

## Fight Climate Change and Decline of Rooftop Solar-PV in Hawaii with Resilient Island Nano-Grid 2nd Solar Wave and Zero Grid-Buy Equivalence

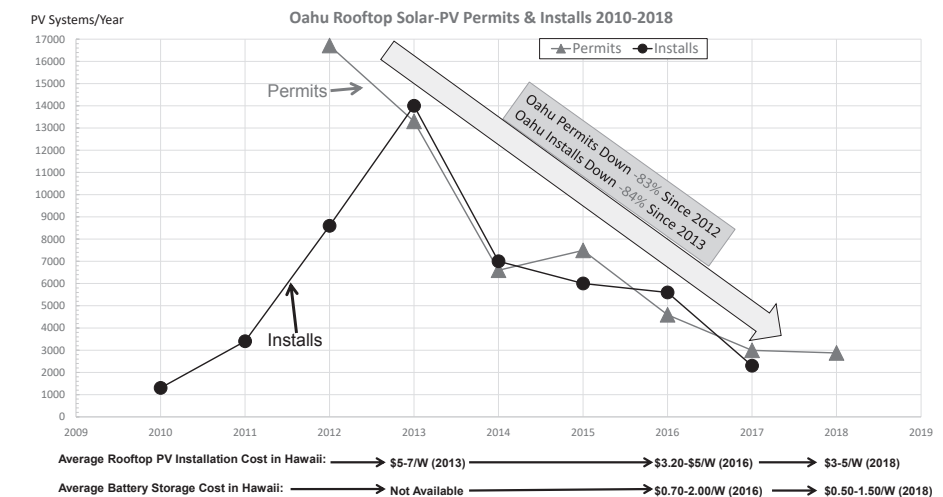
by John Borland, J.O.B. Technologies

### Problem Statement:

1) The US at #2 has increased carbon emissions by +2.5% to 5.4B tons in 2018 and globally +2.9% to 37.1B tons. So we must all do our part to fight Climate Change (Global Warming) today by reducing carbon footprint one home/building at a time by switching to 100% Renewable Energy (Solar Energy + Multi-Storage) in our Day-to-Day life!

2) However, the 1st Solar Wave in Hawaii driven by the Net Energy Metering (NEM) program was not sustainable. The residential rooftop solar-PV market has declined by 84% to <3,000 permits on Oahu for 2017 and 2018 since peaking in 2012 with >16,700 permits as shown in **Figure 1**.

3) Lessons learned from: 1) Puerto Rico hurricane Maria, 2) California blackouts, wildfires and mudslides and 3) Hawaii volcano lava flow disaster. Utilities with centralized grid, especially with above ground distribution power lines are not resilient to natural disasters. These can cut off power, locally isolating homes and communities for weeks and months costing 2,975 lives as in the case for Puerto Rico. During the 2018 California wildfire, many peo-



**Fig.1. Oahu rooftop solar-PV permits and installs 2010 to 2018.**

ple described not being able to see at night to escape their homes after losing power highlighting safety issues and importance of resilience with 86 lives lost. In Hawaii homes

that were not engulfed by the lava flow still lost power due to power lines destroyed by lava, were looted so security issues and again the importance of resilience.

*continued on page 6*

## 36th ANNUAL HAWAII STATE MATHCOUNTS COMPETITION RESULTS

The Hawaii Society of Professional Engineers (HSPE) announced the 2019 Hawaii MATHCOUNTS team on Saturday, March 9, 2019. The Hawaii team includes Coach Sung Park of Washington Middle School and Mathletes Adam Inamasu, Zachary Tyrrell, and Felicity Zhou of Washington Middle School, and Allison

Eto of Iolani. They will represent Hawaii at the 2019 Raytheon MATHCOUNTS National Competition on May 11-14, 2019 in Orlando, FL. The four will be among 224 final Mathletes from 50 states, U.S. territories, State Department schools and Department of Defense schools, competing for the title National Champion.

The Hawaii team was determined at the 36th Annual Hawaii State MATHCOUNTS Competition at Kamehameha Schools Kalama Dining Hall on March 9, 2019, after intense competition between Mathletes from the Oahu, Hawaii Island and Maui MATHCOUNTS Chapters, which included eight finalist schools, and 39 finalist Mathletes. These 39 elite Mathletes all had a chance of competing for a Hawaii Team spot and a trip to the

National. The ten highest scorers as a result of combining scores from the Sprint and Target Rounds competed in the Countdown Round with the top four Mathletes from this round making the Hawaii team. The ten competing students listed by total scores in the Sprint and Target Rounds, included in tenth place Travis Kuo of Kamehameha Schools, ninth place Khai Tran of Washington Middle School, eighth place Natalie Kuo of Niu Valley Middle School, seventh place Conner Davidson of Punahou School, sixth place Zachary Tyrrell of Washington, fifth place Arthur Chesshir of Washington, fourth place Hyun Seo of Washington, third place Allison Eto of Iolani School, second place Adam Inamasu of Washington, and in first place Felicity Zhou of Washington.

