Date: 29 May 2013, rev. 5 August 2013 **DRAFT**

Title: "Unlimited solar Photo-Voltaic (PV) generation for homes and businesses"

A Resolution or Bill to secure:

- Electric energy for homes, businesses and transportation;
- 2020 Electricity rates of 21 ¢/kWh (compared to HELCO projections of 87¢/kWh), as described in recent testimony to HELCO's 2013 IRP Plan (Appendix of http://alohafuels.pbworks.com/f/PB-%2013-HELCO-IRP-PUC-0036.pdf)
- Reduced need for electricity generation via combustion of imported oil, biomass conversions and geothermal, and their associated remediation costs of air pollution, health impairment, global warming and ocean acidification.

WHEREAS public utility sales of electricity are declining and likely to continue to decline because of exponential increases in demand for distributed solar photo-voltaic (PV) installations, which can generate distributed electricity at lower rates than Hawaii's and many other state's utilities can deliver, and therefore threaten the sustainable competitiveness of the central generation business model

WHEREAS the cost of oil for power generation has risen by an average of 5%/year from Jan 2006 to Jan 2013, the average electricity rate in Hawaii has risen 8%/year (and at this rate would rise from 44 ¢/kWh today to 140 in 15 years and to 443 in 30 years) and the average residential electricity usage decreased by 3%/year during that same 7-year time period, according to DBEDT data [see Related Facts #1 below];

WHEREAS the present ability of our grid to accept more distributed but variable and not "dispatchable" PV-generated power is limited (by the total available grid power flexibility to follow reliable load demand) to "75% of the minimum daytime load demand," i.e. power, which (with an average Hawaii PV Capacity Factor of 17%*) is equivalent to 75 x 0.17 = 12.75% of total grid electric energy generation, and thus too small to meet the market demand for PV generation. * Corresponding to 17% of 24 hours/day or 4.1 hours per day of full sun equivalent

WHEREAS promoting and subsidizing the introduction and expansion of renewable, clean, secure and affordable electricity generation for all homes, businesses and transportation is part of Hawaii's "Clean Energy Goals," and distributed PV generation being one such desirable, clean, unobtrusive and renewable energy technology, the recently signed bills: (1) **SB1087**, to set aside $100 million to finance PVs for low income households; and (2) **SB19**, to allow landlords to install PVs and sell such electricity to his tenants, without violating wheeling prohibition) are indeed commendable,

WHEREAS both above bills are commendable for facilitating the generation of more renewable energy, neither one of them requires on-site storage nor contributes to lower the general $/kWh rate billed to all ratepayers not hooked up to a PV system, because the utility does not own the PV or PVBB system (as presently prohibited by the PUC) and therefore does not or cannot own and sell the low-cost generated electricity; on the contrary, electricity rates will have to increase due to the need to install utility-sized storage systems, and due to higher transmission losses caused by lack on on-site storage,

WHEREAS each 1 $/W invested in a completely installed PVBB system results in a 30-year levelized electricity cost of 2.7 ¢/kWh before subsidies, and a typical PVBB cost today being 10$/W, resulting in a rate of 27 ¢/kWh before any subsidies, and 15.4 ¢/kWh after application of present federal and state subsidies for an average home, thereby being significantly lower than today's average residential utility rate of over 40 ¢/kWh, despite the potentially 30% higher cost of PVBBs over PVs without on-site storage, and life-cycle costs of safe solid-state Li batteries now approaching that of lead-acid batteries,

WHEREAS each PVBB installation may optionally be configured to provide uninterruptable power to its user even in case of planned or accidental grid outages, either via (1) "Trickle charge-only" configuration without NEM contract or (2) Automatic grid disconnect in case of NEM or FIT contracts – to enable PV and battery to provide uninterrupted power, as our laptops do today when disconnected from its adapters,

WHEREAS such distributed PV generation of electricity is more secure (in the aftermath of hurricanes, earthquakes or acts of sabotage), reliable (=long service life), affordable, unobtrusive and generally more desirable than large utility-scale wind-, bio-mass- or PV-farms and cleaner & more reliable than geothermal plants,

WHEREAS many more of such distributed PV generators could be connected to our grid without impairing its reliability and stability -- if the power injected to the grid by these PVs were controlled and/or reduced to some fraction of their name-plate output (such as to 60% as in Germany[5]), as enabled e.g. by a minimum of on-site energy storage (e.g. 1 to 2.5 hours worth of "active" battery storage of the peak PV kW-output power) were determined by individual rate payer situation such as his/her battery price, FIT/NEM contract terms, energy security concerns, oversize of the PV system (i.e. self-consumption), and average daily consumption profile,

WHEREAS retaining a profitable utility grid-based business of electricity generation and distribution is in the best interests of a thriving community economy, because it facilitates balancing individual daily (weather-caused) PV energy output variability of about +/-50% due to daily and seasonal weather variabilities of insolation at such PV installations – around the average, as described by the local Capacity Factor or 17% +/-50% or 17 +/-8.5%,

