Pono Home - Honowai Elementary School
Energy Efficiency Pilot Project

June 2016

This report was prepared by Pono Home CEO Scott Cooney, with support from team members Sara Cobble and Anthony Ng, for Opterra Energy Services, in fulfillment of Work Order #1244000001

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Introduction

The Department of Education (DOE) is the one of the biggest users of energy in Hawaii, ranking second only to UH Manoa for energy consumption on Oahu among public infrastructure[1]. The DOE is working to address this challenge on many levels. The DOE pays a blended rate of 31.77 cents per kilowatt hour[2]. With plans to expand air conditioning across its ~300 campuses, the DOE will continue to be a significant contributor to Hawaii's energy demand, and energy will continue to be a significant financial burden to the school's public education system. To address these challenges, the DOE has launched Ka Hei, a broad sustainability effort across Hawaii's K-12 public schools. The program is being administered by Opterra Energy. Ka Hei's mission is very critical to helping the state of Hawaii reach its goal of 100% renewable energy by 2045.

Opterra contracted Pono Home to implement some of the smaller scale aspects of the energy efficiency tier of Ka Hei, starting with a pilot project at Honowai Elementary School in Waipahu (Honolulu County) in early June 2016. The Scope of Work includes education, survey research, and electronic hardware installations (timers and advanced power strips). Honowai is a relatively small campus with an engaged administrative staff and therefore was chosen as a good test site for a pilot for this program.

[1] http://energy.hawaii.gov/wp-content/uploads/2011/10/2005benchmarkingstudy.pdf
[2] http://www.hawaiipublicschools.org/ConnectWithUs/Organization/SchoolFacilities/Pages/Energy-Efficiency.aspx

Conservation and Efficiency Measures Implemented

Location/Quantity

Pono Home staff delivered educational packets about the Ka Hei program to teachers across the campus. A 60 watt equivalent LED bulb accompanied these packets, which teachers were free to use in their desk lamps or to bring home to test out there. In some cases, we left packets on desks when neighboring classroom teachers suggested that those staff members would return soon, but in most cases, our staff spent a few minutes with each teacher to show them the benefits of LED lighting and to walk through the sustainability initiatives introduced in the educational packets. We placed educational stickers in 51 rooms on campus. The stickers remind people to turn off lights when they leave the room and to show them the most energy efficient methods for cooling rooms.

Our team installed 6 advanced power strips and two digital timers on campus. Advanced power strips were installed in rooms A4, Workroom A (2), P7, and the Admin building (2). Digital timers were installed on two chilled water fountains in the cafeteria. This was shy of the original scope of work due to the timing and availability of key stakeholders. These devices are most effective following a bit of investigation with the people who are using them, in order to determine the appropriate setup and settings that will work best for people, without interrupting their work. On the days we performed the pilot, the teaching staff was largely unavailable. Many were deconstructing or had deconstructed their computer equipment in their classroom, making advanced power strip installation unproductive in many cases, and our staff opted to not install products without full knowledge of where they would eventually end up and how they'd be set up. After discussion with several stakeholders, it was decided that the best course of action would be to install these devices wherever it made sense to do so, and then to deliver extra products to the school's IT person, Serena Moriya, for installation in the fall, when teachers return and set up their electronics. We trained Moriya in the installation of both, and we requested that she follow up with Pono Home when and if she has questions on their installation and use. Thus, 6 advanced power strips were installed, and 9 more given to Moriya, and similarly, 2 timers were installed and 3 more delivered to Moriya.

Estimated Annual Savings

Advanced power strips can save 102.8 kWh per year[3]. Once all are properly installed on campus, estimated savings from their use will therefore be 1542 kWh per year or $489.89.

Savings from timers vary depending on the devices they are installed on. We only installed two timers, both on Elkay brand wall-mounted water fountains, model EZS4. One state energy office estimated these devices may cycle on to chill water 60% of the time[4]. These models consume an

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[3] Energy savings assumption from Hawaii Energy's Technical Reference Manual (TRM), provided to Pono Home by Hawaii Energy staff

[4] https://ncdenr.s3.amazonaws.com/s3fs-public/Environmental%20Assistance%20and%20Customer%20Service/IAS%20Energy%20Efficiency/Opportunities/Drinking%20Fountains.pdf

average watt usage of 325 according to the manufacturer spec sheets[5], though our watt meter read the device at 288 watts while in chilling cycle (see Figure 7). The differential is likely attributable to assumptions made on the spec sheet with regard to incoming water temperature and ambient room temperature. Using a ballpark figure of 300 watts, this yields 1576.8 kWh per year. We installed a timer on the devices to power them down 50% of the time, which may yield an energy savings of 788 kWh per year, or $250.47 per year, per fountain.

This means there will be no cold water on the fountains between 7 PM and 7 AM, which we were informed was a time in which those particular water fountains should see little to no activity, and thus should not interfere with students or staff.

Photos of Installed Hardware

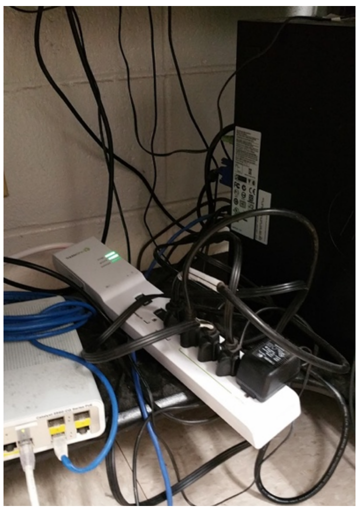

Figure 1. Smart Strip Installation.

Figure 2. Timer Installation.

[5] http://www.drinkingfountains.us/ezs8specs.html

Figure 3. Classroom doors with the "Sustainable Cooling Tips" sticker.

Figure 4. Classroom light switch with the sticker reminding people to turn off lights when they leave.

Aggregate of total measure quantities and savings installed at site

Installed:
6 Advanced Power Strips: 616.8 kWh per year, $195.96 per year
2 PowerDown Timers: 1576 kWh per year, $500.70 per year

Total Installed savings: 2192.8 kWh per year, $696.66 per year

Potential savings from delivered measures:
9 Advanced Power strips: 925.2 kWh per year, $293.94 per year
3 PowerDown Timers: 2364 kWh per year, $751.04 per year

51 LED lamps, 9 watt (60 watt equivalent): 2183.54 kWh per year potential savings if used similarly to a residential setting[6], $693.71 per year

Total Potential savings: 5472.74 kWh per year, $1738.69 per year

Total (Installed plus potential) savings: 7665.54 kWh, $2435.34

Signage installed

Fifty one (51) of each of the two types of signs were installed in rooms across the Honowai Campus.