These top ten Mathletes competed in the Countdown Round in a single-elimination tournament style, head-to-head, oral round starting with the tenth and ninth place Mathletes. The problem is read and shown on a screen and the Mathletes are given 45 seconds to answer. Calculators are not allowed. The first to press the buzzer answers first, and if wrong, the other

*continued on page 7*



**2019 Hawaii Team, L-R: Coach Sung Park, Zachary Tyrrell, Allison Eto, Felicity Zhou, and Adam Inamasu**



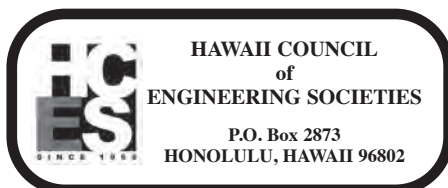
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**WILIKI MAILING LIST**

Additions and/or corrections to the Wiliki mailing list should indicate the proper society, institution or association. Corrections to email addresses should be submitted to your society coordinator.



HOME PAGE: [hceshawaii.org](http://hceshawaii.org)  
EMAIL: [hcesorg@gmail.com](mailto:hcesorg@gmail.com)

**2018-2019 OFFICERS**

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Website: [hawaii.apwa.net](http://hawaii.apwa.net)**2019 Officers**

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Jordan Urabe, Past President  
[jurabe@ascehawaiiymf.org](mailto:jurabe@ascehawaiiymf.org)

**YMF General Meeting**

The next YMF general meeting is scheduled for Wednesday, April 3rd, 2019 at 6:00 pm at Workplay in Kakaako. If you are interested in attending and learning more about the various professional, social and service opportunities available through YMF, please contact YMF at [yymf.hawaii@gmail.com](mailto:yymf.hawaii@gmail.com).

**Mililani Mauka Elementary STEALTH Fest**

The Mililani Mauka STEALTH Fest was held on March 2nd to educate students about STEM and Health related fields. The event kicked off with a fun run for the students followed by activities provided by roughly 20 organizations. The ASCE Hawaii Section partnered with YMF to provide two activities for the students. Six YMF volunteers spent their Saturday morning teaching kids about surface tension and buoyant force through a fun penny boat activity.

ASCE Hawaii Section YMF would like to thank Mililani Mauka Elementary for inviting us to be a first-time participant in this event! We hope the event sparked interest in the students to continue learning about the STEM and Health fields. We would also like to thank the YMF volunteers who dedicated their time to make this event a success!

**26th Annual Education Fund Golf Tournament - April 5**

The 26th annual Education Fund Golf Tournament will be held Friday, April 5 at the Ala Wai Golf Course. Proceeds will sustain the Chapter's education fund which provides annual monetary awards at the Hawaii State Science and Engineering Fair and annual partial scholarships towards higher education tuition to eligible students who major in a public works-related field. Interested golf players may contact Rouen Liu at 543-7245 or [rouen.liu@hawaiianelectric.com](mailto:rouen.liu@hawaiianelectric.com).

**Hawaii Public Works Conference – May 24**

Registration is now open for the inaugural Hawaii Public Works Conference which will be held Friday, May 24, at the Daniel K. Inouye International Airport, Interisland Terminal Conference Rooms (7th floor, Terminal 1). Contact Jon Young at [jon@hawaiiasphalt.org](mailto:jon@hawaiiasphalt.org) or 808-847-4274 for more information.

**Moanalua Elementary School Junior Engineering Night**

The Moanalua Elementary School Junior Engineering Night was held on March 6th as the culmination of the 5th grade class' Popsicle Stick Bridge Competition. In addition to judging and testing the bridges, the night included several hands on STEM related activities for the students to try out. Ten YMF volunteers helped to teach the students through two activities: marshmallow and spaghetti towers on a shake table were used to teach the kids about building for earthquakes, and flood barriers made out of play dough, sponges, popsicle sticks and cardboard required the kids to find a creative way to protect against water.

Thank you to Moanalua Elementary School for inviting YMF to be a part of this event each year! We enjoy coming out and hope the students had a fun learning experience. Thank you also to the YMF volunteers who took time out of their busy schedules to participate, we couldn't have done it without you!

**2019 Western Regional Younger Member Council**

On March 8 and 9, 2019, the ASCE Hawaii Section YMF had the honor of hosting the 2019 Western Regional Younger Member Council (WRYMC) at the Hilton Hawaiian Village. WRYMC, along with the Workshop for Section, Branch, and Institute Leaders (WSBIL) and the Workshop for Student Chapter Leaders (WSCL), make up the Regions 8 and 9 ASCE Multi-Regional Leadership Conference (MRLC). 147 younger members, 135 students, and 70 section, branch, and institute leaders from 10 states attended MRLC. The conference provides an incredible opportunity for attendees to learn more about ASCE and to attend valuable leadership sessions. The ASCE Hawaii Section YMF was tasked with planning and running a couple of these sessions for the younger members as well as planning technical tours and a multitude of networking socials, including an awards banquet. The feedback from everyone, including the Society leaders, has been overwhelmingly positive. This conference brings such a positive and motivational energy, and we hope that all attendees were able to take something away from the weekend.