WHEREAS PV **FIT** contracts without on-site battery backup are not smart economically for consumers (who should try to maximize self-consumption = ratio of PV energy consumed / total PV energy produced), neither are PV **NEM** contracts w/o on-site battery backup smart for utilities, while smart operation of a PVBB system would try to maximize such self-consumption

WHEREAS commercial PV installers and the public might be concerned about investing more "power" in utilities if these were to be allowed to finance and own roof-top PVs or PVBBs in order to optimally maintain grid stability, and install and maintain such in partnership with said installers,

BE IT RESOLVED by the Hawaii County Council, that the Hawaii Senate and House of Representatives, the Governor and the Public Utilities Commission be requested to consider and to approve:

1. **A new class of clean, renewable, unobtrusive, distributed PVs**, which may feature sufficient on-site means to reduce the peak power injection to the grid to no more than some safe amount (e.g. 60%) of the PV's name-plate output. This "means" may be on-site energy management, diversion loads or storage (most likely battery storage). This safe amount would not only reduce grid load, transmission losses and FIT payments, but also increase grid stability, (uninterruptible) energy security of rate payers and self-consumption at each PV site.
2. The new FIT (Feed-in Tariff) and new NEM (Net Energy Metering) contracts, **may limit the PV peak power injection to the grid** to be no more than a safe fraction (about 60%??) of the PV's name-plate output. This may incentivize installation of PV systems with battery backup (PVBBs). The PVBB acronym may be used to represent this new class of PV systems, but should not constrain creative ways to achieve grid loads compatible with utility/PUC guidelines
3. **Unlimited installation** of such distributed PVBBs as a preferred alternative to the industrial wind-, biomass-based- or geothermal-generation facilities and interisland high-voltage undersea electric transmission cable system now being considered; and
4. For our **utilities to finance, own and manage grid input/output** of distributed PVBBs, in partnership with commercial PV installers (independent or acquired as Edison Int'l. just did), which would install and maintain them, thereby bringing down the kWh cost for all ratepayers,** while sustaining and expanding the grid and traditional "central generation" business model.
   ** Not true if the PVs are privately owned, because then our utilities would only have expensive fossil-based electricity to sell

If the above Resolution is approved and signed into law, we would not only benefit from more clean energy and less combustion pollution, avoid permitting hassles with HELCO/HECO/MECO, reduced oil imports, and meet State-mandated clean energy goals, but we would also:

- Incentivize the utilities to minimize curtailment of their own clean energy generators, which is not true with present PPAs, involving generators not owned by utilities
- Reduce the general $/kWh rates, as fossil generators are systematically being replaced by solar and wind generators, and
- Incentivize the utilities to optimize selection of roof-top PV sites to balance micro-region demand with generation and storage

In view of our utilities not having proposed a timeline to achieve lower $/kWh rates in their 2013 IRP Report, I think that we should submit such a proposal, for example for the PUC to set a goal for our utilities to achieve a general retail rate of 20 cents/kWh by 2020, with measurable mini-goals for the interim years.

Related legislative activity

1. **SB 1087 provides for $100 million bond financing of PV for all regardless of economic means –** A first ever combination of bond financing and on-bill repayment for clean energy infrastructure, including distributed generation solar PV systems. SB 1087 will also make it easier for all Hawaii residents to finance solar PV hosted at their residences or businesses by providing them access to low cost loans from the loan fund that can be repaid through on-bill repayment on their utility bill. Signed June 2013

2. **SB 19 allows PVs installed by landlords on their property to sell electricity to tenants --** Exempts such landlords or lessors from the definition of public utility. Signed June 2013

3. **Hawaii-specific energy alternatives** – The passed resolution HR-150 urges the Governor and the PUC to seek energy alternatives and asks that the state explore and develop energy options that may be "less disruptive" to the environment and community than industrial wind generation and inter-island cable, as proposed for islands of Molokai and Lanai. http://legiscan.com/HI/text/HR150/id/788329

4. **Low tariffs for Aquaculture, Aquaponics, and Agriculture** -- SR 16 2013-2014 Session, Hawaii Senate Resolution -- Urges the PUC to establish reduced tariffs for the sale of electricity generated by non-fossil fuel producers that electric utilities would otherwise curtail during off-peak hours to persons engaged In Aquaculture, Aquaponics, and Agriculture.

5. **Permanent wind and solar subsidies** -- President Obama's on 10 April 2013 proposed budget for Fiscal year 2014 proposes this, according to a White House fact sheet: "To provide a strong, consistent incentive to encourage investments in renewable energy technologies and to help meet our goal to double generation from wind, solar, and geothermal sources by 2020, the Budget would make permanent the tax credit for the production of renewable electricity. The Budget makes the Production Tax Credit refundable so new, growing firms can benefit and provide renewable electricity generation."