[6] Energy savings assumption from Hawaii Energy's Technical Reference Manual (TRM), provided to Pono Home by Hawaii Energy staff

Additional savings opportunities

Minifridges

The prevalence of compact refrigerators ("minifridges") on campus is an opportunity for significant energy savings. Energy consumption of minifridges can vary greatly from model to model, and are also affected by their use patterns, temperature settings, capacity, age of the unit and whether it has manual or automatic defrost. Regardless, minifridges can use almost as much energy as a full-sized fridge. Current options for sale at HomeDepot.com are about 40% Energy Star certified. An average relatively small (2.4 cubic foot) Energy Star certified mini-fridge is rated to use roughly 213 kWh per year[7]. An average larger (4.5 cubic foot) Energy Star certified mini-fridge will tend to use slightly more energy (265 kWh)[8]. Models not certified as Energy Star may use about 10% more energy[9]. Older minifridges can use quite a bit more energy. A few 2013 minifridge models tested by Consumer Reports used about 424 kWh (3.1 cubic foot) and 678 kWh annually (4.4 cubic foot)[10], for instance, when they were brand new. The efficiency of minifridges degrades over time, meaning the older minifridges on campus might each be using more than 700 kWh annually. In addition, minifridges dissipate heat through their exterior walls, and when inside a classroom, they can add to the room's heat load, which can exacerbate the energy used for cooling.

We did a cursory inspection of several of the minifridges encountered on campus. Some appeared to be relatively new and some appeared to be older. We did not find the Energy Star label on any of them. We noted 11 minifridges in classrooms. These were found in classrooms A4, C3, D4, D8, G1, G2, H1, H2, H4, J2, and P7. Assuming these were an average age of 2-3 years old, and in the mid-range of size and energy consumption, these 11 minifridges might add ~500 kWh each per year to the school's energy use, or roughly 5500 kWh and $1747.35 for the 11 minifridges.

Fans cool people, not rooms

A common misperception is that fans help cool a room. The opposite is actually true. Fans all have motors that generate heat when in use, thereby adding heat to their environment (this contribution may likely be a relatively small amount of heat but the fact remains). Fans cool people through convection, sometimes referred to as the "wind chill" effect. Air that is cooler than a person's body temperature moving across that person's skin will remove heat from that person's body, thereby giving the effect of cooling. However, if no one is there to enjoy the moving air, the net effect of a fan is counterproductive if the intent was to cool off a room[11].

While on site, our staff witnessed fans on in most rooms, many times unattended. We asked staff members about this, and, like most people, they believed that fans do cool rooms. Everyone understood the logic and the difference between "conditioning" air, and simply moving it around

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[7] http://www.homedepot.com/catalog/pdfImages/c1/c112a038-6e32-488e-83c7-ca5d266e4f9b.pdf
[8] http://www.homedepot.com/catalog/pdfImages/50/5053bfa2-a483-42a3-aeb5-a884e425e256.pdf
[9] https://www.energystar.gov/products/appliances/refrigerators
[10] http://www.consumerreports.org/cro/news/2013/03/a-mini-refrigerator-can-max-out-your-utility-bill/index.htm
[11] http://www.nrel.gov/docs/fy01osti/29513.pdf

(as fans do) after we explained it. Given that oscillating fans may use 30-75 watts[12], we believe that this represents an opportunity for substantial energy savings, if staff can be cognizant of powering fans down when no one is around to enjoy them.

Plugloads

We found several examples of so-called vampire power on campus. The large whiteboard-enabled TV devices (Prometheus brand) were using roughly 25 watts of energy when powered down. We were not able to ascertain whether a timer installed on these devices would cause IT or administrative use burdens, as many people use the devices at different times and for different lengths, and therefore more investigation with all stakeholders would be required prior to setting up any timer device. Several Keurig coffee makers found across the campus used anywhere from 5 to 25 watts when not in use.

Figure 5. Electronic whiteboard device, with a resting energy consumption of 25.5 watts.

[12] http://www.siliconvalleypower.com/for-residents/save-energy/appliance-energy-use-chart

Figure 6. One of several Keurig brand coffee makers located on campus, using 5.5 watts while powered down.

Figure 7. Chilled water fountains can use a substantial amount of energy during their chilling phases.

Faucet fixtures

While water conservation is not part of the Ka Hei energy program, water efficiency is an additional easy step that schools can take to reduce their utility bills. For schools that have boilers or other heaters on campus, water efficiency can translate to substantial energy savings, but for those that do not, like Honowai, water efficiency measures will not translate directly into energy savings but will save water and wastewater charges. Most faucets noted on Honowai's campus were up to code—2.2 gallons per minute. These can easily be retrofitted with high efficiency, high pressure water fixtures to cut that rate to 1.0 or 0.5 gallons per minute without any noticeable difference in performance for washing hands and other common sink uses. Water efficiency will also save the state energy, simply due to the "energy-water nexus[13]", which is a name given to the concept that it takes energy to move water around. While we have no estimate of water use per faucet, it is reasonable to assume that these faucets will go through more water than faucets in a residential setting, simply due to the much higher number of users. For residential applications, high efficiency faucet aerators can pay for themselves in short order (1-3 months) in water, hot water, and wastewater savings.

Figure 8. Most faucet fixtures on site could be retrofitted for greater water efficiency, which will reduce the school's energy use when hot water is used, as well as saving energy for the Board of Water Supply to move water around the state.

[13] http://cleantechnica.com/2014/10/04/energy-water-nexus/

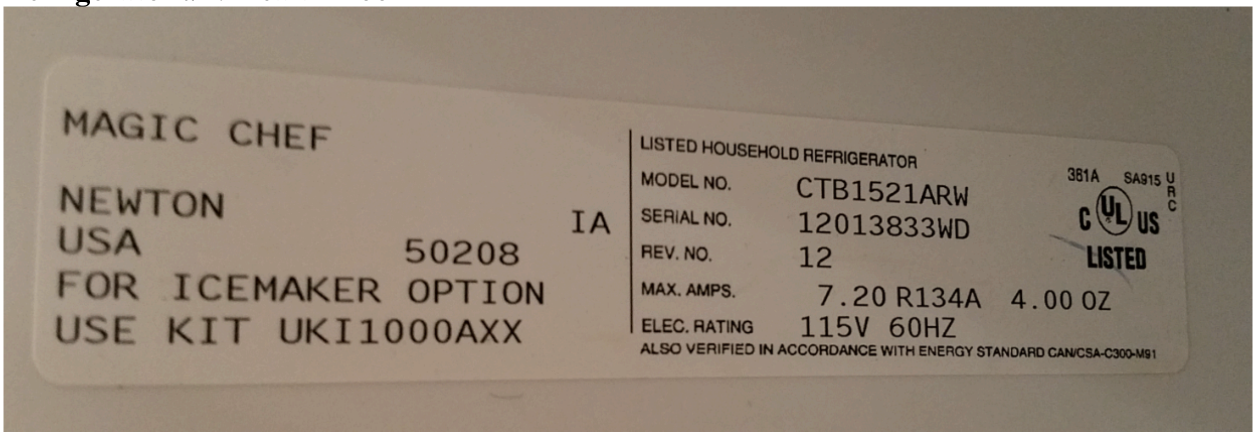
Full-Sized Refrigerator Analyses

We performed a cursory assessment and followup analysis of the full-sized refrigerators on campus. This included identification of estimated energy use based on year/make/model, an assessment of the condition of the fridge seal and condenser coils, a cleaning of the condenser coils, and a financial analysis for swapping out these fridges for a similarly sized new, Energy Star Certified refrigerator. Pricing for these potential refrigerator replacements were gathered through online search in early June 2016, and may vary substantially with seasonal specials, in-store offers, and with potential rebates. Prices provided here are for example purposes only.

