not provide it.
Technical	There is a serious lack of technical skills

Market	There is too much protection for diesel power generation (e.g. SIEA has no incentive to improve so how can REs compete) We cannot develop markets (i.e coconut oil in Honiara) unless more shipping is dedicated to transport copra. Shipping and infrastructure is a problem. There are no exports whatsoever and there is no industry in SI outside of Honiara & Noro. Downstream processing is absent, largely due to poor shipping.
Knowledge and Public Awareness	A large share of donor support funds for RE go to expatriate consultants; very little is spent within the country towards building-up local expertise Limited knowledge within government (civil servants and ministers) on energy In general, very little public awareness of RE technologies and programmes in rural areas Even where there is a government policy, it is not followed up by appropriate training so our knowledge is low.

Category	Opportunities
General and miscellaneous	There are lots of opportunities for socio-economic development of the country and these will provide RE opportunities RE can help create employment at the village level RE can improve welfare at the village level Something has to be achieved in 2004 that we can show the donors (who can then assist us) when they come back in November 2004 We can set up a lobby group to influence the international community regarding RE Although Government is suspicious about private enterprises, in the last twelve months some of the barriers have been removed. For example, the Manufacturers' Association has now established a good relationship with the Department of Commerce.
Fiscal, Financial and Economic	The existing aid systems and willingness to assist the Solomons means that aid funds are available With community owned electricity, generation can be low cost so there are friendly tariff rates
Legislative, Regulatory and Policy	If the Kyoto protocol is approved, there will be more resources to help meet Solomon Islands' obligations under the climate change convention
Technical	Quality design can be achieved locally if funding is available
Market	Private enterprise is optimistic and will be the driving force to make things work. There are business opportunities now for RETs RETs can reduce import of fossil fuel
Knowledge and Public Awareness	Through media and schools and training, there are opportunities to raise the level of knowledge of the public and government

Category	Threats
General and miscellaneous	Land tenure and ownership can be a serious threat to RETs The SI Government is suspicious about private enterprises and see business people as a threat. Safety of facilities are threatened by cyclones and other natural disasters Many RETs are poorly managed and there is a threat of low sustainability The attitude of "give me money" has become part of the culture and needs to change.
Institutional	Government may not develop good policies to open up to renewable energy Government has a monopolistic approach
Legislative, Regulatory and Policy	There is over-protection of fossil fuel because of the power of the oil companies. Deregulation is needed.
Knowledge andPublic Awareness	Some water supply projects do not look at electric power generation, missing an opportunity (e.g. Kogulae)

List of Workshop Participants. The following people attended the workshop:

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Annex 4 – Village First Electrification Programme

Established in 1976, APACE assisted communities in the Asia/Pacific region implement low-impact, environmentally-responsible energy-for-development projects. APACE initially offered services in energy, gender, community development, and village enterprise; and provided technical assistance with project identification, design, and management. Until restructuring in 2000, it was a CSIRO-approved research institution, an NGO accredited with AusAID and a charity under New South Wales Law. APACE was a community-based organisation, where voluntary members elected and controlled the Board. It has long had an informal relationship with the University of Technology in Sydney.

In 1993, the Provincial Assembly of the Western Province signed a Memorandum of Understanding (MOU) with APACE to design a provincial village electrification programme based on the community development model first tried by APACE in Iriri in 1983.[18] APACE opened a field office in Gizo to oversee village social, economic, and environmental assessments and technical surveys. In 1995, the Prime Minister approached APACE to sign a similar national MOU, under which APACE and the GoSI (with Western Province co-operation), would design and implement a national village electrification programme based on the Western Province model. To co-ordinate this, a Village First Electrification Programme-SI (VFEP-SI) office was established in Honiara. VFEP-SI — a broad rural village development initiative, not focussing only on energy— also acted as the secretariat for a national co-ordinating body, which evolved in 1996 into SIVEC, the Solomon Islands Village Electrification Council, formed with community, NGO and GoSI representation. SIVEC promotes, encourages, and supports community owned renewable energy systems. It lobbies for appropriate energy policies, seeks funding or financial ventures to support rural community energy projects, co-ordinates village energy projects within a national framework, assists village communities with productive economic uses of the electricity, and advocates for village-based electrification and related policy issues.

