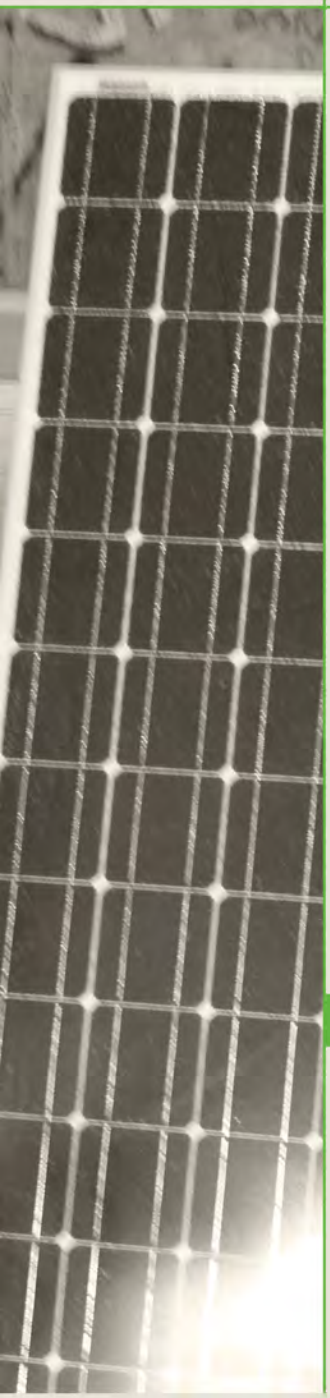

SOLOMON ISLANDS NATIONAL ENERGY POLICY AND STRATEGIC PLAN

Volume 4

RENEWABLE ENERGY STRATEGIES & INVESTMENT PLAN 2014

MINISTRY OF MINES, ENERGY AND RURAL ELECTRIFICATION

SOLOMON ISLANDS NATIONAL ENERGY
POLICY AND STRATEGIC PLAN

VOLUME 4

RENEWABLE ENERGY STRATEGIES & INVESTMENT PLAN

2014

MINISTRY OF MINES, ENERGY AND RURAL ELECTRIFICATION
2014

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1. Minister's Foreword

The Renewable Energy Strategy and Investment Plan (RE-SIP) lays out the Solomon Island's renewable energy targets and policy outcome and strategies and financial requirements for achieving a sustainable energy future for all Solomon Islanders.

The Solomon Islands is blessed with potential renewable energy resources however most of these resources have not been exploited due to a number of barriers and challenges including the geographical locations of these resources which are far away from available demand. In addition, there have been limited opportunities in terms of financial and technical resources and capacities, our cultural and social issues to enhance the use of these resources. These challenges have contributed to a low percentage of total populations having access to electricity.

The government realised the potential that the energy sector will contribute to the economic growth and therefore has included the energy sector as its priority list for investment. In 2009 through its foreign investment reform, the government has created better enabling environment for private sectors and investment through the amendment of its Foreign Investment Act 2005 and Regulation 2006. The government is looking well ahead to the contribution of the two renewable energy developments being supported for private investments; the Tina Hydro Power Development and the Savo Geothermal Project.

The targets that have been assessed and adopted in the 2014 National Energy Policy for utilising the renewable energy potentials are promising for all Solomon Islanders. The potential for renewable energy use and technologies for power generation has been assessed through the Asian Development Bank Renewable Energy Investment Plan and has identified renewable energy targets for the short term (2020), the medium term (2030) and long term (2050). There is expectation that the 100% renewable energy share in the power generation can be achieved by 2050. The RE-SIP is a five years strategy, therefore will provide guidance to meeting the short term renewable energy target of 50% renewable energy by 2020.

The Energy Division of the Ministry of Mines, Energy and Rural Electrification is to coordinate the effective deliverables of the RE-SIP and the SINEP policy outcomes for rural electrification while the state owned utility, the Solomon Islands Electricity Authority will coordinate the implementation of renewable energy options for the urban areas, including its outstations in the provinces.

Again I need to reiterate the need for the activation of a national Energy Advisory Committee , comprised of high –level multi-sectoral members tasked with assessing, monitoring the progress of the RE-SIP including other energy strategies and investment plans and to achieve the overarching focus area of our National Development Strategy; building better lives for all Solomon Islands.

It is with great pleasure to know that this RE –SIP when implemented effectively will contribute to improving the livelihoods of all the people of the Solomon Islands through the access to sustainable, appropriate and affordable energy services and therefore I urge all stakeholders and those that have interest in this RE –S IP to provide support, guidance and advice throughout its implementation and its future continuation.

I wish to thank all national stakeholders including the communities and the development partners that have contributed toward developing this renewable energy strategy and investment plan.

Hon. Moses Garu
Minister for Mines, Energy and Rural Electrification

2. Executive summary

The Renewable energy strategy and investment plan (RE –SIP) provides a way forward for strengthening the renewable energy sector in the Solomon Islands, highlighting the potentials and investments for the renewable energy options, resources and technologies.

The RE-SIP has three main objectives;

1. Provides guidance including funding requirement in utilising the renewable energy potentials and therefore increasing the access to appropriate, reliable, sustainable and affordable energy services. In both the urban and rural areas.
2. To identify and provides plans on how each of the un-electrified rural and urban households of the Solomon Islands will be served with an appropriate and affordable renewable energy technology.
1. Provides policy guidance and instruments (standards, regulations, net –metering policies) to enhance the use of renewable energy resources and their potentials.

The Solomon Islands government has set a 50% renewable energy use for power generation by 2020 to be achieved through its Tina Hydro Development Project and the Savo Geothermal projects, both developments to be commissioned by the end of 2017.

The RE –SIP includes both renewable energy options and investments for solar and hydro resources for both rural and urban areas. The RE-SIP proposed rural electrifications to all households, provincial centres and institutions, through micro grid solar and hydro and solar home systems for rural households.

The RE-SIP has one policy outcomes which is aligned to the 2014 Solomon Islands National Energy Policy (SINEP); the use of renewable energy sources for power generation in urban and rural areas increased to 50% by 2020.

There are three policy statements which are aligned to the strategies;

1. Establish an appropriate, reliable, affordable and sustainable energy-based power supply systems
2. Assess, cost, promote and enhance the potential for renewable energy resources
3. Facilitate partnerships in development of renewable energy development

The RE-SIP is based on achieving the SIG 2020 target of 50% of energy being supplied by renewables in particular the Savo Geothermal, Tina Hydro Development, micro grid hydro where there is water resources available and sola PV for SIEA outstations and standalone solar PV systems of 100Wp for rural households. Land issues are still key challenges in particular for the use of hydro resources and therefore solar home systems can be considered the best option for rural areas, when land issues, population density and access are taken into account.

The RE-SIP will require a total investment of $75.00 million to 2020 to achieve a 44% country wide household electrification rate and a total investment of $234.15 million to 2030 to achieve a 71% household electrification rate.

3. Introduction

The REIP Report prepared under the Asian Development Bank technical assistance through its Provincial Renewable Energy Project provided much needed information for the development of the RE-SIP. The final report was presented to the Energy Division of the Ministry of Mines, Energy and Rural Electrification in June 2013. The REIP findings and recommendations was adopted as part of this RE –SIP while the policy outcomes and strategies were identified during the review of the 2009 SINEP and at the National Energy Forum conducted in Honiara in November 2013.

The RE –SIP is presented as Volume 4 of the 2014 National Energy Policy and Strategic Plan of the Ministry of Mines, Energy and Rural Electrification.

The RE –SIP is presented into three sections; the Energy Sector Overview, Renewable Technologies and Options, Renewable energy Strategy and Investment Plan.

Preface and Acknowledgment

The formulation of the RE – SIP strategy was done as part of the review and formulation of the 2014 Solomon Islands National Energy Policy (SINEP) and the formulation of the subsequent energy sub sectors strategies and investment plan ; the energy efficiency and conservation strategies and investment Plan (EE-EC-SIP) and petroleum strategies and investment plan (PET-SIP).

The Ministry of Energy, Mines and Rural Electrification has been instrumental in directing the development of SINEP and energy sub sectors strategy and investment plans as it sees a need for a more cohesive approach to its planning and that all its efforts are aligned to the National Development Strategy key focus areas. A five years approach to budget allocations by Parliament has also been adopted by the Solomon Islands Government in 2014 and this provides a clear direction in financial resources that are available against implementation of sectoral policies and strategies.

The RE- SIP is a five year plan and is intended as a guiding document to the Solomon Islands government and development partners.

4. Energy Sector Overview

4.1 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. 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.

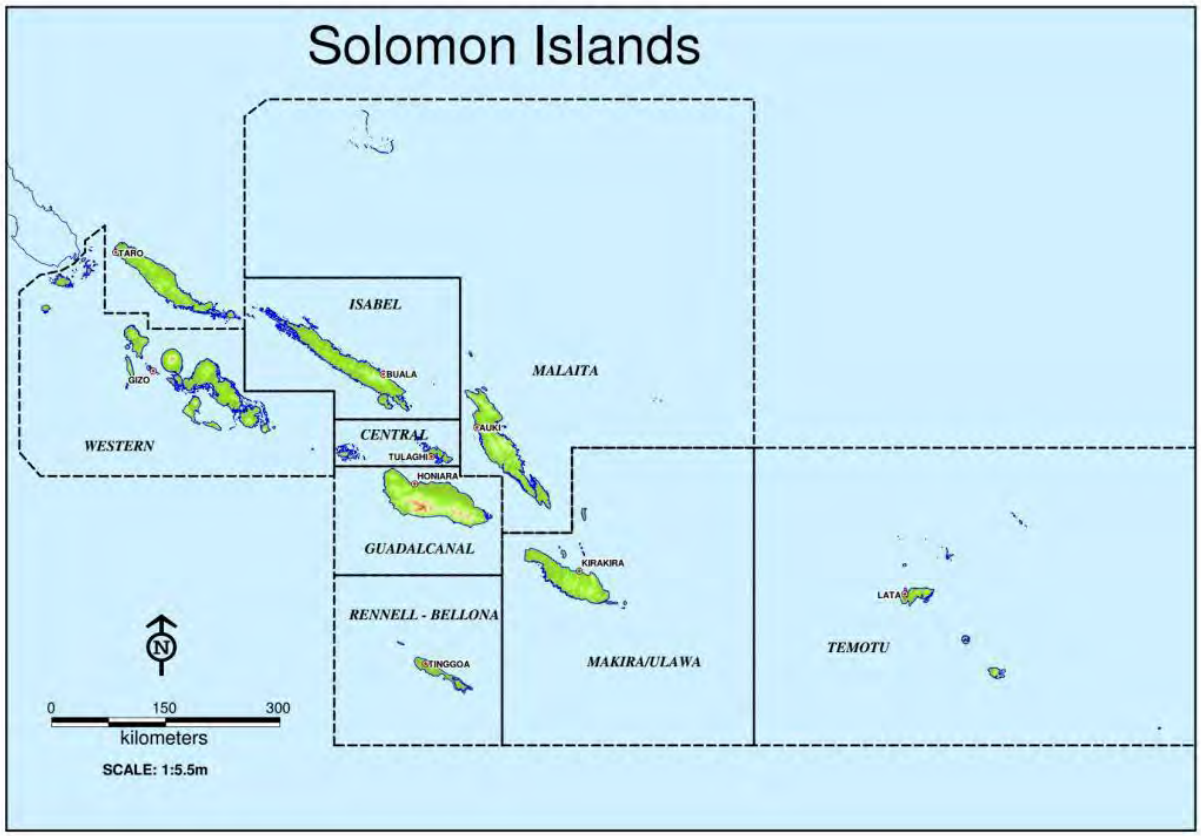


Figure 1 Solomon Islands

4.2 Population

The population of Solomon Islands on 22 November 2009 was 515,870. This means an increase of 106,828 persons (26%) compared with the population size of 409,042 reported in the Census of 21 November 1999. The annual rate of growth since 1999 was 2.3%, which is lower than the annual growth rate between 1986 and 1999 (2.8%) census. Males were 51.3% of the total, out numbering females by 264,455 to 251,415. About 80.3% of the population (75,916 households) lived in rural villages and 19.7% were considered urban. Overall, there were 17 people per km^2 and the average household size was 5.5 persons. Urban and rural population by island is shown in.

About 63.5% of the 2009 urban population lived in Honiara, accounting for 12.5% of the national total. From 1999 to 2009, the overall population increased rapidly at an average annual growth rate (AAGR) of 2.3% per annum. The urban population grew even more rapidly with an AAGR of 4.7 %.