We want to say mahalo to our incredible WRYMC committee who put in so much hard work. We owe the success of this conference to them.

Finally, WRYMC would not have been possible without the support from our generous sponsors. You all made this possible.







#### 2018-2019 ASCE Hawaii Section Officers

President: Eric Arakawa, P.E.  
*email: earakawa@ascehawaii.org*  
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*email: jkage@ascehawaii.org*  
 Vice President: Dayna Nemoto-Shima, P.E.  
*email: dnemoto@ascehawaii.org*  
 Treasurer: Clifford Lum, P.E.  
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*email: lkaramatsu@ascehawaii.org*  
 YMF President: Nicole Nakaoka, P.E.  
*email: nnakaoka@ascehawaiiymf.org*

#### EXECUTIVE COMMITTEE MEETING

Last held: Feb 7, 2019

Next meeting: Apr 4, 2019

#### ASCE HAWAII SECTION DINNER MEETING

##### Program: University of Hawaii at Manoa ASCE Student Chapter

The UH Manoa ASCE Student Chapter will be sharing their experiences and accomplishments for the 2018-2019 school year, including highlights from this year's ASCE Pacific Southwest Regional Conference. The ASCE Hawaii Section will also be presenting awards to two (2) outstanding student chapter members.

**Speakers:** UHM ASCE Student Chapter

**Date:** Thursday, April 18th

**Location:** Dave and Busters, Paina Room

**Time:** 5:30pm Social Time  
 6:30pm Dinner  
 7:00 Program

**Menu:** Multi-entrée buffet

**Cost:** \$35.00 for ASCE Members  
 \$40.00 for Non-Members and Guests  
 \$20.00 for ASCE Student Chapter Members

#### SUNDAY BRUNCH HAWAII SECTION PAST PRESIDENTS

On Sunday, March 10, 2019, eleven ASCE Hawaii Section Past Presidents whose presidency years ranged from 1984 to 2018



attended a brunch at the Hale Koa Banyan Tree Showroom to talk story and catch up with Nancy Berson, ASCE Director of Geographic Services. Nancy was in Hawaii for the ASCE Region 8 & 9 Multi-Region Leadership Conference. She has been with ASCE for 40 years and was of great help and always a pleasure to work with for each of our Past Presidents during their tenure. The brunch was a wonderful opportunity for everyone to update Nancy on their lives since last working with her and reminisce with her on their ASCE memories.

#### COMMITTEE POSITIONS

ASCE Hawaii is looking for volunteers to fill the following committee positions: History & Heritage Chair, Advocacy Captain, Student Practitioner Advisor, Water Resources, and OahuMPO CAC Representative. If you are interested or have questions on any of these positions, please contact President Eric Arakawa, [earakawa@ascehawaii.org](mailto:earakawa@ascehawaii.org).

#### MEMBERSHIP

If you haven't already done so, please renew your ASCE membership. You can renew your membership at [www.asce.org](http://www.asce.org).

#### ASCE JOB LISTINGS

The following job listings are currently posted on the ASCE Hawaii Section website:

- **Booz Allen Hamilton** (Senior Civil Engineer and Wastewater Specialist)
- **City and County of Honolulu** (Civil Engineer V (Geotechnical), Civil Engineer III, V, VII, Mechanical Engineer V)
- **HartCrowser** (Geotechnical Engineers – Principal Level & Project Level)
- **Kennedy/Jenks Consultants** (Project Manager, Staff Engineer for Honolulu Office and Staff Engineer for Hawaii Office)
- **Nagamine Okawa Engineers Inc.** (Structural Engineer)
- **PGH Wong** (Change and Claims Manager, Change and Claims Specialist, Civil/Building Inspector, Office Engineer, Scheduler)
- **SSFM** (Civil Engineers V, Structural Engineer IV)
- **US Army Corp of Engineers** (USACOE) (Interdisciplinary Project Manager, GS-12)
- **Zane & Associates, LLC** (Facility Planners)

For further information, please visit <http://www.ascehawaii.org/job-listings.html>.



P.O. Box 31218, Honolulu, HI 96817

Web page: [www.samehonolulu.org](http://www.samehonolulu.org)

#### SAME Honolulu Officers and Directors

President	CDR Todd Wimmer, USCG
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VP/Sustaining Members	Will Boudra, USN (Ret)
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Week Luncheon	CSM Yolanda Tate, USA
Director, Enlisted Matters	Robin Cababa
Director, Nominations	Jeff Clark
Director, Pacific Industry Forum	Lance Lum
Director, Readiness	

#### 2019 SAME Honolulu Pacific Industry Forum

##### and Icebreaker Reception, May 13-14, 2019

SAME Honolulu Post will hold its annual Pacific Industry Forum and Icebreaker Reception that are open to all SAME sustaining and individual members as well as non-members.

