Date: 6 December 2012

Subject: **HELCO 2013 Integrated Resource Planning (IRP) – PUC Docket 2012-0036. Request HELCO study a business plan involving its support of many small, individual PV + battery back-up systems to enable:**

- **< 0.20 $/kWh rates,**
- **Eliminate imports of oil-for-electricity,**
- **Increase Hawaii economic activity,**
- **Attract more new businesses**
- **Increase state tax revenue,**
- **Maintain HELCO's transmission, metering, and billing infrastructure and**
- **Meet State clean energy goals and reduce the cost of air pollution effects**

To: HELCO

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cc.: IRP Advisory Group members: Will Rolston, Denny Coffman, Betsy Cole, Gregory Barbour

The Problem: As HELCO electricity rates increase, more and more households and businesses will join the folks who have left the grid to generate their own electricity off-grid. This is easy to do via photo-voltaic (PV) generation with battery back-up, and maybe a small diesel generator for secondary back-up. There are reportedly over 200 applications for FIT (Feed-In Tariff) contracts to be approved by HELCO, which has in the past opposed any notions or attempts to discuss the merits of battery back-up, despite the fact that such back-up has been operational for off-grid households for decades and more recently even for utility-sized back-up on other Hawaiian islands.

Having a large number of NEM PV contracts without on-site battery back-up is clearly not economically viable for you, the utility, whereas FIT PV contracts without on-site battery back-up are not economically viable for the rate payers. Both NEM and FIT contracts become viable with on-site battery back-up.

One Solution: Therefore, how about actively supporting (rather than opposing and inhibiting) massive deployment of many small, distributed PVs with battery back-up, which enable a more affordable (**~20 ¢/kWh**), more secure and cleaner electricity? This alternative would not require new bio-mass, geothermal or power plants in anyone's back yard, but may create a new version of HELCO, which would help with financing (if needed) and/or installing distributed "HELCO" PV+battery generation systems on homes and businesses, and thereby tackle a great clean-energy opportunity, building on the fact that all transmission (for excess PV power and for trickle-charging batteries), distribution, metering, and billing infrastructure is already in place. Such a solution would be a win-win and pono for rate payers, our economy, HELCO and state tax revenue. A shining example for businesses is the 250-kW PV system, backed by 250-kWh of Li-battery storage, with a FIT contract, which is now supplying electricity to our West Hawaii Civic Center. Its performance is illustrated in **Fig. 1.**

Analysis Conclusions – Let me summarize below the findings of an analysis of optimistically installing PV+battery systems for all of the ~73,000 homes in Hawaii County. In this new scenario, we looked at pros and cons for rate payers, our economy, HELCO and state tax revenue, and described it also in more detail in a PUC Testimony to Docket 2012-0099, on 29 Nov. 2012, also available at http://alohafuels.pbworks.com/f/PB-12-HELCO-AKP-PUC-1.pdf.[1]

