Vanuatu
Country Report
Global Applications Program
Alaska Center for Energy and Power

Jason Meyer – 12/18/2013
Presentation Outline

1. Background Information – Country and Economics
2. Background Information – Energy Sector
4. Review – Geothermal
5. Review – Hydroelectric
6. Findings
Background Information

COUNTRY AND ECONOMICS
Background

- Republic of Vanuatu
  - Democratic Republic
  - Independence in 1980 from UK and France

- Archipelago of 82 volcanic islands
  - 65 inhabited islands
  - 80% lives on 7 islands
  - Total area of 12,200 km²
  - 4,700 km² of land
Background

- 2 “urban” centers
  - Port Vila (Capital, Efate)
  - Lugarville (Santo)
- 6 admin provinces
  - Torba, Penama, Sanma, Malampa, Shefa, Tafea
- Population ~250,000
  - 98.5% Melanesian
  - 51,000 households
Population by Island/Region

<table>
<thead>
<tr>
<th>Location</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>75%</td>
</tr>
<tr>
<td>Urban</td>
<td>25%</td>
</tr>
<tr>
<td>Port Vila</td>
<td>19%</td>
</tr>
<tr>
<td>Luganville</td>
<td>6%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

ACEP Global Applications Program
Vanuatu is classified as a Small Island Developing States (SIDS)

“[SIDS] are low-lying coastal countries that tend to share similar sustainable development challenges, including small but growing populations, limited resources, remoteness, susceptibility to natural disasters, vulnerability to external shocks, excessive dependence on international trade, and fragile environments. Their growth and development is also held back by high communication, energy and transportation costs, irregular international transport volumes, disproportionately expensive public administration and infrastructure due to their small size, and little to no opportunity to create economies of scale.”
Economic Overview

- “Classic duel economy”
  - Small, high-cost modern sector
  - Subsistence/small-scale agriculture outside of cash economy
- Exports include:
  - Copra, beef, timber, kava, coconut oil
- Other economic drivers:
  - Tourism, construction, aid inflows, remittance
- “Poverty” difficult to comparably quantify

<table>
<thead>
<tr>
<th>Year</th>
<th>GNI per capita</th>
<th>GDP</th>
<th>GDP growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>$3,050</td>
<td>$314 mill</td>
<td>4%</td>
</tr>
<tr>
<td>2004</td>
<td>$3,170</td>
<td>$365 mill</td>
<td>4%</td>
</tr>
<tr>
<td>2005</td>
<td>$3,310</td>
<td>$395 mill</td>
<td>5%</td>
</tr>
<tr>
<td>2006</td>
<td>$3,690</td>
<td>$437 mill</td>
<td>8%</td>
</tr>
<tr>
<td>2007</td>
<td>$3,870</td>
<td>$526 mill</td>
<td>5%</td>
</tr>
<tr>
<td>2008</td>
<td>$4,310</td>
<td>$608 mill</td>
<td>6%</td>
</tr>
<tr>
<td>2009</td>
<td>$4,250</td>
<td>$610 mill</td>
<td>3%</td>
</tr>
<tr>
<td>2010</td>
<td>$4,310</td>
<td>$701 mill</td>
<td>2%</td>
</tr>
<tr>
<td>2011</td>
<td>$4,390</td>
<td>$786 mill</td>
<td>1%</td>
</tr>
<tr>
<td>2012</td>
<td>$4,500</td>
<td>$785 mill</td>
<td>2%</td>
</tr>
</tbody>
</table>
Background Information

ENERGY SECTOR
Petroleum Imports

• High dependence on imports
  – Significant risk of price volatility and supply shock
  – Two primary suppliers supported by small private retailers and distributors
    • Diesel, petrol, kerosene and lubricants
    • LPG
  – Imports are relatively small... could be handled by one 40,000 tonne medium range ocean tanker (assuming adequate storage) that currently delivers fuel.
Petroleum Imports

**Imports (2010)**

- Avgas: 63.30%
- Petrol: 16.50%
- Kerosene: 13.80%
- Diesel: 5.90%
- LPG: 0.30%
- Jet Fuel: 0.20%

**Market Segments**

- Land Trans: 50%
- Domestic Av: 38%
- Electricity: 5%
- Ind/Comm: 4%
- Household: 3%
- Marine Trans: 2%

