DAVID Y. IGE
GOVERNOR

DR. CHRISTINA M. KISHIMOTO
SUPERINTENDENT

STATE OF HAWAI`I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI`I 96804

OFFICE OF THE SUPERINTENDENT

December 21, 2017

The Honorable Ronald D. Kouchi, President
and Members of the Senate
State Capitol, Room 409
Honolulu, Hawaii 96813

The Honorable Scott K. Saiki, Speaker
and Members of the House of Representatives
State Capitol, Room 431
Honolulu, Hawaii 96813

Dear President Kouchi, Speaker Saiki and Members of the Legislature:

For your information and consideration, I am transmitting a copy of the Sustainable Schools Initiative, pursuant to Section 302A-1510, Hawaii Revised Statutes ("HRS"). In accordance with Section 93-16, HRS, I am also informing you that the report may be viewed electronically at: http://www.hawaiipublicschools.org/VisionForSuccess/SchoolDataAndReports/StateReports/Pages/Legislative-reports.aspx.

Sincerely,

Dr. Christina M. Kishimoto
Superintendent

CMK:mt
Enclosure

c: Legislative Reference Bureau
Office of School Facilities and Support Services

State of Hawaii
Department of Education

Annual Report on the Department of Education's Sustainable Schools Initiative 2018

December 21, 2017

Section 302A-1510, Hawaii Revised Statutes (HRS), Sustainable Schools Initiative, requires the Department of Education (DOE) to report annually on: 1) the progress toward its net-zero energy goal, 2) plans and recommendations to advance its net-zero goal; and 3) any challenges or barriers encountered or anticipated by the DOE in meeting its net-zero energy goal.

Annual Report on the Department of Education's Sustainable Schools Initiative 2018

Act 176, SLH 2016, established Section 302A-1510, Hawaii Revised Statutes (HRS), *Sustainable Schools Initiative*. The purpose of the Act was to accelerate the goals of the Department of Education (DOE) to cool Hawaii's schools, reduce energy costs, meet Hawaii's clean energy goals, and provide all students with better classrooms in which to learn. Act 176 also requires the DOE to report annually on the following: 1) The overall progress toward the net-zero energy goal set forth in Section 302A-1510(a), HRS; 2) Its plans and recommendations to advance the net-zero goal set forth in Section 302A-1510(a), HRS; and 3) Any challenges or barriers encountered or anticipated by the DOE in meeting the net-zero energy goal set forth in Section 302A-1510(a).

(1) OVERALL PROGRESS TOWARD THE NET-ZERO ENERGY GOAL SET FORTH IN SECTION 302A-1510(a), HRS:

Hawaii School Facilities Energy Report
Comparison of FY 2016 & FY 2017

	FY 2016		FY 2017	
School Facilities Energy	kWh	$	kWh	$
Utility Energy [1]	138,749,065	$ 36,765,519	130,325,145	$ 35,186,085
Renewable Energy	7,364,016	$ 1,621,222	12,617,152	$ 2,751,253
Total Energy	146,113,081	$ 38,386,741	142,942,297	$ 37,937,338

[1] Utility Energy includes Hawaiian Electric Company, Hawaii Electric Light Company, Kauai Island Utility Cooperative, and Maui Electric Company.

The Year-Over-Year percentage changes and the Percent of Total Energy are provided in the tables below:

	YOY Change (%)		Percent of Total Energy (kWh)	
School Facilities Energy	kWh	$	FY 2016	FY 2017
Utility Energy	-6%	-4%	95%	91%
Renewable Energy	71%	70%	5%	9%
Total Energy	-2%	-1%	100%	100%

LIGHT-EMITTING DIODE (LED) AND AIR CONDITIONING REPLACEMENT PROGRAMS:

As described in last year's report, energy efficiency is a major component of the Sustainable Schools Initiative. In this regard, the DOE has embarked on two programs designed to reduce energy consumption by 38 million kilowatt hours (kWh), with electric bill savings over $10 million, in the first year as estimated by Hawai'i Energy (a ratepayer funded energy conservation and efficiency program administered by Leidos Engineering, LLC, under contract with the Hawaii Public Utilities Commission

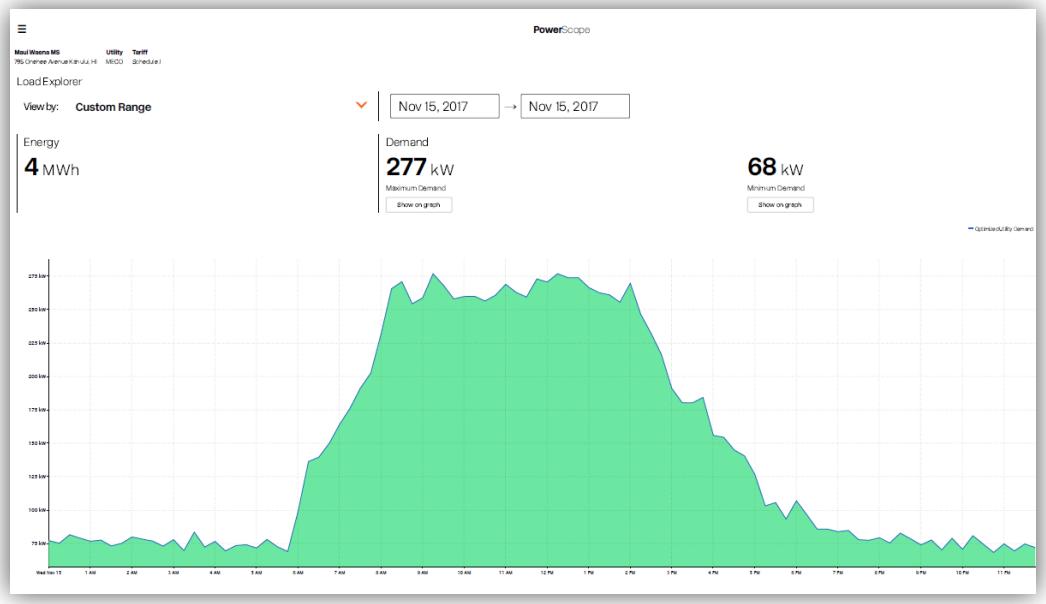
serving the islands of Hawaii, Lanai, Molokai, Maui, and Oahu). The first program is well underway and will replace all lighting at Hawai'i public schools with LED bulbs. The second program will replace many of the oldest and least efficient air conditioning systems with higher efficiency systems.

