

Developing A Renewable Energy-based Off-Grid Electrification Master Plan for Remote Islands of Vanuatu along the Example of Four Islands

Review Workshop

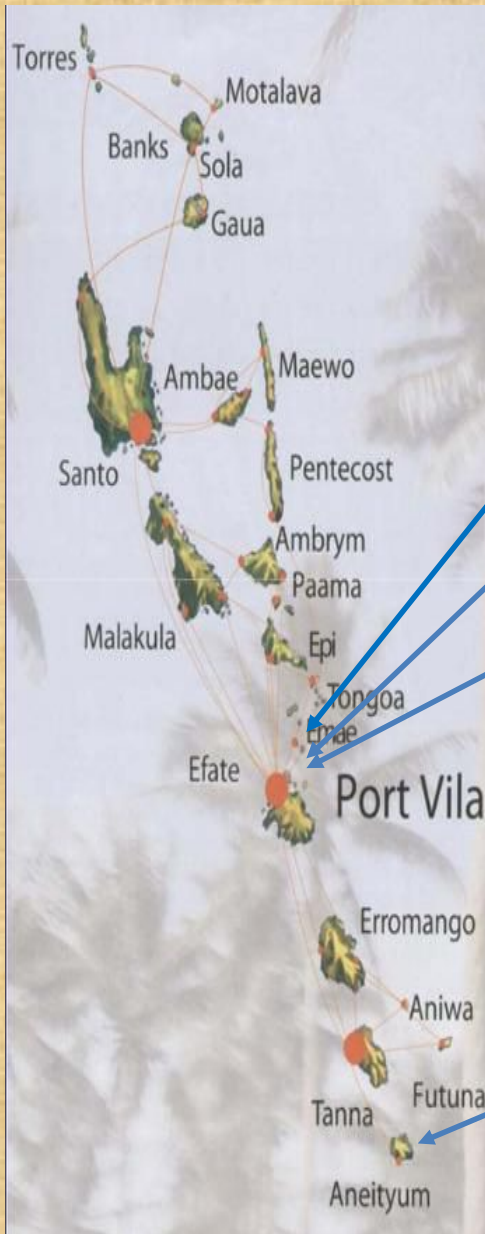
Meteo Complex Conference Room
Port Vila, Tuesday 14 June 2016

Peter Johnston
Dr Herbert Wade
John Salong

Session 1: Island Visits: Mataso, Makira & Emae (11th-15th April & 20th -21st May) & Aneityum (19th-28th April & 24th-26th May)



Only four islands visited. Representative of remote Vanuatu?



Emae

Makira

Mataso

Aneityum

Two visits

Mataso 12th April and 20th May

Makira 12th April and 20th May

Emae: 11th-15th April & 20th & 21st May

Aneityum 19th -29th April and 24th – 26th May

Visitors:

**Mataso, Makira & Emae - April
Uwe Mades, Herb Wade & John Salong.**

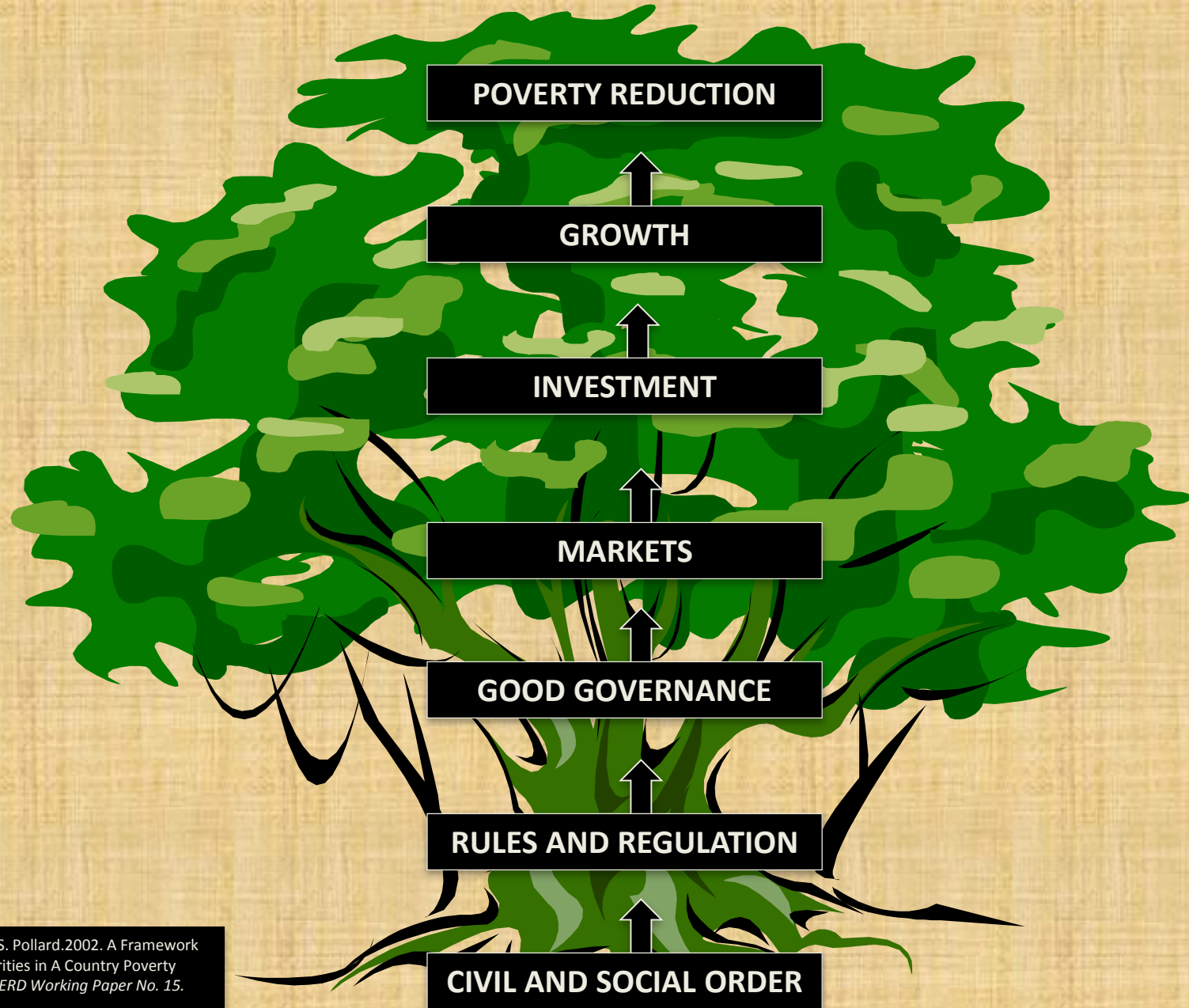
**Aneityum – April:
Herb Wade and John Salong**

May Visits: Peter Johnston & John Salong

Vanuatu Political Economy Framework



The Nature of Sustainable Development



Mataso Island

12th Apr & 20th May



- Small Island
- Difficult to get to
- Limited land or resources
- Visible effects of TC Pam
- 32 households
- Limited phone reception
- Mataso Community on Efate
- Cohesive Social Capital
- Needing vision to overcome dependence