Table 1 Population of the Solomon Islands (2009)

Island or group	Total	Urban	Rural
Choiseul	26,372	810	25,562
Western	76,649	9,755	66,894
Isabel	26,158	971	25,187
Central	26,051	1,251	24,800
Rennell-Belona	3,041	-	3,041
Guadalcanal *	93,613	15,241	78,372
Honiara	137,596	5,105	132491
Malaita	40,419	2,074	38,345
Makira	21,362	1982	19,380
Temotu	64,609	64609	0
National Total	**515,870**	**101,798**	**414,072**

Source: Solomon Islands Government (SIG), Solomon Islands National Statistics Office. 2012. *Statistical Bulletin No 6: 2012, Basic Tables and Census Description, 2009 Population and Housing Census.* Honiara

Table 2 Growth of Urban Population 1976-2009

Province	Urban Centre	1976	1986	1999	2009
Choiseul	Taro				810
Western	Gizo	2,707	3,710	6,882	9,755
Isabel	Buala	1,414	1,901	451	971
Central	Tulagi	808	1,622	1,333	1,251
Renbel	Tingoa				
Guadalcanal					15,241
Malaita	Auki	1,926	3,252	1,606	5,105
Makira	Kirakira	1,767	2,588	979	2,074
Temotu	Lata	795	1,295	361	1,982
Honiara		14,942	30,413	49,107	64,609
National Total		**24,359**	**44,781**	**63,732**	**101,798**

Source: Solomon Islands Government (SIG), Solomon Islands National Statistics Office. 2012. *Statistical Bulletin No 6: 2012, Basic Tables and Census Description, 2009 Population and Housing Census.* Honiara

Table 3 Honiara Population and Persons per Household 1970-2009

Year	1970	1976	1986	1999	2009
Population	12,006	14,942	30,413	49,107	64,609
AAGR, %/annum	-	3.7%	7.4%	3.8%	2.8%
Persons / household	5.4	5.5	7	7.1	7.2

Source: Solomon Islands Government (SIG), Solomon Islands National Statistics Office. 2012. *Statistical Bulletin No 6: 2012, Basic Tables and Census Description, 2009 Population and Housing Census.* Honiara

4.3 Economic Overview

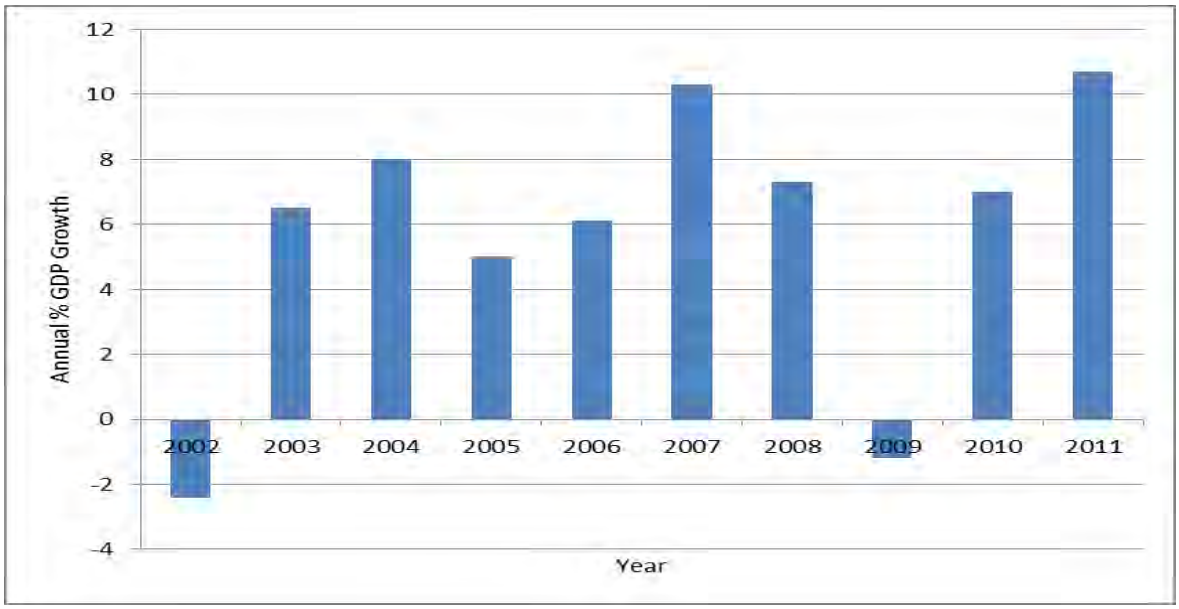
The economy of the Solomon Islands is made up of a mixed subsistence sector on which the majority of the population is dependent, and a small monetised sector dominated by large scale commercial enterprises. These sectors straddle both rural and urban space. Production in the mixed subsistence sector 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.

The Solomon Islands dollar has performed erratically against major currencies for well over a decade with a slight appreciation in 2011. The appreciation came about as a result of a 5% revaluation of the Solomon Dollar in June 2011.

Between 2007 and 2009, GDP in real (constant dollar) terms declined by 1.2% as a result of the global economic crisis. CBSI reported in its annual 2011 report "*Despite subdued growth in the global economy, Solomon Islands economic performance registered another year of record growth. The economy grew in real term by 10.7% in 2011. This growth was driven primarily by strong performance in commodities particularly logs and minerals during the year. Non-forestry & non-mining sectors also contributed to the overall growth, boosted primarily by activities in the agriculture, telecommunications & transportation, construction and fisheries sectors. Strong international commodity prices across the year, especially in the first six months, generally lifted production levels in the agriculture, fishery and other commodities. Higher trade volumes boosted growth in the transport sector, whilst investment in development infrastructure projects contributed to growth in the construction and communication sectors*."

Performance has been improved considerably for the modern monetised sectors of the Solomon Islands economy. Table 4 shows economic growth - or contraction - by sector. Some key indicators of commodity production are also provided in **Error! Reference source not found.**.

Figure 2 Change in Real GDP (2002-2011)



Source: CBSI. 2011, 2012. *Annual Report.* Honiara

Table 4 Real Gross Domestic Product 2002 - 2012 (1985 = 100)

Sector	2003	2004	2006	2007	2008	2009	2010	2011	2012
Agriculture	70.9	77.3	102.7	147.6	167.7	167.7	177.7	197.7	188.6
Forestry, Logging, Sawmilling	131.7	135.6	188.3	381.5	398.6	287	379.5	501.9	506.1
Fishing	72.3	76.8	104.4	116.5	122.1	117.4	128	140.4	150.7
Mining & Exploration	38.2	36.7	-3.2	5	5.6	55.7	55.7	533.4	877.5
Manufacturing	158.1	149.8	134.3	144.1	147.7	141.8	141.3	146.7	171.5
Electricity and Water	183.4	214.4	211.8	285.6	291.1	283	296.1	316.1	335.9
Construction	21.8	26.1	35.9	101.2	110.3	115.3	115.7	122.2	144.4
Retail and Wholesale Trade	119.9	131.7	136.6	152.6	162.4	167.8	171.2	181.6	190.3
Transport and Communications	114.7	129.8	139.2	223	250.8	260.5	275	327.9	348.1
Finance	231.4	228.3	223.5	257.8	262.6	267.5	272.5	284	296.5

Sector	2003	2004	2006	2007	2008	2009	2010	2011	2012
Other Services	172.4	138.5	119.1	154.8	171.4	184.4	198.9	202.8	222.6
Index of Monetary GDP Production	122	118	127.6	179.1	194	187.8	205.2	225.1	230.4
Annual % movement	-12.3	-3.6	7.7	13.1	8.4	-3.3	9.2	9.7	2.4
Index of Primary Production	84.1	89.6	121.2	190.3	206.6	181.8	209.5	249.5	247.6
Annual % movement	-10.4	6.4	33.7	17.2	8.5	-12	15.2	19.1	0.8
Non-Monetary: Food	151.9	155.9	160.5	179.2	184.2	189.4	193.8	188.9	193.3
Non-Monetary: Construction	147.2	150.1	155.6	173.8	178.6	182.7	186.9	182.3	186.5
Non-Monetary GDP Index	151.5	155.4	160	178.8	183.8	188.9	193.2	188.4	192.7
Index of Total GDP Production	127.9	125	133.9	178.5	191.4	187.9	202.7	224.2	235
Annual % movement	-9	-2.4	6.5	10.8	7.3	-1.9	7.9	10.6	4.8

Source: CBSI. 2013. *Quarterly Review*. Honiara

Table 5 Production by Major Commodities 2000 - 2012

Year	Copra (mt)	Coconut Oil (mt)	Palm Oil (mt)	Palm Kernel (mt)	Cocoa (mt)	Fish (mt)	Logs ('000 m^3)	Gold (ounce)	Silver (ounce)
2004	21,831	12	--	--	4,181	27,249	1,043	--	--
2005	26,182	28	--	--	4,928	23,853	1,118	--	--
2006	21,213	59	5,427	1,236	3,835	29,597	1,130	--	--
2007	27,903	741	17,151	4,829	4,470	21,196	1,446	--	--
2008	38,979	520	21,981	3,285	4,326	25,378	1,523	--	--
2009	24,740	89	25,123	3,098	4,553	19,300	1,045	--	--
2010	25,389	123	28,615	3,205	5,376	21,385	1,428	--	--
2011	35,280	470	31,592	3,537	6,495	28,195	1,937	51,054	19,043
2012	26,493	399	31,846	3,387	4,838	29,377	1,948	67,819	28,993

Source: CBSI. 2013. *Quarterly Review*. Honiara

In 2011, the GDP in nominal (current dollar) terms was $5,578 million, an increase of 17% from a revised 2010 level of $4,754 million. This presented an increase by 15% to $10,332 per capita.

4.3.1 Household Expenditure

The 2005/6 household (HH) income and expenditure studies suggest that incomes and expenditures vary considerably by province. The survey report states "*In theory, household income should equal household expenditure but in practise as in most income and expenditure surveys in the pacific region, the information collected from the HIES 2005/6 recorded that a majority of the households' income were relatively lower than their corresponding expenditures*". Households' annual expenditure to its annual income by province **Error! Reference source not found.** shows that expenditure in most cases was significantly higher than income. In Honiara expenditure was well above those of other locations. In 2005/6, Honiara residents had an annual average household expenditure of about SI$ 75,053 per household or SI$ 4,887 per capita.

Table 6 Average Annual Household Per Capita Expenditure and Household Size by Province

Province	Average Annual Household Expenditure	Median Annual Household Expenditure	Average Household Size	Average Annual Per Capita Expenditure	Median Annual Per Capita Expenditure
	(SI$)	(SI$)	(No.)	(SI$)	(SI$)
Choiseul	21,980	14,037	6.18	3,557	2,271
Western	28,024	21,278	6.00	4,671	3,546

Province	Average Annual Household Expenditure	Median Annual Household Expenditure	Average Household Size	Average Annual Per Capita Expenditure	Median Annual Per Capita Expenditure
	(SI$)	(SI$)	(No.)	(SI$)	(SI$)
Isabel	19,035	17,116	5.12	3,718	3,343
Central	32,223	23,144	5.82	5,537	3,977
Rennell - Bellona	35,432	28,092	6.57	5,393	4,276
Guadalcanal	30,285	24,597	5.78	5,240	4,256
Malaita	21,018	16,538	6.36	3,305	2,600
Makira-Ulawa	18,965	15,130	6.65	2,852	2,275
Temotu	15,759	12,389	5.53	2,850	2,240
Honiara town	75,053	58,367	6.93	10,830	8,422
Solomon Islands	30,069	20,035	6.15	4,887	3,256

Source: SIG, National Statistics Office. *2006. Housing Income & Expenditure Survey (HIES) 2005/2006.* Honiara

4.3.2 Investment Climate

The ease of doing business in the Solomon Islands has improved significantly since the passage of the Companies Act and the Foreign Investment Act in 2009. It has been recognised by successive governments, the importance of overseas investment in broadening the economic base.

The 2013 ranking by World Bank and International Finance Corporation places Solomon Islands at:

- 92/185 for ease of doing business placing it 13th in the Asia Pacific region of 24 counties
- 9/185 for starting business, making it much easier to start a business, (apart from Samoa and Tonga) than most of the other Pacific Island Countries
- 18/185 for getting connected to the electricity grid, it is easy to connect to the grid in the Solomon Islands on an International basis but difficult in comparison to others in the region
- 8/185 for protecting investors and 15/185 for obtaining credit. These rankings indicate relatively high levels of investor protection.

Since the commencement of the Foreign Investment Act 2009, proposals that usually take a minimum of 30 days to approve can successfully be completed in 5 days. Approvals that are subject to exchange control approval has been relaxed which has resulted in the shorter timeframe for registration.

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.
- About 88% of land is customary and 12% registered. In 1977, an Amendment Bill to the Lands and Titles Ordinance converted perpetual estates registered and owned by non-Solomon Islanders and Solomon Islanders alike into 75 year fixed term estates (leases from government) with development conditions.

4.4 Institutional Arrangements for Energy Sector

4.4.1 Energy Policy

A number of draft energy policies have been developed since the 1980s, including the following:

- *Solomon Islands National Energy Policy and Guidelines* (1995), which included an annex, titled *Solomon Islands Rural Electrification Policy - Background*.

- *National Economic Recovery, Reform and Development Plan for 2003-2006* (NERRDP), issued in October 2003.
- National Energy Policy Framework, endorsed by Cabinet, 2007.

4.4.2 Energy Legislation

The following acts of parliament of the Solomon Islands deal directly or indirectly with energy issues:

- *Electricity Act* (1969)
- *Petroleum (Exploration) Act* (1996)
- *Petroleum Act* (1939).
- *Consumer Protection and Price Control Act (1995)*
- *Environmental Act* (1998)

The *Electricity Act* (1969) (Chapter 128 of the Laws of the Solomon Islands) and associated regulations provides a legal framework for is the establishment of a state-owned, vertically integrated utility providing grid supply to urban and provincial centres. In 1982, the Act was amended to align with utility practice at the time and allow the SIEA to expand its jurisdiction.

The *Consumer Protection and Price Control Act* (Chapter 64 of the Laws of the Solomon Islands) was revised in 1995. It establishes price control rules throughout the country including price control of petroleum products and LPG. No legislation has yet been enacted for regulating biofuels.

The *Environmental Act* (1998) commenced operation in September 2003 and its associated regulations were gazetted in 2008. Under the Act there are formal requirements for environmental impact assessments, and requirements for energy sector investments such as power stations or oil storage, these are specifically mentioned under the second schedule (section 16) “Prescribed Developments”.