At the time of this writing, Hawaii Energy's rebate programs were being revamped for their next fiscal year. We spoke with Hawaii Energy, and were told that their commercial rebate for refrigerator upgrades is $125 and that there is still funding available for it[14]. Thus, the $125 rebate has been included in the payback period calculations below.

[14] https://hawaiienergy.com/for-businesses/incentives/energy-star-appliances

Refrigerator #1: Health Room



Magic Chef, Model #CTB1521ARW
Year: 1997 Energy Rating: 570 kWh/yr
Adjusted Energy Rating for age: 627 kWh/yr[15]
14.96 cu. ft.

Fridge seal condition: Good
Condenser coils were behind the refrigerator in a tightly arranged space, and thus were not analyzed so as not to disturb the area.

Potential Replacement Refrigerator: Frigidaire 15 cu. ft. Top Freezer Refrigerator in White, Energy Star
Model #FFHT1514QW
Energy Consumption: 336 kWh/yr[16]
Cost: $539.10 - $125 Hawaii Energy rebate: $414.10

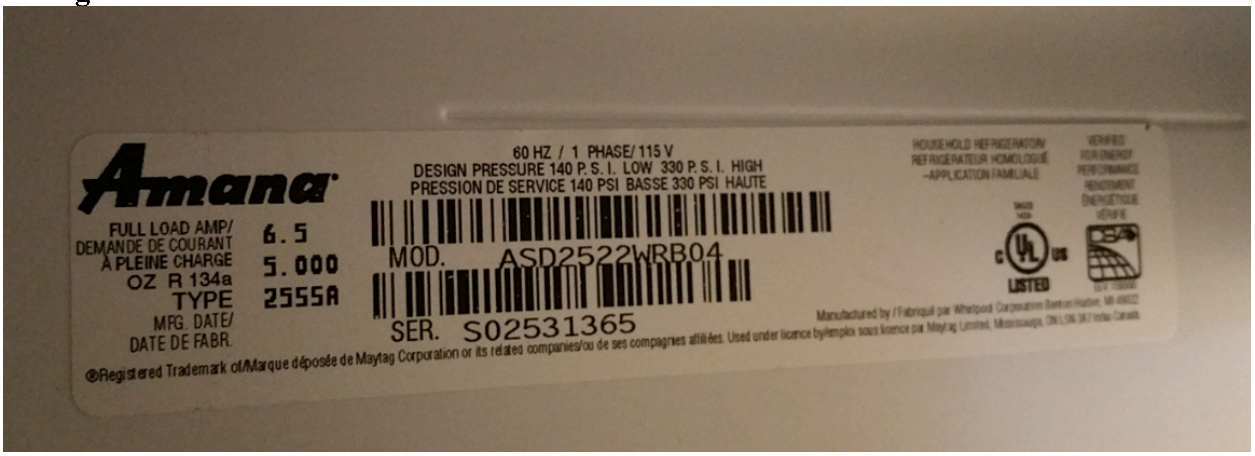
Energy savings per year with new refrigerator: 627 kWh – 336 kWh = 291 kWh/yr
Money saved per year from energy savings: 291 kWh/yr * $0.3177/kWh = $92.45/yr

Payback period: 4.48 years

[15] http://www.kouba-cavallo.com/cgi-bin/refrigsearch.exe?type=0&brand=113&model=CTB1521ARW

[16] http://www.homedepot.com/p/Frigidaire-15-cu-ft-Top-Freezer-Refrigerator-in-White-ENERGY-STAR-FFHT1514QW/205463562

Refrigerator #2: Admin Office



Amana, Model #ASD2522WRB04
Year: 2008 Energy Rating: 721 kWh/yr[17] (No change in adjusted rating)

Fridge seal condition: Good

Condenser coils were clogged thoroughly upon our arrival. Our "Before" photo did not come out well, but here is the "after":

Potential Replacement Refrigerator: Frigidaire Gallery 25.6 cu. ft. Side by Side Refrigerator in White, Energy Star
Energy Consumption: 582 kWh/yr[18]
Cost: $1,199 - $125 Hawaii Energy rebate: $1074

Energy savings per year: 721 kWh – 582 kWh = 139 kWh/yr
Money saved per year from energy savings: 139 kWh/yr * $0.3177/kWh = $44.16/yr

Payback Period: 24.32 years

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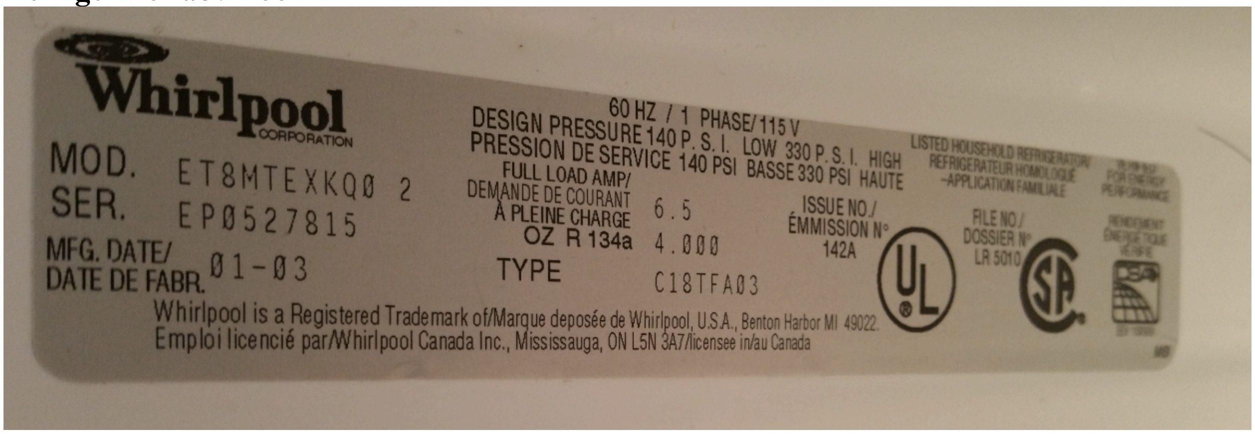
[17] http://www.kouba-cavallo.com/cgi-bin/refrigsearch.exe?type=0&brand=7&model=ASD2522WRB04

[18] http://www.homedepot.com/p/36-in-W-26-cu-ft-Side-by-Side-Refrigerator-in-White/204160615

Refrigerator #3: Room A2



Whirlpool, Model #ET8MTEXKQ02
Year, 2001, 2003, 2004
Energy Rating: 434 kWH/yr[19] (No change in adjusted rating)
18.2 cu. ft.

