

# IEEE Electron Device Society Brings Energy Equity to Native Hawaiian Homesteaders on Molokai Living Without Access to Grid Electricity

By John Borland, IEEE

The IEEE Electron Device Society (EDS) recently approved funding a humanitarian project to bring Energy Equity to Native Hawaiian Homesteaders on Molokai living without access to electricity from the Grid. The \$25K grant will be used as part of the 6-month phase-1 pilot project administered by IEEE Smart Village (ISV). Three homestead sites with 2 to 5 multi-generational family dwellings have been selected. John Nelson President of ISV and John Borland chair of the IEEE Hawaii EDS chapter traveled to Molokai on Dec 15th and met with each Homestead family representative to discuss the project. Everyday life on Molokai involves using 5gallon propane tanks for heating hot water and cooking but one family was using wood and charcoal for cooking. Gasoline is \$6.35/gallon and they use 5gallon gasoline containers to fill and power several electric generators. We noted the various gasoline nozzles in use to reduce spilling and the toxic odor when handling. One Homestead site had a propane tank gas leak fire in July that destroyed their bus-home (see Figure 1). Another homestead family uses ice

depending on fossil fuel usage. Replacing dirty fuel usage (propane and gasoline) with 100% clean energy from the Sun (light & heat) will not only create a healthier environment but also reduce Energy Burden for Energy Equity and improve Quality of Life, never having to take a cold shower. We will install Island Nano-Grid and Nano-Grid Clusters using Solar + Wind + Storage (battery and thermal hot water) systems with energy sharing between each family dwelling. Energy efficient household appliances will also be installed including heat pump hot water, heat pump washer/dryer, Energy Star refrigerator/freezer, LED lighting and other energy saving household appliances (microwave oven, toaster oven, etc.). Each homesteader will have access to internet connection for smart home energy digitization to monitor, control and balance energy usage to maximize savings. After phase-1 completion, phase-2 would be a 2-3year project to expand Energy Equity to the remaining 126+ Native Hawaiian Homesteaders living without grid access. Molokai is an island of ~7,500 residents relying on tourism and government subsidies, reducing the need for each homestead family to generate ~\$500/month (\$6,000/year) reduces the need for Molokai to generate cash inflow of \$774K/year! Residential Island Nano-Grid systems getting 100% energy from the Sun will create a source of cash inflow for Molokai from **Passive Renewable Energy** rather than from tourism and government subsidies. A long time resident of Molokai says, "a dollar saved is a dollar earned" on Molokai. This project is "bringing electricity, a better quality of life, hot water, refrigeration and saving them money, you are reducing air pollution and stemming the outflow of money from Molokai to the oil companies."



Figure 1: July 2022 Homestead #1 propane gas fire.

boxes requiring ice for refrigeration, gasoline generator for electricity, propane for cooking on their livestock and agriculture farm (see Figure 2). They try to live off the land but end up

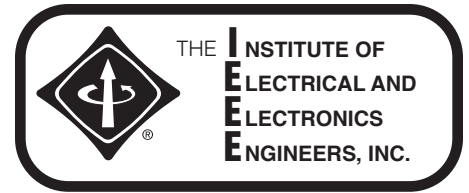


Figure 2: Homestead #3 ice box & gasoline generator.

polluting the air. Total monthly costs for fuel and ice for each family varies from \$400-\$800/month

To bring Energy Equity to all on Molokai including the remaining ~1,250 households with grid access but no access to rooftop solar including renters and low to moderate income (LMI) households, another future IEEE humanitarian project will look at "Battery Only or Battery + Portable/Mobile-Solar" systems as reported by Borland in his IEEE-PVSC June 2022 paper. Energy Burden reduction by 43-87% by lowering the schedule R rate 57¢/kWh (Aug 2022) to daytime Time-of-Use (TOU) rate which is ~31% lower on Molokai compared to >40% lower on Oahu (see Table 1 energy burden analysis for Molokai and Oahu). But the new federal Inflation Reduction Act (IRA) falls short to reverse Energy Divide by not providing direct cash rebates/incentives to LMI households. Solar Builder reported that 4 in 10 Americans do not pay any taxes and 7 in 10 do not have enough tax liability to receive full income tax credit benefits. Running the same numbers as above, there are ~1250 renters/LMI households without residential solar, saving \$100/month (\$1,200/year) reduces the need for Molokai to generate cash inflow of

\$1.5M/year. Combined with the Homesteaders that totals ~\$2.27M less in needed tourism and government subsidies creating a new industry from **Passive Renewable Energy**.