Mataso – coconuts 20th May



Makira Island 12th Apr & 20th May

- Small Island
- Difficult to get to
- Limited resources
- Visible effects of TC Pam
- 30 households
- Limited phone reception
- Large Makira Diaspora on Efate
- Cohesive Social Capital
- Focus on health & Education
- Needing Vision to overcome dependence

Makira Island

12th Apr & 20th May



➤ Emae Island

11th-15th Apr & 20-21st May



10 Villages with unequal access to land & marine resources

Visible effects of TC Pam
219 households

Phone towers but poor reception in some villages

Road link to every village

Human Resources

Weak Bridging Social Capital

Visionary leadership is needed to realize the potential of the island of Emae

Chiefs of Emae – 20th May 2016





Aneityum island

19th -28th Apr & 24th -26th May

- 3 stations with access to land, forest, marine resources
- Airstrip, & monthly shipping
- No visible effects of TC Pam
- 292 households
- Phone towers but unreliable reception in places
- 100 Cruise ships a year
- Healthy Cohesive and Bridging Social Capital
- Focus on Education
- visionary leadership demonstrating sustainable development



Thanks to the people of the islands who
welcomed us to
Mataso, Makira & Ermae I: 11-15 April & II:
20-21 May 2016
Aneityum I: 19-28 April & 24-26 May





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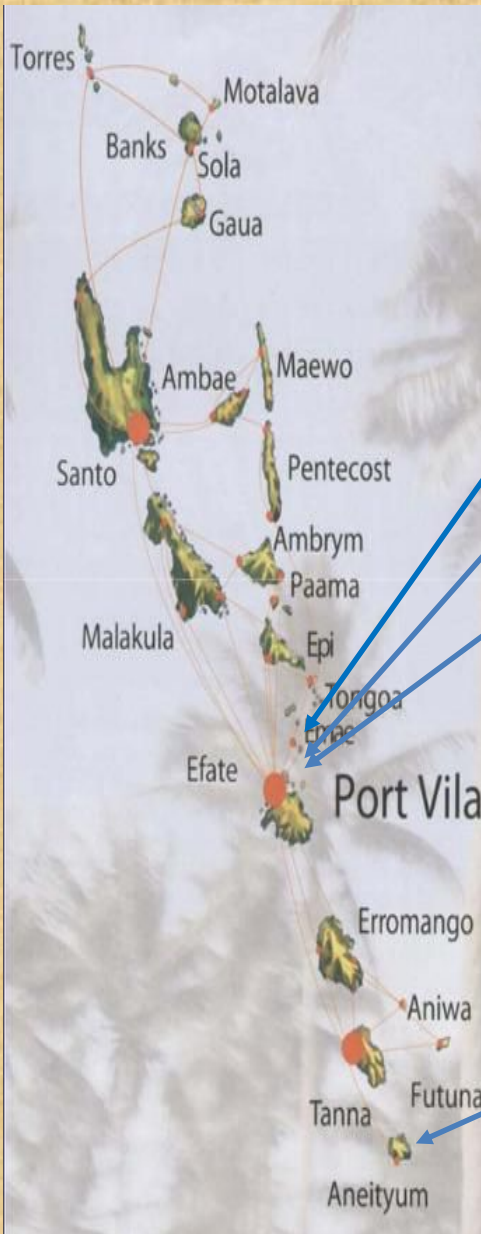
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**Session 2: Ability & Willingness to Pay for
Electricity**



4 islands, 13 villages

Emae

Mataso – One Village

Makira

Makira – One Village

Mataso

Emae – Ten Villages

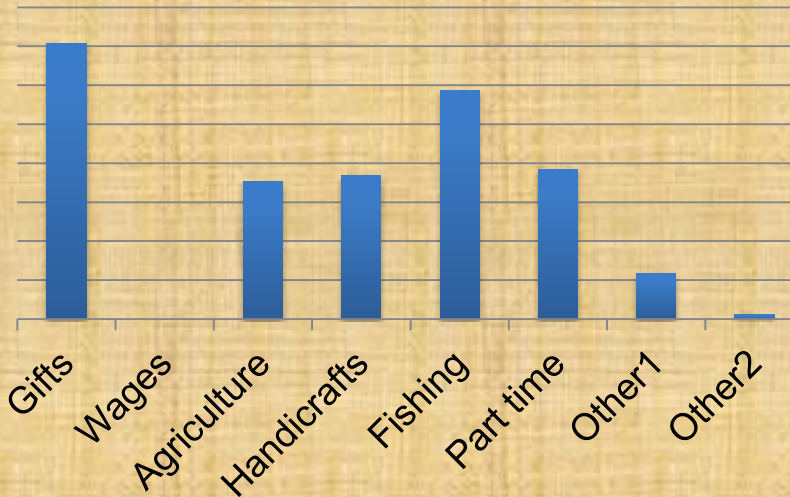
Aneityum – 3 Villages

Aneityum

Sangava Village, Emae Is. Ability to pay

SOURCES OF CASH INCOME

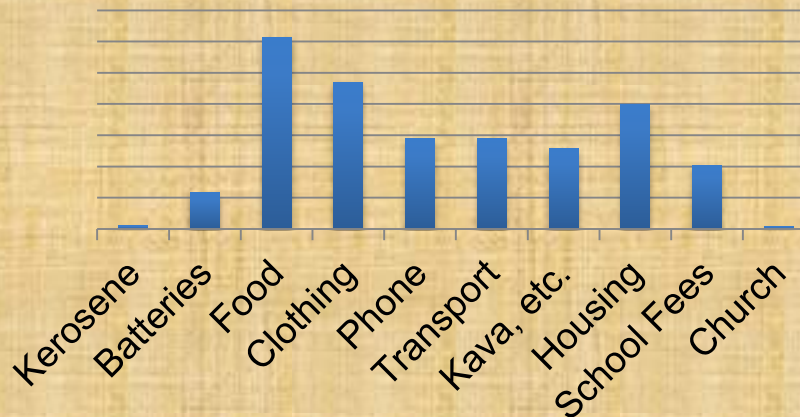
Relative averages over a year (Entire Village)



- Median
- 2418 Vt/mo
- Average
- 2138 Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year (entire village)



- Median
- 1807 Vt/mo
- Average
- 2407 Vt/mo

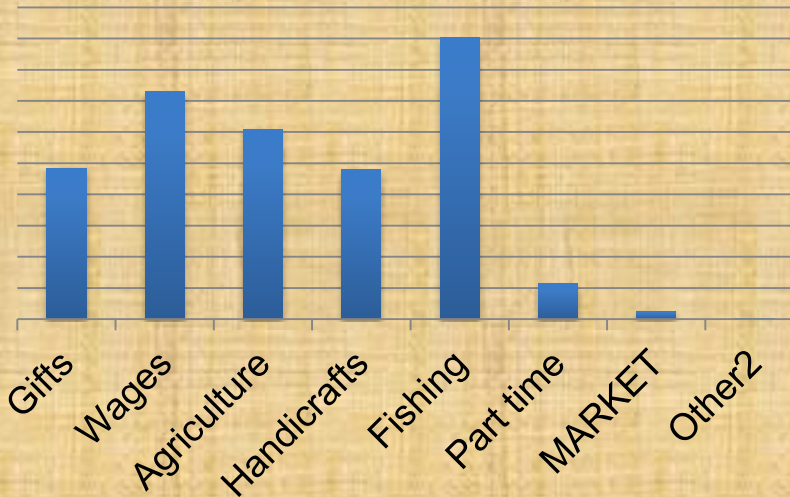
Sangava, Emae Is. Willingness to pay

HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)		Median Acceptable Payment (Lighting + additional Services)
51	234	300 Vt/Month		500 Vt/Month
High Priority Services*		Lights	Radio	Phone Charger
Priority		1.12	1.61	1.47
Other Services Desired		None listed		
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches
7% Digicel 16% TVL 67% Both 90% TOTAL	94%	76%	6.9	Monthly 100% Prepaid 14%