6. **New PV "Checkpoint" for Hawaiian utilities** -- To decide whether a "study" is needed before more NEM applications (of 10 kW or less) can be approved is if "75% of minimum daytime load" is exceeded or not, see http://hawaii.gov/dcca/dca/newsletter/ConSpot1012.pdf

7. **New PVBB subsidies in Germany** -- Starting May 1, 2013, the German government has budgeted for 2013 and 2014 Euro 25 million each ($ 33) to subsidize battery backup for PV systems, to more than double the self-consumption of such PVBB installations. The budget may be enough to subsidize about 8000 residences with 5-kW PVs each. The eligibility requirements for the subsidy are:
   (A) The PVBB system is laid out to never inject more than 60% of the nominal or peak PV output into the grid and
   (B) The battery warranty is for at least 7 years.
   The battery subsidies are for new systems installed after 1 Jan 2013, as follows:
   a. For new, complete PVBB systems: 30% of battery system cost is refundable, but capped at 600 Euro per kW of the PV.
   b. For retrofitted batteries, with associated electronics (charge control, inverter, disconnect switch, etc.) to existing PV systems: 30% of the battery system cost is refundable, but capped at 660 Euro per kW of PV
   See http://www.solarwirtschaft.de/fileadmin/media/pdf/Speicherprogramm_Hintergrundpapier.pdf

8. T**he Minnesota House, Senate agree to 1.5 % solar energy standard** -- 15 May 2013. -- The Minnesota House and Senate agreed on Tuesday, May 14 to an energy bill that requires investor-owned utilities to meet a 1.5 % solar energy standard by 2020, i.e. the total electric sales to retail customers shall include 1.5% energy from solar. The House and Senate versions of the energy bill reached a compromise in conference committee; the bill now moves on to the overall Legislature for a final vote.. Electric co-ops and municipal utilities are exempt from the standard. In addition to the solar energy mandate, the bill includes more incentives to expand solar as an energy source in Minnesota. For instance, the bill allows for the creation of community solar gardens and includes a "Made in Minnesota" solar energy production incentive to install solar equipment made by Minnesota manufacturers. http://content.govdelivery.com/bulletins/gd/MNCOMM-7ac4f9

9. **Net Energy Metering (NEM)** -- In the United States, as part of the Energy Policy Act of 2005, all public electric utilities are now required to make available upon request net metering to their

customers. Time Of Use (TOU) NET metering enables use of cheap base-load electricity at night, and then during the day to "pay back" with power from a renewable source such as solar panels. The Interstate Renewable Energy Council, Inc. (IREC) reported on a 20 Oct.2008 agreement between the Hawaii utilities and the state, that

- Support the modification of Hawaii's net metering option to include provisions for the annual sale of customers' NEG at the feed-in tariff rate (or at a somewhat lower fixed rate) to fairly balance the option risks available in all customer options;
- Require net metered installations to incorporate time-of-use metering equipment and, when time-of-use (TOU) rates are implemented on a full scale basis, allow the net metered customer to move to TOU net metering and sell NEG.
- Hawaiian Electric Companies agreed that there should be no system-wide caps on net-energy metering for residential and commercial renewable energy projects. Instead DG interconnection will be limited on a per-circuit basis, where generation
  http://www.irecusa.org/2008/11/hawaiian-government-utilities-sign-energy-agreement/

10. **How fossil fuel incumbents hope to tame solar juggernaut** – 25 May 2013. The Australian solar sector is warning that the industry could be facing its toughest challenges in the coming years, as cost-competitive solar PV puts enormous strain on the business models of fossil fuel technologies. Muriel Watt, the chair of the Australian Photovoltaic Association cited examples of how incumbent utilities would attempt to push back on solar:
    - Low buy back rates – low or no payments for electricity exported back to the grid from rooftop solar systems. This has already happened in most states in Australia.
    - Gross metering – a proposal made in Queensland which would force households to sell all the output from their rooftop systems to the grid operators, and buy it back at a higher price
    - Higher fixed charges
    - Restrictions on new connections
    - Discriminatory offerings
    - Restrictions on operation
    - Attempts to divide customers with have and have nots
    - Mobilizing anti renewable lobby groups

    http://cleantechnica.com/2013/05/25/how-fossil-fuel-incumbents-hope-to-tame-solar-juggernaut/

Related facts:

1. **DBEDT fuel and electricity escalation data** (see Fig.1 below), the cost of oil for power generation has risen by an average of 5%/year from Jan 2006 to Jan 2013, the average electricity rate in Hawaii has risen 8%/year and the average residential electricity usage decreased by 3%/year during that same period. See http://www.hawaiienergy.com/10/hawaii-residential-electric-cost-and-oil-cost-per-kwh and http://www.hawaiienergy.com/12/hawaii-residential-kwh-per-day, respectively