SIVEC has, through VFEP, adopted guidelines and criteria for community participation, and advised the government on an appropriate national village electrification policy, which includes gender issues. The policy specifies that all village electricity projects are to be wholly owned and operated at the community level. Although VFEP-SI works within an agreement with the GoSI, and has informal support of the Solomon islands Electricity Authority, there is no working relationship with the Energy Division of the Department of Mines and Energy and no financial support from the GoSI.

Internationally, APACE has become APACE VFEG (Village First Electrification Group), a division of a non-profit limited company, Earth Trust.

Reference. Silas Pio, Nixon and Tutua, Joini, 2004 Village Power in Solomon Islands - a Grassroot Development (In Energia - Newsletter of the Network for Gender and Sustainable Energy. Vol 6 No. 2, January)

[18] It included the establishment of a Ministry of Water Supply and Rural Electrification in Western Province. The MOU is currently (March 2004) up for renewal. Actual activities wound down about 2000, as both parties were short of funds.

Annex 5 – Solar Electric Light Fund PV Projects

After four years of planning and preparation, the Solar Electric Light Fund (SELF) of Washington DC (USA) established the first solar-electrified village in the Solomon Islands in early 1997. SELF undertook the electrification of Sukiki, a small village located on the Southeast coast of Guadalcanal, only accessible by canoe and approximately 8 hours from Honiara. Forty-six homes and a school in Sukiki were electrified with solar home systems (SHS). A further four systems were installed at health clinics in rural areas elsewhere in Guadalcanal. The project was undertaken in partnership with the Guadalcanal Rural Electrification Agency (GREA), a non-governmental organisation based in Honiara, which was specifically established as the local partner for the project.

Each SELF SHS consists of a 50 Wp Solarex module, a Morningstar controller, a 12V battery, and three 8 w compact fluorescent lights (CFL). The system reportedly provides enough electricity for several hours of lighting as well as radio. Instalment credit for the purchase of the SHS was through a revolving credit fund managed by GREA. Participants were to make an initial down payment of US$50, followed by monthly instalments of US$15 for a period of four years. Payments were meant to go to a revolving credit fund managed by GREA to finance additional systems.

The Sukiki project included training in PV design, installation, and maintenance in order to improve on-going technical support. Trainees included village technicians as well as others from the Solomon Islands College of Higher Education (SICHE), the Ministry of Mines and Energy (MME), and the Solomon Islands Electricity Authority (SIEA). The training – presumably in English with translation – was led by Johnny Weiss of Solar Energy International (SEI), of Carbondale, Colorado, USA.

In 1998, a second solar electrification project was implemented by SELF and GREA in the neighbouring coastal village of Makaruka. Sixty-five homes, a school and several churches in Makaruka were electrified. A further eleven solar systems were installed at rural houses in Gatokiae (Western Province, seven systems) and at rural health clinics on the island of Santa Isabel (four systems). Equipment installation and training were carried out by SIEA staff.

Based on its experience in Sukiki and Makaruka, GREA planned to develop larger-scale SHS programme, and established an office at the Guadalcanal Provincial Government headquarters. However, the subsequent years of civil unrest left their marks. The provincial government building in which the GREA office was housed was burnt. Many of the solar-electrified houses in Sukiki and Makaruka were destroyed. Other solar home systems were stolen. Solar systems still in place were not maintained properly and monthly fees were not paid. Although the exact status of the systems is not known, it is believed that in Sukiki some 20-odd systems (about half) and in Makaruka some 10-15 systems (perhaps 20%) are still in working order.