#### Date/Time:

Icebreaker Reception: May 13, 2019 | 5:00 pm – 7:00 pm

Pacific Industry Forum: May 14, 2019 | 7:30 am – 3:00 pm

#### Location:

Icebreaker Reception: Gordon Biersch Honolulu

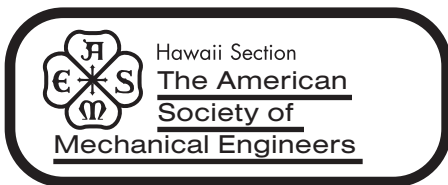
Pacific Industry Forum: Ala Moana Hotel

The sponsorships from the Pacific Industry Forum will support SAME Honolulu Post's scholarship program, construction camps, and youth outreach programs for Hawaii students pursuing their education in engineering or architecture.

The 2019 Pacific Industry Forum will bring SAME sustaining and individual members, non-members, and senior leaders from the Federal, State and County Governments for program briefings, a luncheon, and small business networking opportunities.

To register, visit SAME Honolulu homepage at [www.samehonolulu.org](http://www.samehonolulu.org).

For more information about the 2019 Pacific Industry Forum and Icebreaker Reception, email [info@samehonolulu.org](mailto:info@samehonolulu.org).



[www.asme-hi.com](http://www.asme-hi.com)

#### ASME-HI 2018-2019 Officers

Chairperson	Froilan Garma	321-2691
	<i>Froilan.B.Garma@jci.com</i>	
Vice-Chair	Derick Kam	
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Secretary	Jason Frifeldt	358-6322
	<i>frifelj@yahoo.com</i>	
Treasurer	Kevin Dang	737-1708
	<i>dangk001@hawaii.rr.com</i>	
Past-Chair	Derek Sato	
	<i>derek.sato@hawaiianelectric.com</i>	
HCES Rep:	Froilan Garma	

#### NEXT ASME-HAWAII GENERAL MEMBER-SHIP MEETING

Date: Date yet to be determined)

Time: from 5:30 pm to 6:45 pm

Place: Usually at Johnson Controls, 420 Waiakamilo Road (map and parking instructions found on the Hawaii Section website)

Agenda: A copy of the agenda will be on the Section website when available.

As usual, all members, students and guests are invited and encouraged to attend our meetings. There are always lots of complimentary refreshments. Please contact Chairman Froilan Garma for directions and for more information, such as parking.

#### ASME-HI MATTRESS FACTORY TOUR

On February 27, 2019, ASME-HI members and guests toured the Serta Simmons Bedding Manufacturing Plant on Komohana Street in Campbell Industrial Park. The tour was conducted by Manufacturing Engineer, Mark Howard, who has worked at plants around the world.

Derek Sato attended the tour and said, "Did you know that Serta Simmons mattresses are made right here in Hawaii? ASME Hawaii was lucky enough to host a tour of the Serta facility in Kapolei and discovered one of two manufacturing facilities that Serta Simmons operates here on Oahu. Raw materials are shipped to Hawaii from Oregon, California, and other states. From those materials the factory custom fabricates mattress foundations (box springs) and all models of the Serta Simmons product line. Hotel double sided mattresses to the top of the line Beautyrest Black Luxury Pillow Top, they produce them all right here on Oahu at their Kapolei and Waipahu facilities. Custom tailored machines and processes all contribute to the amazing products produced right here in Hawaii."

For such an interesting and informative tour given by Mr. Howard, ASME-HI is considering a second tour of his plant. Having worked in plants all over the world, Howard's parting advice to the students present, "Have a strong work ethic and ability to learn and you can work anywhere."

#### ASME-HI MEMBERS AT THE 2019 MATHCOUNTS HAWAII STATE COMPETITION

The competition was held Saturday, March 9, 2019, and this article is an avenue as a member of the Hawaii MATHCOUNTS Steering Committee for acknowledging the Hawaii State MATHCOUNTS Competition volunteers and contributors.

