The Relevance of Renewables to the Pacific Region

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Content of talk

1. Energy Challenges faced by PICs
2. Can Renewable Energy help?
3. Renewable energy resource availability in the PICs
4. Problems with Renewable Energy
5. Requirements for the development of a viable RE sector
6. Towards a viable energy solution for the Pacific
7. Are there lessons for Fiji?
8. Conclusion
1. Energy challenges in the PICs

- Lack of indigenous fossil fuel sources
- Heavy dependence on fossil fuel for power generation
- Remoteness means high import costs and energy supply chain issues
- Lack of institutional mechanisms (including trade infrastructure) and policy frameworks for RE development
- Lack of human capacity
Fraction of imported fossil fuel for power generation in selected PICs

Power Generation mix in selected PICs

Source: JICA report (2009); TERM (2010); FEA annual report (2008)
2. Can Renewable Energy Help?

• Is the traditional belief that RE can replace fossil fuel true?
• How Fiji’s imported fossil fuel is used

Table 1: Fuel consumption in Fiji in 2007

<table>
<thead>
<tr>
<th>Fuel type</th>
<th>Quantity (000 litres)</th>
<th>Percent of total (%)</th>
<th>Value F$(000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor spirit</td>
<td>78,753</td>
<td>9.55</td>
<td>95,429</td>
</tr>
<tr>
<td>Auto Distillate</td>
<td>62,231</td>
<td>7.55</td>
<td>62,208</td>
</tr>
<tr>
<td>Aviation fuel</td>
<td>291,327</td>
<td>35.33</td>
<td>321,743</td>
</tr>
<tr>
<td>Industrial distillate</td>
<td>375,656</td>
<td>45.55</td>
<td>416,912</td>
</tr>
<tr>
<td>Residual fuel</td>
<td>16,017</td>
<td>1.94</td>
<td>12,950</td>
</tr>
<tr>
<td>Kerosene</td>
<td>667</td>
<td>0.08</td>
<td>1,062</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>808,650</strong></td>
<td><strong>100</strong></td>
<td><strong>910,304</strong></td>
</tr>
</tbody>
</table>
What do we need energy for?

Stationary energy

• *Power* – diesel, hydro, wind, solar, geothermal, biomass and biofuels (including gasification)
• *Domestic energy needs*; cooking (firewood, gas, kerosene), appliances (electricity), heating (solar, electricity), cooling (electricity)
• *Industrial energy needs* – e.g. process heat (bagasse, fuelwood, timber milling residues), electricity

Transportation

• Several forms of fossil fuels (petrol, diesel, LPG, some biofuel blends (E10 etc)
• i.e. almost totally dependent on imported fossil fuels
• biofuels can replace fossil fuels, but we cannot produce enough biofuels
Fossil fuel and transportation

Transportation will depend mainly on fossil fuel for a long time to come, because we cannot produce enough biofuels globally or locally to totally replace fossil fuel for transportation.

Thus, it is unlikely that fossil fuel will be totally replaced by renewable energy in the PICs.

The PICs (and the rest of the world) will remain dependent on fossil fuels for the foreseeable future.
3. RE resource availability in the PICs

Fiji – current status

- Hydro- monasavu (80MW), Wainikasou (6 MW), Nadago (2.8MW), Nadarivatu (40MW)
- Solar – yes
- Wind – Butoni (10MW)
- Biomass – Bagasse (FEA), Hog fuel (Tropic woods)
- Biofuel – coconut oil (FdoE projects, standards)
- Geothermal – possibilities
- Ocean – ?
## Renewable energy resources of selected PICs