Fridge seal condition: Good

Condenser coil condition: caked on dust. After a brushing and removal of a layer of dust, the condenser coil condition improved but remains a potential source of energy drain.

Potential Replacement Refrigerator: Frigidaire Gallery 18 cu. ft. Top Freezer Refrigerator in Smudge Proof Stainless Steel, Energy Star

[19] http://www.kouba-cavallo.com/cgi-bin/refrigsearch.exe?type=0&brand=185&model=ET8MTEXKQ0

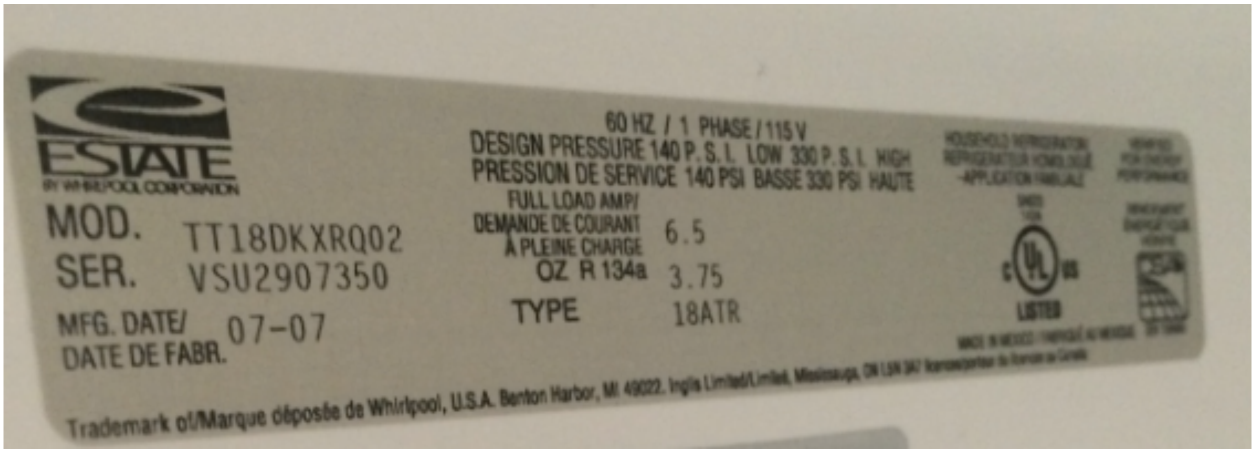
Energy Consumption: 363 kWh/yr[20]
Cost: $999 - $125 Hawaii Energy rebate: $874

Energy savings per year: 434 kWh – 363 kWh = 71 kWh/yr
Money saved per year from energy savings: 71 kWh/yr * $0.3177/kWh = $22.55/yr

Payback period: 38.84 years

[20] http://www.homedepot.com/p/Frigidaire-Gallery-Gallery-18-1-cu-ft-Top-Freezer-Refrigerator-in-Smudge-Proof-Stainless-Steel-ENERGY-STAR-FGHT1846QF/205557278

Refrigerator #4: Room A4



ESTATE, Model #TT18DKXRQ02
Year, 2007 Energy Rating: 470 kWH/yr[21] (No change in adjusted rating)
17.59 cu. ft.

Fridge seal condition: Good

Condenser coils not easily accessible and were not investigated.

Potential Replacement Refrigerator: Frigidaire Gallery 18.1 cu. ft. Top Freezer Refrigerator in Pearl, Energy Star
Energy Consumption: 363 kWh/yr[22]
Cost: $899.00 - $125 Hawaii Energy rebate: $

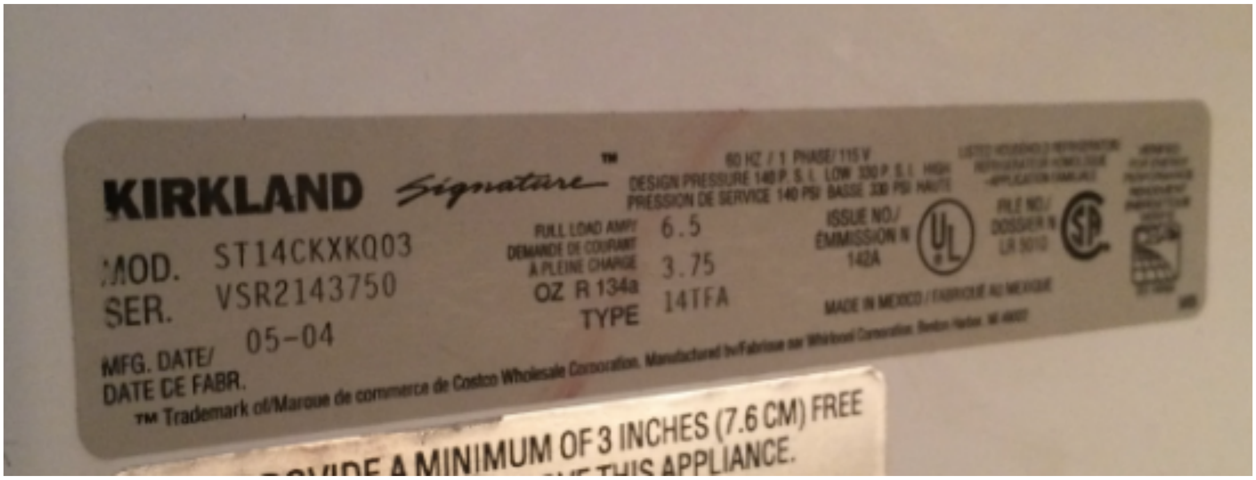
Energy savings per year: 470 kWh – 363 kWh = 107 kWh/yr
Money saved per year from energy savings: 107 kWh/yr * $0.3177/kWh = $33.99/yr

Payback period: 22.8 years

[21] http://www.kouba-cavallo.com/cgi-bin/refrigsearch.exe?type=0&brand=56&model=TT18DKXRQ02

[22] http://www.homedepot.com/p/18-1-cu-ft-Top-Freezer-Refrigerator-in-Pearl-ENERGY-STAR/205557276

Refrigerator #5: Custodian Room



Kirkland, Model #ST14CKXKQ03
Year, 2004 Energy Rating: 438 kWH/yr[23] (No change in adjusted rating)
14.4 cu. ft.

Fridge seal condition: Good

Condenser coils were behind the refrigerator in a tightly arranged space, and thus were not analyzed so as not to disturb the area.

Potential replacement refrigerator: Frigidaire 16.3 cu. ft. Top Freezer Refrigerator in White, Energy Star
Energy Consumption: 348 kWh/yr[24]
Cost: $649.00 - $125 Hawaii Energy rebate: $524

Energy savings per year: 438 kWh – 348 kWh = 90 kWh/yr
Money saved per year from energy savings: 90 kWh/yr * $0.3177/kWh = $28.60/yr

Payback period: 18.3 years.