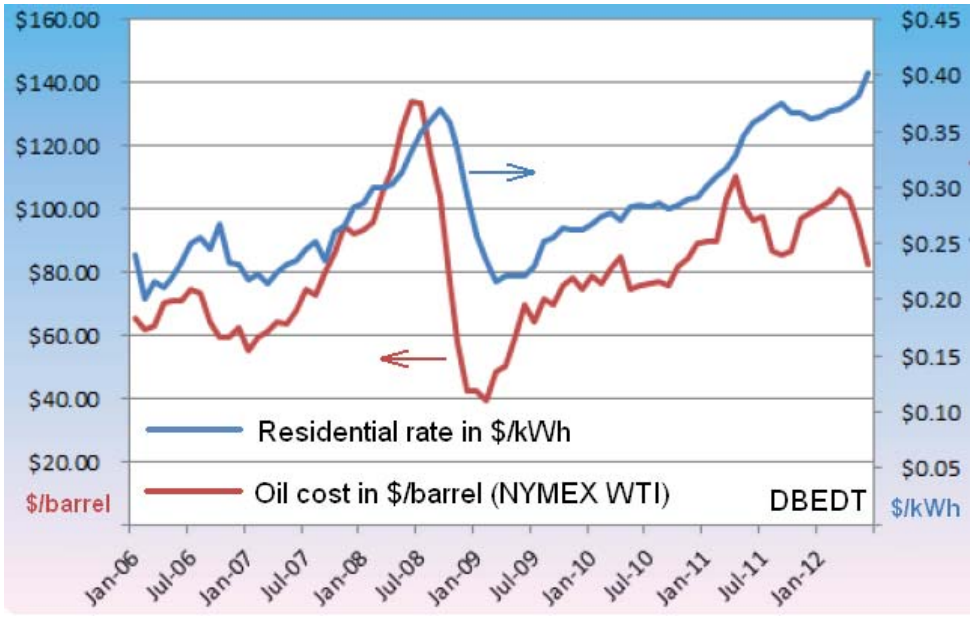

Fig. 1. Hawaii's costs of fuel oil and average residential electricity.

2. **"Want a solar home? Consider batteries"** by David J. Unger (Christian Monitor), April 27, 2013 -- Most solar homes are still dependent on the grid, so when the grid fails, they lose power. But that's beginning to change as the solar industry begins to focus on battery storage as the next 'green' frontier. "Storage to me is the holy grail of renewable technology," says Dan Juhl, head of Juhl Energy, a Minnesota-based clean-energy company that offers, among other things, a hybrid solar-storage system called SolarBank. "With solar and wind we can produce power – no ifs, ands, or buts about it. And with a little storage, you're good to go." See http://www.csmonitor.com/Environment/2013/0427/Want-a-solar-home-Consider-batteries

3. **The Kona Civic Center's PVBB** – Their 250-kW on-grid PV system is backed by 240 kWh of Li-ion batteries by Saft Co., as described at http://gbdmagazine.com/2012/west-hawaii-civic-center/

4. **A comparison of renewable energy Life-Cycle Costs** (LCC) – The estimated LCC in $/Wa* include fuel costs of oil and LNG at 5%/year cost escalation and 30-year levelized electricity costs from different renewable and non-renewable (fossil) sources in $/kWh. *$/Wa = LCC to produce an **a**verage (not peak) watt; $/Wa,s = $/Wa after available subsidies are applied; and $/kWh = cost of electricity

Table 1. 30-Year levelized life-cycle electricity generation costs, to compare renewable and non-renewable sources.

	30	Years. Fuel cost escalation in %/year:				5		Yellow=Input data	
	---Distributed, 4-5-kW--			----------Central----------					
	Units	PV	PVBB*	OTEC	Wind	Geother	Oil	LNG	
CapEx	$/Wp	7	10	20	3	7	2	2	
Cap.Factr., %		17	17	80	40	80	45	45	
CapEx Subsd, %		40	40	20	40	30	0	0	
OpEx, %CapEx/y		0.7	0.5	10	10	10	6	4	
OpEx	$/Wop	1.47	1.50	60	9	21	3.6	2.4	
CapEx	$/Wavg	41.2	58.8	25.0	7.5	8.8	4.4	4.4	
Fuel cost,	$/Wavg	0	0	0	0	0	63.6	14.0	
CapEx	$/Wa,s	24.7	35.3	20.0	4.5	6.1	4.4	4.4	
	$/kWh	0.127	0.168	0.398	0.113	0.136	0.707	0.221	
		Fuel oil cost		100	$/barrel, LNG:		5	$/mill.Btu	
	10	% of central transm.costs & losses incl.						Ger\TL-13-PVBBo	
	Cost of capital not included								
	* Battery size: ~10-kWh, or ~2 to 2.5 PVp hours of active storage								

5. **PV + wind for water pumping** -- The new (April 2013) Hawi off-grid, 100-kW wind- and solar PV-powered 100-HP water pumping "Power Cube" system by Gen-X, see www.gen-xenergydevelopment.com. It is backed by Altairnano Li-batteries. Total project cost: $1.72 million. Gen-X works with: (1) private and public entities who desire to install large commercial distributed renewable energy systems to reduce and control electrical and operational costs; and, (2) utilities who seek to acquire energy from renewable energy independent power production; (3) and develops large scale stand alone systems to serve the agriculture community.

6. **Starter Homes Get Solar PV Panels as Standard Equipment in CA.** – March 2011 -- Among the standard features offered for new homes at Manzanita at Paseo del Sol, a KB Home development in a desert suburb southeast of Los Angeles, are nine-foot ceilings, six-panel doors and a 1.4-kilowatt solar array.

7. **Carbon Dioxide at NOAA's Mauna Loa Observatory Reaches New Milestone: Tops 400 Parts Per Million,** -- On May 9, the daily mean concentration of CO2 in the atmosphere of Mauna Loa, Hawaii, surpassed 400 ppm (parts per million) for the first time since measurements began in 1958. Independent measurements made by both NOAA and the Scripps Institution of Oceanography have been approaching this level during the past week.