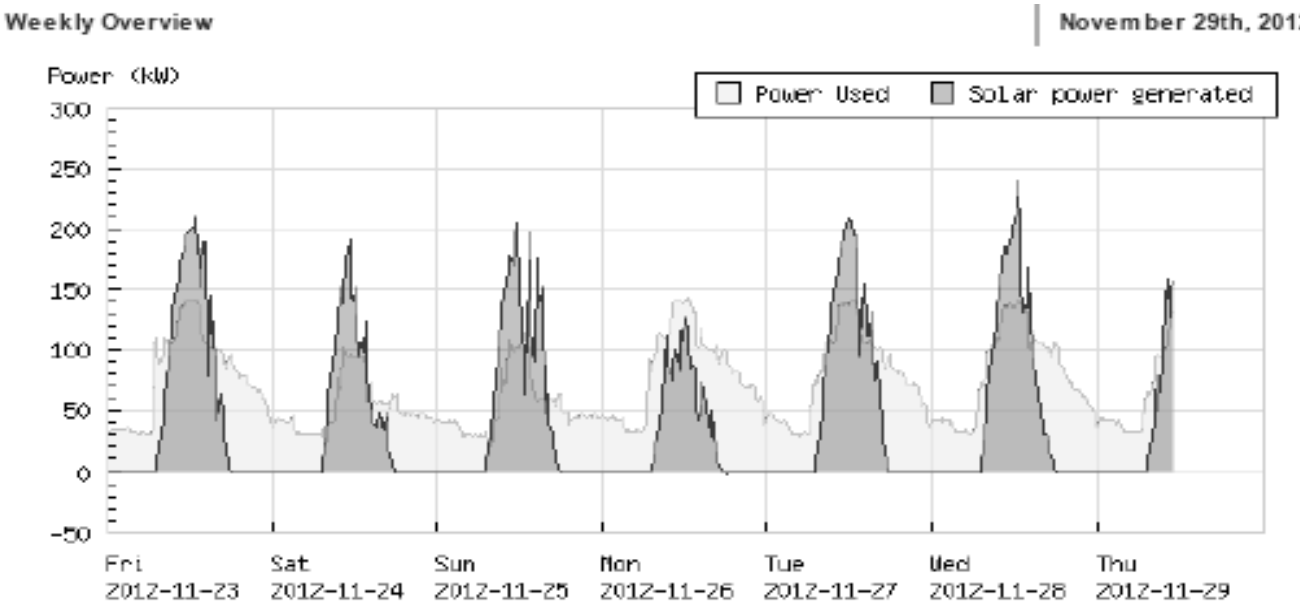

Fig. 1. Performance of the West Hawaii Civic Center Solar 250-kW PV generation plus 250-kWh battery storage system, showing total power used and total power generated over a week's time. Average capacity factor over the past 48 weeks: 18.6% Overview provided by the monitoring system at https://www.mypvdata.com

Because these PV systems can be wired to not inject energy into the grid, they may **not require any permit by HELCO,** which in such case would just provide secondary back-up trickle-charge when needed.

Primary PV back-up (e.g. batteries of ~ 5 kWh / kW(p) for lead-acid or ~2.5 kWh / kW(p) for Li-batteries) were located on-site and integrated with all newly-installed PV systems, especially if only FIT contracts were available. PV systems under NEM contracts have lower ownership Life Cycle Costs (LCC) than those under present FIT rate contracts and are therefore preferred[1]. In addition, NEM LCCs are predictable and not dependent on possible "updates" in the PUC-approved FIT $/kWh rates.

a. Rate Payers: Battery additions for PV systems raise their total cost, but provide uninterruptible power and are affordable now, i.e. may not cost more than SUVs or pick-up trucks, at 12.33 $/W total costs before subsidies (incl. 4%/y interest for 10 years), with a present payback of 16.5 years, or 6.7 $/W(p) and ~8.3 years with present subsidies. Such a subsidized PV installation results in 30-year levelized rates of **16 ¢/kWh,** or **19 ¢/kWh** without the state subsidy, compared to a projected HELCO rate of 59 ¢/kWh, based on an escalation rate of only 2%/year.

Without the Federal subsidy (which may expire in 2016), that rate would presently rise to 27 ¢/kWh, but come down to **18 ¢/kWh**, incl. interest, if low installation costs (as in Germany[1]) were also achieved here, with support from high-volume pricing for 1000s.of PV installations, i.e. well below today's 6.7 $/W(p) after subsidies. Rate payers achieve lowest LCCs with PVs sized to match 100% of the average load under NEM contracts, or oversized 10-30% under present FIT rates; and often with ground-mounted "PV-panels-with-battery" "appliances."

b. Our Economy: The total imports for electricity generation for the County's 73,000 households, over a 30-year period would drop by a factor of 3.7, from $5 to $1.4 billion, despite the initial ~10x higher import costs of PV + battery system hardware. Moreover, the money saved on oil and on reduced electricity rates, which frees up discretionary money of households, would increase economic activity (jobs and sales) by a multiple of above factor (the economic multiplier), which in turn depends on the fraction of those savings used on local vs. imported products and services.[1]

c. HELCO: HELCO is now supplying some 500*73000*12 = 438 GWh/year to about 73,000 "average" homes, out of about 1100 GWh/year sales. If PV + battery systems are installed in all those homes, HELCO would only need to deliver, on average, an estimated 2% or 8.8 GWh/year trickle-charge to those homes, save about 40 million gallons/year of fuel, but lose electricity sales of ~430 GWh/year. On the positive side, HELCO would (1) Increase its income from the Minimum Monthly Charge (MMC) to over $17M/year, based on the present $20/month per meter and (2) Derive additional income from sales of the excess free or discounted electricity from NEM and FIT contracts, respectively.