Tongamea, Emae Is. Ability to pay

SOURCES OF CASH INCOME

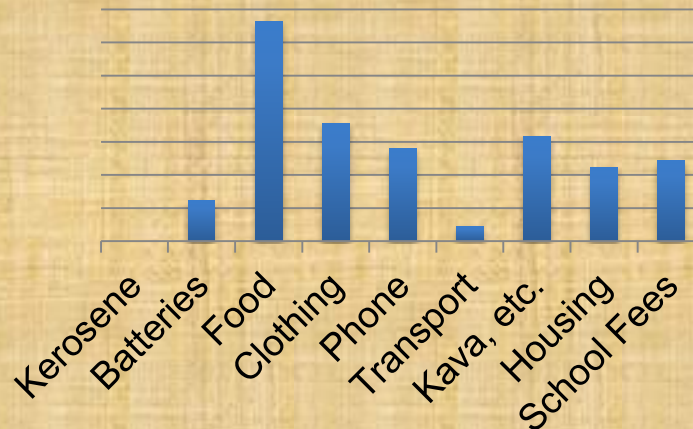
Relative averages over a year
(Entire Village)



- Median
- 6417 Vt/mo
- Average
- 10702 Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year
(entire village)



- Median
- 4758 Vt/mo
- Average
- 6845Vt/mo

Tongamea, Emae Is. Willingness to pay

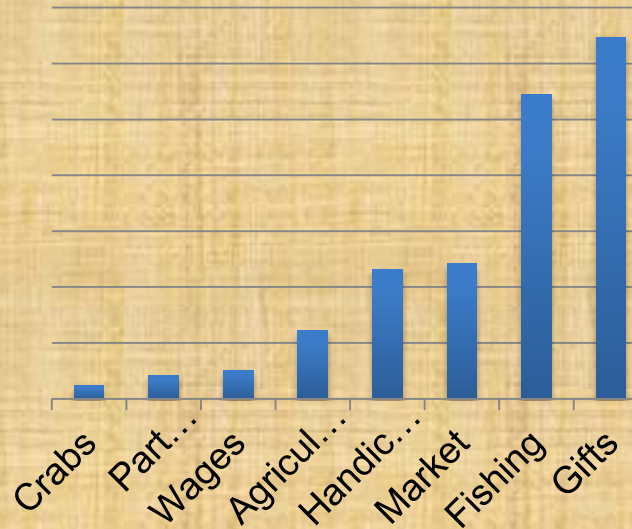
HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)					Median Acceptable Payment (Lighting + additional Services)
32	154	1000					1250
High Priority Services*	Lights	Radio	Video	Phone Charger	Freezer	Washer	
Priority	1.13	1.38	1.56	1.13	1.66	1.91	
Other Services Desired	Power tools, Sound System, Iron, Blender, Electric pot						
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches			
22% DIGICEL 47% TVL 25% BOTH 94% TOTAL	94%	94%	6	Monthly 81% Prepayment 50%			

*With a median priority of 2.0 or higher on a scale of 1 (essential) to 5 (not needed)

Na'sang , Mataso Is. Ability to pay

SOURCES OF CASH INCOME

Relative averages over a year
(Entire Village)



- Median
- 2500 Vt/mo
- Average
- 2733 Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year
(entire village)



- Median
- 2000 Vt/mo
- Average
- 2570 Vt/mo

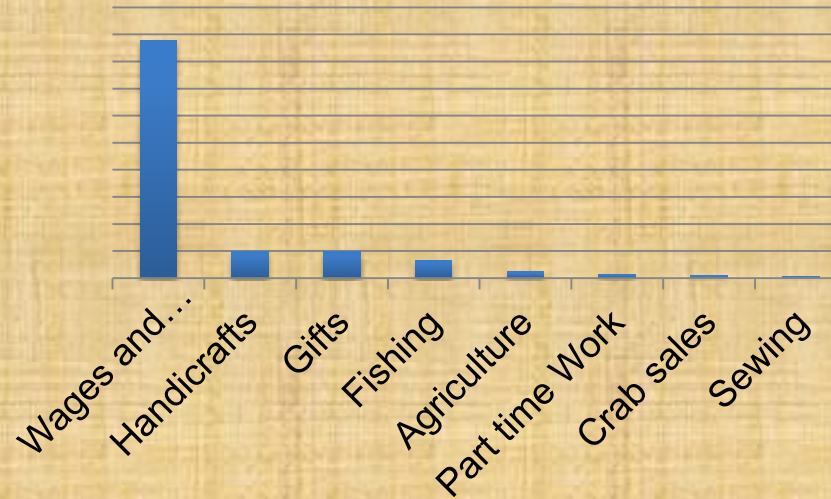
Na'sang , Mataso Is. Willingness to pay

HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)		Median Acceptable Payment (Lighting+additional Services)
36	124	500 Vt/Month		600 Vt/Month
High Priority Services*	Lights			Phone Charger
Priority	1.64			1.36
Other Services Desired	Fan, Spotlight			
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches
7% Digicel 16% TVL 67% Both 90% TOTAL	04%	76%	6.9	Monthly 100% Prepaid 14%

Malakoto , Emae Is. Ability to pay

SOURCES OF CASH INCOME

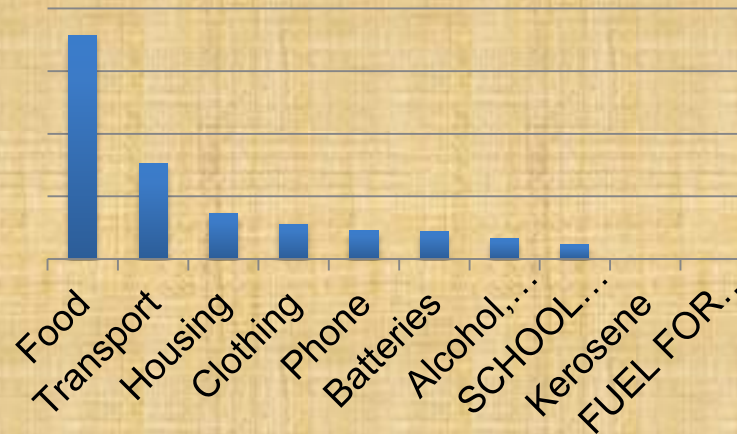
Relative averages over a year
(Entire Village)



- Median
- 1242 Vt/mo
- Average
- 7107 Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year
(entire village)