8. Before the Industrial Revolution in the 19th century, global average CO_2 was about 280 ppm. During the last 800,000 years, CO_2 fluctuated between about 180 ppm during ice ages and 280 ppm during interglacial warm periods. Today's rate of increase is more than 100 times faster than the increase that occurred when the last ice age ended. See the full article at http://www.sciencedaily.com/releases/2013/05/130510180610.htm . Worldwide installation of PVs and PVBBs for all homes and business AND also by making EVs and PHEVs available would reduce the use of fossil fuels to generate electricity, for transportation and for heating in colder

climates and therefore reduce our contribution to the increase in CO2, to global warming and to ocean acidification.

9. **PV + Battery Bundle** -- Rooftop solar panel maker SunPower has announced it's plans to bundle energy storage, possibly using lithium-ion batteries, with its solar offerings. With the announcement, SunPower joins a rapidly growing portion of solar companies looking to provide energy storage. SunPower has not established a timetable for the product launch, May 16, 2013. http://www.utilitydive.com/news/sunpower-to-bundle-solar-with-energy-storageyour-move-utilities/131746/ . SolarCity, for example, has been bundling lithium-ion batteries from Tesla Motors with its solar energy systems and applying for a California program that subsidizes energy storage installations. One Roof Energy is working with battery maker Silent Power to roll out products. Korean conglomerate Hanwha Group, which runs a solar panel manufacturing subsidiary, is an investor in both OneRoof and Silent Power. SunEdison has done a pilot project with a battery system from startup Seeo. http://gigaom.com/2013/05/16/solar-company-sunpower-to-sell-energy-storage-potentially-lithium-ion-batteries/

10. Andrew Herndon "**Rooftop Solar Battle Pits Companies Against Utilities**," 10 May 2013, http://www.bloomberg.com/news/2013-05-10/rooftop-solar-battle-pits-companies-against-utilities.html?cmpid=yhoo . SolarCity, Sungevity Inc., Sunrun Inc. and Verengo Inc., companies that financed the majority of U.S. rooftop solar installations, formed a lobbying group to counter efforts by "monopoly utilities" to quash programs that support renewable energy in 43 states.

11. James Montgomery, Associate Editor, RenewableEnergyWorld.com, "**Tracking and Analyzing Energy Legislation Across the US**," 23 May 2013. http://www.aeltracker.org/ covers all 50 states. http://www.renewableenergyworld.com/rea/news/article/2013/05/tracking-and-analyzing-energy-legislation-across-the-us?cmpid=rss

12. Chris Lee (Hawaii State Reop.), "**A bill for an act relating to solar** (association rules)," HB-1406, 27th Legislature 2013 – Requires private entities to submit a copy of their duly adopted rules regarding the placement of solar energy devices on or before their due date of their next condominium association biannual registration. Provides that private entities that fail to submit a copy of their rules shall lose their tax exempt status. http://www.capitol.hawaii.gov/session2013/Bills/HB1406_.PDF

13. Trieu Mai,1 Debra Sandor,1 Ryan Wiser,2 Thomas Schneider1 1 National Renewable Energy Laboratory(NREL) 2 Lawrence Berkeley National Laboratory, "**Renewable Electricity Futures Study. Executive Summary**." Dec. 2012, http://www.nrel.gov/docs/fy13osti/52409-ES.pdf. -- The RE Futures study assesses the extent to which future U.S. electricity demand could be supplied by commercially available renewable generation technologies—including wind, utility-scale and rooftop PV, CSP, hydropower, geothermal, and biomass—under a range of assumptions for generation technology improvement, electric system operational constraints, and electricity demand. Within the limits of the tools used and scenarios assessed, hourly simulation analysis indicates that **estimated U.S. electricity demand in 2050 could be met with 80% of generation from renewable energy technologies** with varying degrees of dispatchability together with a mix of flexible conventional generation and grid storage, additions of transmission, more responsive loads, and foreseeable changes in power system operations. While the analysis was based on detailed geospatially rich modeling down to the hourly timescale, the study is subject to many limitations both with respect to modeling capabilities and the many assumptions required about inherently uncertain variables, including future technological advances, institutional choices, and market conditions.

14. "**Solar for All**," by Paul Rauber (sr. editor of Sierra Club magazine), Jan/Feb. 2013, p.38 – Cash grants instead of tax credits after 2016? A nation-wide FIT? Launching solar cooperatives. Two bills were quashed by CA's PG&E and S.Cal.Edison utilities: (1) "Solar for All" would have established a small FIT to promote solar gardens and other renewable energy projects in low-income communities; (2) Allow Californians purchase shares in 2 GW worth of solar facilities and get credit on their electric bill for the clean energy produced. On the web with comments, see http://www.sierraclub.org/sierra/201301/community-solar-rooftop-panels-292.aspx