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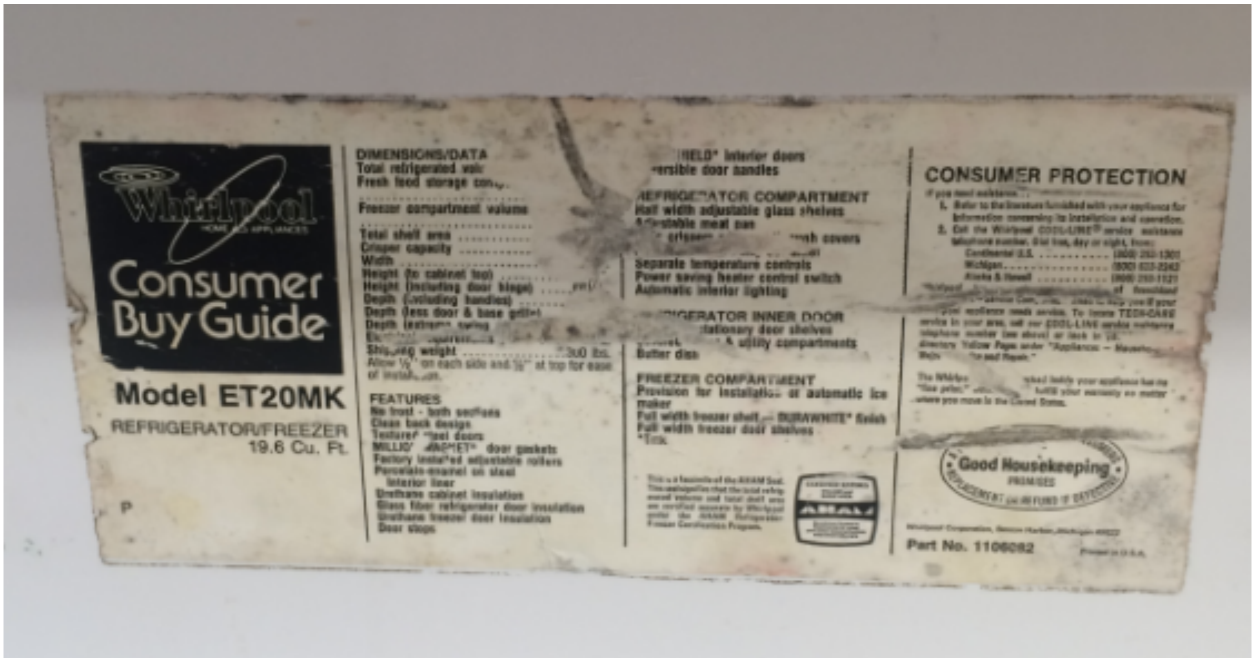
23 http://www.kouba-cavallo.com/cgi-bin/refrigsearch.exe?type=0&brand=104&model=ST14CKXKQ02

24 http://www.homedepot.com/p/Frigidaire-16-cu-ft-Top-Freezer-Refrigerator-in-White-ENERGY-STAR-FFHT1621QW/205463584

Refrigerator #6: Upper D classroom



Whirlpool, Model #ET20MKXPWR0
Year, 1986, 1987 Energy Rating: 1140 kWH/yr
Adjusted Energy Rating for age: 1482 kWh/yr[25]

[25] http://www.kouba-cavallo.com/cgi-bin/refrigsearch.exe?type=0&brand=185&model=ET20MKXPWRO

19.6 cu. ft.

Fridge seal condition: Good

Condenser coils were behind the refrigerator in a tightly arranged space, and thus were not analyzed so as not to disturb the area.

Potential replacement refrigerator: Frigidaire Gallery 20.4 cu. ft. Top Freezer Refrigerator, Energy Star
Energy Consumption: 386 kWh/yr[26]
Cost: $899.00 - $125 Hawaii Energy rebate: $774

Energy savings per year: 1482 kWh – 386 kWh = 1096 kWh/yr
Money saved per year from energy savings: 1096 kWh/yr * $0.3177/kWh = $348.20/yr

Payback period: 2.2 years

[26] http://www.homedepot.com/p/Frigidaire-Gallery-20-4-cu-ft-Top-Freezer-Refrigerator-in-Pearl-ENERGY-STAR/205557279

Survey Research

Methodology

The survey was administered by Pono Home staff in person using a tablet and allowing teachers and staff to use the device to type in responses. Pono Home staff simultaneously engaged teachers and staff in informal conversations to solicit less systematic suggestions, ideas and insights.

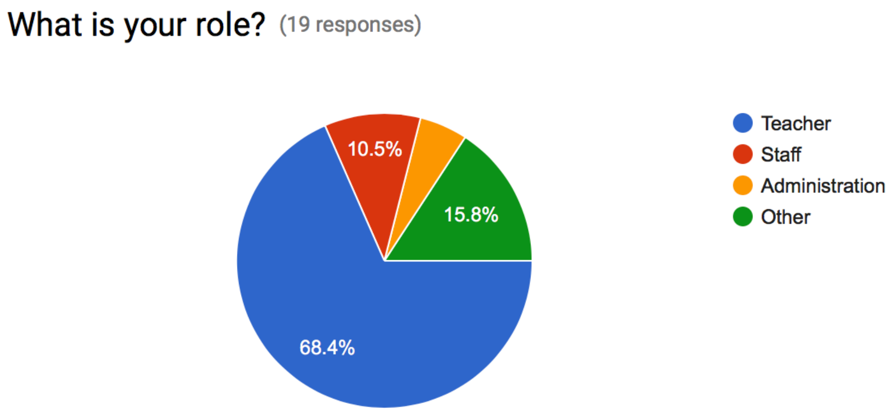
The survey consisted of 10 questions, and took approximately 4-7 minutes to complete per survey. The survey questions were:

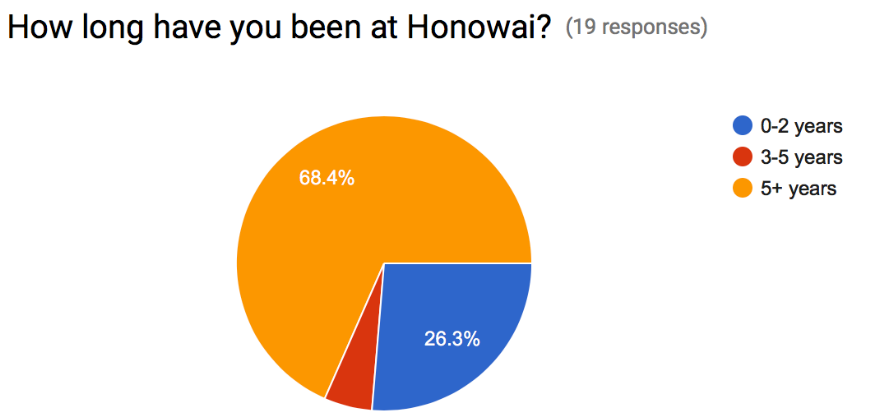
1. How would you rate your level of understanding of concepts of sustainability like energy efficiency, recycling, composting, etc.?
2. Which one of these concepts would you like to learn more about?
3. How do you think the school is currently doing in energy efficiency and conservation?
4. What do you think could be done to help the school save energy?
5. What do you think the school administration can do to get students and staff more engaged in creating a sustainable campus?
6. What do you think are the barriers to adopting better practices in energy conservation?
7. What is your role?
8. How long have you been working at Honowai?
9. Would you like to be contacted to become part of a campus green team, and/or to learn more about the topics above?
10. If you'd like to be contacted, please provide your contact info.