- Median
- 1027 Vt/mo
- Average
- 2646 Vt/mo

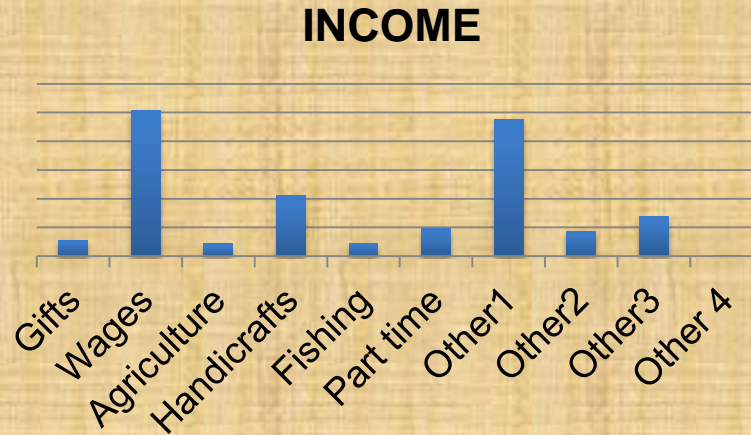
Malakato , Makira Is. Willingness to pay

HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)	Median Acceptable Payment (Lighting + additional Services)	
17	93	500 Vt/Month	500 Vt/Month	
High Priority Services*	Lights	Radio	Phone Charger	
Priority	1.64	1.88	1.59	
Other Services Desired				
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches
0% Digicel 23% TVL 71% Both 94% TOTAL	94%	81%	4.9	Monthly 47% Prepaid 65%

Anelcauhat , Aneityum Is. Ability to pay

SOURCES OF CASH INCOME

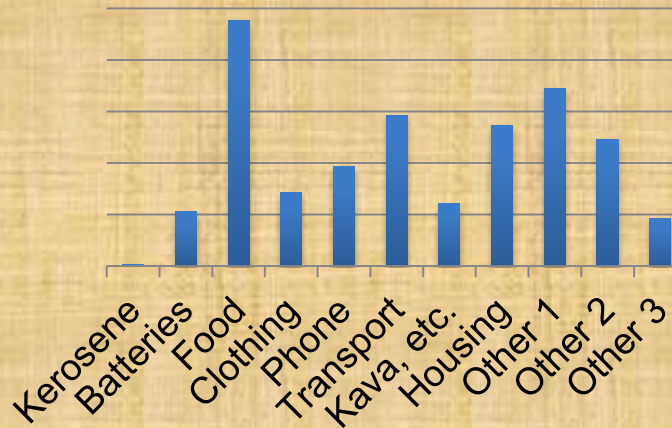
Relative averages over a year
(Entire Village)



- Median
- 33000 Vt/mo
- Average
- 56590 Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year
(entire village)



- Median
- 8963 Vt/mo
- Average
- 18357 Vt/mo

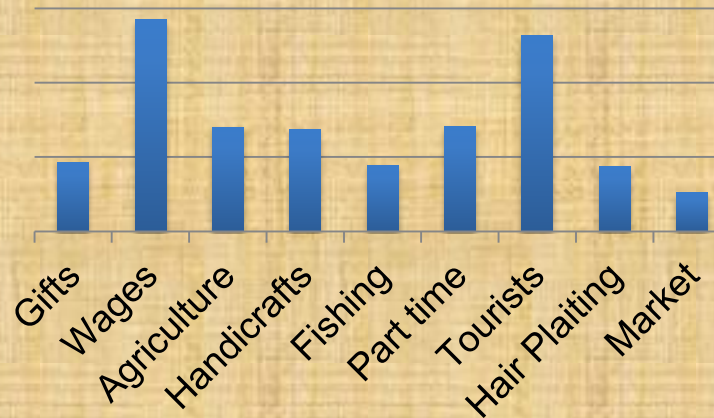
Anelcauhat , Aneityum Is. Willingness to pay

HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)	Median Acceptable Payment (Lighting+additional Services)	
52	246	2000	3000	
High Priority Services*	Lights		Phone Charger	
Priority	1.33		1.54	
Other Services Desired	Power tools, shell polishers, sewing machines, electric cooker, electric fry pan, fan, computer, water pump			
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches
TVL 53% Both 35% Digicel 4% Total 92%	69%	31%	4.9	Weekly 4% Prepay 8% Monthly 84% Custom Economy 18%

Umetch , Aneityum Is. Ability to pay

SOURCES OF CASH INCOME

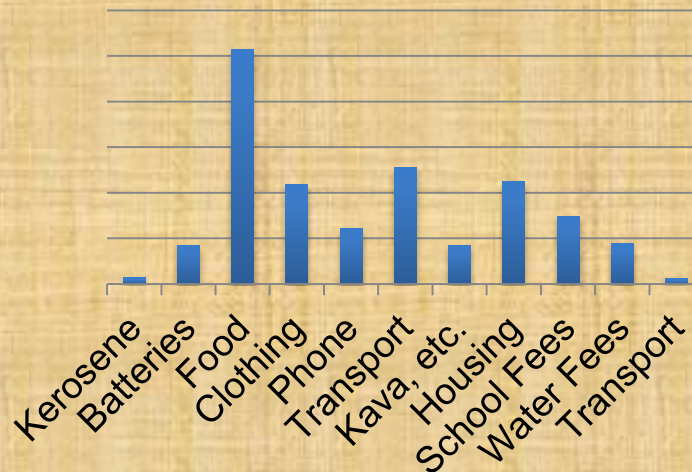
Relative averages over a year (Entire Village)



- Median
- 13917 Vt/mo
- Average
- 19858 Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year (entire village)



- Median
- 3985 Vt/mo
- Average
- 6080 Vt/mo

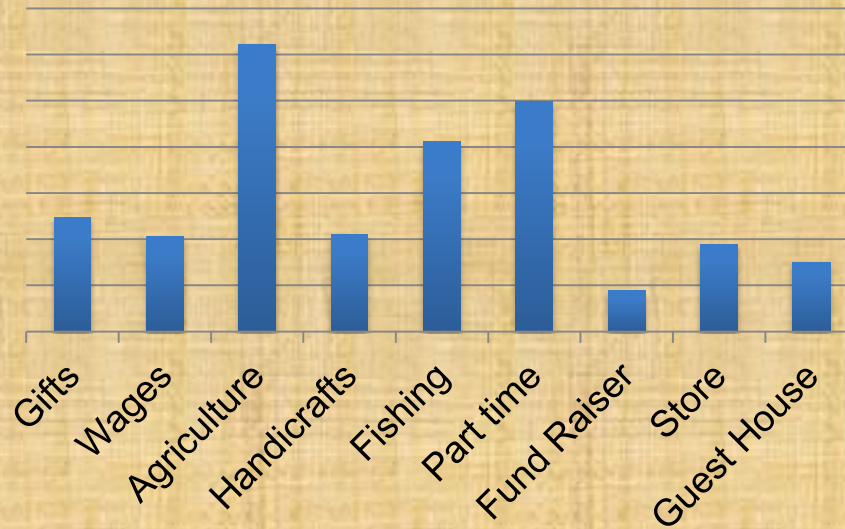
Umetch , Aneityum Is. Willingness to pay

HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)	Median Acceptable Payment (Lighting+additional Services)	
28	139	500	1000	
High Priority Services*	Lights		Phone Charger	
Priority	1.18		1.79	
Other Services Desired	No other services listed			
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches
Digital 3% TVL 54% Both 18% Total 75%	50%	32%	5.1	Monthly 75% Custom Economy 50% Prepayment 11%

