Imagine what we could do...
if the energy for Palmyra’s scientific study came from the sun.

PROJECT LOCATION: THE NATURE CONSERVANCY, PALMYRA ATOLL
PROJECT SUMMARY

The Site: The proposed project site, the research station of the Palmyra Atoll Research Consortium, lies in one of the most remote, and yet scientifically important, islands of the Pacific – the Palmyra Atoll. As a designated wildlife refuge since 2001 (when The Nature Conservancy Council and the US Fish and Wildlife Service jointly established the Palmyra Atoll National Wildlife Refuge), the site needs to operate with the absolute minimum of impacts on the local environment. The proposed energy efficiency and generation solution will need to ensure that the site's energy needs are met, while fully complying with that requirement.

The Solution: We envisage the implementation of an integrated micro-grid platform for Palmyra. This will have, as its foundation, a comprehensive EECED (energy efficiency, conservation and demand) action plan. Reducing the site's energy profile is critical to 'right size' its energy generation systems, to reduce operating costs and to maximize the return on the proposed investment.

Additionally, the proposed solution will integrate a number of proven clean energy generation components. The micro-grid solution will combine solar PV electricity generation with an on-site storage solution. It is expected that this storage can be provided by tapping into the battery capacity of an upgraded electric vehicle (EV) fleet. The EV's themselves will be charged by the excess power generated through the solar PV system.

We can also see substantial benefits accruing from an optional biomass generation unit, to provide an air-cooling capacity through adsorption cooling technology. This could supplement, or replace, the existing air-conditioning systems. The biomass system could be scaled to fit the supply of waste woody biomass material from ongoing ground clearance at Palmyra. Such a biomass system will, however, need to be equipped with stringent emission control technology.

The existing diesel-based system would be retained, and integrated as a secondary fail-safe power option. This could then be flexibly called-upon, through an intelligent balancing of the various cost and power supply factors of the micro-grid's components (PV, biomass, EV storage and diesel backup).

Given the long supply chain, the importance of choosing proven, robust, low-maintenance components cannot be overstressed. All equipment to be supplied will need to demonstrate robust performance in the face of the challenging conditions to be expected at this Pacific island site. This will require compliance with the relevant marine-environment electrical standards, including those relating to salt-water corrosion (IEC62217), and for installations to be built with appropriate wind effect mitigation and hurricane survival measures.

The Benefits: We expect the proposed system, as a whole, to offer the following benefits to The Nature Conservancy, and its site on Palmyra Atoll:

» Tangible on-site reductions to the deleterious effects of diesel combustion emissions

» Equipping the facility with a vital backup of stable stored power, in case of emergency – even for the most sensitive equipment and experiments

» Generating energy for the powering of zero-emission electric vehicles, which provide an additional source of emergency back-up power

» Seeing the site's electricity fuel costs reliably slashed by around half, over the long term

» Strengthening TNC's credentials for ecological-sensitivity, by making a visible commitment to clean energy
The Details: After assessing the available roof-space – including the research facilities and accommodation buildings – the estimated maximum size of the overall system is 120kW, consisting of 100kW of roof mounted PV and two 10kW vertical wind generators. The envisioned renewable micro grid system would generate over 150,000 kWh of clean energy annually. Not only would this system be capable of directly supplying 100% of the electrical load for the atoll at all times, any excess electricity will be stored, in energy storage systems including SCUBA compressed air, potable hot water and a battery bank. There will be more than enough spare production capacity for the charging one or more on-site EVs (boats and truck), given the anticipated low user travel requirements.

Remote Location Security: In addition to providing the tangible environmental and financial benefits detailed above, the proposed solution will also provide something less tangible, but perhaps more critical – a sense of security in an insecure world. Whether caused by natural disaster, modern-day piracy, terrorist attack or system mismanagement, power outages place a severe stress on any organization. This stress is all the greater when assistance is over 1,000 miles away.

The system will be designed to offer a robust and capable solution to these dangers, should they disrupt any of the system’s power-generating components. By leveraging on the energy stored in its connected EV’s (and optionally, backup battery banks), we expect that the site will have continuity of power – and service – when you need it.

How Do We Pay for It?

How much will energy cost us tomorrow?

- @ 5% annual increase in fuel over the next 5 years: $694,055
- @ $0.93 kW $884,376

Can we afford a renewable solution for $750,000 with an ROI of 5 years?

![Graph showing energy costs from 2013 to 2017 with rates of $0.73 kWh and $0.93 kWh.]

- Hawaiian homes with central AC, Powered per year
- EV Cars Charged per year
- Barrels of Oil Saved per year
- Pounds of CO₂ Avoided per year
- Metric tons of CO₂ Avoided per year
- Lb of Sulphur Dioxide Avoided per year
- Lb of Oxides of Nitrogen (NOx) Avoided per year
- Lb of Fine Particulate Matter (FPM) Avoided per year
- Pounds of Volatile Organic Compounds (VOC) Avoided per year

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www.rpdelio.com
Based on the expected output of your system, current electricity rates with a 5.5% increase in electricity prices, we estimate that you will save the following amount over the 20 year life of the system.