4.4.3 Energy Division

An Energy Division within the Ministry of Mines, Energy and Rural Electrification is responsible for energy policy, renewable energy development and project implementation. The Director of Energy is responsible to the Permanent Secretary, appointed through the normal public service mechanism, who in turn is responsible to the Minister.

The roles and responsibilities of the Energy Division include:

- Develop and monitor a national energy work programme(s) by which energy policies will be achieved
- Coordinate activities and programmes 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 lacking in technical maturity economic viability or environmental sustainability

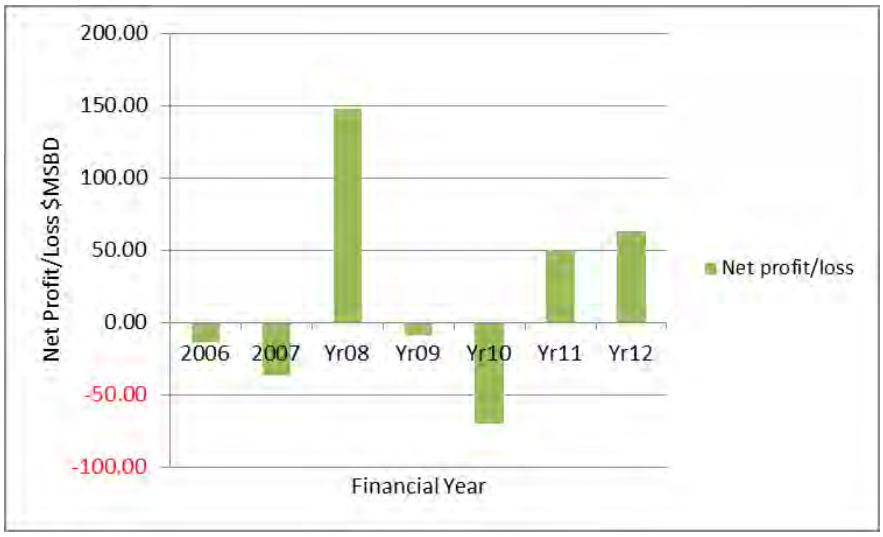
- Provide advice to government and its agencies concerning energy investment budgets and / or specific project funding
- In conjunction with other ministries and agencies, develop, implement and monitor regulations and standards governing the energy sector, particularly concerning the safety of petroleum 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 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 photovoltaic, solar thermal technology and biomass
- Train local staff.

4.4.4 Solomon Islands Electricity Authority

The Solomon Islands Electricity Authority is responsible for electric power supply and distribution to Honiara, nine provincial centres, and Noro Township in the Western Province. The SIEA is a state owned enterprise a statutory body established by an act of Parliament. The Minister of Mines Energy and Rural Electrification, along with the Minister of Finance, appoints a board consisting of six members and a chair.

SIEA provides power to urban centres through diesel generators, except for Buala town on Isabel Province and Malu'u substation in Malaita which includes supply by mini-hydro (both hydropower stations were not operational at the time of report). Various boarding schools, rural training centres, health centres, rural fisheries centres, tourist resorts, private shops and residents located away from SIEA grid use their own diesel generators, micro hydropower or solar PV to generate electricity. As shown in **Error! Reference source not found.**, SIEA's financial position has improved in recent years since the 2010 net loss of $65,994,811. The SIEA 2012 annual report noted a year end net profit of $62,701,365.

Figure 3SIEA Net Profit/Loss ($SI million)



Source: SIG,SIEA. 2012. *Annual Reports 2006-2012.* Honiara

4.4.5 Rural Electrification Service Companies (RESCOs)

There are a number of Rural Electrification Service Companies (RESCO) in the Solomon Islands that sell solar PV equipment. One RESCO (Willies Electric Power and Solar) specialises in solar pv

systems and has pioneered the concept of accepting local products in payment for solar installations, thereby avoiding the common problem in rural areas of poor access to cash. It also provides training in solar installation and maintenance. Since 2008, the SIG through the MMERE has acted as a partial RESCO and has been implementing solar electrification projects at rural schools and clinics as well as providing infrastructure for rural communities such as solar battery-charging stations and solar water-pumping.

4.4.6 Petroleum Supply Companies

Petroleum products are imported into the Solomon Islands by South Pacific Oil and Markwarth Oil, both Solomon Islands' based companies. The storage depots of both companies are at the main port in central Honiara. Origin Gas Ltd. of Australia is the sole importer and distributor of liquid petroleum gas (LPG). Origin's main LPG storage is also in Honiara. Origin operates in Honiara and Noro in the Western Province and sells LPG to private outlets, some of which distribute to customers in other locations. Major users of LPG, apart from hotels and restaurants for cooking and heating, include air conditioning in Honiara.

4.4.7 Inter-Ministerial Energy Committees

The establishment of a national energy committee was proposed in the mid-1990s but did not eventuate. A committee was set up to oversee the feasibility study activities of the Komarindi Hydropower Scheme. A similar set up was proposed for the UNDP/GEF/SPREP Pacific Islands Climate Change Project (PICCAP), which dealt with greenhouse gas (GHG) emissions and a national GHG inventory. The committee considered energy issues, as it must deal with GHGs, and the Energy Division was represented. 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, NGOs, and the private sector but reportedly has not met since October 2002.

The committee arrangements have become inactive over the years as confirmed by the Energy Division. The Energy Division will pursue establishment of an Energy Advisory Committee in 2014. Following Cabinet's approval (11 July 2013) to establish a "Labelling & Standards Steering Committee" to coordinate implementation of the Australian Govt funded "Pacific Appliances Labelling & Standards project", the Energy Division plans to have this committee play the role of Energy Advisory Committee and to eventually assume that role after the PALS project is completed.

4.5 Energy Supply and Demand

4.5.1 Energy Supply

The Solomon Islands are almost entirely 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 are estimated as one percent.

4.5.2 Cooking Fuel

Fuel wood is by far the most common cooking fuel in the Solomon Islands, used **Error! Reference source not found.** by 93% of the population as their main fuel, increasing to 97% if Honiara is ignored. Even in Honiara, more than half of households primarily use wood or wood products for cooking. Malaitans, who make up nearly half of Honiara's population, have no traditional access to land on Guadalcanal and therefore undertake illegal cutting in the outskirts of the city. A commercialised fuel wood market is well established in Honiara. Supplies come mainly from secondary forest and logged over areas of Tenaru and Mt Austin, about 10 km from Honiara. Drift wood is also used as and when available.

Table 7 Cooking Fuel, by Household and by Province (2009)

Location	Total	Electricity - main grid	Kerosene	Wood Coconut shells	Char-coal	Households using Biomass fuel	% Households Using Biomass	Gas	Other
	Households (N°)								
Choiseul	4,712	8	23	4,588	11	4,599	97.6%	74	8
Western	13,762	60	141	12,990	109	13,099	95.2%	441	21
Isabel	5,143	5	40	4,860	132	4,992	97.1%	104	2
Central	4,905	12	7	4,790	0	4,790	97.7%	96	-
RenBell	688	-	4	666	0	666	96.8%	18	-
Guadacanal	17,163	39	39	16,423	21	16,444	95.8%	617	24
Malaita	24,421	34	77	24,016	12	24,028	98.4%	254	28
Makira	7,173	30	8	7,068	2	7,070	98.6%	47	18
Temotu	4,303	6	12	4,258	0	4,258	99.0%	25	2
Honiara	8,981	331	261	4,761	131	4,892	54.5%	3,281	216
Total	**91,251**	**525**	**612**	**84,420**	**418**	**84,838**	**93.0%**	**4,957**	**319**

Source: SIG. 2012. *2009 Population and Housing Census.* Honiara

4.5.3 Electricity

As Table 8 shows, only 21% of households in the Solomon Islands had access to electricity in 2009, ranging from well just over 8% in Central Province to 67% in Honiara. Overall, 56% of those households electrified received power from SIEA. Away from Honiara, only 37% of electrified households had SIEA service, 28% had their own source of supply, and 23% reported that they received electricity from a private company.

As **Error! Reference source not found.** shows, in 2012 total consumption was about 63.5 GWh of which domestic consumers accounted for 14%, commercial 63%, industrial 1% and 8% by Government. The Honiara system accounted for 89.7% of total demand, Auki 3.3%, Noro 2.6%, Gizo 1.9% and six others less than 1% each.

SIEA has a national tariff (**Error! Reference source not found.**), with substantial cross-subsidies from Honiara consumers to SIEA consumers on the outer islands. In early 2013, the cost of electricity was 86 US¢/kWh for domestic consumers and 92 US¢/kWh for commercial or industrial consumers. There is an '*automatic fuel price adjustment*' (AFPA), varying with the cost of diesel fuel the present AFPA is 27 SI¢/kWh. 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).

Error! Reference source not found. shows the annual maximum demand in each SIEA grid (system) in kW peak from 2000 to 2012. For the past twelve years and longer, peak demand has usually exceeded firm capacity e.g. during April 2013 one unit at Lunga Generating Station in Honiara was out of commission on a 10,000 hour maintenance overhaul which resulted in rotating load shedding. The CAGR (Compound Average Growth Rate) for maximum power demand across all systems for the last 10 years, 2003 to 2012 is 3.49%.

Table 11 shows annual energy demand in each SIEA grid (in GWh per annum) over the last 12 years. The table shows that energy demand growth has been mixed and has probably been constrained by the lack of significant grid extension in recent years and the relatively high tariff, pointing towards supressed demand. The CAGR for energy demand across all systems for the last 10 years, 2003 to 2012 is 4.06%.

Table 8 Households by Source of Electricity & by Province (No. 2009)

Location	Total	Electricity - main grid	Own Generator	Solar	HH with electricity	% HH with electricity	Gas	Kerosene Lamp	Coleman lamp	Wood / coconut	Other	None
Choiseul	4,712	194	52	478	724	15.4%	19	3,869	17	2	76	5
Western	13,762	1,665	145	1,149	2,959	21.5%	10	10,425	19	88	238	23
Isabel	5,143	298	62	870	1,230	23.9%	20	3,825	16	3	47	2
Central	4,905	189	33	188	410	8.4%	7	4,476	-	-	10	2
RenBell	688	3	1	515	519	75.4%	-	145	-	-	12	12
Guadacanal	17,163	1,411	229	597	2,237	13.0%	20	14,198	20	411	227	50
Malaita	24,421	827	74	2,969	3,870	15.8%	48	19,211	26	228	963	75
Makira	7,173	265	48	424	737	10.3%	8	5,735	74	62	471	86
Temotu	4,303	116	8	532	656	15.2%	2	3,431	22	68	119	5
Honiara	8,981	5,780	31	202	6,013	67.0%	13	2,835	36	3	60	21
Total	**91,251**	**10,748**	**683**	**7,924**	**19,355**	**21.2%**	**147**	**68,150**	**230**	**865**	**2,223**	**281**

Source: SIG. 2012. *2009 Population and Housing Census.* Honiara

Table 9 SIEA Annual Energy Demand by Customer Type (MWh 2012)

Category	Honiara	Noro	Munda	Gizo	Auki	Malu'u	Buala	Kira	Lata	Tulagi	Total	% of total
Domestic	7,532,481	157,136	68,004	104,992	1,016,787	28,601	120,516	55,781	17,335	3,664	9,105,297	14%
Commercial	38,036,290	511,174	350,544	753,747	842,369	18,092	139,993	116,519	60,981	217,402	41,047,111	65%
Industrial	6,122,577	990,659	12,975	9,838	113,292	141	141	463		2,596	7,252,682	11%
Govt	4,699,220		95,554	274,806	59,526	11,728	47,016	63,777	34,731	3,895	5,290,253	8%
Min. Charge	0	353	3,766	4,419	8,638	5,540	4,481	5,997	143	354	33,691	0%
Others	551,776	2,925	10,543	79,608	66,179	1,358	9,644	2,646	44,590	1,062	770,331	1%
Total	**56,942,344**	**1,662,247**	**541,386**	**1,227,410**	**2,106,791**	**65,460**	**321,791**	**245,183**	**157,780**	**228,973**	**63,499,365**	**100%**
% of total	89.7%	2.6%	0.9%	1.9%	3.3%	0.1%	0.5%	0.4%	0.2%	0.4%	100.0%	-

Source: SIG, SIEA. 2013. *Customer Demand Statistics.* Honiara

Table 10 SIEA Tariff April 2013 (SI$)

Category	Charge (SI$)
Domestic	6.1867/kWh
Commercial & Industrial	6.6465/kWh

Category	Charge (SI$)
High Voltage Tariff	6.4746/kWh
Minimum Charge	20.00/month
Note: Costs incl. AFPA, SI$ 0.2785/kWh	

Source: SIG, SIEA. 2013. *Customer Demand Statistics.* Honiara

Table 10 SIEA Historical Maximum Power Demand by System (kW Peak)

System	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Honiara	10,300	9,200	8,800	9,280	9,910	10,790	11,470	12,600	12,610	12,880	13,780	13,870	14,241
Noro/Munda	1,730	1,530	1,439	1,350	1,520	730	750	860	800	580	550	440	410
Gizo	315	355	350	332	340	495	360	380	360	390	450	423	450
Auki	315	343	385	435	320	288	274	315	320	365	367	360	360
Buala	65	70	70	65	70	85	75	80	78	80	70	74	72
Kirakira	68	52	51	46	45	65	70	88	75	67	45	71	62
Lata	65	65	60	57	64	80	86	93	82	107	82	92	88
Malu'u	33	40	40	40	30	31	29	30	24	22	22	22	30
Tulagi	60	68	65	60	60	65	64	74	69	89	79	103	92
Total Demand, Power	**12,951**	**11,723**	**11,260**	**11,665**	**12,359**	**12,629**	**13,178**	**14,520**	**14,418**	**14,580**	**15,445**	**15,455**	**15,805**
Demand Growth		-9%	-4%	4%	6%	2%	4%	10%	-1%	1%	6%	0%	2%