Thanks to the Hawaiian Electric Company

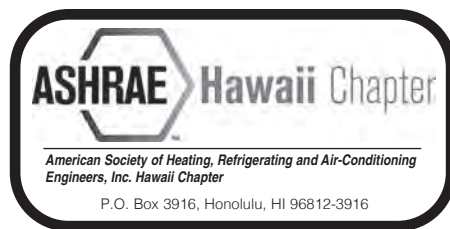
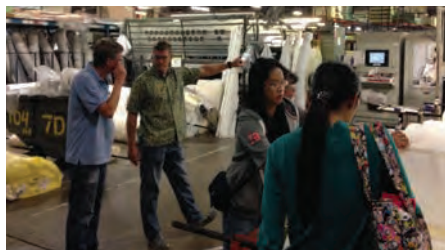
(HECO) scorers about 20 who helped ensure the answer sheets were properly scored in reasonable time, to the HECO refreshment volunteers, who efficiently handed out the refreshments and lunches to the Mathletes, and to the U.S. Army Corps of Engineers (USACE) and their leader, Kevin Araki, for effectively proctoring all rounds of the competition, to Lou Muzzarini, retired USACE and SSFM consultant, for again being Master of Ceremonies and Moderator of the rounds, and to Rosella Motoki of Hawaiian Electric for helping Muzzarini with the awards ceremony.

Also helping with scoring were the Department of Education volunteers who supervised the scorers, providing instructions and solutions to questionable answers.

Hawaii MATHCOUNTS is thankful to Hawaiian Electric Industries Charitable Foundation and Covanta Energy for their financial support and to Kamehameha Schools for providing the Kalama Dining Hall and other facilities to conduct the Hawaii MATHCOUNTS Competitions for so many years.

Nhut Pham of Bowers + Kubota and Barry Nakamoto of Covanta Energy are the MATHCOUNTS co-coordinators for HSPE.

Please refer to the MATHCOUNTS news article in this Wiliki issue.



#### Hawaii Section Officers 2018-2019

President	Mofazzal Mir, PE
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#### PRESIDENT'S MESSAGE

ASHRAE Hawaii Chapter organized its annual Technical Seminar on March 7, 2019. A few interesting topics were covered in the seminar. One of them was Fundamentals, Techniques, and Technology to grow Cannabis in an indoor environment. The information shared can be applied to grow other agricultural products in an indoor environment such as "indoor vertical farming" that could cut back our dependency on imported food and increase the food security of Hawaii residents. The seminar also covered how our built environment will be increasingly smart and intelligent with the advent of the "Internet of Things" and how HVAC professionals can handle huge amounts of data produced by smart sensors & devices that will be ubiquitous in the future. A renowned local construc-

tion lawyer also discussed risk mitigation in design and construction. In short, the seminar was very informative and beneficial for our members.

We will have a contractor round table at our April monthly meeting. We are hoping that the round table discussion will be helpful in bridging the communication gaps among the design consultants and the contractors, which will be beneficial for our local construction industry.

Mahalo Nui Loa!

Mofazzal Mir, P.E

2018-19 ASHRAE Hawaii Chapter President

#### APRIL MEETING ANNOUNCEMENT

Technical Session: "What's New in Solar" presented by Mark Hertel of Inter-Island Solar Supply.

Main Presentation: Mechanical Contractors Round Table

Date: April 11, 2018

Location: The Plaza Club, 900 Fort St. Mall, 20th Floor

o Registration: Starts at 5:30 pm

o Technical Session: 6:15 pm

o Dinner: 7:00 pm

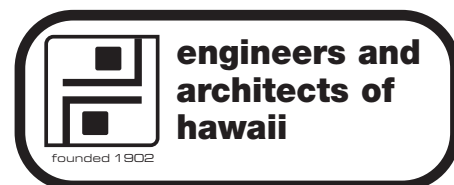
o Main Program: 7:30 pm

o Adjournment: 9:00 pm

Cost: \$45 per ASHRAE Member, \$50 per guests, \$55 at the door.

Visit our website for online registration and more information!

<https://ashraehawaiichapter.info/meetinginfo.php>



P.O. Box 1901, Honolulu, HI 96805-1901

An association for Hawaii's Engineers and Architects

WEB address: [www.eahawaii.org](http://www.eahawaii.org)

#### EAH 2018- 2019 Officers

President	Howard Wiig	587-3811
1st V. P.	Open	
Treasurer	Aaron Erickson	591-2728
Secretary	Gary Yamamoto	485-2777
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Director	George Coates	234-5659
Director	Bill Brizee	523-9636
Director	Phil Blackman	282-7948
Director	Rob Kinslow	
Past President	Dave Martin	543-4504

EAH's new meeting location is Room 301 in the Topa Tower (Ewa tower on Fort Street; Old AMFAC Building). Validated parking is available (enter from Nimitz). The WEB site has been updated to provide directions and a Map. If you have questions please call Sam Gillie (543-4739).

Meetings are held every Friday (except Holidays). Meetings start at NOON and have ended PROMPTLY at 1:00 pm for 70 Years.

Program schedule may be adjusted. Call Sam Gillie to confirm speaker 543-4739; Fax 203-1335.

Lunch is \$10.00 Members, \$12.00 Guests. (All Welcome), Students Free. Drink refreshments are complimentary. You may bring your own lunches, in which case a \$2.00 donation is gratefully appreciated!!





## 19<sup>th</sup> Annual Dinner

The College of Engineering invites you to an evening with students, faculty, alumni, and friends to honor their achievements in academic and research excellence and outstanding service and leadership.