15. **E.ON Utility in Germany offers help and hardware for PV systems** – Website application, battery backup systems compatible with all PV systems and programmed to maximize self-consumption, interconnection to grid. -- The refrigerator-sized battery as complete systems are compatible with all solar systems, easy to install and operate, and are of high quality, reliability and are extremely durable. The battery manufacturer Prosol Invest is the market leader for lithium storage systems in Germany and already has several years of experience with battery storage technologies. More at https://www.eon.de/de/eonde/pk/produkteUndPreise/E.ON_Solar/Stromspeicher/index.htm

16. **GOP and PUC push Georgia Power to embrace solar energy**, by Jim Galloway (AJC.com), 1 June 2013, http://www.ajc.com/weblogs/political-insider/2013/jun/01/gop-revolutionaries-push-georgia-power-embrace-sol/ -- Members of Georgia's PUC, Tea Partiers and Republicans are joining in an effort to persuade Georgia Power to embrace solar energy. Before the Legislature adjourned this spring, state Rep. Rusty Kidd, an independent from Milledgeville, introduced H.B. 657, a bill that would authorize a new solar utility – a monopoly independent of Georgia Power, with several Republicans as co-sponsors. H.B. 657 may not pass next year in its present form. Georgia Power has one of the most effective lobbying forces in the state Capitol, but the effort seems to follow the trend of North Carolina-based Duke Energy, which has a 1,700 MW (PV) program going on right now, and Walmart's plan to derive 20% of its energy from solar now, and eventually to 100%.

17. **Solar Universe has opened three new franchises in MA, CA and CO**. This national expansion, specifically within key markets, adds to the existing Solar Universe Network of 37 franchises in the U.S. and Puerto Rico, bringing the total to 40 locally-owned and operated franchises nationwide and overseas. Solar Universe has been steadily growing since being founded in 2008 and last month announced its first overseas operation in Puerto Rico. Since its founding, the company has created thousands of green jobs and installed over 17,601 Kilowatts of solar energy. Additionally, the company's network wide revenue has grown an impressive 347 % from Dec. 31 '09 to Dec.31, 2012.

18. **Northern Power 100-kW Turbine Powers Off-grid Water-pumping System in Hawaii.** GreenEnergyNews, June 6, 2013 – Vol.18 No. 12 -- Fourteen farms in North Kohala, Hawaii, installed an off-grid water-pumping system powered by a Northern Power NPS 100 gearless, Permanent Magnet Direct Drive wind turbine. This SkyGrid Energy microgrid project, marks the growing trend of turning to affordable, clean, renewable wind energy as the solution. It includes a battery bank and solar panels. The system is capable of pumping more than 30 Mgal/year and is being used to irrigate 400 acres of agricultural land and support 14 participating farms and ag-businesses. This project was partially funded by the U.S. DOE through the Hawaii Renewable Energy Development Venture. Gen-X Energy Development LLC, the project developer, plans to replicate this microgrid solution throughout Hawaii and other island communities. NPS headquartered in Barre, VT, has been in the microgrid business for 40 years. Their turbines have been used in microgrid projects world-wide, from Alaska to Newfoundland and the Bahamas to Antarctica. Contacts: http://www.northernpower.com, **877-906-6784**

19. **Energy return on energy investment (EROI) of photo-voltaics (PV): Methodology and comparisons with fossil fuel life cycles,** Energy Policy**,** 45, 576–582, June (2012), by Marco Raugei[a, b], Pere Fullana-i-Palmer[a], Vasilis Fthenakis[b, c] ([a] UNESCO Chair in Life Cycle and Climate

Change, Escola Superior de Comerç Int'l. (ESCI)—Univ. Pompeu Fabra, 08003 Barcelona, Spain, [b]Center for Life Cycle Analysis, Columbia Univ., N.Y., NY 10027, USA, [c]National Photovoltaic Environmental Res. Ctr., Brookhaven Nat. Lab., Upton, NY 11973, USA), http://www.sciencedirect.com/science/article/pii/S0301421512002133#BBIB38 We show that the EROI of renewable PV energy of is comparable to those of fossil fuel electricity life-cycles, via use of updated data and a consistent calculation method. Our results show that for a range of modern PV systems, PVs sit squarely in the same range of EROI of 19-Si to 38-CdTe, as conventional fossil fuel life cycles of 10 (oil) to 30 (coal).