Now that the ethnic tensions have ceased, SELF and GREA plan to refurbish and expand solar electrification systems. In addition to refurbishing the Sukiki and Makaruka projects, they would like to see solar electrification of rural health clinics in Temotu Province, a geographically isolated group where fuel is expensive and shipment of diesel and kerosene are erratic. Due to undependable energy supplies, surgical procedures are interrupted by light outages, vaccines are ruined by intermittent refrigeration, and consultations by radio with the province's only doctor are disrupted by power failures. Solar electrification can overcome these problems.

(Based on SELF website and Tovosia, 2004)

Annex 6 – Solar Energy for Rural Tourism Development in the Solomon Islands

(Proposed Pre-feasibility study by Department of Culture and Tourism, Solomon Islands)

Background information. The Tourism industry in the Solomon Islands although small has the potential to grow substantially when resources are more fully developed. The many islands throughout the country offer a wide variety of natural socio-cultural and historical attractions. The Central and Western Provinces are popular destinations for divers, with the latter having more tourist facilities and tourism-related infrastructure. The islands of Malaita and Makira are famous for their cultural and traditional practices. Rennell Island is well known for its lake, which has been include in the World Heritage Programme listing. The recent discovery of the wrecks of the ships of the French Explorer La Perous in Temotu Province is another attraction which needs to be developed and marketed. Tourism arrivals during the past four years declined as a result of ethnic tensions. With the return of law and order there has been a gradual improvement of tourist arrivals since the second half of 2003 and prospects for continued growth if we can provide adequate facilities.

Most of the provinces have very basic accommodations, located in the provincial capitals with only limited activities that can be arranged for visitors. Services are often poor. The Solomon Islands government recognises and supports the development of tourism throughout the country and therefore encourages tribes, landowners and provincial governments to participate in order to realise the economic benefits of the industry. The development of tourism in Solomon Islands will be in a controlled and sensitive manner in accordance with the following guiding principles:

- tourism should be expanded to become a significant sector of the Solomon Islands economy and kept in balance with other sectors of the economy;
- tourism should be developed at a relatively moderate rate to minimise disruptive and harmful socio-economic cultural and environmental impact;
- tourism should be developed in such a way as to ensure maximisation of economic benefits for the country and stimulate other types of social and economic development; and
- tourism development and activities should not result in serious socio and economic problems, and tourist facilities and activities should be compatible with the local culture and environmental setting.

The proposal. Many requests have been received for financial assistance in establishing resorts in rural areas. These requests are increasing. For successful development of small-scale resorts, owned and operated by Solomon Islanders, there must be adequate communications and services. However, the locations are remote from basic services. An affordable and reliable source of energy is necessary in order to provide hot-water, lighting, refrigeration and other amenities. The resorts require reliable communications (phone; e-mail) in order to receive and confirm visitor bookings.

The Solomon Islands Government wishes to see environmentally acceptable and cost effective energy, in place of conventional diesel generators, which are very expensive to operate, noisy, suffer from irregular fuel deliveries and have proved to be environmentally unacceptable. Many small resorts require refurbishment and repair, including new energy systems. All nine provinces submitted applications to the Department of Tourism for government support for the renovation and establishment of small resorts ranging from 4 self-contained bungalows to 10 bungalows. The total cost of meeting the submissions is estimated at $100 million (about US$13 million).

Financial support is sought for a study to focus on the following:

- determine the economic and financial viability of using solar photovoltaic (PV) energy, and solar water heating, (SWH) in place of conventional diesel generation for small self-contained bungalow resorts in remote locations in the Solomon islands;
- advise on the specifications of the solar PV and SWH systems required, and the equipment and appliances (lights, fans, possibly small refrigerators, etc) to provide adequate services;
- advise on the training and maintenance needs for operators and how this can best be provided to the resort owners and operators; and
- note that this is a preliminary proposal to be further developed as required.

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