Sample Set and Results

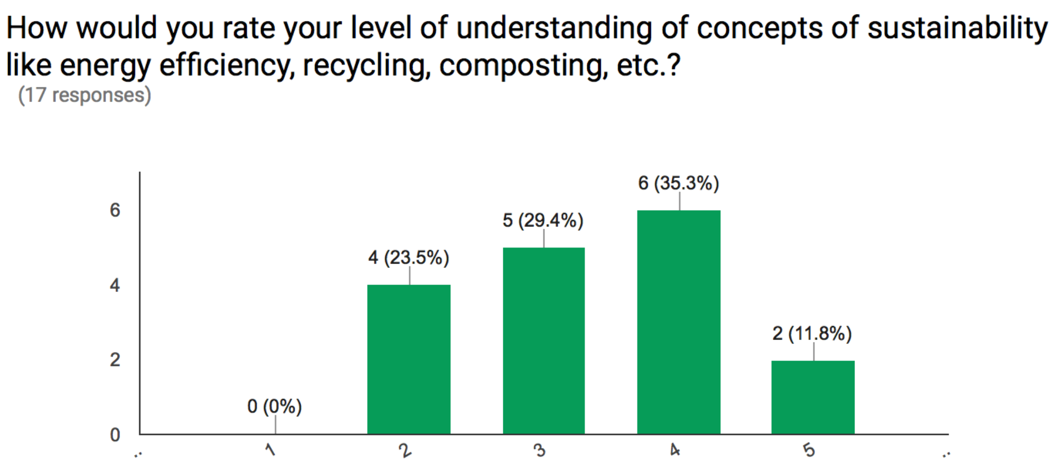
19 Honowai Elementary School employees completed the survey. The respondents consisted of teachers, staff, administrators, and other employees, and the respondents were asked how long they had been working at the school. The majority of respondents were teachers (68.4%) and most respondents (68.4%) had been working at the school for 5 years or longer.

Question 1. Respondent Roles and Career Length at Honowai Elementary School.

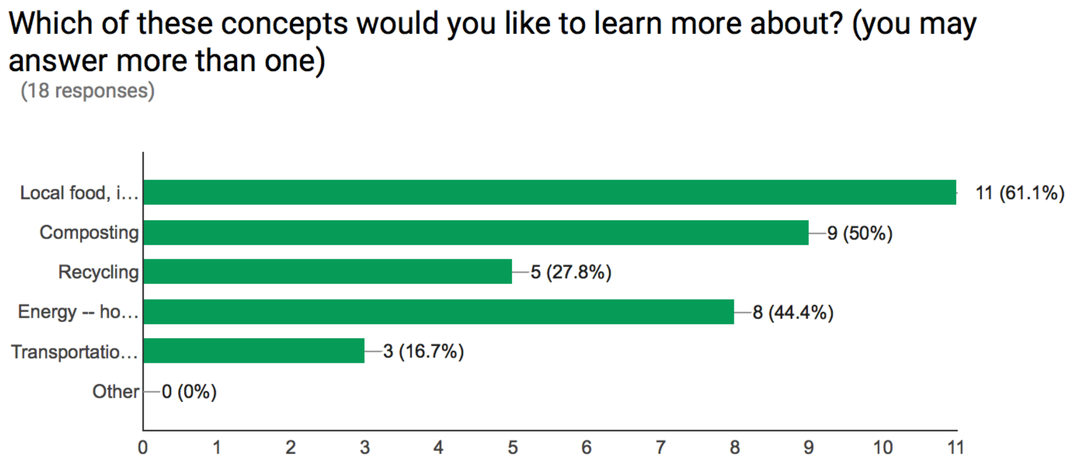




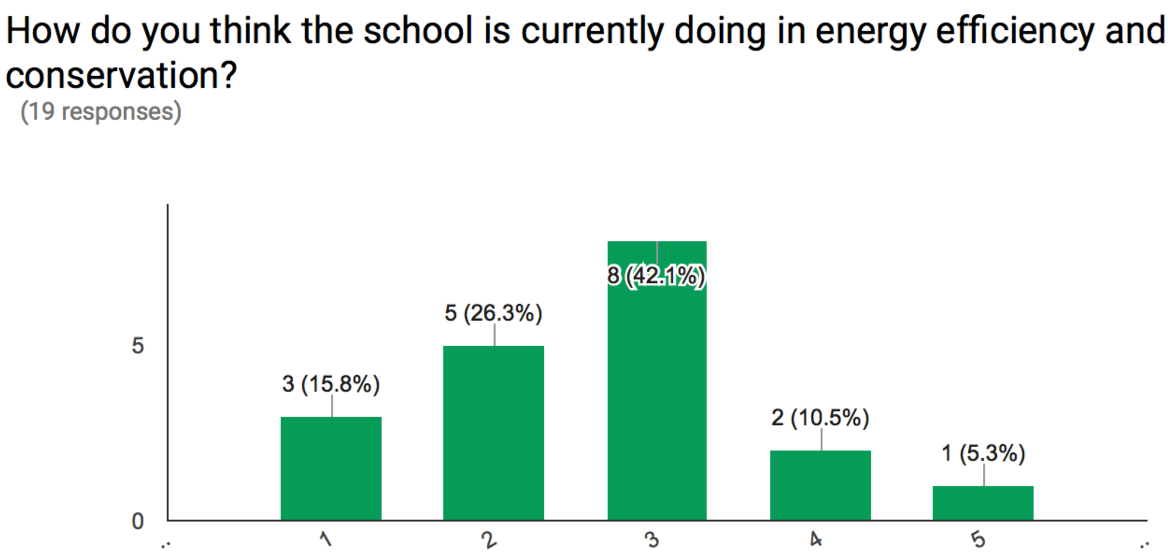
Question 2. Understanding of Sustainability Concepts, from 1 – very little to 5- thoroughly immersed.



Question 3. What sustainability topic interests Honowai staff the most for future learnings. Answers were Local food, including school garden programs; Composting; Recycling; Energy—how it's produced, how it's used and how we can do it better; Transportation alternatives (biking / bike lanes, safe streets, "walking school buses", ride pools, public transit, carshare, etc.)