Finonge, Emae Is. Ability to pay

SOURCES OF CASH INCOME

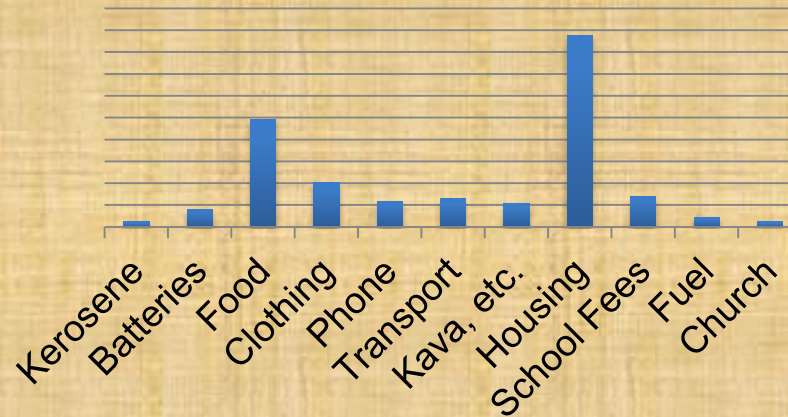
Relative averages over a year
(Entire Village)



- Median
- 5242 Vt/mo
- Average
- 8695 Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year
(entire village)



- Median
- 5496 Vt/mo
- Average
- 7138 Vt/mo

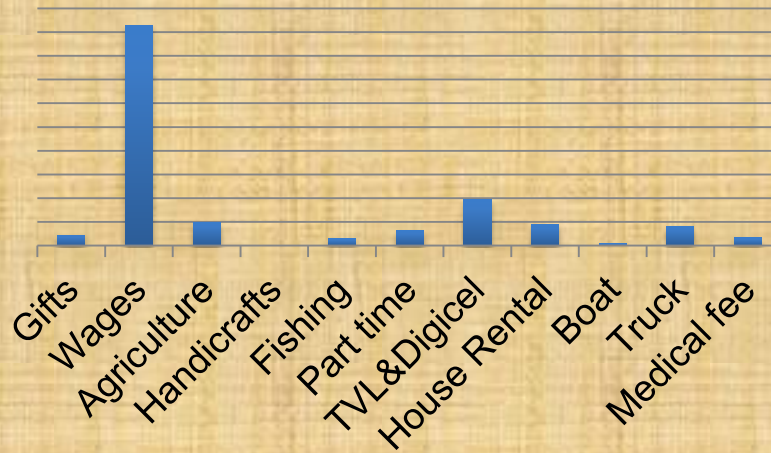
Finonge, Emae Is. Willingness to pay

HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)	Median Acceptable Payment (Lighting + additional Services)	
23	89	500	1000	
High Priority Services*	Lights	Radio	Phone Charger	
Priority	1.52	1.52	1.65	
Other Services Desired	Water Pump			
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches
Digicel 22% TVL 4% BOTH 52% Total 78%	87%	43%	4.7	Prepayment 52% Monthly Payment 48%

Sasake, Emae Is. Ability to pay

SOURCES OF CASH INCOME

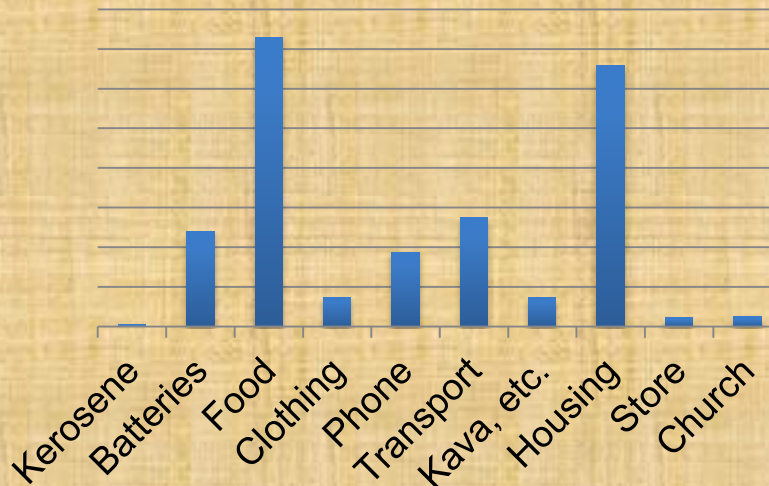
Relative averages over a year
(Entire Village)



- Median
- 4910 Vt/mo
- Average
- 14650 Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year
(entire village)



- Median
- 2131 Vt/mo
- Average
- 8671 Vt/mo

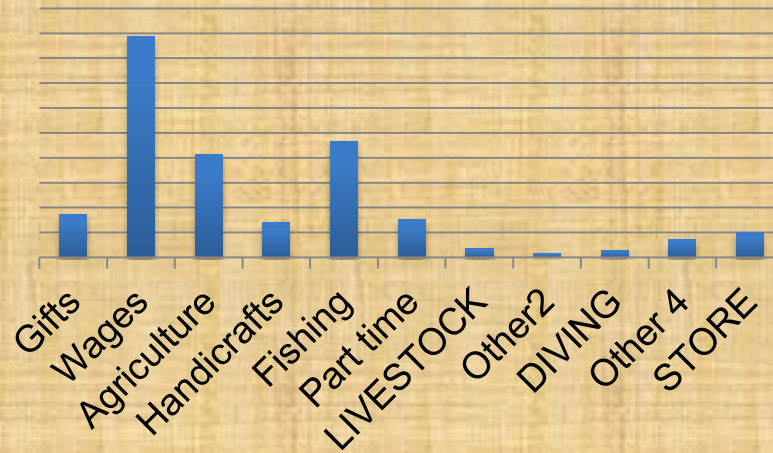
Sasake , Emae Is. Willingness to pay

HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)			Median Acceptable Payment (Lighting+additional Services)	
22	96	1000 Vt/Month			2500 Vt/Month	
High Priority Services*	Lights	Radio	Video	Phone Charger	Freezer	Fridge
Priority	1.32	1.18	1.55	1.14	1.73	1.86
Other Services Desired	None listed					
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches		
Digicel 9% TVL 9% Both 82%	95%	77%	4	Prepayment = 5% Pay Quarterly = 5% Pay Monthly = 90%		

Marae, Emae Is. Ability to pay

SOURCES OF CASH INCOME

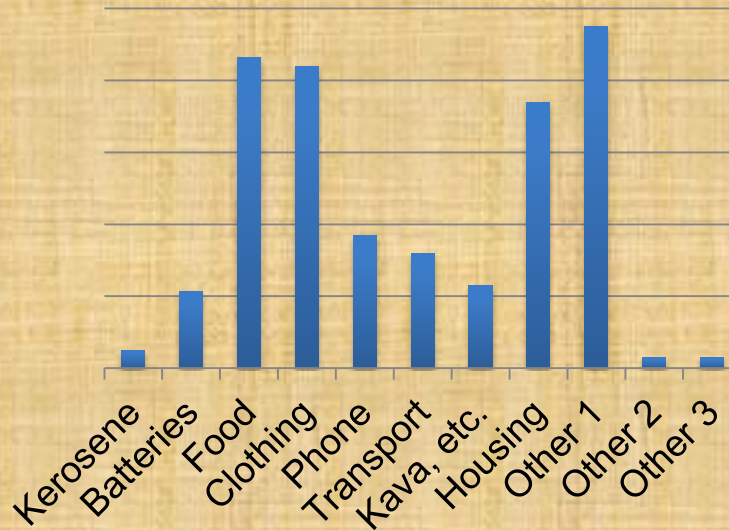
Relative averages over a year
(Entire Village)