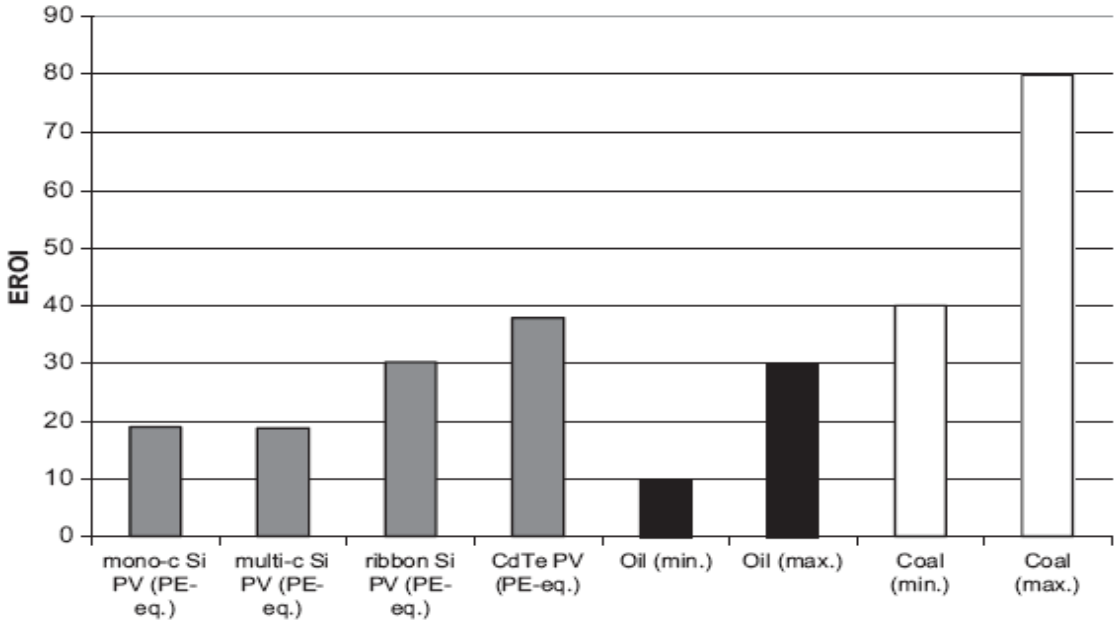

Fig. 2. $EROI_{PE\text{-}eq} = E_{OUT} / (E_{PP}\, \eta_{grid})$ or Primary Energy equiv. of PV vs. fossil plant energy. This is defined as net energy output at the point of use / primary plant energy. The calculation includes the average grid efficiency; but it does not include (1) The infrastructure investment to store energy to make PV electricity a load-following or 'dispatchable' energy source, nor (2) Sequestration of CO2 from fuel use or the cost of ameliorating associated pollution.

20. Pedro Prieto and Charles A S Hall, "Spain's photovoltaic revolution - the energy return on investment," Springer Vlg., Germany, 2013, conclude that because of the amounts of fossil fuel integrated into the process, PV is a fossil fuel extender- not a replacement. They estimate the EROI of thermal solar cells to be 2.45 to 1, but EROI = 7.35 for electric output PVs.*
21. Folks who do these kinds of studies estimate that we need an Energy Return on Investment of 12-1 in order to send our kids to grad school and have a symphony orchestra. The stuff in Saudi Arabia was discovered a long time ago and has a high EROI. But, we're using it up everyday. Geothermal at 11-1 is powered by steam.
    * However, the above EROI numbers are representative of remote large scale PV parks in Spain and includes many unnecessary energy investments from the construction of roads, water pipes and transmission lines to the remote location, to international flights necessary to visit the site. Clearly, none of these measures are necessary in the case of roof-top PV.
    In addition, older EROI values for PV tend to be lower, because recent production efficiency advances may have not been included. A 2010 Wikipedia table lists an EROI for PV of 6.8, without differentiating among different types of PVs https://en.wikipedia.org/wiki/Energy_returned_on_energy_invested
22. **PSEG opens 11 EV charging stations** in NJ. 8 July'13 --9 employees signed up and bought EVs

http://www.green-energy-news.com/nwslnks/clips713/jul13010.html Charging is free until Jul.2016

23. **Compressed Air Energy Storage (CAES)** -- In California, Pacific Gas & Electric is building its own $50 million, 300-megawatt, 10-hour CAES project (16.7 $/kWh), meant to use wind power to compress air at night when it's cheap and plentiful, then release it to manage peak afternoon loads. Half of the funding is provided by a Department of Energy smart grid stimulus grant, which means results of its performance will be made public to guide future projects. 9 July 2013 http://www.greentechmedia.com/articles/read/texas-calls-for-317mw-of-compressed-air-energy-storage2

24. **Higher grid load and transmission losses with PVs than with PVBBs** – Let's start with a ~7% (EIA US average) transmission resistive loss to a ratepayer without PV, as per the average daily demand profile, with peak demand between 5 and 9 pm. With an installed PV system peaking around the noon hour, see Fig. 3, not only does the grid need to "shift" the PV energy from its peak period (in synch with all other PV systems) to match the peak home evening demand, but also pass current levels **into** the grid near noon that are on average 2x higher (i.e. I^2R-losses that are 2^2 = 4x higher) than w/o grid-tied PV systems. Then in the evening, homes draw the usual power **from** the grid. The bottom line is that PVs without battery backup cause 4 + 1 = 5x higher grid transmission losses on an average day than before PV installation. It gets worse during sunny days, when peak PV power is 50% higher.

However, PVs with on-site battery-backup (PVBB) with the ability to store e.g. 2.5 hours of peak PV power, can dramatically reduce their about constant grid draw, down to less than half (338 W in Fig. 3) of the avg. 915-W peak load, on cloudy days, and down to zero on average days. .

