THE ROLE OF ENERGY SUPPLY IN THE SHAPING OF DEVELOPMENT PROSPECTS IN SMALL AND ISOLATED PACIFIC ISLAND COMMUNITIES – PAST, PRESENT AND FUTURE.

A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

DEVELOPMENT STUDIES

AT MASSEY UNIVERSITY, MANAWATU CAMPUS, NEW ZEALAND

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2015
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ABSTRACT

The thesis examines the way that energy supply has influenced directly or indirectly the transformation of society in Niue and Tuvalu from the time before the arrival of palagi (Europeans) to the present day. Of particular interest is the vulnerability that this reliance creates in terms of the risk to people’s wellbeing. Most of New Zealand’s South Pacific neighbours have to import energy in the form of oil products. In the case of Niue and Tuvalu, over 90% of their energy is imported, largely paid for through aid from overseas donors. Like New Zealand, people in both countries rely on energy to maintain their livelihoods and lifestyles. There is near 100% electrification and vehicle ownership is high and government and commercial enterprises that provide services and employment rely on continuous and affordable energy, the supply of which is highly vulnerable to economic and political pressures beyond their control, a situation not expected to improve. The thesis addresses four questions: how and why this situation has come about, would these two communities be able to adapt to a much reduced or changed energy supply, what steps are being taken to reduce this dependency before a crisis occurs and whether these steps are likely to be effective.

The research used the sustainable livelihoods approach to develop an integrated research methodology including field methods and a novel, systematic form of analysis. Field research methods involved interviews, conversations and observation. The results of the research are set out in narrative form that reviews changes to livelihoods in Niue and Tuvalu over time from the arrival of palagi to the present day. The narrative is followed by an original sustainable livelihoods analysis, the output of which is a series of livelihood profiles including livelihoods asset pentagons that illustrate changes in livelihood assets. A parallel series of “livelihood energy pentagons” were developed to demonstrate the influence of energy on livelihoods. The same method of analysis is used to analyse an “energy-deprived” future scenario, postulated in order to illustrate the impact on livelihoods in Niue and Tuvalu should the supply of oil-based fuels become severely constrained.

The narrative and the analyses show that the role of energy has changed from having an essential role although limited in form, in supporting people’s traditional livelihoods to one that enables the full spectrum of services on which contemporary livelihoods rely in Niue and Tuvalu. The analysis of the energy-deprived scenarios underlines this reliance by demonstrating the serious and negative impact on contemporary society should imported fuel supplies be seriously disrupted. Current plans by the two governments to reduce reliance and imported fuel supplies are reviewed and this thesis concludes that while proposed measures go some way to mitigating the impact of a fuel supply disruption, the consequences of such a disruption will still be severe. A recommendation is made that both governments prepare strategic action plans that specifically address fuel supply disruption by emphasising a focus on endogenous rather than exogenous energy sources.
ACKNOWLEDGEMENTS

A number of people have made completion of this thesis possible but in first place has to be my wife Barbara to whom I am eternally grateful for her patience, tolerance and support over the last six years.

I am sure that my two supervisors, Associate Professor Glenn Banks and Dr Maria Borovnik will not be offended at being second on the list after Barbara, a placing that does not mean that their assistance, guidance and advice was other than first class. Together, Glenn and Maria provided an excellent team providing wisdom, extensive development research experience, enthusiasm and good ideas. I particularly appreciated Glenn’s patience when I was slow on the uptake, and Maria’s attention to detail, combined with good humour. I will miss our monthly meetings which were not only useful but enjoyable.

My research in Niue, Tuvalu and in New Zealand was greatly assisted by a wide range of people. I mention two people who provided excellent background information on life and livelihoods in their countries: Deve Talagi in Niue and Mafalu Lotolua in Tuvalu. I particularly appreciate their friendship and the time they both gave me during several field visits. There were other people of course, in both countries too numerous to name and who were happy to talk to me, sometimes on more than one occasion. I cannot recall coming across one unfriendly or uncooperative person in either Niue or Tuvalu.

In New Zealand, I am grateful for the valuable assistance of Warren Crawley who shared with me his detailed knowledge of electrical engineering and renewable energy technology, particularly in the context of Niue. Also I received excellent cooperation from staff at the Ministry of Foreign Affairs and Trade; people, even though very busy, were always happy to talk to me which was much appreciated. They were also kind enough to show genuine interest in my research progress.