Source: SIG, SIEA. 2013. *Customer Demand Statistics.* Honiara

Table 11 SIEA Historical Annual Energy Demand by System (GWh/Annum)

System	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Honiara	49.63	47.13	45.39	45.07	51.44	58.30	59.40	66.75	68.59	69.76	74.52	74.67	75.29
Noro/Munda	7.47	4.77	6.97	6.41	6.78	4.20	4.35	4.75	4.76	3.38	3.43	2.28	3.32
Gizo	1.85	1.89	1.64	1.89	1.91	1.88	2.00	1.92	1.88	1.86	2.26	1.96	2.48
Auki	1.76	1.69	1.71	1.57	1.53	1.60	1.57	1.67	1.42	1.58	2.05	1.96	1.88
Buala	0.00	0.33	0.34	0.33	0.37	0.39	0.30	0.49	0.32	0.33	0.38	0.29	0.38
Kirakira	0.33	0.34	0.32	0.29	0.25	0.33	0.34	0.37	0.32	0.34	0.32	0.40	0.07
Lata	0.27	0.24	0.26	0.26	0.25	0.36	0.30	0.27	0.26	0.44	0.22	0.13	0.30
Malu'u	0.10	0.05	0.05	0.06	0.08	0.14	0.19	0.61	0.27	0.08	0.03	0.40	0.14
Tulagi	0.33	0.39	0.37	0.40	0.33	0.37	0.42	0.45	0.36	0.42	0.41	0.35	0.17
Total Demand, Energy	**61.72**	**56.84**	**57.06**	**56.28**	**62.95**	**67.55**	**68.86**	**77.28**	**78.19**	**78.19**	**83.62**	**82.43**	**84.04**
Demand Growth		-8.6	0.4	-1.4	10.6	6.8	1.9	10.9	1.2	0.0	6.5	-1.5	1.9

Source: SIG, SIEA. 2013. *Customer Demand Statistics.* Honiara

4.5.4 Prospective Demand Growth

Table 12 shows prospective SIEA peak demand to 2030 assuming a CAGR of 3.5% and *Table 13* shows prospective SIEA energy demand to 2030 assuming a CAGR of 4.1%. Both of these figures are based on the SIEA historical CAGR 2003 - 2012. These growth rates can be compared with PIREP 2004 which assumed a) a base case of 4% CAGR, b) a low growth case of 2%, c) a high case of 6% and also with JICA 1998 which assumed a projected average growth rate of 5.2% for power and energy. The projected power and energy demands are no more than roughly indicative but provide a basis for estimating future generation requirements until 2016. A horizon year of 2016 should provide sufficient time for the planned rehabilitation of the diesel outstations, the Lunga and Honiara diesel upgrades and the development of smaller scale renewable generation options. The larger scale renewable generation options on Guadalcanal including Tina River Hydro and Savo Geothermal, of indicative capacity of 20 MW each, will take longer to develop and construct and should be considered for meeting demand growth in the period 2015-2020.

Table 12 SIEA Projected Maximum Power Demand by System (kW Peak)

System	2012	2013	2014	2015	2016	2020	2025	2030
Honiara	14,241	14,739	15,254	15,787	16,338	18,745	22,257	26,427
Noro/Munda	410	424	439	455	470	540	641	761
Gizo	450	466	482	499	516	592	703	835
Auki	360	373	386	399	413	474	563	668
Buala	72	75	77	80	83	95	113	134
Kirakira	62	64	66	69	71	82	97	115
Lata	88	91	94	98	101	116	138	163
Malu'u	30	31	32	33	34	39	47	56
Tulagi	92	95	99	102	106	121	144	171
Total Demand	**15,805**	**16,357**	**16,929**	**17,520**	**18,133**	**20,803**	**24,701**	**29,330**
Demand Growth	3.49%							

Source: SIG, SIEA. 2013. *Customer Demand Statistics & Consultant's Estimates.* Honiara

Table 13 SIEA Projected Annual Energy Demand by System (GWh/Annum)

System	2012	2013	2014	2015	2016	2020	2025	2030
Honiara	75.29	78.34	81.53	84.84	88.28	103.52	126.32	154.14
Noro/Munda	3.32	3.46	3.60	3.74	3.89	4.57	5.57	6.80
Gizo	2.48	2.58	2.69	2.80	2.91	3.41	4.16	5.08
Auki	1.88	1.95	2.03	2.12	2.20	2.58	3.15	3.84
Buala	0.38	0.40	0.41	0.43	0.45	0.52	0.64	0.78
Kirakira	0.07	0.07	0.08	0.08	0.08	0.10	0.12	0.15
Lata	0.30	0.31	0.33	0.34	0.35	0.41	0.50	0.62
Malu'u	0.14	0.15	0.16	0.16	0.17	0.20	0.24	0.29
Tulagi	0.17	0.18	0.19	0.19	0.20	0.24	0.29	0.35
Total Demand	**84.04**	**87.45**	**91.00**	**94.70**	**98.54**	**115.55**	**141.00**	**172.05**
Demand Growth	4.06%							

Source: SIG, SIEA. 2013. *Customer Demand Statistics & Consultant's Estimates.* Honiara

5 Renewable Technologies and Options

5.1 Geothermal

There are surface manifestations of geothermal energy in West Guadalcanal, the Ngokosoli river valley of Vella Lavella, Simbo Island, and Savo Island. There is an on-going feasibility study for a 20 MW geothermal generation plant on Savo Island. In the initial stages exploration of potential sites is required to identify good sites for geothermal based power generation, which will require the drilling of trial wells. Geothermal is a good resource for future base load renewable generation but may be constrained by difficulties with land acquisition, transmission line routing and volcanic activity. The economics of geothermal generation are also sensitive to scale.

5.2 Hydropower

There is substantial hydropower potential in the Solomon Islands. The total hydroelectric potential of the Solomon Islands is estimated to be 326 MW[1]. A feasibility study conducted by the SIG, with support from the World Bank and the Government of Australia, proposed a 15-20 MW hydropower development on the Tina River near Honiara, with annual electricity production of 60 GWh. Feasibility studies on the Tina River hydropower scheme proposed for Honiara are continuing. The Energy Division is currently assessing 4 small-scale hydro schemes for provincial centres to reduce SIEA's use of diesel-based power generation in outer island provincial centres[2].

Table 14 Small Scale Hydro Feasibility Studies

Type	Location	Capacity kW	Planned Commissioning Year
Hydro, run-of-river	Fiu river, Auki, Malaita Province	750	2017
Hydro, run-of-river	Luembalele river, Lata, Temotu Province	190	tba
Hydro, run-of-river	Huro river, Kirakira, Makira Province	120	tba
Hydro, run-of-river	Mase river, Western Province	1,750	tba

Hydropower is attractive in the Solomon Islands for centralised power generation to supply the SIEA urban grids. Hydropower fed mini-grids can also be an option in rural areas depending on a suitable site location and water resources. As shown in **Error! Reference source not found.**, there is a history of community rural based micro hydro plants feeding small mini-grids.

Table 15 Community Rural Based Micro Hydro Plants Feeding Small Mini-Grids

Type	Location	Year	Capacity	Generation	Funding	Comments
Hydro	Iriri Settlement Kolombangara	1983	10 kW	3-4 kW	Unido	Not operating due to weir and penstock failures, etc. Community is still considering whether to refurbish this system
Hydro	Malu'u River (Malaita)	1986	32 kW	15 kW	NZ Aid	Not operational due to on-going land disputes
Hydro	Vavanga (Kolombangara)	1994	12 kVA	4-5 kW (now 8 kW)	AusAID +Australian	Reconstructed on a new site with a new 8 kW turbine / genset.

[1] *Japan International Cooperation Agency, Master Plan Study of Power Development in Solomon Islands*, 2001, volume 1, p 5-1.

[2] Asian Development Bank, TA-8130 SOL: Provincial Renewable Energy Project, 2013

Type	Location	Year	Capacity	Generation	Funding	Comments
					Citizens	Commissioned June 2006. Currently operating reliably
Hydro	Buala Santa Isabel	1996	185 kW	185 kW	GTZ	Present status unknown
Hydro	Ghatere (Kolombangara	1997	12 kW		AusAID + Australian Citizens	Not operating due to turbine failure, flood damage, theft of electrical equipment, etc. Community is still considering whether to refurbish this system.
Hydro	Manawai Harbour (Malaita)	1997	50 kW	15-25 kW	Republic of China	Operating. Various economic and rural development spin-offs.
Hydro	Bulelavata (New Georgia)	1999	29 kW	14 kW	AusAID	Has operated reliably for 7 years. Supplies power to 20 houses plus a large boarding school.
Hydro	Raeao (Malaita)	2002	25 kW	14 kW	Republic of China	Operational.
Hydro	Nariaoa (Malaita)	2004	25 kW		Republic of China	We understand that this project has been completed, but its current operational status is not known

5.3 Ocean

Ocean energy would appear to be promising as an option based on extrapolating results from Fiji and Vanuatu. Annual average wave power could be roughly 14 kW/metre of wave front, with a wide range varying by site. However the technology for tidal and ocean generation is still in an early stage of development and therefore would not be an immediate option for renewable generation in the Solomon Islands.

5.4 Wind

There is little data on the Solomon Island wind energy potential derived directly from in country wind data logging. The NASA-NREL data derived from remote sensing, shows a poor wind regime in the Solomon Islands. The average wind speed is about 3.5 m/sec. On the basis of the NASA-NREL wind data, it is likely that wind power will have a higher LCOE than other renewable generation options presented.

Figure 4 Mean Annual Wind Speed at 45 m (m/s)

Source: ASTAE/WB. 2006. *Wind Resource Maps, Pacific Island.* Consultant's Report. Washington D.C.

The Energy Division is currently installing four wind monitoring systems in the provinces[3]. For a wind energy project it is essential to monitor and record wind speed data for minimum period of one year at potential sites. Thus in the absence of wind speed data, large wind power projects are not recommended. However small scale wind power projects may be used as independent stand-alone system or as a hybrid with solar. Small wind turbines are being used in places like hotels etc. in Honiara but they are unlikely to be financially viable. Due to the poor wind resource indicated by the NASA data and absence of actual site data, wind energy is generally not recommended as a renewable generation option.

5.5 Solar

As the Solomon Islands lies near the equator, there is considerable solar energy potential, with insolation values of 5 kWh/m^2/day or higher which are among the highest levels in the region. A number of small-scale and demonstration projects are operational, including solar home systems (SHS) provided through Government funding since 2011 while Government of Republic of China (Taiwan) has supplied SHSs (2009) for all constituencies in the country and solar systems for rural schools. The respective Governments' of Italy & Turkey have complemented the Government of Solomon Islands programme to provide solar lighting for rural-based schools including boarding schools and rural clinics. In September 2012, the Government launched a 2 year-pilot project on installation of SHSs for 2000 households in the country that requires each household to pay the cost of installation (including transportation) and operation & maintenance costs over the 2 years period. RESCOs contracted by the Government will install the SHSs and service the systems over the lifetime of the pilot phase[4]. Depending on the outcome of the pilot phase, the Government plans to rollout this programme to cover rest of the rural population. There was a solar lighting scheme through SOPAC/REEEP co-operation, with tailored financing mechanisms, allowing recipients to pay for installations via non-fiscal means, for example with crop production.

Figure 4 Mean Annual Direct Normal Solar Insolation Contours (kWh/m^2/day)

[3] Pacific Islands Greenhouse Gas Abatement and Renewable Energy Programme

[4] This project is funded under the Pacific Environmental Fund provided by the Government of Japan

Source: NREL/NASA

There is no data on solar radiation (direct and indirect) available in the Solomon Islands based on terrestrial measurement over an extended period of time. NREL-NASA data indicates the Solomon Islands are endowed with good year round solar radiation resource (5.1 kWh/m^2/day to about 5.6 kWh/m^2/day direct normal annual average). This is one of the more abundant renewable energy resources available in the Solomon Islands. The main advantages solar energy has in the Solomon Islands are as follows:

- A good solar energy resource is available in almost all provinces, even in remote inland areas and can be used in stand-alone or household applications. Stand-alone and household solar will eliminate the construction of transmission and distribution lines
- A good year round solar resource
- During the last year the cost of solar panels have fallen by about 50% making it price competitive with other sources of fossil fuel and renewable energy generation.

5.6 Biomass

There are four options for using biomass energy in the Solomon Islands.

- Biomass gasification technology can be utilised for power generation using waste from the forestry industry or coconut processing industry.
- Direct combustion for power generation where biomass waste and by products are burnt to raise steam to generate electricity via a turbo alternator.
- Direct usage of coconut oil (CNO) as a substitute for diesel fuel oil or as an admixture to the diesel fuel for existing diesel gensets.
- Biodiesel manufactured from biomass - Biodiesel consists of long chain fatty acids derived from vegetable oils or animal fats and can be used in diesel engines. Biodiesel refers to the pure fuel before blending with diesel fuel. Biodiesel blends are denoted as, "BXX" with "XX" representing the percentage of biodiesel contained in the blend (ie: B20 is 20% biodiesel, 80% petroleum diesel).

Biomass Power- Biomass Gasification

The first option for biomass based renewable generation is biomass gasification. The Solomon Islands have large palm oil plantations and the waste product from these plantations could be used as a feedstock for biomass gasification for power generation. The biogas produced by the biomass

gasification process can be used in dual fuel engines mixed with diesel (20% diesel and 80% biomass gas) and also alone in 100% gas engines.