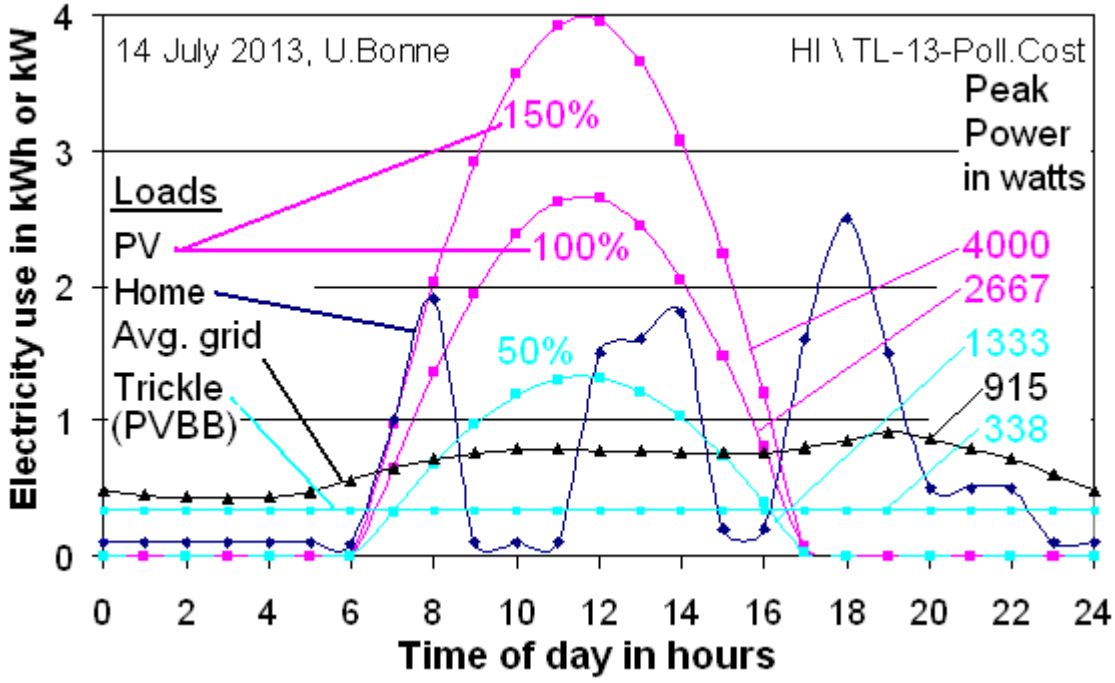

Fig. 3. Illustration of grid loads today, and what they would be like after high penetration of PV or PVBB systems in Hawaii County, under an assumed average daily use of 16.8 kWh or 500 kWh/month, also delivered by a 4-kW PV with a 17% capacity factor.

While the average grid load contributed by this home (+ other users) peaks at 915 W, the PV-home (synchronized with others) would peak between 2000 and 4000 W, while a PVBB home striving for high self-consumption would stay within about +/- 400 W.

25. **DC Fast Chargers --** On 10 July 2013, the Hawaiian Electric Companies (HECO) released two new EV rates which make the cost of providing DC Fast Charging more transparent and affordable. 1) The **Commercial Public Electric Vehicle Charging Facility Service rate**, or **Schedule EV-F**, allows businesses to take advantage of the EV Time-of-Use (EV-TOU) rate without receiving a "demand charge". HECO defines "demand charge" as "the electric utility's cost to maintain the capacity to meet a commercial customer's highest demand for a fixed period." 2) The **Commercial Public Electric Vehicle Charging Service**, or **Schedule EV-U** will allow the Hawaiian Electric companies (HECO, HELCO, MECO) to install and operate up to a total of 25 new DC fast chargers and charge a fee for their use.

26. **Utility Ownership of Roof-Top PVs** -- Rosemead, CA, 6 Aug. 2013 -- Edison Int'l.(NYSE:EIX) today announced that it has completed the acquisition of SoCore Energy, LLC. Based in Chicago, SoCore Energy is a **distributed solar developer** focused on commercial rooftop installations Edison International (www.Edison.com), through its subsidiaries, is a **generator and distributor of electric power** and an investor in infrastructure and energy assets, including renewable energy. Headquartered in Rosemead, Calif., Edison International is the parent company of Southern California Edison, one of the nation's largest electric utilities. http://www.businesswire.com/news/home/20130805006016/en/Edison-International-Acquires-Distributed-Solar-Company

27. **Steven Chu's comments on a new utility model** – Stanford Report, 15 May 2013 -- http://news.stanford.edu/news/2013/may/steven-chu-qanda-051513.html …One model that I've proposed is making the utility company, or some third party, responsible for owning, installing and maintaining all the rooftop solar. What the company gets out of it is they have systems that they know about and can control how they function and know how to fix them. Ten years from now, the company can install a battery in the house that stores some of that energy for the house, but also can be called upon to help balance the distribution system, which they're dying to have. The utility has a sustainable industry, and the consumer gets a cheaper rate of electricity and feels good about using carbon-free energy, so everybody gains if you have this system. -- If distribution companies and regulators got behind this, then all of a sudden they're making money by deploying solar-energy systems, instead of fighting it or dragging their feet. It's now in the profit/win column. You have to allow people to make money; that's what motivates them. We need to be thinking about these changes now, because industries don't turn on a dime.

http://alohafuels.pbworks.com/f/PR-%13-PVBB-Unlimited.pdf