Question 4. Energy Efficiency and Conservation. Answers from 1 – needs improvement to 5- very well.



Question 5. Energy Conservation Recommendations.

What do you think could be done to help the school save energy? (15 responses)

Have more energy star things like coffee makers,
Maybe using less electricity.
Awareness
Turn off electronics when not in room
Turn off all electronic devices, etc. when not in use
Turn off lights when not in use.
Changing to solar and using LED lighting
Motion sensor lighting
The improvements that are currently happening.
Efficient lighting
PV, energy efficient lighting
Composting
Solar energy, information on ways to save energy as a school
To educate the staff and students to pr
Use more electronic or online resources instead of relying on hardcopies, printing 2-sided, reusing 1-sided printed paper, finding new homes for unwanted items, etc.

Question 6. Barriers to Energy Conservation.

What do you think are the barriers to adopting better practices in energy conservation?
(14 responses)

Cost
Cost
Laziness
Not enough time for teachers, not enough money
People are used to old ways
Inform the staff/students how important it is to conserve energy
Understanding
Money.
Lack of knowledge
Expensive
Money, time, resources
Time, money
To provide information or a space for students to compost, recycle, and gardening.
Unsure.

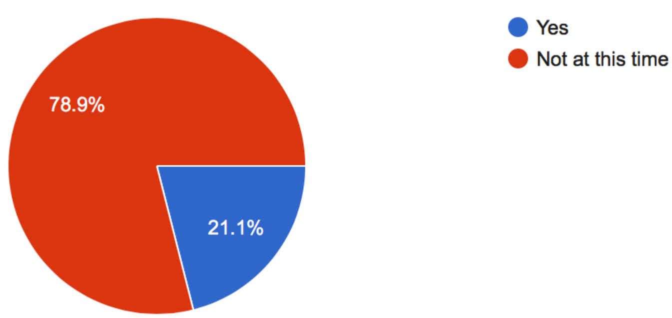
Question 7. Creating a More Sustainable Campus.

What do you think the school administration can do to get students and staff more engaged in creating a sustainable campus?
(14 responses)

Contests
Maybe starting lessons on sustainability
Awareness
Provide more activities regarding to the necessary resources
More projects
Teaching them in class so they understand about sustainable energy
Don't know
Discuss the importance of sustainability.
Awareness to school
Information sessions
Videos, performances to educate students
Show examples of what other schools are doing that create this environment
To provide an area where it would be visible for students to see and partake in.
Educate students from a younger age.

Question 8. Interest in Creating a Campus Green Team.

Would you like to be contacted to become part of a campus green team, and/or to learn more about the topics above?
(19 responses)



Survey Analysis and Key Takeaways

Survey respondents were generally longer tenured staff and people who describe their knowledge of sustainability issues on the higher end of the scale. This suggests that these staffers would tend to have a fairly high level of understanding about Honowai's energy and other sustainability challenges, which lends some degree of credibility to their suggestions for improvement and what would work at Honowai.

When asked about barriers to implementation of sustainability measures, half (7 of 14) of respondents replied that financial resources were the primary challenge. Just shy of half (5 of 14) suggested that more education was needed for stakeholders at the school.

It is clear that the main suggestion for making potential improvements (besides the LED lighting and the suggestion for installing solar, which are already happening) revolves around education and getting people knowledgeable and empowered to act. This is in alignment with our general takeaway from our informal in-person interviews, where we found virtually all staffers were very interested in talking to us about sustainability issues, and learning more about plugloads, LEDs, and other aspects of energy use.

The key learnings we got from our informal conversations were that some teachers and staff are highly engaged but others were less so. Several people mentioned that they were very good about turning lights and electronics off when they leave the room, while others are less so.

Recommendations

1. **Support project – based learning and best practices from other DOE schools.** The clearest takeaway from our survey and informal conversations with Honowai Elementary teachers and staff is the need for more education in terms of energy literacy. It was also clear that respondents enjoy project-based and hands-on learning and feel these approaches are very effective for students and teachers alike. There are many energy-based projects of this type that could be implemented. Having real-life examples of these will be important in order to scale this approach across the DOE.
2. **Remove and/or replace the less efficient full-sized refrigerators.** The full-sized fridge analysis provides insight into potential upgrades. The best case scenario is simply to consolidate the full-sized refrigerators on campus and eliminating the biggest energy users, if possible. Our recommendation for a priority order of removal or replacement of the full-sized fridges on campus is to look into replacing the Whirlpool in Upper D first and the Magic Chef in the Health Room second.
3. **Establish and/or enforce a minifridge policy.** Minifridges found on campus are using a substantial amount of energy. We were unable to determine whether there can be some consolidation of these minifridges, or the placement of full-sized fridge that teachers can use in aggregate rather than having their own minifridge, but some consolidation and elimination of these minifridges would benefit the energy conservation initiative at Honowai.
4. **Implement low-hanging water efficiency fruit.** Faucet fixtures can be installed across campus that will save substantial water without much up-front cost or change in user experience.
5. **Verify vampire power and address plugloads.** While our assessment provides a "snapshot" of vampire power and plugload energy use, we recommend training a campus IT person to analyze vampire power and plugload burdens, as these are the people who will be helping set up electronics across campus. These employees could make a workshop and/or a plugload sweep a regular part of their job (once per quarter, for instance). This would give them an opportunity to identify and reduce energy waste, as well as a reason to interact, engage, and educate with other school employees to bring energy conservation awareness to the forefront on a somewhat regular basis. We highly recommend making participation in this type of practice voluntary, such that no employees are caught off guard by an investigation into energy use at their desk, and such that their buy-in is gained ahead of time. One way to show the multiple benefits in sustainability approaches is to make a case study out of Keurigs. In addition to their reputation for being energy wasters, Keurigs are also notorious for generating significant amounts of unrecyclable, uncompostable solid waste (from single-use cups). Removing Keurigs and replacing them with electric kettles / French Presses or traditional coffee pots can reduce substantial energy from campus as well as reduce solid waste. Waste issues came up fairly frequently in the survey, indicating it may be one of the bigger concerns among staff at the campus.
6. **Create a system for powering down fans.** Simply turning off fans when no one is around to be cooled by them will save Honowai a lot of energy. This type of program can be run in tandem with the campaign to turn off lights when people leave rooms so as to capitalize on an existing program with a similar goal/mindset.