The main disadvantage of biomass gasification based power plant is that it is a complex process requiring additional mechanical plant as well as diesel or gas engine genset to generate electricity. Due to the difficulty and cost of transporting biomass feedstock biomass gasification generation is best located adjacent to processing industries which have an abundant biomass by product. The other disadvantage of this form of generation is that the gasification process involves a complex chemical and mechanical process and the capacity for managing this may not be available in rural areas.

Biomass Power- Direct Combustion

A direct combustion steam electric power system is for the most part indistinguishable from other steam electric power systems (for example, oil and coal) that combust fuel in a boiler to generate steam for power production. A biomass-fired boiler generates high-pressure steam by direct combustion of biomass in a boiler. There are two major types of biomass combustion boilers - pile burners utilising stationary or traveling grate combustors and fluidised-bed combustors. Current biomass combustor designs utilise high efficiency boilers and stationary or traveling grate combustors with automatic feeders that distribute the fuel onto a grate to burn. Fluidised-bed combustors are the most advanced biomass combustors. In a fluidised-bed combustor, the biomass fuel is in a small granular form (for example, rice husk) and is mixed and burned in a hot bed of sand. Injection of air into the bed creates turbulence, which distributes and suspends the fuel while increasing the heat transfer and allowing for combustion below the temperature that normally creates nitrogen oxides (NOx) emissions. This form of biomass power generation is a complex process and relies on good operation and maintenance practices when running and maintaining the steam raising boiler and steam turbine.

Biomass Power - Coconut Oil

Most compression engines will run on coconut oil (CNO). The chemical and physical characteristics of CNO vary considerably from diesel which provides challenges for trouble free operation. The use of CNO as a substitute for diesel is technically feasible but as a minimum requires water free oil filtered to 2 micron and generally fuel heating and a higher degree of operator attention. The technical feasibility of CNO use in diesel engines requires the following fuel system and engine modifications to avoid problems:[5]

- Fuel heating
- Blending fuel
- Additional filtration
- Dual fuel tanks for diesel and CNO
- Fuel pump replacement
- Injector replacement
- Conditioning of CNO prior to use
- Additional monitoring of engine and lubrication system
- Earlier replacement of filters
- Earlier oil changes.

The conclusion of a recent CNO blending trial in Auki noted that there are no technical issues which would stop the use of CNO in SIEA outstation generators provided the CNO used meet the required standards. There is however an increased capital and operating cost associated with this. It was also noted that using CNO derived from small existing milling facilities will not financially benefit SIEA to any significant degree when compared with diesel.

Figure 5 Auki CNO Trial Processing & Storage Equipment

[5] ADB. 2013. *Final Project Workshop - ADB TA 7329 Access to Renewable Energy in the Pacific, CNO Use in SIEA Outstations*. Consultant's Presentation. Honiara.

Source: ADB. 2012. Access to Renewable Energy in the Pacific. Consultant's Report. Manila (TA 7329)

Biomass Power- Biodiesel

Biodiesel is a high-cetane fuel, which can be fully blended with fossil diesel to run compression ignition engines. It offers low emissions of GHG, sulphur compounds and particulate matter compared with fossil diesel. In current practice, a 5-20% (B5, to B20) 1st generation biodiesel (fatty acid methyl ester, FAME) is blended with fossil diesel. A full blending (up to B100) is also possible with advanced processing methods[6]

Commercial production of biodiesel is based on trans-esterification of vegetable oils (chemically or mechanically extracted). In the Solomon Islands this would principally be palm oil, coconut oil, animal fats and waste oil through the addition of methanol (also bio methanol or other alcohols) and catalysts, with glycerine as a by-product. Biodiesel production from animal fats and waste oils is cheaper and more efficient, but the basic feedstock is limited. The production of biodiesel in the Solomon Islands would require setting up a processing plant and importing the methanol, bio methanol and catalysts for use in the production process.

5.7 Renewable Energy Technology Assessment

5.7.1 Levelized Cost of Energy

The LCOE is the constant unit cost (per kWh or MWh) of a payment stream that has the same present value and represents the total cost of building and operating a generating plant over its life. It can be used for comparing differing RET technologies with different operating characteristics.

A conservative approach has been used for the determination of LCOE for various technologies. The range of capital costs and O&M costs assumed were principally sourced from International Renewable Energy Agency (IRENA), ESMAP and the consultant's estimates. These costs and their source are detailed in **Error! Reference source not found.**. The renewable resource data for wind and solar were based on NREL and NASA data.

Table 16 Assumptions Used for Calculating LCOE

[6] IRENA, IEA-ETSAP. 2013. *Production of Liquid Biofuels, Technology Brief*. http://www.irena.org/Publications/ReportsPaper.aspx?mnu=cat&PriMenuID=36&CatID=141.

N°	Potential Renewable Energy Technology and diesel based generation	Capital Cost (US$/kW)	O & M Cost	Data Source
1	Geothermal	5,500	USD $100 /kW/year	IRENA
2	Hydropower	3,500	2% of capital cost	IRENA
3	Micro hydropower	15,350	USD $212 /kW/year	Auki HPP Estimate SMEC
4	Wind	3,567	USD $38 /kW/year	NREL
5	Solar PV	4,874	USD $30 /kW/year	Solar PV Estimate, SKM
6	Biomass gasification	5,500	6.6% of capital cost	IRENA
7	Biomass direct combustion	4,000	5% of capital cost	IRENA
8	Biomass coconut oil	970	USD $0.025-$0.07 kWh	Consultants estimates
9	Diesel based generation	970	USD $0.025-$0.07 kWh	Diesel estimates, SKM

Source: IRENA, ESMAP, NREL and Consultant's estimates as detailed

Table 17 Calculations of LCOE for Various Renewable Options

Electrification Option	System Configuration	LCOE (US$/kWh)
Geothermal	Geothermal	$0.14
Hydropower	Large scale hydropower	$0.10
Micro hydropower	Micro hydropower	$0.42
Wind	Wind plus diesel hybrid	$0.49
Solar PV	Solar PV plus diesel hybrid	$0.49
Solar PV home system	Solar PV plus battery	$0.61
Biomass gasification	Biomass gasification	$0.39
Biomass direct combustion	Biomass direct combustion	$0.29
Biomass coconut oil	Biomass coconut oil gensets	$0.51
Diesel based generation	Diesel gensets	$0.51

Source: Homer Energy LLC. 2013. *Homer 2 v 2.81 Software.* http://homerenergy.com/software.html

5.7.2 Conclusion

The main findings of the LCOE assessment can be summarised as follows:

- Small hydropower would appear to be the best of the options considered for renewable generation in the Solomon Islands grid supply and for remote villages where there is an available water resource. The next best options for remote villages and individual households based on LCOE alone are biomass followed by solar PV plus battery.
- Land issues are key when considering the renewable energy options available, land issues can mean that the least cost renewable generation option is excluded from consideration.
- Renewable energy options for urban and rural electrification need a site specific solution.
- Solar energy is widely and consistently available throughout the country and can be used for utility scale, commercial scale, village mini-grids and solar home systems. Solar home systems can be considered the best option for rural areas when land issues, population density and access are taken into account.

6 Renewable Energy Strategy and Investment Plan

6.1 Renewable Energy policy outcome, statement and strategies

Policy outcome: Use of renewable energy sources of power generation increased to 50% by 2020 [7]

Policy statement 1: Establish an appropriate, reliable, affordable and sustainable renewable energy-based power supply in urban and rural areas

Strategies	
1.1	Support the development and implementation of the Tina River Hydropower Development Project (TRHDP).
1.2	Support the development and implementation of the Savo Geothermal Project.
1.3	Improve SIEA energy services through isolated grids (hydro and solar) and generating plants.
1.4	Replicate successful and scaling-up of deployment of solar PV home systems in rural households
1.5	Encourage the establishment of rural centres including ICT powered by renewable energy at provincial level
1.6	Encourage Renewable Energy Services Company (RESCO's) involvement in productive uses of renewable energy sources.
1.7	Promote the use of renewable energy technologies in rural schools.
1.8	Promote the use of renewable energy technologies in health centres.
1.9	Promote the use of low-cost specific renewable energy technologies (e.g. solar charging stations, solar lanterns).

Policy statement 2: Assess, cost, promote and enhance the potential for renewable energy resources.

Strategies
2.1 Undertake an assessment and data collection on wind energy potential.
2.2 Undertake an assessment and data collection on geothermal energy potential.
2.3 Undertake an assessment of biofuel potential based on coconut.
2.4 Undertake an assessment of gasification potential from by-products and forest waste.
2.5 Undertake an assessment and data collection on mini hydro sites
2.6 Develop training and capacity development on new renewable energy technologies.

Policy statement 3: Develop renewable energy policy instruments (standards and regulations, net metering policies, market-based instruments, procurement strategies) to meet the renewable energy targets.

Strategies	
3.1	Develop a clear policy on fiscal incentives e.g tax holiday incentives and duty tax exemptions including loans for renewable energy technology deployment[8]
3.2	Develop clear policies and legislations/regulation on net metering
3.3	Establish standards for on- and off-grid connections of renewable energy technologies.

[7] 35% in rural areas by 2020 and 45% of grid connected in the urban and provincial centres

[8] The proposed National Energy Advisory Committee TOR is also to approve tax incentives for renewable energy technologies. Therefore the Income Revenue Department is to be included as one of the members.

6.2 Time Bound Renewable Energy Investment Plan

This section develops a time bound renewable energy investment plan, together with renewable energy targets. The REIP is based on the SIG Energy Policy target of **50% renewable energy by 2020.** The renewable energy target is an installed capacity target.

6.3 Renewable Energy Targets

The renewable energy targets are separately tabulated for rural and urban areas so that each area can be targeted with a different approach to electrification. To some extent this is historical as SIEA is active in the urban areas of each Province but has no presence in rural areas. Urban areas are more economically supplied by grid based electrification limited from centralised sources of generation whereas rural areas are more suited to individual technologies such as solar home systems or mini-grids in the case of smaller villages. The proposed electrification targets are as follows:

Table 18 Rural Households Electrification Targets

Technology	2015		2020		2030	
	N°	%	N°	%	N°	%
Diesel self-generation	4,471	5	4,870	5	3,390	3
Hydro mini-grid	894	1	4,870	5	11,299	10
Solar home systems	4,471	5	19,480	20	47,457	42
Biomass / CNO	0	0	4,870	5	11,299	10
Total	**9,835**	**11**	**34,090**	**35**	**73,445**	**65**

Source: Consultants estimates, 2013

The rural household electrification targets place emphasise a rapid scale up of solar home systems such as 100 W_P solar systems with battery storage to supply minimum electrification requirements. Also included are hydropower based mini-grids to supply smaller groups of houses and villages.

Table 19 Urban Households Electrification Targets

Technology	2015		2020		2030	
	N°	%	N°	%	N°	%
Grid	13,565	65	19,365	75	31,686	85
Solar home systems	209	1	1,291	5	1,864	5
Total	**13,774**	**66**	**20,656**	**80**	**33,550**	**90**

Source: Consultants estimates, 2013

It is anticipated that the grid will be supplied by the following range of renewable energy technologies:

Table 20 Urban grid Connected Generation Targets

Technology	2015	2020	2030
Diesel	100%	50%	10%
Hydro	0%	41%	50%
Utility scale solar	0%	4%	10%
Geothermal	0%	0%	25%
Biomass / CNO	0%	5%	5%
Total	**100%**	**100%**	**100%**

Source: Consultants estimates, 2013

The urban grid generation targets emphasise small hydropower and geothermal in the medium to long term. At this stage the 2030 grid maximum demand is projected to be 33MW of which the Honiara grid will be 28MW.