- Median
- 3692 Vt/mo
- Average
- 5175 Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year
(entire village)



- Median
- -504 Vt/mo
- Average
- -1120 Vt/mo

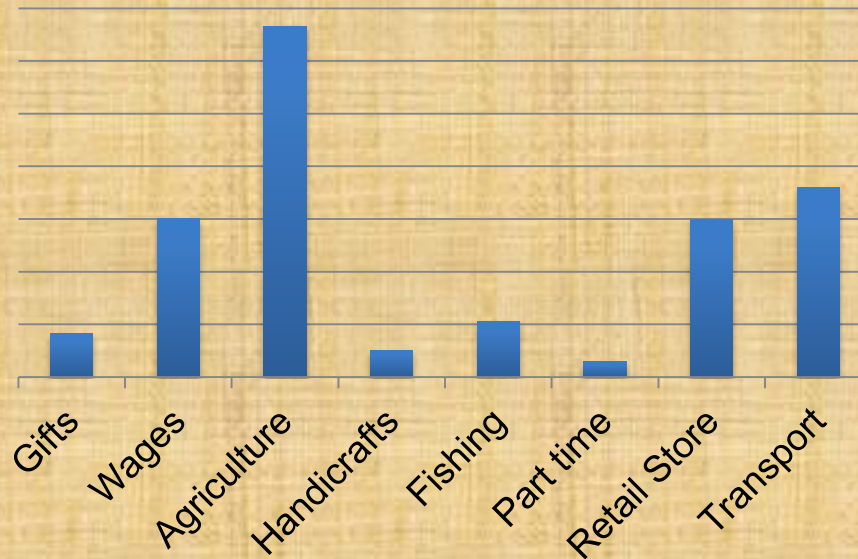
Marae , Emae Is. Willingness to pay

HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)		Median Acceptable Payment (Lighting+additional Services)
22	121	1000 Vt/month		1250 Vt/month
High Priority Services*	Lights		Radio	Phone Charger
Priority	1.05		1.27	1.50
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches
95%	95%	32%	7	Monthly 73% Prepayment 32%

Vaitini, Emae Is. Ability to pay

SOURCES OF CASH INCOME

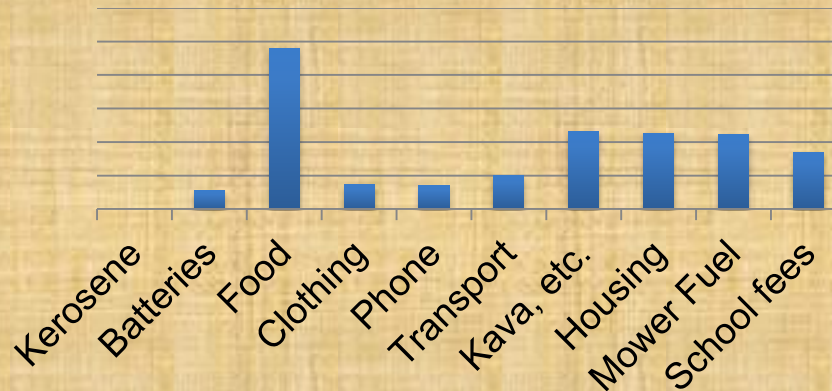
Relative averages over a year
(Entire Village)



- Median
- 61000 Vt/mo
- Average
- 172409
- Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year
(entire village)



- Median
- 87,350 Vt/mo
- Average
- 74231 Vt/mo

Vaitini , Emae Is. Willingness to pay

HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)	Median Acceptable Payment (Lighting+additional Services)	
12	46	100	150	
High Priority Services*	Lights		Radio	
Priority	1.33		1.75	
Other Services Desired	Water Pump, Toaster			
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches
TVL 42% Both 58% TOTAL 100%	100%	92%	7.5	Prepayment (8%) Monthly (92%)

Conclusions

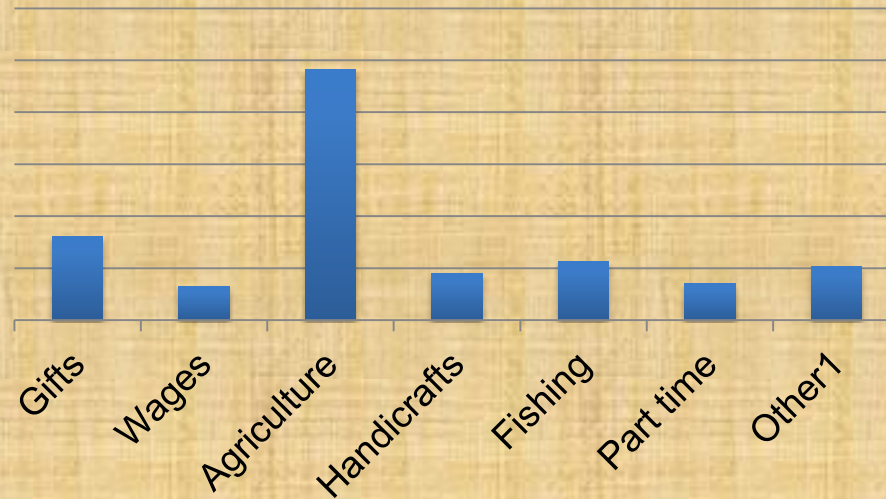
The selected islands provide a variety of village types that cover a range of cash access from under an average of USD 10 per month per household in Tebakoro to over USD 500 per month in Anelcauhat. Village geography ranges from compact and laid out in well-defined blocks and pathways to dispersed, random housing. Access to urban centers ranges from flights several times a week to hours of walking or boating between the area transport hub and the village. The desire of communities for electrical services ranges from very little to very strong. For all the villages, it will be costly to get the technicians and equipment to the electrification sites and carry out the electrification. Carrying out electrification of the four islands comprising this project will be a good test for both the various rural electrification technologies being used and the institutional structure that is developed for rural electrification.

Based solely on the site visits and survey, technologies for electrification are recommended for each village. All villages have a wide range of income levels and it is clear from the surveys that basic pico-solar kits will suffice for affordable basic electric services. In villages proposed for mini-grids, there are always outlier houses that may get better (and cheaper) service from a SHS as well as eliminating the substantial cost of a grid extension. Therefore all villages are expected to have households that are best served by SHS and pico-solar installations though the main form of electrification may be mini-grids or SHS. (for more detail on the village electrification design process please see Report 3 “Resources and Prioritized RE Options” and Report 4 “Preliminary Technical Design”