### Student Project Presentation

**Austin Yoshino, GTrainer**

### Special Awards

#### *Distinguished Alumnus*

**John Arizumi (ME '68)**

#### *Outstanding Service*

**Neal Miyake (EE '87)      Sean Sugai**

#### *Dean's Award of Excellence*

**Anurag Bist (EE '94)    Pradeep Sindhu (EE '76)**

**April 25, 2019**

**Hawai'i Convention Center – Kalākaua Ballroom**

**5:00 p.m. Student/Faculty Exhibits and Cocktails**

**6:30 p.m. Dinner and Program**

**\$300 per person or table sponsorship:**

<b>Platinum</b>	<b>\$10,000</b>
<b>Gold</b>	<b>\$5,000</b>
<b>Silver</b>	<b>\$4,000</b>
<b>Bronze</b>	<b>\$3,000</b>

**Tables seat 10. With your permission, we would like to seat a faculty or student at your table. Register at <https://engineeringdinner19.eventbrite.com/> R.S.V.P. by April 5, 2019.**

Pay by credit card on Eventbrite website or mail checks made payable to 'UH Foundation/COE' to College of Engineering, 2540 Dole St., Holmes Hall 240, Honolulu, HI 96822, ATTN: Carrie

All proceeds will be used to benefit current and prospective College of Engineering students.

Last year, more than \$100,000 was raised in support of the College of Engineering.

***Mahalo!***

### **Banquet Committee:**

Alan Arakawa, CE '86, Ken Hayashida, CE '83, *Co-Chairs*

H. Ronald Riggs, Interim Dean

Clay Asato, CE '81

Kendall He, CE '82

Ken Kawahara, CE '92

Derek Mukai, ME '89

Sean Sugai

Tony Gaston, CE '90

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Russell Young, CE '73

Duke Hartman, ME '09

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Brennon Morioka, PhD CE '99

Ross Okuda, ME '92

Kyle Yukumoto, CE '93

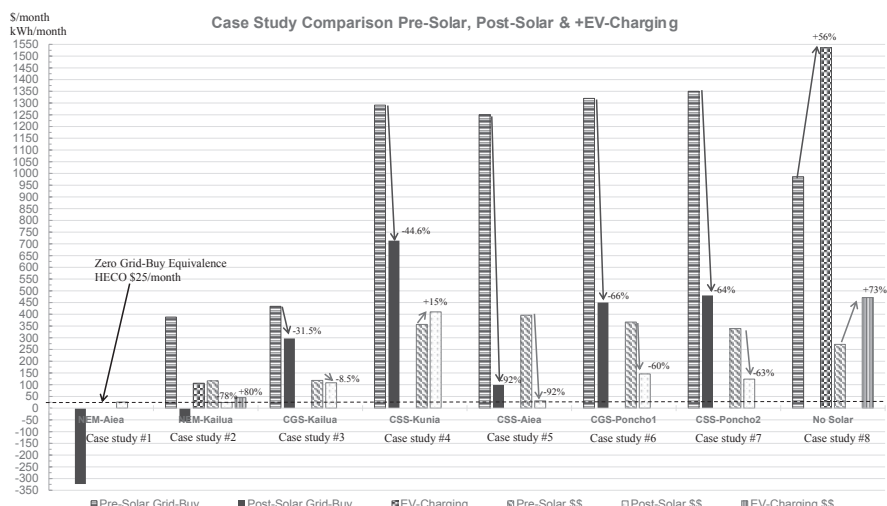
## Flight Climate Change continued from page 1

**Solution:** 2nd Solar Wave sustainability requires more customer education and interaction to control Home/Building energy ecosystem to achieve Island Nano-Grid and Zero Grid-Buy Equivalence for resilience, safety, security, savings and save lives.

**1st Solar Wave:** Many homeowners achieved Zero-NEM (actually negative NEM) thanks to their oversized rooftop solar-PV systems' excess daytime solar-PV generation exported back to the grid at full retail rate (~30¢/kWh). This resulted in the minimum monthly Hawaiian Electric (HECO) bill of \$25/month requiring no interaction between homeowner and their PV generation system.