Table 21 All Households Electrification Targets

Year	Total HH	Diesel	Hydro	Utility solar	Geo-thermal	Biomass/ CNO	SHS	Total
2015	110,314	16%	1%	0%	0%	0%	4%	**21%**
2020	123,218	12%	10%	1%	0%	4%	17%	**44%**
2030	150,269	4%	18%	2%	5%	9%	33%	**71%**

Source: Consultants estimates, 2013

The following graphs represent the electrification targets; the target for the change in the grid connected generation mix from one that is predominately based on diesel gensets to renewables is shown below:

Figure 6 Rural Household Electrification Rate – 2014-2030

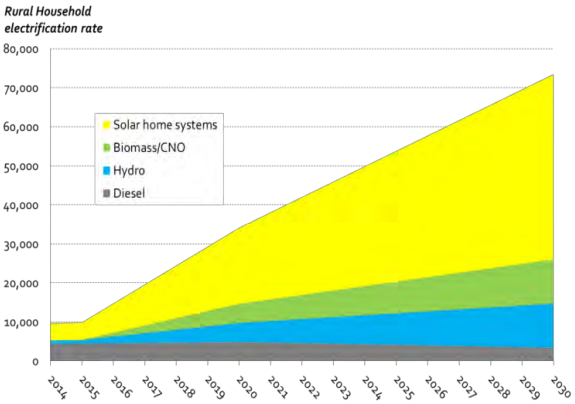


Figure 7 Urban Household Electrification Rate - 2014-2030

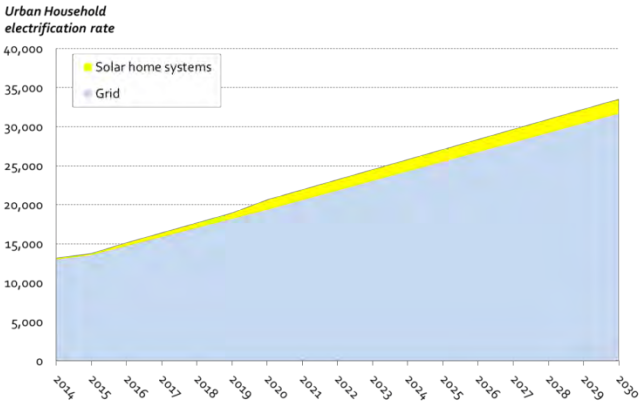


Figure 8 Total Household Electrification Rate - 2014-2030

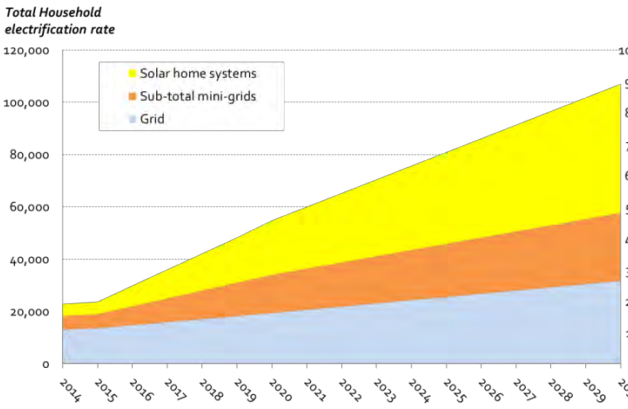
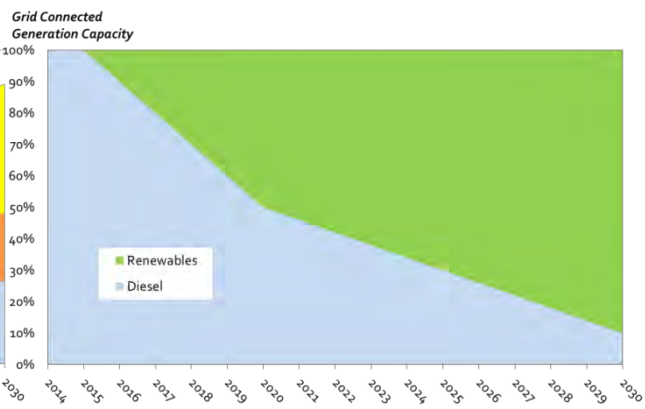


Figure 9 Grid Connected Generation Mix - 2014-2030



Source: Consultants estimates, 2013

6.4 Renewable Energy Strategies and Actions Timelines

The renewable energy strategies, actions and timelines have been collated from the REIP proposed activities as well as from the Renewable Energy Development programme developed by the Energy Division and submitted as part of the MTDS 2014 TO 2016. In addition proposed projects from development partners such as SPC, PPA, SPREP etc are included. The table below provides a timeline for the five years, 2014 to 2019.

Strategies	2014	2015	2016	2017	2018	2019
Policy statement 1: Establish an appropriate, reliable, affordable and sustainable renewable energy-based power supply						
Tina River Hydro development and implementation, a prospect of 14 MW						
Acquisition & Registration of land required for the project completed by August 2014						
Development consent confirmed with the Ministry of Environment						
Development Agreements and Documents signed with identified winning bidder (developer) by Sept 2015						
Constructions commenced						
Transmission line planning, design and procurement (SIEA)						
Construction period						
Expected to be commissioned in 2018						
Savo Geothermal scheme , a prospect of approx. 20 to 40 MW						
Exploration Drilling						
Land Acquisition						

Strategies	2014	2015	2016	2017	2018	2019
completed 2014						
Engineering and Financing completed						
Construction commences 2015						
Construction period						
Commissioning of geothermal-power plant - December 2017						
Solar PV Grid - SIEA office – a total of 62kW						
Head office Solar 60- -100kW – Planning, design and procurement						
Head office solar – installation and commissioning						
Phase 2 Solar 1.5 kW solar farm planning design and procurement						
Phase 2 Solar – 1.5 kW solar farm construction & commissioning						
Solar Electrification for Rural Schools and Clinics						
Selection of schools and clinics for solar electrification and site visits (Jan 2014)						
Design of systems (June 2014						
Procurement of equipment (August 2014)						
Installation of SHS						
Micro-Hydro for Economic Growth Centres and Government Administration Centres: Provincial Centres Renewable Energy projects						
Set up Technical Management Unit within SIEA						
Land acquisition for Fiu, Huro and Leumbalele						
Construction commences on Fiu Hydro scheme						
Commissioning of Fiu Hydro Scheme						
Land acquisition for Noro-Munda Hydro scheme 2016						
Commissioning of Huro Luembalele hydro						
Construction commences Noro-						

Strategies	2014	2015	2016	2017	2018	2019
Munda hydro						
Commissioning of Noro - Munda Hydro						
Solar Equipment for Rural ICT stations (PIGGAREP +)						
Preparatory works started – Jan to June 2014						
International and local consultants recruited and contracts signed ; end of May						
Equipment procurement						
Installation and commissioning - August 2014						
Rural Home Solar systems Project – targets of 3,000 HHs per year (total of 15,000 HHs)						
Pre-selection phase-selection of SHS recipient and respective location – targeting 3000 HHs per year						
Procurement of SHS equipment by August 2014						
Sub- contracting RESCOs – October 2014						
Capacity building of RESCOs November 2014						
Payment for installation and service maintenance received from solar recipients by Dec 2014						
Assembly of SHS and installation at sites commences Jan 2015 – up till 2018						
Promote the use of low-cost specific renewable energy technologies (e.g. solar charging stations, solar lanterns) – SPC Melaneia Million Miracle programme (M3P), BlizClim						
Site selection and partnership with NGO (						
Business model study - BlizClim						
Hardware component procurement and installation initial 200 HHs						
Replication for business model in other communities						

Strategies	2014	2015	2016	2017	2018	2019
Replication of Biofuel based on coconut – SIEA for provincial centers						
CNO demonstration for Auki completed and CNO supply contract signed						
Feasibility studies for CNO uses at Lata, Kira Kira, Noro and Taro						
SIEA up scaling of CNO use						
Policy statement 2: Renewable energy assessment and data collection on renewable energy resources						
Feasibility Studies completed for Mase River						
Update feasibility studies for 2 hydro sites per year						
Proposal development for Renewable energy Assessment of gasification on potential from by-products and forest waste						
Develop training and capacity development on new RETs especially with hydro and solar PV						
Policy Statement 3: Develop renewable energy policy instruments (standards and regulations, net metering policies, market-based instruments, procurement strategies) to meet the renewable energy targets.						
Develop clear policy on fiscal incentives on RE private sector participation						
Draft net metering policy for Independent power producers						
Establish and adopt standards for on- and off-grid connections of renewable energy technologies.						

6.5 Renewable Energy Costs

The renewable energy capital costs are separately tabulated for rural and urban areas as they represent a different approach for each area. The urban areas will be supplied by the grid. The grid in turn will be supplied by renewable generation including hydropower, geothermal, biomass and utility scale solar. Rural areas are more suited to individual technologies such as solar home systems or mini-grids in the case of smaller villages. The average capital cost to electrify an urban household will be USD 5,915 for the period 2014-2030 whereas each rural household which will cost on average USD 596 to electrify. This can be explained to a certain extent as follows:

- Rural areas will be predominately electrified by 100 W_p solar home systems and mini-grids
- Urban areas will be supplied by the grid which will require grid extension capital costs and new renewable generation to be installed as diesel plant is retired. In addition grid supply is planned to have greater capacity in the vicinity of 1000 W per household.

Table 22 Rural Electrification Capital Costs ($ million)

Renewable Technology	Capital costs ($ million)							
	2014	Avg pa	2015-20	Avg pa	2021-30	Avg pa	2014-30	Avg pa
Grid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mini-grids	0.05	0.03	8.05	1.01	11.71	1.17	19.76	1.10
Solar home systems	0.04	0.02	6.52	0.82	12.03	1.20	18.55	1.03
Total	**0.09**	**0.05**	**14.57**	**1.82**	**23.74**	**2.37**	**38.31**	**2.13**

Source: Consultants estimates, 2013

Table 23 Urban Electrification Capital Costs ($ million)

Renewable Technology	Capital costs ($ million)							
	2014	Avg pa	2015-20	Avg pa	2021-30	Avg pa	2014-30	Avg pa
Grid	0.37	0.37	60.05	10.01	134.71	13.47	195.12	11.48
Mini-grids	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Solar home systems	0.00	0.00	0.47	0.08	0.25	0.02	0.72	0.04
Total	**0.37**	**0.37**	**60.52**	**10.09**	**134.95**	**13.50**	**195.84**	**11.52**

Source: Consultants estimates, 2013

Table 24 Total Electrification Capital Costs ($ million)

Renewable Technology	Capital costs ($ million)							
	2014	Avg pa	2015-20	Avg pa	2021-30	Avg pa	2014-30	Avg pa
Grid	0.37	0.37	60.05	10.01	134.71	13.47	195.12	11.48
Mini-grids	0.05	0.05	7.99	1.33	11.71	1.17	19.76	1.16
Solar home systems	0.04	0.04	6.96	1.16	12.28	1.23	19.27	1.13
Total	**0.46**	**0.46**	**75.00**	**12.50**	**158.69**	**15.87**	**234.15**	**13.77**

Source: Consultants estimates, 2013

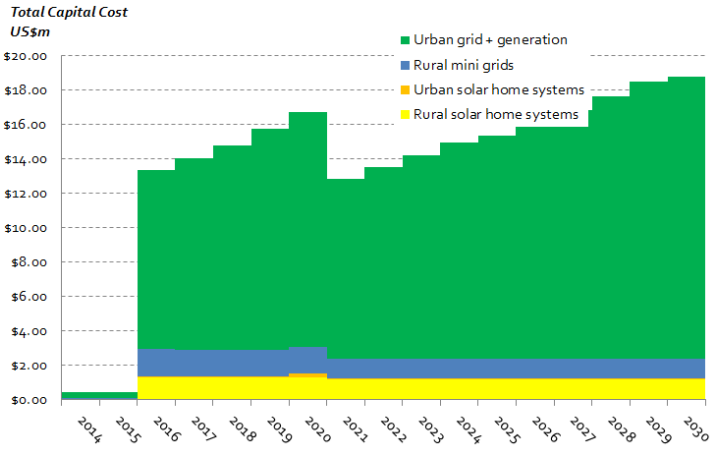
Table 25 Electrification Cost per Household ($/HH)

Renewable Technology	Rural average costs ($/HH)	Urban average costs ($/HH)
	2014-30	2014-30
Grid	0	6,158
Mini-grids	949	0
Solar home systems	430	430
Total	**500**	-

Source: Consultants estimates, 2013

The following graph represents the REIP capital costs:

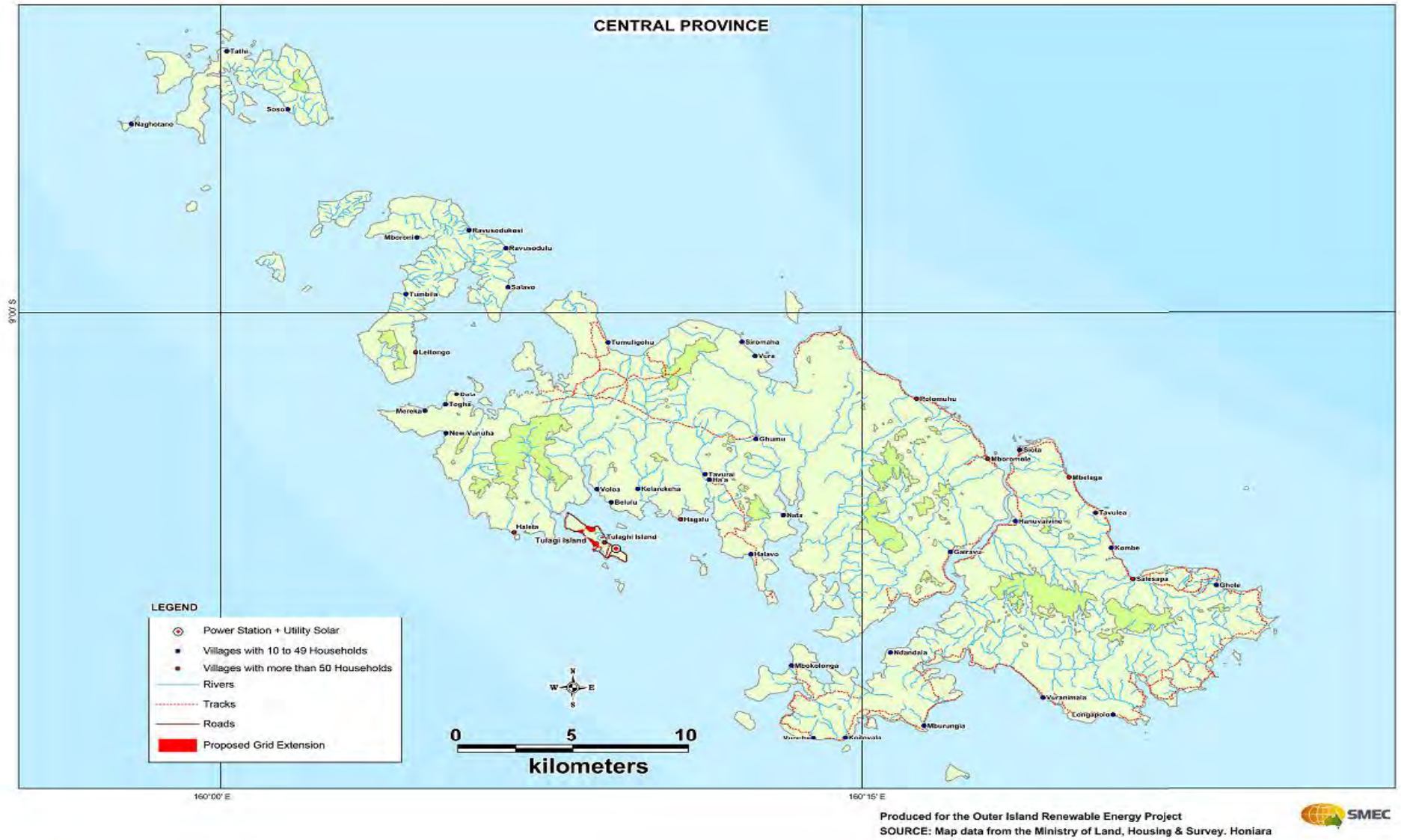
Figure 10 Total Capital Cost - 2014-2030