<table>
<thead>
<tr>
<th>Country</th>
<th>Geog</th>
<th>Solar</th>
<th>Wind</th>
<th>Hydro</th>
<th>Biomass/fuel</th>
<th>Geothermal</th>
<th>Ocean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nauru</td>
<td>21 km²</td>
<td>Yes</td>
<td>?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Kiribati</td>
<td>32 atolls</td>
<td>Yes</td>
<td>No–atolls</td>
<td>No</td>
<td>CNO</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>PNG</td>
<td>mountainous</td>
<td>Yes</td>
<td>Yes–19 sites</td>
<td>Yes (1400MW)</td>
<td>Timber, palm oil</td>
<td>Yes (1 station)</td>
<td>No</td>
</tr>
<tr>
<td>S.I.</td>
<td>6 volc.Is</td>
<td>Yes</td>
<td>No data</td>
<td>Yes (JICA 330MW)</td>
<td>CNO</td>
<td>Maybe</td>
<td>No</td>
</tr>
<tr>
<td>Samoa</td>
<td>2 volc is</td>
<td>Yes</td>
<td>~3m/s</td>
<td>Yes (issues)</td>
<td>5%CNO blend</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Fiji</td>
<td>2 volc</td>
<td>Yes</td>
<td>Yes - Butoni</td>
<td>Yes</td>
<td>Timber, CNO</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
Hydro potential for Fiji

• FDoE- 8 projects installed (977 kW) at Wainiqeu (600 kW), Bukuya(100kW), Muana (30kW), Marist tutu(20kW), Nasoqo(4 kW), Vatukarasa(3 kW), Kadavukoro(20kW) – but only 3 operational
• 1983 World Bank/UNDP study estimated a total of 300MW promising (>2 MW) hydro resources (including Monasavu and Nadarivatu)
  • But recent reports indicate at least 23 MW additional potential in Namosi alone
  • A thorough and independent resource assessment required.
### 4. Problems with Renewable Energy data and viability of technology

#### Table 3: Technical Assessment of RE Technologies for power generation

<table>
<thead>
<tr>
<th>RET</th>
<th>Technology efficiency</th>
<th>Capacity Factor</th>
<th>Lifetime</th>
<th>Cost/kW</th>
<th>Payback period</th>
<th>Commercial availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>~40%</td>
<td>10-25%</td>
<td>&gt; 25 yrs</td>
<td>~$10,000</td>
<td>&lt;25 yrs</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PV</td>
<td>12-15%</td>
<td>~50%</td>
<td>25-30 yrs</td>
<td>~$25,000</td>
<td>25-35 yrs</td>
<td>Yes</td>
</tr>
<tr>
<td>Micro-Hydro</td>
<td>90%</td>
<td>~100 %</td>
<td>&gt;25 yrs</td>
<td>$2000-5000</td>
<td>5-10 yrs</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>low maintenance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomass</td>
<td>&lt; 60%</td>
<td>Biomass availability</td>
<td>~25 yrs</td>
<td>-</td>
<td>&lt; 25 yrs</td>
<td>Yes</td>
</tr>
<tr>
<td>Biofuel</td>
<td>&lt; 60%</td>
<td>Biofuel availability</td>
<td>~25 yrs</td>
<td>-</td>
<td>&lt; 25 yrs</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>
Problems with RE (cont.)

*Hydro is the most viable renewable energy resource.*

*We must optimise our use of this resource.*
5. Requirements for the development of viable RE sector

- Policy framework (policy/legislation, strategy, action plan)
- Resource availability
  - Access to mature and commercially available (off the shelf) technology
- Institutional mechanisms for resource development and utilization
- Human capacity (sci and tech, admin, business know-how)
- Economic infrastructure
  - roads, information communication and energy database
- Stable economy based on capable and stable population (migration and brain drain)
- Political stability
# Case studies of PICs