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Petroleum Market Concerns

• Concerns
  – Monopoly market
  – Cost impacted by lack of scale... supply infrastructure cannot scale down
  – No bulk or strategic storage
  – No regulatory framework
    • Pricing, risk management, and energy security left to industry

• Petroleum products vital to key economic sectors
  – Tourism, transportation, fishing, agriculture
Retail Diesel Fuel Prices in Pacific

Source: Hale & Twomey and Pacific Islands Fuel Price Gazette

Average April - September 2011, excluding duties and taxes; Source: Hale and Twomey, and David Butcher and Associates “Draft Final Report: Options for Increasing the efficiency of Vanuatu’s oil and gas supply chain” November 2012
LPG Retail Prices

Access to Modern Cooking Fuels

Population still Dependent on Solid Cooking Fuels (2008; by Country)

Source: World Bank and authors' calculations.


Solid cooking fuels include wood, dung, coal, charcoal
Electrification

- 2 private companies responsible for generating and supplying “main grid” electricity under concession agreements with the government
  - Union Electrique du Vanuatu Ltd. (UNELCO)
  - Vanuatu Utility Infrastructure, Ltd. (VUI)
Electrification Regulatory Framework
## Electricity Generation Profile

<table>
<thead>
<tr>
<th>Concession Area</th>
<th>Installed Capacity (MW)</th>
<th>Gross Annual Generation</th>
<th>Renewable Contribution</th>
<th>Renewable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efate</td>
<td>26.27</td>
<td>59,461</td>
<td>11.8%</td>
<td>Wind (8.7%), Coconut Oil (0.8%)</td>
</tr>
<tr>
<td>Malekula</td>
<td>0.43</td>
<td>650</td>
<td>3%</td>
<td>Coconut Oil</td>
</tr>
<tr>
<td>Tanna</td>
<td>0.45</td>
<td>522</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Santo</td>
<td>4.1</td>
<td>8,311</td>
<td>80%</td>
<td>Hydro</td>
</tr>
<tr>
<td>Total</td>
<td>31.25</td>
<td>68,944</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Energy Generation Mix

- Diesel: 84%
- Hydro: 1%
- Wind: 6%
- Coconut Oil: 9%

### Generation by Concession

- Efate: 86%
- Malekula: 1%
- Tanna: 12%
- Santo: 1%
Sarakata Hydro Plant

• 1.2 MW run-of-river plant funded by Japanese government
• Luganville concession customers are charged the regular diesel generation rate while the value of the fuel saved by the hydro installation is placed into the Sarakata Special Reserve Fund (SSRF).
Devil’s Point Wind Farm

- UNELCO 3.025 MW wind farm
- Vergnet 275 kW tilt-down wind turbines
- Can reach 15% power penetration rate
- Vergnet chosen due to limited road and lifting infrastructure, and prevalence of cyclones
Rural and Urban Electrification Rates

![Bar chart showing electrification rates in different regions, comparing national, rural, and urban areas.](chart.png)
Low Concession Connectivity

“In the existing concession areas, there remain a large number of households and some businesses without a grid connection. Moreover, many of those with electricity service are households sharing connections with neighbors and do not have their own account. For example, in Port Vila about 9,000 households are connected to the grid using only 5,000 UNELCO electricity accounts.”

Global Electrification


Source: World Bank and authors' calculations.

Rural/Urban Divide

Remote Energy

- Energy for Rural Development Programme???
- Primarily solar, but also wind, hydro, biogas

<table>
<thead>
<tr>
<th>Year</th>
<th>Summary</th>
<th>Location</th>
<th>Size</th>
<th>Funded by</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>2 health facilities</td>
<td>2 sites</td>
<td>0.3 kWP</td>
<td>British High Commission (UK)</td>
</tr>
<tr>
<td>1995–2000</td>
<td>Community-based</td>
<td>4 sites</td>
<td>2 kWP</td>
<td>Energy Unit (GoV)</td>
</tr>
<tr>
<td>1995</td>
<td>Community-based</td>
<td>6 sites</td>
<td>1 kWP</td>
<td>ACCT (France)</td>
</tr>
<tr>
<td>1996–1997</td>
<td>13 schools</td>
<td>5 islands</td>
<td>5 kWP</td>
<td>ACCT/FONDEM (France)</td>
</tr>
<tr>
<td>1999</td>
<td>220 solar home systems</td>
<td>5 sites; 4 islands</td>
<td>22 kWP</td>
<td>JICA (Japan)</td>
</tr>
<tr>
<td>2000</td>
<td>45 solar home systems</td>
<td>Efaté</td>
<td>4.5 kWP</td>
<td>Energy Unit (GoV)</td>
</tr>
<tr>
<td>2000–2001</td>
<td>About 200 systems at 27 schools and 18 health facilities</td>
<td>45 sites</td>
<td>22 kWP</td>
<td>AFD (France)</td>
</tr>
<tr>
<td>2001–2002</td>
<td>12 schools, 8 health facilities and 40 staff houses</td>
<td>60 sites</td>
<td>6 kWP</td>
<td>PREFACE (France, Australia)</td>
</tr>
</tbody>
</table>