Source: Consultants estimates, 2013

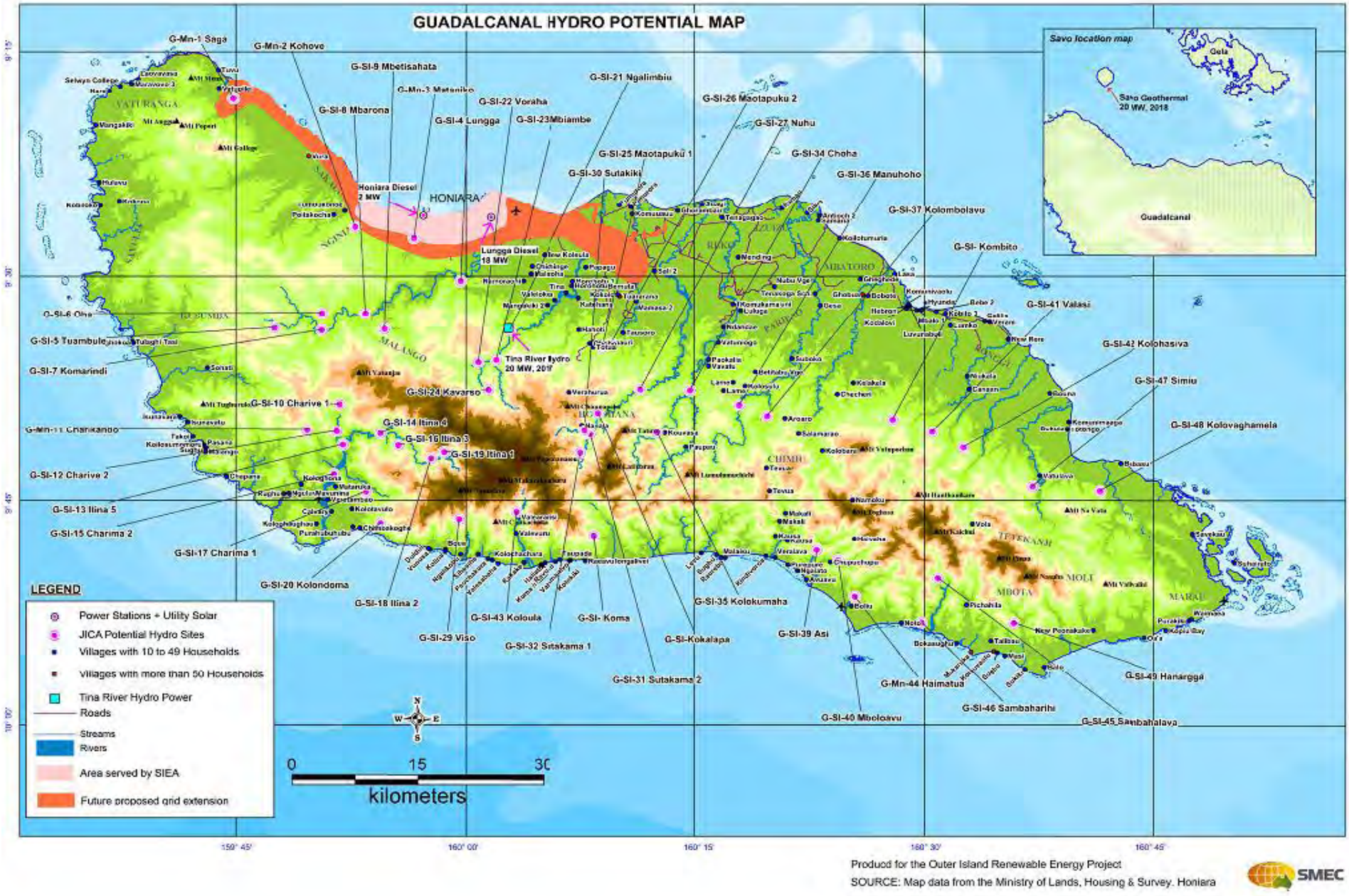
The RE-SIP is based on achieving the SIG 2020 target of 50% of energy being supplied by renewables. The REIP will require a total investment of $75.00 million to 2020 to achieve a 44% country wide household electrification rate and a total investment of $234.15 million to 2030 to achieve a 71% household electrification rate.

APPENDIX A - Provincial Renewable Energy Options


CENTRAL PROVINCE
Tathi
Soso
Naghotano
Mboreni
Ravusodukesi
Ravusodulu
Salavo
Tumbila
Lellongo
Tumuligolhu
Siromaha
Vura
Dudu
Togha
Mereza
New Vanuha
Ghumu
Tavurai
Ho'a
Voloa
Kolanikeha
Belolu
Hagalu
Nata
Haleta
Tulagi Island
Tulaghi Island
Halavo
Kolomuhu
Siota
Mboromole
Mbolaga
Tavulea
Hunuvaivino
Kombe
Gaiavo
Salesapa
Ghole
Ndandala
Mbokolonga
Veranimala
Longapolo
Mburungio
LEGEND
Power Station + Utility Solar
Villages with 10 to 49 Households
Villages with more than 50 Households
Rivers
Tracks
Roads
Proposed Grid Extension
N
W
E
S
0
5
10
kilometers
9°00' S
160°00' E
160°15' E
Produced for the Outer Island Renewable Energy Project
SOURCE: Map data from the Ministry of Land, Housing & Survey. Honiara
SMEC

Produced for the Outer Island Renewable Energy Project
SOURCE: Map data from the Ministry of Land, Housing & Survey. Honiara

SMEC



Produced for the Outer Island Renewable Energy Project

SOURCE: Map data from the Ministry of Lands, Housing & Survey. Honiara

SMEC


ISABEL HYDRO POTENTIAL MAP
SI-Mn-3 Skaleo
SI-Mn-5 Kubolata
SI-Mn-4 Poporo
SI-Mn-EX1 Buala
SI-Mn-1 Kotov
SI-SI-2 Korighole
SI-SI-6 Ghonoghano
N-Mr-15 Pijaka
LEGEND
Buala Power Station + Utility Solar
Villages with 10 to 49 Households
Villages with more than 50 Households
JICA Potential Hydro Sites
Area served by SIEA
Future Proposed Grid Extension
0
25
50
kilometers
7°30' S
7°45' S
8°00' S
8°15' S
8°30' S
158°15' E
158°30' E
158°45' E
159°00' E
159°15' E
159°30' E
159°45' E
Produced for the Outer Island Renewable Energy Project
SOURCE: Map data from the Ministry of Lnd, Housing & Survey, Honiara
SMEC

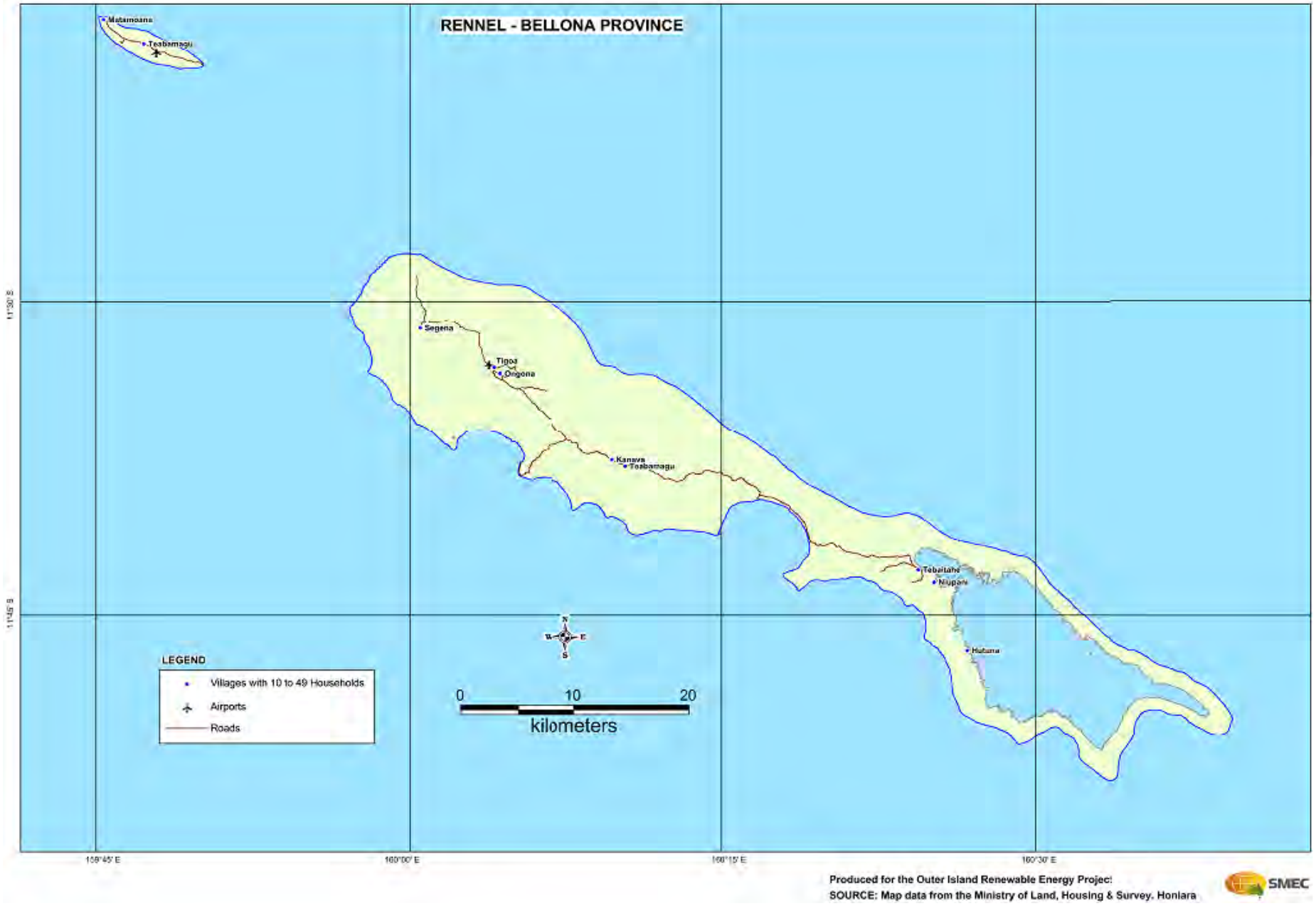
Produced for the Outer Island Renewable Energy Project
SOURCE: Map data from the Ministry of Lands, Housing & Survey, Honiara

SMEC

Produced for the Outer Island Renewable Energy Project

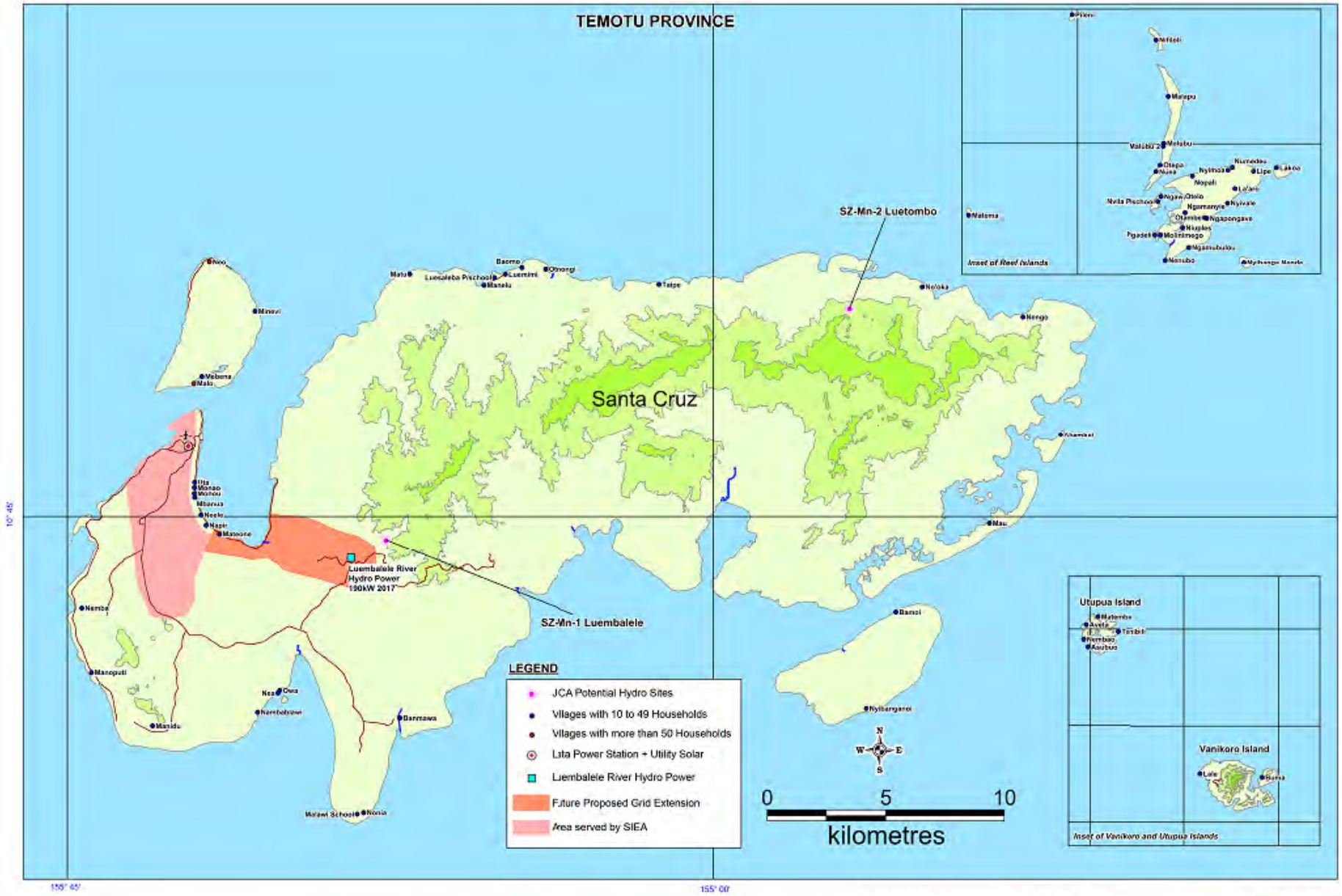
SOURCE: Map data from the Ministry of Lands, Housing & Survey, Honiara