**Figure 2** shows NEM case study #1 for Aiea averaging a Zero-NEM of -323kWh/month while NEM case study #2 for Kailua Zero-NEM averaged -57kWh/month compared to a pre-solar average grid-buy of 388kWh/month. With the NEM program, the grid acts as an infinite storage battery for each solar-PV customer but this was not sustainable. It caused utility grid instability due to large amount of excess daytime PV generation exporting back to the grid and the Duck Curve problem. The NEM program ended in Oct 2016 on Oahu as reflected by the -84% drop in rooftop solar-PV permits peaking in 2012 with ~16,700 permits/year when the cost of a solar system was ~\$5/W dropping to <3,000 permits for 2017 and 2018 even though solar system costs dropped 40% to ~\$3/W and Li-ion battery system costs \$0.5-1.50/W as shown in **Figure 1**. Today exporting excess PV generation back to the Grid is restricted and the credit rate was reduced to a wholesale rate of 15¢/kWh under the current customer grid supply (CGS) and 10¢/kWh for CGS+ programs, making battery storage a better option. Case study #3 for Kailua with CGS program and no storage reduced grid-buy from 434kWh/month (\$118/month) for pre-solar in 2017 to 297kWh/month (\$108/month) for post-solar in 2018, a carbon footprint reduction of 31.5% but the cost savings was only 8.5% due to HECO effective rate increase of 33% from 27.2¢/kWh to 36.3¢/kWh (see **Figure 2**). In comparison the results for case study #4 Kunia with customer self-supply (CSS) program and no grid export requiring solar + storage, grid-buy was reduced from 1291kWh/month (\$357/month) to 714kWh/month (\$225/month), a carbon footprint reduction of 44.6% but the total cost for electricity actually increased by 15% to \$410.82/month due to the added fees/costs of the 20 year solar lease program from Sun Run adding \$185/month. So no savings.

**Zero Grid-Buy Equivalence:** To achieve the same cost savings as Zero-NEM with the minimal monthly HECO utility bill of \$25/month in Hawaii requires Zero Grid-Buy (ZGB) or Equivalence. At the current residential electricity grid-buy rate of 30¢/kWh and HECO grid connection fee of \$11.50/month, ZGB-Equivalence allows \$13.50/month or up to 45kWh/month with CSS for rainy/cloudy days and still realize a \$25/month bill. However, on average only 25% of a household daily energy usage occurs during daylight (solar generation) hours leaving the remaining 75% usage at night so this must be reduced. Our simulation modeling shows that the overnight grid-buy usage needs to be reduced to <1.5kWh/night. Case study #5 Aiea results show we can achieve ZGB-Equivalence on sunny and partly cloudy days for a total of 5 months out of the



**Fig.2. Comparison between several case study monthly residential electricity costs and usage.**

year in 2018 and an average HECO usage bill of 99kWh/month and \$31/month (31.3¢/kWh) for a 92% reduction in carbon emissions and costs as shown on **Figure 2**.

**IoT Smart Devices and Data Analytics:** The key to achieving ZGB-Equivalence mentioned above is having the right data analytics for daily energy usage monitoring and by being renewable energy conservation minded with interactive assets that can be controlled to make the necessary lifestyle behavioral changes to achieve 100% Renewables with Solar Energy + Multi-storage. We integrated the use of IoT home automation devices and Smart (Home/Building) Energy Management System to maximize solar-PV generation, maximize solar thermal generation, optimize electrical battery storage/discharge and maximize hot & cold thermal storage. By just adding solar + storage the monthly grid-buy electricity usage for case study #5 was reduced by only 44.4% going from 1267kWh/month or \$308/month (24.3¢/kWh) for May 2016 to 705kWh/month or \$179/month (25.4¢/kWh) for June 2016, a savings of 562kWh/month (\$134/month), very similar to the case study #4 44.6% reported earlier. This was solar phase 1, using IoT energy monitoring devices we made some lifestyle behavioral changes which further reduce grid-buy to 450kWh/month or \$120/month (26.7¢/kWh) for a 62% savings. Similarly, 64-66% savings were also reported for solar + storage CGS case study #6 and CSS case study #7. For solar phase 2, 3 & 4 we made hardware and software changes to the Tabuchi Electric hybrid inverter with embedded Panasonic Li-ion battery storage system as well as adding IoT and smart devices for home/building automation, energy usage monitor & control, improvements to solar hot water system (thermal generation and storage), adding sky-camera with local radar/satellite imaging for weather forecasting and adding UPS. Using these multiple renewable energy storage techniques for overnight discharge we reduced the night-time grid-buy energy usage to <5% or 0-1.5kWh/night for a 92% savings and 3.2 year ROI payback.

**Adding Home EV Charging:** Many electric vehicle (EV) homeowners are shocked at how much their monthly electric bill will increase 60-80% due to overnight EV charging at home. **Figure 2** shows the results for case study #8 no solar with average grid-buy of 985kWh/month and monthly bill of \$272/month (27.6¢/kWh). After installing a level-2 EV-charger for a Tesla-

75 the monthly grid-buy jumped 56% (+552kWh) to 1536kWh/month and monthly bill increased by 73% (+\$199) to \$471/month (30.6¢/kWh). For comparison case study #2 Kailua NEM customer purchased a Chevy Bolt in Nov 2017 and used level-1 EV charging at home. Achieving Zero-NEM the monthly average grid-buy from 2014-2017 was -57kWh/month (high of +165kWh/month and low of -205kWh/month) but after EV purchase the monthly HECO bill for 2018 with NEM jump 80% from \$25/month to \$45/month with a new NEM average of 106kWh/month (high of +341kWh/month and low of -84kWh/month) due to an increased daily grid-buy of 5.4kWh/day (+163kWh/month) for driving an average of 21.7 miles per day at 4miles/kWh (see **Figure 2**). Therefore, if you have NEM, adding EV can actual be FREE like for case study #1 having an excess Zero-NEM of -323kWh/month (high of -181kWh/month and low of -508kWh/month).