Where: U.K. is United Kingdom; Gov is Government of Vanuatu; ACCT is the Agence de coopération culturelle et technique, France; JICA is the Japan International Cooperation Agency; AFD is the Agence Française de Développement; PREFACE is the Pacific Regional rural Energy France Australia Common Endeavour; FONDEM is Fondation Énergies pour le Monde.
Potential of Renewables

- Geothermal and hydro (slides to follow)
- Wind
  - Very limited data on wind energy potential. Several current measurement programs underway
- Solar
  - Substantial solar potential. Annual sunshine hours from 2,000-2,300 hours per year, with a solar insolation of ~6 kWh/m²/day.
- Bioenergy
  - Coconut oil, biogas, gasification. Significant barriers, including economics, competing markets, and scale
- Ocean
  - Limited determine potential from regional study
- http://www.youtube.com/watch?v=hkV5zPO-X14
Review

VANUATU NATIONAL ENERGY ROAD MAP 2013-2020
Vanuatu Nation Energy Road Map

• Vision:
  – “To energy Vanuatu’s growth and development through the provision of secure, affordable, widely-accessible, high quality, clean energy services for an Educated, Health, and Wealthy nation.”

• ACEP GAP motivation:
  – [Alaska rural energy applications]... seeking energy provision that is affordable, cost-stable, reliable, and secure
VNER Priorities

Priority objectives in the energy sector from a national development perspective

1. Access
   – Access to secure, reliable and affordable electricity for all Citizens by 2030

2. Petroleum Supply
   – Reliable, secure, and affordable petroleum supply throughout Vanuatu
VNER Priorities

3. Affordability
   – A more affordable and low cost of energy services in Vanuatu

4. Energy Security
   – An energy secure Vanuatu at all times

5. Climate Change
   – Mitigating climate change through renewable energy and energy efficiency
VNERM Strategic Framework for Scaling Electricity Access Nationwide by 2030

- **Outside Concession Areas**
  - (remote areas and low population density)
  - Individual Solutions
  - Micro-grid solutions

- **Immediately Contiguous to Concession Areas**
  - Extend Networks

- **Concession Areas**
  - Port Vila
  - Luganville
  - Malekula
  - Tanna

- **OFF GRID**
  - Higher Costs per Household

- **GRID**
  - Higher Household Densities
VNERM Strategic Framework for Scaling Electricity Access Nationwide by 2030

• Existing concession areas
  – “...aggressive development... of cost effective grid connected renewable energy for base load supply and diesel fuel substitution...”
  – Extend the grid where cost effective and supported by additional renewable contribution

• Off-grid areas
  – All social institutions are equipped with reliable electricity supply facilities
  – Hybrid micro grids: solar PV-battery-hybrid) and small hydro
  – “Basic electricity access for all program”
• SWER Extension
  – “In addition to ‘conventional’ grid extensions, the Government will explore the option to use cheaper ways to expand electricity networks than the approaches previously used in Vanuatu. Some of the relatively dense communities in the isolated rural areas within the concessions areas (for example, Paama on Santo), are well suited to a lower cost wiring option such as Single Wire Earth Return (SWER). In Australia and New Zealand, capital costs are estimated to be 50 percent lower than 2 wire, single-phase solutions, and 70 percent lower than 3 wire and 3 phase solutions. Cost savings of 26-30 percent have been achieved relative to single-phase systems. SWER also reduces maintenance costs by around 50 percent.”
Micro-grid initiative

– The government is to commission a feasibility study to identify which communities (and technologies) are appropriate for micro-grids