Regarding grid loads -- On a worst-case occasion that all 73,000 homes simultaneously require trickle-charge service, the total power demand would not exceed 1 MW by much, if the 2% estimate holds. A more difficult problem arises if all homes simultaneously were to generate excess power, on an island-wide sunny day, which may generate 110-130 MW of excess power around the peak-sun noon hours[1]. However, short of dissipating that power in resistor banks, HELCO could turn down any remaining oil-burning equipment, activate pumped hydro, send power to EV charging stations, sell energy to H2 producers and/or even add some utility-sized batteries. Worthy of consideration may be a contractual agreement with willing households to curtail excess power by activating diversion loads, as off-grid PV systems now do. The main point is that there may not be a need for any significant new capital investment by HELCO in this scenario[1], other than considering the extent that HELCO would want to participate with financing and/or owning such PV+battery systems.

d. State Tax Revenue: The 30-year levelized state and county tax revenue (~$18M/year for conventional generation hardware & oil imports, and electricity sales) may experience a possible "no change" or even a small increase over the 30-year PV service life period to ~$20M/year, after including the present state PV subsidy (-$12M/year), thanks to an increase by $27M/year in tax revenue from the above increased economic activity.

Not considered were estimates of the beneficial impact of reducing combustion-based electricity generation on lowering the cost of healthcare (Medicare / Medicaid) and environment (climate & ocean-level and -acidification). Nor were improved energy and food security considered, which come with distributed rather than central electricity generation, whether via large combustion, geothermal, ocean (OTEC, wave-motion) or solar plants.

Recommendations – Based on the above preliminary analysis results and conclusions, please consider the following:

e. After analyzing the technical and economic feasibility of **PV + battery systems**, we recommend that they become a top deployment priority (with County & HELCO's permitting process to be streamlined), because of their low grid stress, low & affordable rates (**~16-19 ¢/kWh**) for the consumer, reasonable payback times; and healthy outcomes for our environment, economy, HELCO, and government tax revenues.

f. NEM PV contracts may only be sustainable in conjunction with individual battery back-up.

g. Hawaii County should join many other US counties to proactively pursue clean, distributed energy via PV+battery systems, as have others such as Sacramento, CA[2], New Orleans, LA[3] and the California Solar Initiative awarding 2.25 to 3.15 $/W to qualifying PV applicants[4]. Lower installation costs in new construction, easing permitting process, and incentives for PV+battery implementation in building codes may also help to accelerate deployment of PV systems.

h. Hawaii should try to emulate the low PV installation costs achieved in Germany, and harmonize the insurance and tax requirements of FIT contracts with those now in place with NEM contracts. The former appear to be more onerous than necessary.

i. Maybe when the time comes, HELCO might re-invent itself as a transmission, distribution and metering company as some have suggested, but continuing to be the energy coordinator of the IPPs. Alternatively, financing, possibly owning, and installing distributed PV+battery systems for homes and businesses would seem like a great clean energy investment opportunity for a new and progressive version of HELCO – with all metering, billing and trickle-charge transmission line infra-structure already in place.

Thank you for listening to our concerns and suggestions.

References

[1] U. Bonne, Testimony submitted 29 Nov.2012 to PUC regarding Dockets 2012-0185 and 0099 about HELCO's requests for (1) AKP's biofuel subsidy of 1/6 ¢/kWh and (2) a 4.2% rate hike, respectively; HELCO PUC hearing in Kailua-Kona, HI, 30 Oct.'12, rev. 27 Nov.'12, http://puc.hawaii.gov, and http://alohafuels.pbworks.com/f/PB-12-HELCO-AKP-PUC-1.pdf

[2] Paul Lau (Asst. GM for Power Supply & Grid Operations, Sacramnto, CA), "SMUD & Partners Kick-off Battery Energy Storage Project," SMUD News Release, June 29, 2012, see Appendix https://www.smud.org/en/about-smud/news-media/news-releases/2012-06-29.htm

[3] Largest Solar Power Neighborhood In Southeast Built In New Orleans," 7 Nov 2012, http://cleantechnica.com/2012/11/07/largest-solar-power-neighborhood-in-southwest-built-in-new-orleans/

[4] New Solar Homes Partnership; State rebate program (1-kW to 100% of expected home load); rev. 17 July 2012, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA150F