7. **Empower local champions.** The best approach to system change usually involves finding and supporting local/internal champions. After analyzing survey results and comparing them to informal, in-person discussions that two of our team had with a wide variety of staff members at Honowai, we believe that significant gains can be made through educational programs and project-based learning. We received contact information for 5 staff members who were interested in becoming part of a campus "green team", and suggest that this group be contacted and supported in creating a campus hui that can lead the charge with regard to further greening Honowai. School gardens have become very popular in Hawaii, as places for students to learn about where their food comes from, and to have a fun and productive activity to engage in while learning. An "energy laboratory" demonstration on campus is one potential option for making a hands-on activity for students and teachers. A much smaller and mobile "energy kit" could also be developed, stored with the IT person and available for check-out by students and faculty. In either a fixed asset laboratory or a mobile kit type of case, a programmatic lesson plan to allow teachers to bring energy awareness curriculum into their classrooms would likely expedite the learning process substantially. We recommend working with the Kōkua Hawaii Foundation (KHF), which has materials and support staff to help with just such a program. KHF is a 501(c)3 non-profit organization that supports environmental education in the schools and communities of Hawaii, whose mission is to provide students with experiences that will enhance their appreciation for and understanding of their environment so they will be lifelong stewards of Hawaii and the Earth. From conversations with KHF staff, we have determined that they currently don't have programs covering energy literacy, but are interested and could be a powerful potential partner in expanding these programs and developing lesson planning and other support materials for them. Interested teachers can even submit an application for a mini-grant ($1,000) KHF has designed for just such a purpose[27]. Pono Home would be happy to support this effort with technology applications designed to improve the energy literacy across the campus as well.
8. **Identify those that need help the most.** It is likely that, as several teachers mentioned, some staff are highly engaged in sustainability and therefore don't need the reminders to turn off lights and electronics when they leave classrooms as much as some others do. Perhaps the use of sensors to identify classrooms that are frequently powered on when unoccupied will help identify the teachers and staff that need more training and support to participate in conservation activities and habits.

[27] http://kokuahawaiifoundation.org/minigrants

Appendix A
Product Specifications and Warranty Information

Power Down Timers

Technical Specifications

USA/CAN: 125V/60Hz: 15A resistive,5A tungsten,1/2HP,TV-5: 1875W
EU 230V/50HZ 16(4)A 3680W
UK 240V/50HZ 13A 3120W
Extra large LCD screen makes PowerDown easy to read without glasses
On-Off green and red indicator lights
Reset button - resets the factory setting
Water-resistant and Fire-resistant
Easy to use five, six or seven-day digital settings with 24-hour clock to avoid any am/pm confusion.
Specialized for the water/chilling machine industry

http://www.powerdowntimer.com/product

TrickleStar®

7 OUTLET ADVANCED POWERSTRIPS

Premium quality, fireproof surge protection and reduces vampire / standby power consumption of PC and TV peripherals

OVERVIEW

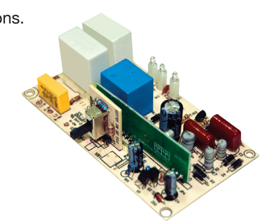
The Advanced Powerstrips (APS) provide premium quality, fireproof surge protection for PC and TV peripherals. They also reduce the amount of vampire / standby energy consumed by PC and TV peripherals. Each APS has inbuilt current sensing circuitry with 2 different switching thresholds to sense when a Control Device (typically a TV or PC) is On or Off / Standby and to then switch On / Off selected Outlets. Easy to install and provides simple automation to reduce wasteful standby energy consumption. Suitable for residential and workplace applications.

KEY FEATURES

- 7 Outlets
    - 1 Control Outlet
    - 2 Always On Outlets (1 outlet transformer spaced)
    - 4 Switched Outlets (1 outlet transformer spaced)
- Selectable switching thresholds 10W / 22W / 42W
- 15A resettable circuit breaker.
- **144,000 Amps / 2160 Joules**
- Ceramic Surge Protection
- LED Status Indication (Ground, Surge Status, Control, Switched Outlets)
- Tel (RJ11) / Data (RJ45) combo surge protection - optional
- Coaxial surge protection - optional
- <40dB noise filtering.
- Angled space saver plug

FIREPROOF SURGE PROTECTION

Traditional surge suppression products use standard MOV (Metal Oxide Varistor components). TrickleStar APS' incoporate advanced surge protection technology. The MOVs are encased in a ceramic casing and are capable of suppressing more energy and dissipating heat faster than traditional MOVs. More importantly the ceramic casing is fireproof and is capable of preventing fire during abnormal surge conditions.



PRODUCT WARRANTY

Lifetime product warranty

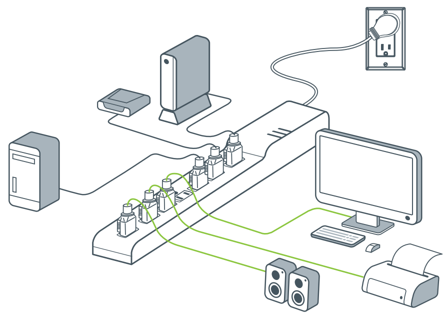
$20,000 connected equipment warranty (181SS product)

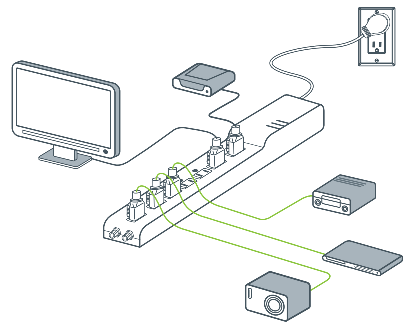
$20,000 connected equipment warranty (180SS product)

TrickleStar®

7 OUTLET ADVANCED POWERSTRIPS

APPLICATION DIAGRAMS





ELECTRICAL SPECIFICATIONS

FOR INDOOR USE

Voltage	120 VAC +/- 10% 60Hz
Power Rating	15A
Switching Thresholds	10W / 22W / 42W
Surge protection	72,000 Amps / 1080 Joules 144,000 Amps / 2160 Joules
Noise Filtering	<40dB
Tel Connectors	RJ11
Coaxial Connectors	F-Type (gold plated)
Standby Power Consumption	<1 Watt

PHYSICAL SPECIFICATIONS

Operating Temperature	32° to 113° F
Storage Temperature	14º to 140º F
Humidity	5 to 90% N/C
IP Rating	IP20

*SAVINGS

Typical savings are $38 / year with a product lifetime of at least 10 years delivering savings of $380 dollars. Savings can be higher or lower depending on the type of devices connected, hours of use and the price of power. For a more accurate calculation please visit:

www.calculator.tricklestar.com

APPROVALS

Conformity to product standards for safety and EMC.
UL (US & Canada)
2002/95/EG (RoHs)
2002/96/EC (WEEE)
1999/5/EC (RTTE)

ORDERING INFORMATION

180SS-US-7XX	7 Outlet Advanced Powerstrip, 2160 Joules Surge Protection, 4ft Power Cord
180SS-US-7CX	7 Outlet Advanced Powerstrip, 2160 Joules Surge Protection, Coax Surge Protection, 4ft Power Cord
180SS-US-7XT	7 Outlet Advanced Powerstrip, 2160 Joules Surge Protection, RJ11/45 Secondary Protection, 4ft Power Cord
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181SS-US-7XX/3	7 Outlet Advanced Powerstrip, 1080 Joules Surge Protection, 3ft Power Cord, plain cardboard packaging

RoHS COMPLIANT

c UL US LISTED

REV 8/24/15