SMEC



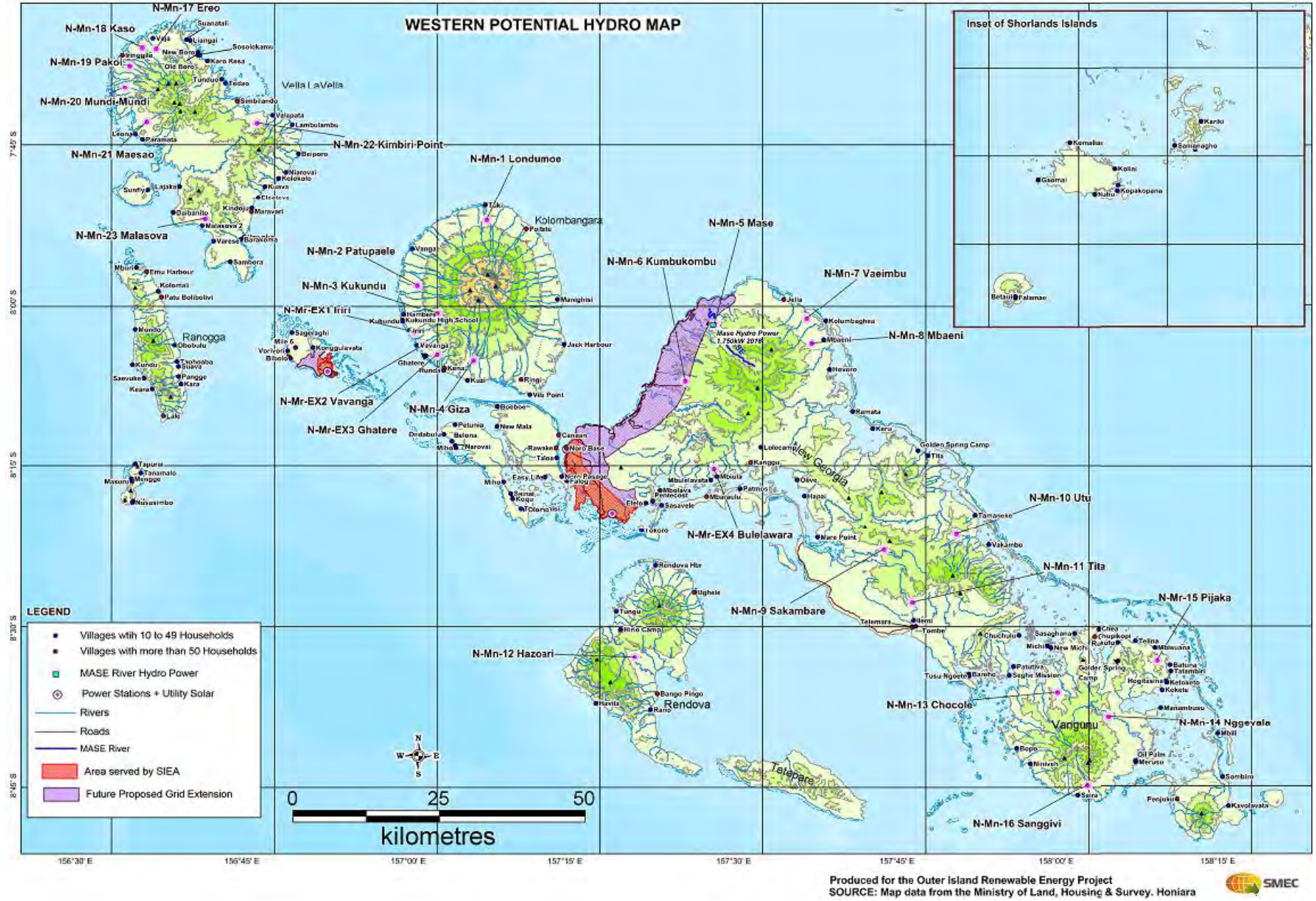
Produced for the Outer Island Renewable Energy Project
SOURCE: Map data from the Ministry of Land, Housing & Survey, Honiara

SMEC



Product for the Outer Island Renewable Energy Project

SOURCE: Map data from the Ministry of Lands, Housing & Survey. Honiara


WESTERN POTENTIAL HYDRO MAP
Inset of Shorlands Islands
N-Mn-17 Ereo
N-Mn-18 Kaso
N-Mn-19 Pakoi
N-Mn-20 Mundi-Mundi
N-Mn-21 Maesao
N-Mn-22-Kimbiri-Point
N-Mn-23 Malasova
N-Mn-1 Londumoe
N-Mn-2 Patupaele
N-Mn-3 Kukundu
N-Mr-EX1 Iriri
N-Mr-EX2 Vavanga
N-Mr-EX3 Ghatere
N-Mn-4 Giza
N-Mn-5 Mase
N-Mn-6 Kumbukombu
N-Mn-7 Vaeimbu
N-Mn-8 Mbaeni
N-Mn-10 Utu
N-Mn-11 Tita
N-Mr-15 Pijaka
N-Mn-9 Sakambare
N-Mr-EX4 Bulelawara
N-Mn-12 Hazoari
N-Mn-13 Chocole
N-Mn-14 Nggevala
N-Mn-16 Sanggivi
Vella LaVella
Kolombangara
New Georgia
Rendova
Tetepare
Vanguna
Ranongga
LEGEND
Villages wtih 10 to 49 Households
Villages with more than 50 Households
MASE River Hydro Power
Power Stations + Utility Solar
Rivers
Roads
MASE River
Area served by SIEA
Future Proposed Grid Extension
0
25
50
kilometres
7°45' S
8°00' S
8°15' S
8°30' S
8°45' S
156°30' E
156°45' E
157°00' E
157°15' E
157°30' E
157°45' E
158°00' E
158°15' E
Produced for the Outer Island Renewable Energy Project
SOURCE: Map data from the Ministry of Land, Housing & Survey. Honiara
SMEC

APPENDIX B – Barrier Analysis

Summary of Barriers to the Implementation of Renewable Energy Technology

Type	Barrier	Barrier Removal
Business Environment	1) Perceptions of sovereign risk add to the financing difficulties for utility and commercial scale renewable energy projects 2) SIEA has sole authority to provide and/or supply electricity	1) Promote smaller scale RETS in the short term to reduce the level of perceived risks 2) Distribution Code for Distributed Generation" has been drafted and is pending approval by MMERE under this code distributed generation will be allowed to connect to the SIEA network.
Governance	1) Lack of legislation for regulating biofuels 2) Present system of taxes and subsidies in the Solomon Islands effectively penalises renewable energy 3) Regulatory approvals are regarded as slow, unwieldy and inefficient	1) Update the petroleum legislation to include biofuels and establish a regulatory framework for the industry. 2) Review the taxes and duties that apply to RETs, this could best done by the Solomon Islands Customs and Excise Division of the Ministry of Finance & Treasury. 3) Removal or lowering of this barrier will enhance the ability of RET SME to be established in the Solomon Islands. This barrier is not specific to RET SMEs so lowering this barrier will require efficiencies to be developed across all the Ministries that influence the use of RETs.
Size of Markets	1) Islands are small with dispersed populations, the electricity market is small	1) Promote RETs that align with the market size such as solar home systems and mini and micro hydro.
Access to Markets	1) Air and shipping services between provincial centres and outer islands are infrequent and unreliable 2) Land transport is difficult	1) This barrier is not unique to the energy sector and to a certain extent will be addressed by the priority projects noted in the Solomon Islands National Infrastructure Investment Plan which include, roading upgrades, airport upgrades and new wharves 2) Ensure RETs are portable, robust and can be easily moved by the types of transport available
Institutional Capacity	1) National and provincial government agencies lack resources and training 2) Renewable energy roles and responsibilities of the SIG agencies are still unclear 3) Insufficient professional and trades qualifications to support RETs, Government	1) Remove this barrier with resources and training for key agencies e.g. MMERE. 2) MMERE to clarify the roles and responsibilities of the National Government agencies, provincial governments, wards, SIEA, development agencies, and other stakeholders 3) Develop RET professional and trades qualification training programmes

Type	Barrier	Barrier Removal
	institutions have limited capacity to train and certify people for such roles 4) Commercial arrangements during operational phase of RETS unclear	4) Develop training programmes for use during the operation and maintenance phase of RET schemes focussing on RE technologies that are easily understood, easy to operate and have minimal maintenance requirements
Currency Issues	1) Exchange rate stability concerns	1) Minimise exchange rate risk by, e.g. PPAs for larger generators with indexation or payment terms denominated in more stable currencies
Ability to Pay	1) Limited ability to pay for electricity especially in rural areas	1) Promote low first cost RETs that can be expanded as income develops e.g. 100 W solar home systems that could be expanded with additional solar panels, batteries and lights
Access to Banks	1) Rural population have limited access to banks and irregular incomes	1) Target low cost RETs, review options for payment for RETs by barter
Land Usage Rights	1) Procuring land usage for RET purposes can be difficult and time consuming 2) Land usage rights and compensation generally take time to resolve and are subject to delays 3) Land acquisition for household and community scale RETs 4) There is no precedent for private ownership of hydro plants in the Solomon Islands 5) Without clear usage rights over land, private investors and lenders are unlikely to commit to projects 6) Effective models are needed for obtaining land usage rights that will outlast a project	1) Develop land procurement procedures and standard form contracts for procuring land rights for differing RE technologies 2) Use models that share the benefits of a project amongst the landowners over the life of the project 3) Prioritised RETs that occupy minimal land area or can be installed at the household and community scale. 4) Deliver a larger scale privately owned RETs, ensuring all safeguard standards are met, this will then serve as a model for subsequent RET projects. 5) Locate utility or community scale RETs on alienated land so that long term leases can be negotiated with a single owner 6) Standard form procedures, contracts and PPAs for benefit sharing amongst all landowners. SIG to ensure that the land requirements for RETs, distribution lines and transmission lines are included in any revised legislation
Financial	1) Energy Division is poorly resourced 2) RETs can have higher initial costs compared to conventional fossil fuel energy 3) Lack of access to finance at the community level to fund utility scale RETs	1) SIG budget allocation. 2) Target low cost RETs that can be self-financed; 3) Use low cost community RE technologies and construction methods, coupled with RETS that can be constructed by community labour; 4) Develop alternatives to land as security for

Type	Barrier	Barrier Removal
	4) Landowners cannot use land as equity for loans	loans for RETS
Technical	1) Lack of RET technical standards 2) Shortage of RET technical skills and virtually no industry away from Honiara and Noro 3) Vandalism and theft of remotely located utility and community scale RETs 4) No geothermal RET experience and limited experience with biomass 5) Grid extension and for utility scale RETS difficult. 6) Negative past experience due to poor quality equipment creating low consumer confidence in solar PV. 7) Disposal of lead acid batteries associated with solar home systems is a potential environment risk.	1) Mandate standards for RETs imported into the Solomon Islands 2) Develop training programmes for RET technical skills. 3) Minimise vandalism and theft by including fences and other security measures when specifying RET installations 4) Pilot projects for RETs for technologies that show promise for future use 5) Develop best practice land procurement procedures and standard form contracts for procuring land for distribution line extensions to connect RETs to the existing grid. 6) Specify minimum quality standards 7) Develop lead acid battery recycling
Knowledge and Public Awareness	1) Lack of public awareness of RE opportunities and technologies with the exception of PV. 2) Knowledge of pros and cons of solar PV is limited. 3) Lack of knowledge of RE resource potentials 4) Low customer confidence due to lack of awareness and information on products and performance. 5) Difficult to confirm the quality of PV products. 6) No laboratory facilities exist to test the quality of biofuels (or petroleum fuels).	1) Actively promote RETs including alternative options such as run-of-river mini/micro hydro, large hydro, geothermal and biofuels 2) Introduce a quality rating system and provide details of recommended PV equipment. 3) Publicise the renewable energy GIS 4) Improve customer confidence by commercial installations of RETs in high visibility areas in each main centre 5) Provide a readily accessible list of PV equipment that meets minimum performance standards 6) Align the implementation of biofuel testing with the introduction of petroleum fuel testing

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