– Micro-grid feasibility study and program design to be completed by 2015

– First micro-grid installations by 2020

– No funding or financing identified... donor funding is needed to carry out the program
All social institutions are equipped with reliable electricity supply facilities

- For current electricity supply, concern about sustainability, performance, and maintenance
  - Capacity of local dealers and service technicians
  - Standardization
  - Timely availability of parts

- Only 50% of public facilities (urban and rural combined) have reliable electricity access/supply
- Projects have been completed piecemeal by many different donor organizations

<table>
<thead>
<tr>
<th>% social facilities with no electricity access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary schools</td>
</tr>
<tr>
<td>Secondary schools</td>
</tr>
<tr>
<td>Health centres</td>
</tr>
<tr>
<td>Dispensaries</td>
</tr>
</tbody>
</table>

• Interesting VNER Points
  – Data collection regarding energy efficiency, energy use, and the performance of the energy sector
  – Bulk fuel delivery and storage throughout the country
  – Policies and strategies for rural energy provision
  – A national renewable energy atlas and wind resource assessments
  – Challenge to historic energy provision institutions and framework (concessions, fuel delivery, etc.)
Case Study

GEOTHERMAL
Geothermal in the SW Pacific

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Papua New Guinea</td>
<td>Active</td>
<td>Excellent</td>
<td>41 thermal areas</td>
<td>Development</td>
<td>36-101</td>
<td>2874</td>
<td>46%</td>
<td>Rugged Terrain</td>
<td>High</td>
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<tr>
<td>Vanuatu</td>
<td>Active</td>
<td>Good</td>
<td>20 thermal areas</td>
<td>Reconnaissance</td>
<td>30-78</td>
<td>40</td>
<td>19%</td>
<td>Active Volcanism</td>
<td>High to Moderate</td>
</tr>
<tr>
<td>Samoa</td>
<td>Active</td>
<td>Good</td>
<td>Prospective Rift Valley</td>
<td>None</td>
<td>-</td>
<td>101</td>
<td>42%</td>
<td>-</td>
<td>Moderate</td>
</tr>
<tr>
<td>Tonga</td>
<td>Active</td>
<td>Good</td>
<td>Hot springs</td>
<td>None</td>
<td>-</td>
<td>43</td>
<td>0%</td>
<td>Distance to population</td>
<td>Moderate</td>
</tr>
<tr>
<td>N. Marianas Islands</td>
<td>Active</td>
<td>Excellent</td>
<td>Submarine only</td>
<td>Reconnaissance</td>
<td>-</td>
<td>4</td>
<td>50%</td>
<td>Active Volcanism</td>
<td>High to Moderate</td>
</tr>
<tr>
<td>Fiji</td>
<td>Recent</td>
<td>Excellent</td>
<td>53 thermal areas</td>
<td>Detailed</td>
<td>31-102</td>
<td>970</td>
<td>82%</td>
<td>-</td>
<td>High</td>
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<td>Solomon Islands</td>
<td>Active</td>
<td>Good</td>
<td>8 thermal areas</td>
<td>Reconnaissance</td>
<td>57-99</td>
<td>70</td>
<td>0%</td>
<td>-</td>
<td>High to Moderate</td>
</tr>
<tr>
<td>New Caledonia</td>
<td>Unknown</td>
<td>Unknown</td>
<td>2 thermal areas</td>
<td>Reconnaissance</td>
<td>22-43</td>
<td>1490</td>
<td>24%</td>
<td>-</td>
<td>Moderate</td>
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<tr>
<td>French Polynesia</td>
<td>Recent</td>
<td>Possible</td>
<td>Submarine?</td>
<td>None</td>
<td>-</td>
<td>442</td>
<td>39%</td>
<td>-</td>
<td>Low to Moderate</td>
</tr>
<tr>
<td>American Samoa</td>
<td>~1 Ma</td>
<td>Possible</td>
<td>None</td>
<td>None</td>
<td>-</td>
<td>167</td>
<td>0%</td>
<td>-</td>
<td>Low</td>
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<tr>
<td>Cook Islands</td>
<td>1.5 Ma</td>
<td>Possible</td>
<td>None</td>
<td>None</td>
<td>-</td>
<td>28</td>
<td>10%</td>
<td>-</td>
<td>Low</td>
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<tr>
<td>Pitcair</td>
<td>0.45 Ma</td>
<td>Possible</td>
<td>None</td>
<td>None</td>
<td>-</td>
<td>&lt; 0.5</td>
<td>0%</td>
<td>-</td>
<td>Low</td>
</tr>
<tr>
<td>Palau</td>
<td>~20 Ma</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>-</td>
<td>122</td>
<td>0%</td>
<td>-</td>
<td>Extremely Low</td>
</tr>
<tr>
<td>Guam</td>
<td>~32 Ma</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>-</td>
<td>1664</td>
<td>0%</td>
<td>-</td>
<td>Extremely Low</td>
</tr>
<tr>
<td>Niue</td>
<td>&gt; 20 Ma</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>-</td>
<td>4</td>
<td>0%</td>
<td>-</td>
<td>Extremely Low</td>
</tr>
<tr>
<td>Kiribati</td>
<td>~80 Ma</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>-</td>
<td>9</td>
<td>0%</td>
<td>-</td>
<td>Extremely Low</td>
</tr>
<tr>
<td>Marshall Islands</td>
<td>~80 Ma</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>-</td>
<td>100</td>
<td>1%</td>
<td>-</td>
<td>Extremely Low</td>
</tr>
<tr>
<td>Micronesia</td>
<td>Unknown</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>-</td>
<td>179</td>
<td>0%</td>
<td>-</td>
<td>Extremely Low</td>
</tr>
<tr>
<td>Nauru</td>
<td>Unknown</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>-</td>
<td>29</td>
<td>0%</td>
<td>-</td>
<td>Extremely Low</td>
</tr>
<tr>
<td>Tuvalu</td>
<td>Unknown</td>
<td>None</td>
<td>None</td>
<td>Unknown</td>
<td>-</td>
<td>Unknown</td>
<td>0%</td>
<td>-</td>
<td>Extremely Low</td>
</tr>
</tbody>
</table>
- PNG and Fiji represent 90% of the energy produced in the region.