Tabakoro, Emae Is. Ability to pay

SOURCES OF CASH INCOME

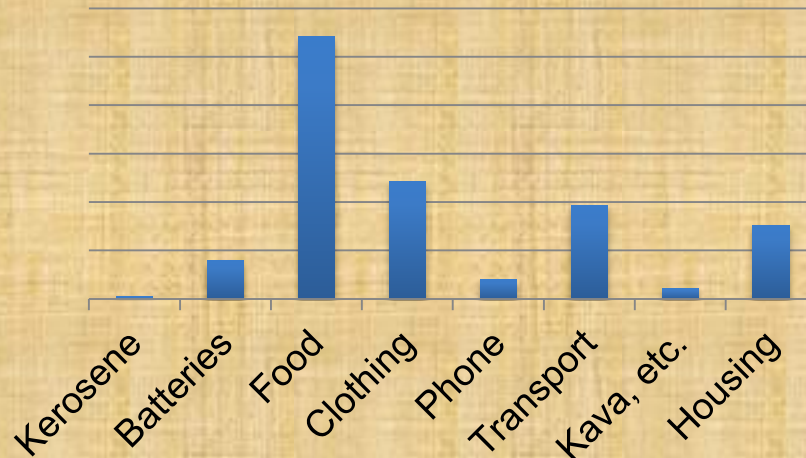
Relative averages over a year
(Entire Village)



- Median
- 938 Vt/mo
- Average
- 903 Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year
(entire village)



- Median
- 1696 Vt/mo
- Average
- 2128 Vt/mo

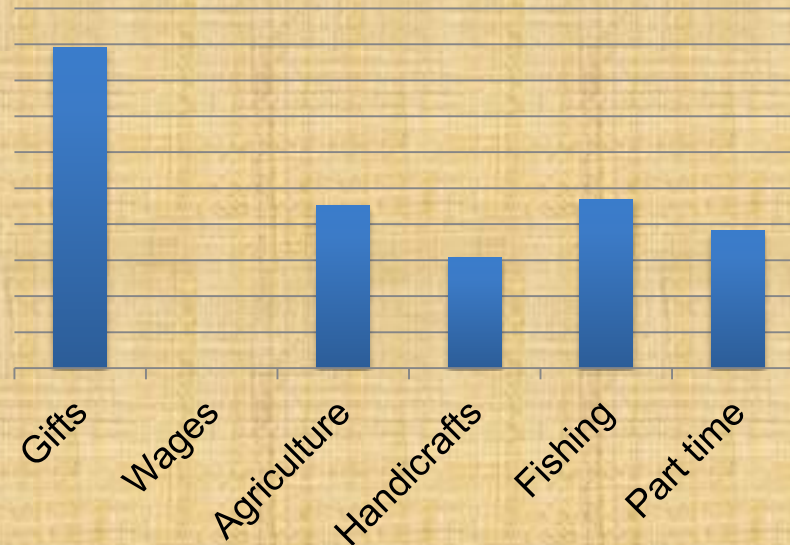
Tabakoro , Emae Is. Willingness to pay

HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)	Median Acceptable Payment (Lighting + additional Services)	
10	52	1000 Vt/Month	1200 Vt/month	
High Priority Services*	Lights	Radio	Phone Charger	
Priority	1.0	1.4	1.2	
Other Services Desired	None listed			
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches
100	100	100	10	Monthly Payments 100%

Makatea, Emae Is. Ability to pay

SOURCES OF CASH INCOME

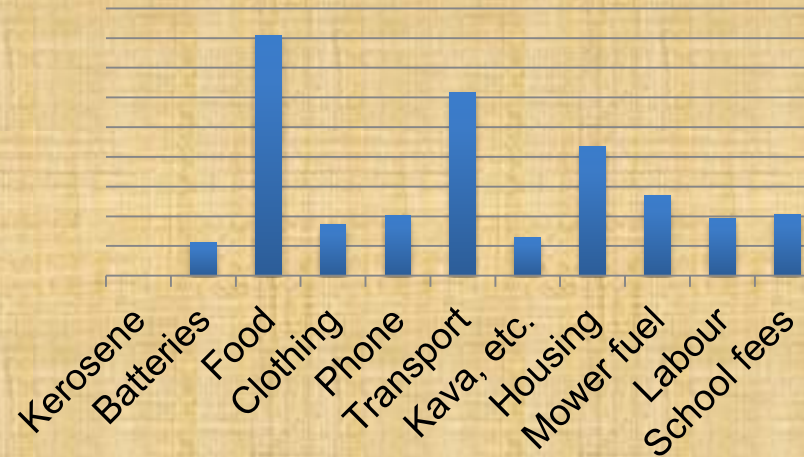
Relative averages over a year (Entire Village)



- Median
- 50083 Vt/mo
- Average
- 5288 Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year (entire village)



- Median
- 3663 Vt/mo
- Average
- 5104 Vt/mo

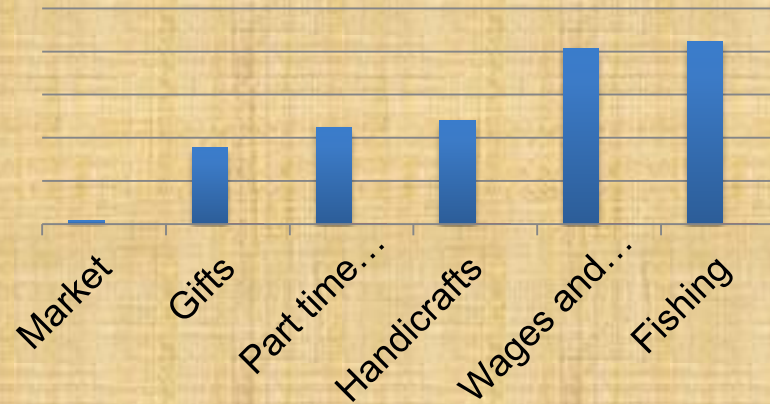
Makatea , Emae Is. Willingness to pay

HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)	Median Acceptable Payment (Lighting + additional Services)	
10	43	400	650	
High Priority Services*	Lights	Radio	Phone Charger	
Priority	1.4	1.4	1.3	
Other Services Desired	None listed			
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches
Digicel 10% TVL 50% Both 30% TOTAL 90%	90%	90%	4.7	Monthly 90% Prepayment 10%

Reisu, Emae Is. Ability to pay

SOURCES OF CASH INCOME

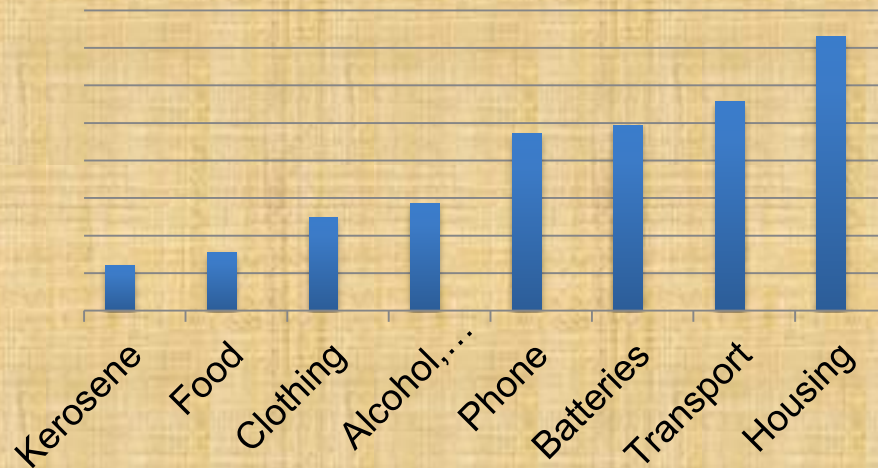
Relative averages over a year
(Entire Village)