**Summary:** In our fight against climate change, we reduced carbon emissions by 92% for 2018 using Solar + Multi-Storage with Island Nano-Grid and Zero Grid-Buy Equivalence for resilience, safety, security and savings. Key was using IoT and smart devices for home/building automation and smart control of energy ecosystem.

**John Borland's Biography (JohnOBorland@aol.com & www.job-technologies.com)**

John O. Borland is President of J.O.B. Technologies and has presented and published case study #5 results last year at the 7th World Conference on Photovoltaic Energy Conversion, Solar Power & Energy Storage International and InterSolar North America. He is a senior member of IEEE, the IEEE Region 6 Central Area chair, past-chair of the IEEE Hawaii section and IEEE Hawaii chapter chair for both the PES and EDS/SSCS.

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## Mathcounts Competition continued from page 1

Mathlete has the rest of the 45 seconds to answer. In the earlier matches, the first to answer more problems correctly after at least two problems are presented moves on to meet the next higher placed Mathlete. In the final three matches, the first Mathlete to answer three problems correctly moves on.

The Mathlete who had to do the most work was Zachary Tyrrell. He worked his way up from sixth place to earn a place on the Hawaii Team. The final match was between highest scorers Adam Inamasu and Felicity Zhou. Unlike the Oahu Chapter competition when Zhou was second in the written portion and had eliminated Inamasu in the Countdown, it was Inamasu who switched things around and beat Zhou to take first in the Countdown Round.

The placement of teams is determined by adding team members' individual scores from the Sprint and Target Rounds plus the Team Round score. Of the eight competing teams, in first place was Washington Middle School, and therefore Coach Sung Park, again, has the honor of being the Hawaii Team Coach at the National in Orlando, Florida. Second place to eighth place teams, respectively, were Iolani School with coaches Joe Guillou and Kristi Sakaguchi, Punahou School with coach Leslee Hosoda, Kamehameha Middle School Kapalama and coach Midori Burton, Iao Intermediate with coach Lynette Zakabi, Niu Valley Middle School and coach Gina Hyun, Waiakea Intermediate School and coach Darwin Mizuba, and Kapolei Middle School and coaches Kristine Lindstrom and Carli Masik.

Awards presenters included Dr. Taran Chun, Head of School, Kamehameha Schools Kapalama; Patricia Ishihara, State Mathematics Resource Teacher, Hawaii Department of

Education; Robert Isler, Vice President Power Supply, Hawaiian Electric Company, Inc., and MATHCOUNTS Steering Committee member; and Sara Doi, President-Elect, HSPE. The organizations they represent have a major role in perpetuating MATHCOUNTS in Hawaii.

Hawaii MATHCOUNTS is organized by HSPE with competition assistance from Hawaii educators and engineers. Hawaiian Electric sponsored the 2019 MATHCOUNTS Oahu Chapter and State Competitions with a grant to the HSPE Educational Foundation.

You will again be able to attend the Competition in your home or office. MATHCOUNTS will present the 2019 Raytheon MATHCOUNTS National Competition live via webcast on [www.mathcounts.org](http://www.mathcounts.org), starting Monday, May 13th at 10:00 AM EDT.



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**Deadline for  
*Wiliki*  
is April 15th**

### NEW STRATEGIC PLAN

The association has a new 2019-2022 Strategic Plan to guide our efforts and activities for the next three years. Please look at the plan on the website ([www.hwea.org](http://www.hwea.org)) and see how you can get involved and contribute.

### NEXT EXECUTIVE COMMITTEE MEETING

April 17, 2019, 11:30am, CSM Baseyard – 99-989 Iwaena St

### NEXT QUARTERLY LUNCHEON MEETING

Program: TBA – please visit [www.hwea.org](http://www.hwea.org)  
Date: Wednesday, April 24, 2019

Location: Dave & Buster's Honolulu

Time: 11:30 a.m. – Check In

11:45 a.m. – Lunch

12:15 p.m. – Program

1:00 p.m. – Adjourn

Menu: Buffet

Cost: \$20.00 for HWEA Members,  
\$10.00 for Students

Please make checks payable to: HWEA and mail to Hawaii Water Environment Association c/o Shelle Silva, CCH-ENV, 650 S. King, 14th Floor, Honolulu HI 96813. Reservations for the luncheon meeting to Shelle Silva by Monday, April 22, 2019, by phone at 768-8763 or email at [shelle.silva@honolulu.gov](mailto:shelle.silva@honolulu.gov).




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