## IEEE Hawaii Section

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### SEMINAR ANNOUNCEMENT FOR IEEE AND ASCE

The Hawaii Section of IEEE is presenting a free seminar on "Practical Instruction on Ufer Grounds" at the Entrepreneurs Sandbox Tuesday, January 10, at 5:30 pm. This seminar is especially interesting to young electrical and civil engineers. The speaker, James Mercier, P.E. (ASCE Life Member, IEEE Life Senior Member), is an expert of the practical issues and IEEE Standard 142-2007 (the Green Book) and the National Electrical Code (NEC).

For more information see <https://events.vtools.ieee.org/m/323897>. Please register so that we manage the size of the meeting space. FREE!!

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Officer and a registered Professional Engineer in the State of Connecticut. He is a member of the Acquisition Professional Community and is a Certified Energy Manager. His personal awards include fore Meritorious Service Medals, two Navy Commendation Medals, the Navy Achievement Medal and various unit awards. In addition, he was the 2016 NAVFAC Mid-Atlantic Military Engineer of the Year.



**Joanna T.S. Victorino, Shipyard Infrastructure Optimization Program (SIOP) Department Director, Pearl Harbor Naval Shipyard, PMO 555, Navan Facilities Engineering Systems Command**

Ms. Victorino is from Northern California and received her Bachelor of Science in Civil Engineering from the University of California, Los Angeles. She is a registered Professional Engineer in the State of Hawaii and a member of Chi Epsilon, the Civil Engineering Honor Society. Ms. Victorino is a graduate of the NAVFAC Leadership Development Program (LDP) and her personal awards include NAVFAC Pacific Environmental Restoration Employee of the Year, and NAVFAC Pacific Engineer of the Year, and Honolulu-Pacific Federal Executive Board Supervisor of the Year. Ms Victorino has served as the Director for the SIOP Department at Pearl Harbor Naval Shipyard (PHNSY) since 2020. As the first SIOP Department Director for PHNSY, she represents the Program Management Office (PMO) 555 at PHNSY and supports the Shipyard Commanding Officer for SIOP.

See SAME website for more registration information.

Energy Burden	Access to Rooftop Solar				No Access to Rooftop Solar			
	HI No Solar	HI NEM	HI CGS+	HI CSS	HI Battery Only	HI Battery + Portable-Solar	HI Community Solar/Battery	HI Community Solar/Battery
Family Energy Usage								
Low Usage = 325kWh/month	/(Savings)	/(Savings)	/(Savings)	/(Savings)	/(Savings)	/(Savings)	/(10% Savings)	/(25% Savings)
High Usage = 1250kWh/month					TOU= (-26-33% Savings)			
Affluent Low Usage (Molokai)	2.4%/(0%)	0.3%/(87%)	0.3%/(87%)	0.3%/(87%)	1.3%/(43%)	1-0.3%/(55-87%)	2.10%	1.80%
Affluent High Usage (Oahu)	6.6%/(0%)	0.3%/(95%)	0.3%/(95%)	0.3%/(95%)	3.3%/(49%)	2.7-0.3%/(58-95%)	5.90%	4.90%
LMI Low Usage (Molokai)	9.9%/(0%)	1.3%/(87%)	1.3%/(87%)	1.3%/(87%)	5.6%/(43%)	4.3-1.3%/(55-87%)	8.90%	7.40%
LMI High Usage (Oahu)	27.5%/(0%)	1.3%/(95%)	1.3%/(95%)	1.3%/(95%)	13.9%/(49%)	11.5-1.3%/(58-95%)	24.70%	20.60%

Table 1: Energy Burden percent reduction comparison between Affluent and LMI households on Oahu and Molokai for various solar programs.