- Median
- 9713 Vt/mo
- Average
- 9946 Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year
(entire village)



- Median
- 5865 Vt/mo
- Average
- 6379 Vt/mo

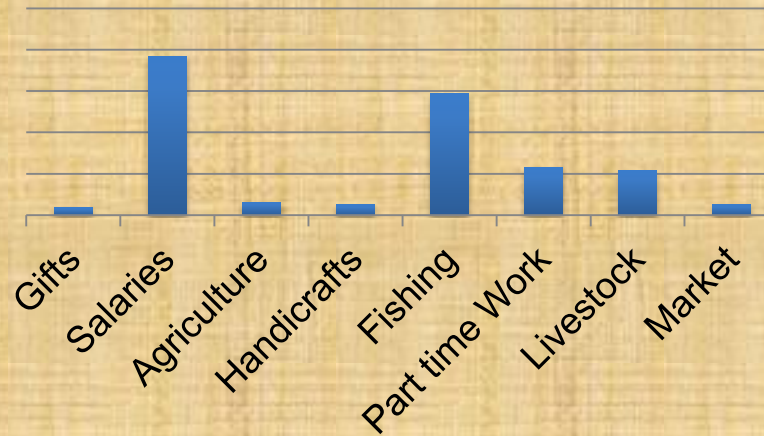
Reisu , Emae Is. Willingness to pay

HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)		Median Acceptable Payment (Lighting+additional Services)
4	16	750		1000
High Priority Services	Lights	Radio	Video	Phone Charger
Priority	<p>Only the phone charging service had an average priority of 2.5, all other services were lower in group priority</p> <p>One Household requested power for a sewing machine</p>			
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches
100%	100%	25%	7.2	Monthly 50% Prepayment 50%

Siwo, Emae Is. Ability to pay

SOURCES OF CASH INCOME

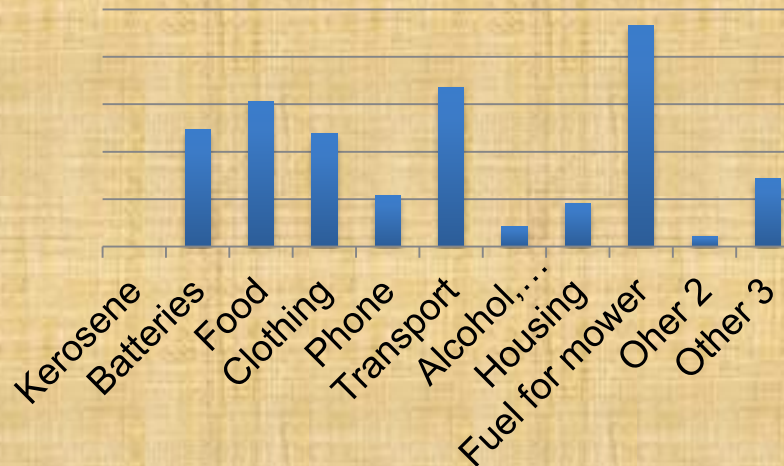
Relative averages over a year
(Entire Village)



- Median
- 11333 Vt/mo
- Average
- 13056 Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year
(entire village)



- Median
- 9046 Vt/mo
- Average
- 9315 Vt/mo

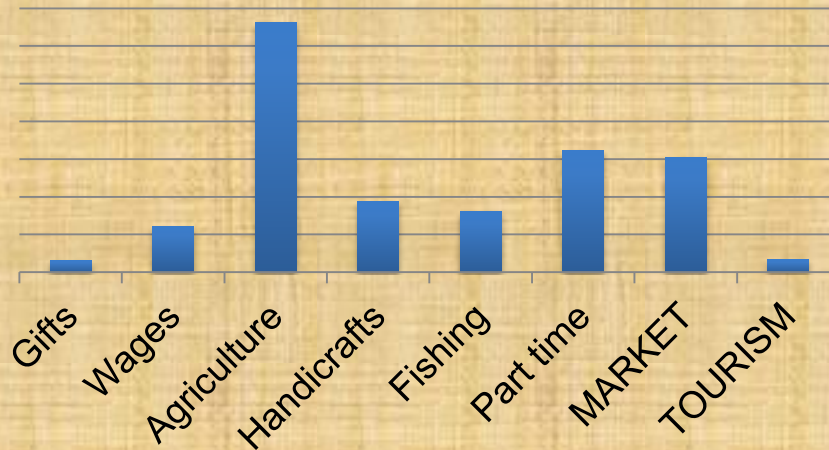
Siwo , Emae Is. Willingness to pay

HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)		Median Acceptable Payment (Lighting+additional Services)	
4	26	1000 Vt/Month		1500 Vt/Month	
High Priority Services*	Lights	Radio	Fridge	Phone Charger	Freezer
Priority	1.25	1.5	1.75	1.25	1.75
Other Services Desired	Water pump				
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches	
DIGICEL TVL 100% BOTH	100%	100%	7	Every day or two Weekly Monthly	

Port Patrick , Aneityum Is. Ability to pay

SOURCES OF CASH INCOME

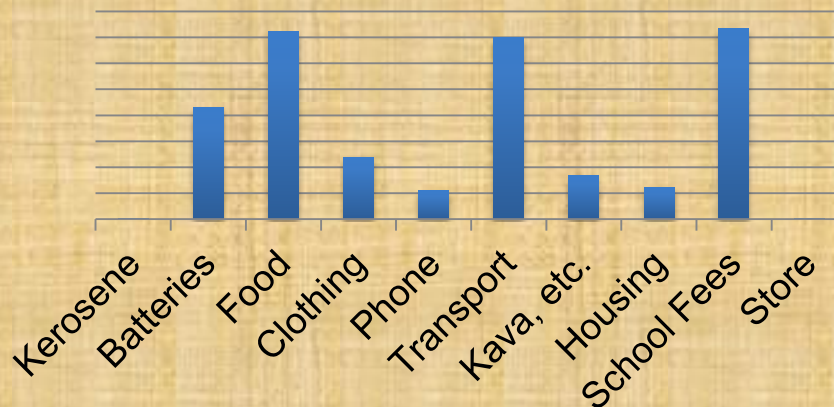
Relative averages over a year
(Entire Village)



- Median
- 10979 Vt/mo
- Average
- 17983 Vt/mo

CASH EXPENDITURES BY CATEGORY

Relative averages for one year
(entire village)



- Median
- 4505 Vt/mo
- Average
- 24110 Vt/mo

Port Patrick , Aneityum Is. Willingness to pay

HH Surveyed	Population Surveyed	Median Acceptable Payment (Basic Lighting Services)	Median Acceptable Payment (Lighting+additional Services)	
19	102	1250	2750	
High Priority Services*	Lights	Radio	Phone Charger	
Priority	1.21	1.53	2.0	
Other Services Desired	No additional loads listed			
Percentage of HH with mobile coverage	Percentage of HH with some type of solar lighting	Percentage with portable solar lights	Average hours of solar lighting per day.	Acceptable Payment Approaches
Digicel 21% TVL 16% Both 37% Total 74%	68%	53%	5.4	Month 58% Prepayment 32% Custom Economy 26%

Mataso – no coconuts 20th May





Aneityum Island
19-28 April & 24-26 May



Aneityum Island
19-28 April & 24-26 May



Aneityum Chiefs meeting -25th May 2016