**20 YEAR PPA SAVINGS**

$3,700,000

**SYSTEMS INCLUDE**

- The most reliable, up-to-date technology, researched and tested by our on-staff engineers.
- Turn key installation & professional system design including permits and engineering.
- Strict compliance to 2008 NEC standards, local permitting authorities, and OSHA regulations.
- Owner Operations and Maintenance system training.
- Spare Parts
- Performance guarantee – 20 years
- State of the art online performance monitoring
- Free “flip the switch” event to announce your property as going 100% renewable

*Include any electrical/roofing/structural upgrades or engineering, if necessary.

**TURN KEY SYSTEM PAYMENT SCHEDULE**

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
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<tbody>
<tr>
<td>Annual kWh's Produced by Microgrid</td>
<td>150,000</td>
<td>150,000</td>
<td>150,000</td>
<td>150,000</td>
<td>150,000</td>
<td>150,000</td>
<td>150,000</td>
<td>150,000</td>
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</tr>
<tr>
<td>Current Palmyra Rate (Evolving 3%)</td>
<td>$0.93</td>
<td>$0.98</td>
<td>$1.04</td>
<td>$1.09</td>
<td>$1.15</td>
<td>$1.22</td>
<td>$1.28</td>
<td>$1.35</td>
<td>$1.43</td>
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<td>Palmyra Increase/Year</td>
<td>5.5%</td>
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<tr>
<td>PPA Rate</td>
<td>$0.33</td>
<td>$0.34</td>
<td>$0.35</td>
<td>$0.36</td>
<td>$0.38</td>
<td>$0.39</td>
<td>$0.40</td>
<td>$0.41</td>
<td>$0.43</td>
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<td>PPA Increase /Year</td>
<td>3.3%</td>
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<tr>
<td>Net Savings with PPA per kWh</td>
<td>$0.64</td>
<td>$0.68</td>
<td>$0.73</td>
<td>$0.78</td>
<td>$0.83</td>
<td>$0.88</td>
<td>$0.94</td>
<td>$1.00</td>
<td>$1.06</td>
<td>$1.13</td>
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<td>System Savings with PPA</td>
<td>$96,039</td>
<td>$102,446</td>
<td>$109,243</td>
<td>$116,451</td>
<td>$124,096</td>
<td>$140,797</td>
<td>$149,908</td>
<td>$159,564</td>
<td>$169,799</td>
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**CUMULATIVE SAVINGS**

- 5 Years: $648,275.47
- 10 Years: $1,300,546.03
- 20 Years: $3,714,974.06

**Bill of Materials**

<table>
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<tr>
<th>Item</th>
<th>Required Unit Count</th>
<th>Spare Unit Count</th>
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<tbody>
<tr>
<td>PV Panels @ 285w</td>
<td>352</td>
<td>18</td>
</tr>
<tr>
<td>Central Inverters @ 8000w</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>Micro Inverters @ 210w</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>10kW Turbines</td>
<td>2</td>
<td>—</td>
</tr>
<tr>
<td>Guy-Wire Towers 120 foot</td>
<td>2</td>
<td>—</td>
</tr>
<tr>
<td>DC Combiner Boxes</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>Batteries</td>
<td>35</td>
<td>5</td>
</tr>
</tbody>
</table>
You are invited to participate in our endowment goal of $750 thousand...

The Nature Conservancy of Hawai‘i Palmyra Program will launch the initial campaign to raise the necessary funds or in kind donations.

Donors will receive significant recognition and will serve as ambassadors for the Foundation and the Atoll.

Input from TNC will be essential to defining the donor categories for this campaign. At this point, the following opportunities have been identified:

» **Naming Opportunities:** Specific features that are suitable for naming have been identified, including the solar array, and wind turbines. It is expected that naming rights as the presenting sponsor of the Palmyra Nature Conservancy will command a seven figure price, and other features will be available in amounts ranging from $15,000 to $100,000 or more. Precise amounts and terms are negotiable, including multiple years.

» **Infrastructure Sponsorships:** Whole system as well as individual component sponsors are negotiable and subject to availability.

» **Concierge Service:** This exclusive donor benefit will be available for annual donations of not less $5,000 per year for a minimum of 5 years. This donation commitment will fund long term Operations and Maintenance of the system.

» **Planned Giving:** Opportunities for planned giving are available on a customized basis.

For additional information and assistance, contact The Nature Conservancy of Hawai‘i, Palmyra Atoll Operations Manager David Sellers at 808-587-6213.

Thank you in advance for helping to achieve this ground breaking and forward-thinking clean energy initiative, diversifying our reach and opening doors to new audiences around the world.

“Nature feeds us, quenches our thirst, supports our health, creates clean air and provides the energy that powers our economy and the inspiration that feeds our souls. It’s not selfish to conserve nature for people; it’s simply a recognition that nature is part of us and we are part of it”

– Co-Chairs, Board of Directors Teresa Beck and Steve Denning

Ref: http://www.nature.org/media/annualreport/annualreport2012_global.pdf