- PNG has significant potential for geothermal development and energy-intense (mining) industry.
  - Several fields on New Britain have inferred reservoir temperatures of >300°C
  - Current 30 MW Lihir project feeds a gold mine
  - There is regional controversy as to the political, social and environmental conditions by which energy-intense industries are developed and operated.

- Regional countries with geothermal expertise were noted as including Indonesia, Japan, and the Philippines.

- The South Pacific Islands Applied Geoscience Commission (SOPAC) was noted as being particularly important for collaboration.
Vanuatu

- “...geothermal resource potential of Vanuatu is moderate to high.”
- “A moderate level of geoscientific investigations have been undertaken...”
- “Efate is likely to be the only island in the Vanuatu archipelago with a sufficiently large population to support geothermal power generation.”
• KUTh Energy: 2009-2010 exploration program
  – Takara Springs, Teuma, Epule
• Three sites in Takara Springs identified to have very promising resource
KUTh recommends the development of an 8 MW project

- 4 MW by 2016 to meet overnight baseload
- 4 MW by 2019 to meet block loads during peak operating times
- 56% of Efate’s energy needs
“The Takara geothermal power plant is the economically least-cost base load power supply addition for Efate under a broad range of conditions when compared to diesel, wind and solar photovoltaics. Development of the Takara geothermal resource should therefore be prioritized above development of other generation technologies.”
• Interesting notes on WB findings:
  – the project was highly favorable, even when explicitly accounting for uncertainty of the resource potential and subjecting the geothermal case to unfavorable economic assumptions when comparing to diesel, solar etc.
  – primary public benefit was identified as lower, less volatile electricity tariffs.
  – secondary public benefit was the extension of transmission to those outside the concession area, although minor in comparison given that only 6% of households live outside the concession area.
**Question:** What should the GoV do within the prevailing legal & contractual framework to maximize the potential benefits to consumers from geothermal development at Takara?