Finally, I am very grateful for the funding received from the Graduate Research Fund. This funding went towards field visit airfares and was of considerable assistance.
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<th>ACRONYMS</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADB:</td>
<td>Asian Development Bank</td>
</tr>
<tr>
<td>AFD:</td>
<td>Abu Dhabi Fund for Development</td>
</tr>
<tr>
<td>AUD:</td>
<td>Australian Dollar</td>
</tr>
<tr>
<td>CEDOL:</td>
<td>Commonwealth Education Online</td>
</tr>
<tr>
<td>CFL:</td>
<td>Compact fluorescent lamp.</td>
</tr>
<tr>
<td>DFID:</td>
<td>Department for International Development (United Kingdom)</td>
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<tr>
<td>EEZ:</td>
<td>Exclusive economic zone</td>
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<tr>
<td>ESDP:</td>
<td>Energy Sector Development Project</td>
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<td>GDP:</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GP:</td>
<td>General Practitioner (medical).</td>
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<tr>
<td>HDI:</td>
<td>Human Development Index</td>
</tr>
<tr>
<td>HIES:</td>
<td>Household Income and Expenditure Survey.</td>
</tr>
<tr>
<td>IMF:</td>
<td>International Monetary Fund</td>
</tr>
<tr>
<td>Kg:</td>
<td>Kilogramme</td>
</tr>
<tr>
<td>LDC:</td>
<td>Least developed country</td>
</tr>
<tr>
<td>LMS:</td>
<td>London Missionary Society</td>
</tr>
<tr>
<td>LPG:</td>
<td>Liquefied Petroleum Gas</td>
</tr>
<tr>
<td>MDG:</td>
<td>Millennium Development Goals</td>
</tr>
<tr>
<td>MFAT:</td>
<td>Ministry of Foreign Affairs and Trade (New Zealand).</td>
</tr>
<tr>
<td>MOFA:</td>
<td>Ministry of Foreign Affairs (Japan)</td>
</tr>
<tr>
<td>NGO:</td>
<td>Non-Governmental Organisation</td>
</tr>
<tr>
<td>NZAID:</td>
<td>New Zealand Agency for International Development.</td>
</tr>
<tr>
<td>NZD:</td>
<td>New Zealand Dollar</td>
</tr>
<tr>
<td>ODA:</td>
<td>Official Development Assistance</td>
</tr>
<tr>
<td>PRA:</td>
<td>Participatory Rural Appraisal</td>
</tr>
<tr>
<td>PV:</td>
<td>Photovoltaic (often referred to as solar generation).</td>
</tr>
<tr>
<td>REEEEU:</td>
<td>Renewable Energy and Energy Efficiency Unit (unit of TEC).</td>
</tr>
<tr>
<td>RRA:</td>
<td>Rapid Rural Appraisal</td>
</tr>
<tr>
<td>SAP:</td>
<td>Structural adjustment programmes</td>
</tr>
<tr>
<td>SDG:</td>
<td>Sustainable Development Goals</td>
</tr>
<tr>
<td>SOPAC:</td>
<td>Applied Geoscience and Technology Division (SOPAC Division of SPC)</td>
</tr>
<tr>
<td>SPC:</td>
<td>Secretariat of the Pacific Community.</td>
</tr>
<tr>
<td>TEC:</td>
<td>Tuvalu Electricity Corporation</td>
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<tr>
<td>TKII:</td>
<td>Te Tekakeega II (the (Tuvalu) National Strategy for Sustainable Development.</td>
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<tr>
<td>TMTI:</td>
<td>Tuvalu Maritime Training Institute</td>
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<tr>
<td>UN:</td>
<td>United Nations</td>
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<td>UNDP:</td>
<td>United Nations Development Programme</td>
</tr>
<tr>
<td>USD:</td>
<td>United States Dollar</td>
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<tr>
<td>USP:</td>
<td>University of the South Pacific</td>
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<tr>
<td>USPEC:</td>
<td>University of the South Pacific Extension Campus</td>
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<tr>
<td>WCED:</td>
<td>World Commission on Environment and Development</td>
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<td>WHO:</td>
<td>World Health Organisation</td>
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<tr>
<td>WST:</td>
<td>Samoan Tala.</td>
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<tr>
<td>$NZ$</td>
<td>New Zealand Dollar</td>
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<td>$A$</td>
<td>Australian Dollar</td>
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<td>United States Dollar</td>
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<td>€</td>
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<td>¥</td>
<td>Yen</td>
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ENERGY UNITS AND FACTORS

Energy units used in this thesis:

J: Joule: unit of energy
    kJ = 1,000 J
    MJ = 1,000,000 J
    GJ = 1,000 MJ

kWh: kilowatt-hour: unit of energy used in electrical industry (1 kWh = 3.6 MJ).
    MWh = 1,000 kWh
    GWh = 1,000 MWh

TOE: Tonnes of Oil Equivalent (42.6 GJ = 11.83 MWh)

W: Watt: unit of power
    kW = 1,000 W
    MW = 1,000 kW
    GW = 1,000 MW

Wp: Watt peak: unit of power used in PV and wind generation sector.
    kWp = 1,000 Wp.

Energy content factors (calorific values) used for various fuels:

- **Diesel oil:** 45.69 MJ/kg 38.45 MJ/litre
- **Petrol (gasoline):** 46.96 MJ/kg 35.25 MJ/litre
- **Kerosene:** 46.19 MJ/kg 37.26 MJ/litre
- **LPG:** 49.51 MJ/kg 26.54 MJ/litre

Note: all the above are gross calorific values.

*Source: New Zealand Energy Data File 2012 (MED, 2012, p. 159).*