<table>
<thead>
<tr>
<th></th>
<th>Samoa</th>
<th>Cook Is</th>
<th>Tuvalu</th>
<th>Vanuatu</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy policy</strong></td>
<td>yes</td>
<td>yes</td>
<td>100% RE powergen by 2020</td>
<td>Rural electrification. policy being drafted</td>
</tr>
<tr>
<td><strong>Grid-connected power</strong></td>
<td>36 MW grids on Upolu and Savaii</td>
<td>11 indiv grids, totaling 5MW on Rarotonga.</td>
<td>1500kW installed capacity, also 8% from PV</td>
<td>11 MW diesel and 2.75 MW wind farm on Efate.</td>
</tr>
<tr>
<td><strong>Energy mix and RE potential/plans</strong></td>
<td>Diesel, hydro, 2MW gasification plant planned</td>
<td>Diesel, small PV grids, wind monitoring on Raro and Aitutaki.</td>
<td>Diesel, PV, wind</td>
<td>Diesel, Solar LED project, 1.2 MW hydro in Sarakatta, geothermal potential on Efate</td>
</tr>
<tr>
<td><strong>Capacity building needs</strong></td>
<td>Technicians, with biomass gasification know-how.</td>
<td>Academic training (eng.) on RE generation, resource assessments</td>
<td>Trained RE staff; ability to compile and analyse energy data; conduct energy audits</td>
<td>No capacity to coordinate RE projects, lack of awareness of RE; feasibility studies.</td>
</tr>
</tbody>
</table>
Country Case studies (cont)

• The recurring story of migration – the case of Tokelau (90%) of Tokelauans live abroad.
• The Diaspora model for analysis of population migration (diaspora = people at home + those abroad).
• Migration causes diaspora.
• Bright side to diaspora - remittances and returning residents who invest in home country ( “diaspora ain’t all bad”) 
• Need to nurture a sense of belonging to home base.
6. Towards a viable energy solution for the Pacific

• Recent awakening amongst energy specialists
  – RE alone not enough to solve energy challenge
• must be coupled with *efficient use of fossil fuels (vis a vis RE), energy efficiency and conservation*
  • Our energy problems can only be solved through a “whole-of-sector approach”.
  • The Tonga Energy Roadmap (TERM) is an excellent prototype for this new methodology.
The Tonga Energy Road Map (TERM) 2010-2020

- “A ten year road map to reduce Tonga’s vulnerability to oil price shocks and to achieve an increase in quality access to modern energy services in an environmentally sustainable manner”

- To reduce Tonga’s fossil fuel dependence for power generation by 50% asap
TERM (cont1)

Four methods to achieve this aim:

- improve petroleum supply chain
- increase efficiency and reduce losses at the Tonga Power Ltd (TPL) Power Station (supply side intervention)
- increase efficiency of conversion of electricity to consumer services (i.e. demand side intervention)
- increase the fraction of renewable energy in the energy mix
TERM – a whole of sector approach

TERM will use a **whole-of-the-sector** approach

- comprehensive, all-inclusive method
- involves all line ministries associated with energy at once
- pragmatic approach to use of RE – only mature technology will be considered
TERM – whole of sector (cont.)

- a malleable approach – if the problem changes over time, the plan will be revised accordingly
- nothing left to the imagination (she won’t be right) – learn from proof-of-concept projects first before deciding the final renewable energy solutions to be used
- a *new paradigm in problem-solving*
The role of regional energy policies

- We need energy policies at both the regional and national levels to solve our energy problems
- The demise of the Pacific Islands Energy Policy (PIEP)
- The birth of the Framework for Action for an Energy Secure Pacific (FAESP)
- starts by accepting the reality of fossil fuels as an essential energy source for the PICs
- Based on the whole-of-sector approach
- But respects the National Energy Policies
- Acknowledges TERM as a prototype
- Implementation plan currently being drafted.
7. Are there lessons for Fiji?

- What can Fiji learn from the new thinking?
- Fiji’s current electricity crisis could be alleviated through
  - Greater DSM and SSM of energy use by power utilities and users
  - A thorough survey of Fiji’s hydro potential
  - A study of Fiji’s internal and external migration
- Treat Fijians abroad as part of the Fijian Diaspora – inculcate a greater sense of belonging to Fiji.
8. Conclusions

The traditional belief that renewable energy (RE) can solve all our energy problems is no longer true.

We must embrace the new thinking in RE:

• *We must consider the whole-of-sector approach to the solution of our energy problems.*

• *We must also think of Energy Efficiency and conservation to achieve our energy objectives.*
Thank you for your attention!