**Solution:** The GoV should participate actively as a partner in the project commensurate with its available resources, while exercising fully its rights under the prevailing legal framework as follows:

1. Establish a GoV team and engage advisors to lead the process
   - Mitigates or manages major risks to the project

2. Share exploration and T&D costs subject to the GoV’s availability of funds and risk profile
   - Helps maximize the benefits to consumers that result from a successful project

3. Establish clear conditions for prospecting license extension & the future production license
   - Helps ensure that developer delivers on commitment at lowest cost & risk

4. Establish the commercial structure of the Project
   - Sets the stage for timely, least cost development
• Project Status
  – KUTNh has secured prospecting and development rights to site
  – Undergoing a takeover bid from Geodynamics

• Next Steps
  – Exploration well drilling and flow tests to confirm resource potential
  – Power Purchase Agreement with UNELCO, facilitated by the Vanuatu Government
  – Land access agreements
But...

• Red Flags:
  – Land access
  – Concession politics
  – PPA with UNELCO
  – Government concerns

• “The Vanua’aku Party is concerned that there is lack of public consultation before the Lands and Energy Minister unilaterally agreed on the principle of extending the concession of UNELCO to cover Efate and its outlying islands...This decision is likely to impact negatively on the proposed Takara Geothermal Energy project already endorsed by government and independently reviewed by the World Bank.”

Vanuatu Daily Post, August 1, 2012. “Kilman should resign: Natapei”
Review

HYDROELECTRIC
Project Potential

• The Vanuatu National Energy Roadmap has identified two projects in particular that could stimulate economic development
  – Brenwe Hyrdo Project (<1.2 MW, Malekula)
  – Wambu River Mini Hydro Project (2.2 MW, Santo)
• The Sarakata plant could be upgraded with an additional 500 kW to 600 kW in capacity
• 75 kW hydro scheme near the Talise river (Maewo Island, Penama Province)
  – The project would provide electricity to 361 houses in several villages and a school
• Teuma River project on Efate not cost effective
FINDINGS
Donor Community

• Very active, many organizations at all levels
• Fund a majority of projects and initiatives
  – “Responsible” for rural energy development
• Limited strategic coordination or overall framework guiding investment
  – Competing/overlapping goals, interests, activities
• Funded projects lack standardized specification, sustainability
• Leading the vision?
Vanuatu Government

• Relatively stable compared to region
• Genuine focus on electrification, renewables
• Critical staffing/capacity/funding deficiencies
  – DOE, DEMM, etc.
• Significant issues with transparency, infrastructure projects prone to politics
  – E.g., Sarakata Special Reserve Fund
• VNER extremely important, but needs strong government leadership and commitment
  – E.g., difficult concession/industry reforms
Scale

• Limited population, low population density, decentralized communities
• Few grid opportunities
  – Grid electrification/extension
  – Microgrids
• Small economy, limited cash
  – Increases susceptibility to fuel volatility/price shock
• Nonexistent rural technical capacity
Industry Environment

• Contractually established concessions for long-term generation rights with private companies
  – No monitoring!!!
  – Unclear industry willingness to participate in VNER or drivers/incentives for technology adoption, efficiency improvements, etc.
  – Signs of tension, corruption, and dissatisfaction

• Petroleum delivery monopoly with little regulation and oversight
Opportunities

• VNER
  – Highly anticipated and just recently published
  – SWER and transmission
  – Micro-grid initiative and rural energy provision
  – Bulk fuel regulations, policy, logistics, and storage
  – Data (Project monitoring and reporting, lessons learned reporting, data collection and analysis)
  – Efate geothermal project (integration and modeling)
• Diesel operations and management
  – ORC, efficiency, etc.
• Wind monitoring and renewable energy atlas creation
Recommendations

• Regional geothermal investigation/monitoring
  – PNG development, Australian industry, etc
• Investigate collaboration with SOPAC, DoE/DEMM
• Monitor Efate geothermal project
  – KUTh takeover bid, initial exploratory work
• Further investigate donor community universe
  – AUSAID, ADB, World Bank affiliates in particular
• Investigate collaboration with UNELCO
  – Integration, modeling, ORC, etc.
• SIDS and EDIN investigation, journal review
  – Formal work in comparative Alaska/SIDS investigation
Vanuatu was identified by an ACEP GAP assessment as a country with potential synergies in remote energy applications with ACEP and Alaska industry partners. The research in support of this presentation was conducted as a preliminary review of Vanuatu, providing context for further exploration of these synergies. For further information regarding ACEP, the Global Applications Program, or this presentation, please contact the presentation author:

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TANK YU TUMAS!

Comprehensive annotated bibliography and reference information can be found in the ACEP GAP document: “Vanuatu: An Annotated Bibliography.”