ENERGY EFFICIENCY SOFTWARE PROJECTS:

Working with DataHouse (a private technology consultancy company), the DOE is developing project management, construction management, and payment processing software that will enable the efficient and effective management of the projects described above.

SCHOOL SITE-ENGAGED ENERGY-SMART (SEES) PROGRAM:

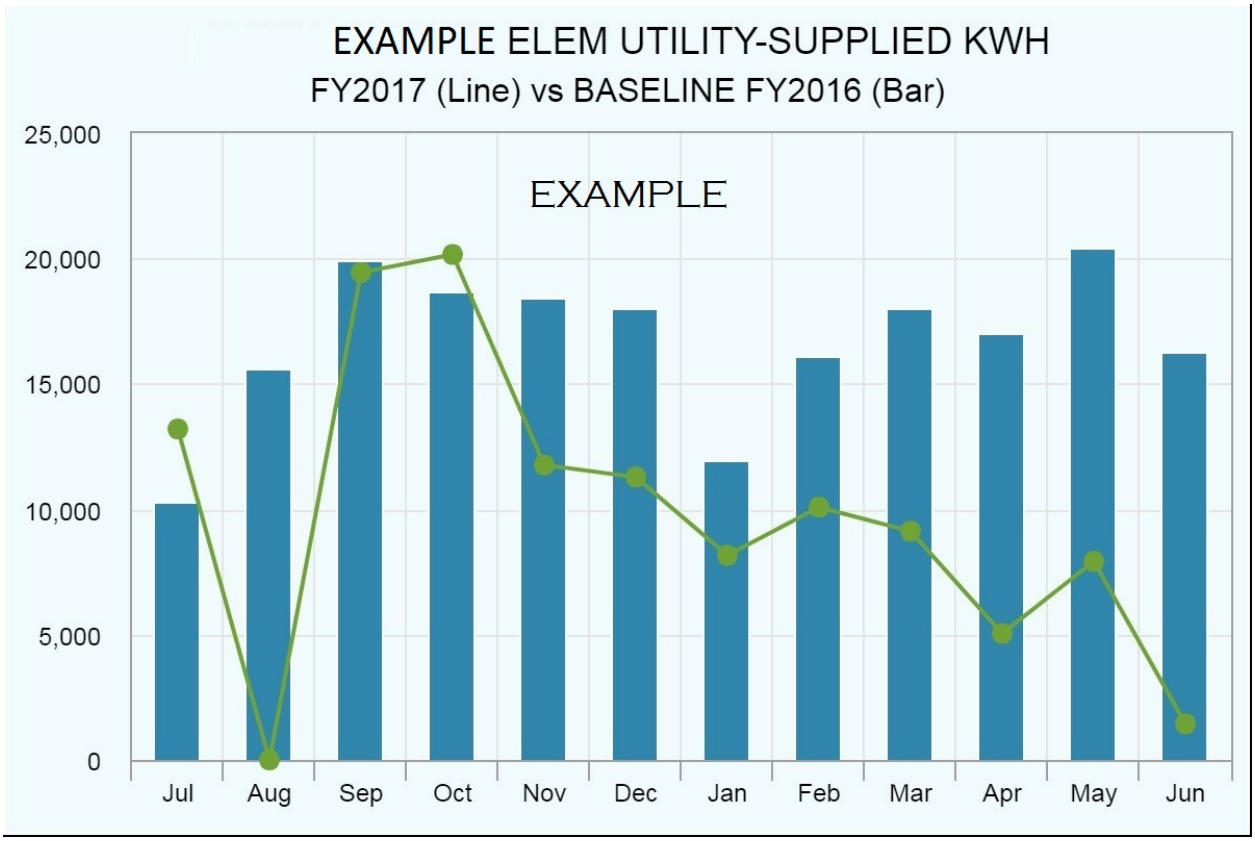
Working with Hawaiian Electric Company and Stem, Inc. (a private energy technology services company), the DOE will soon have Stem Powerscope power monitoring systems installed at all schools. Utilizing these systems, school staff and students are able to access live data on school energy usage. The program will also install Ibis Networks Plug Load Management Systems at 60 schools to enable control of energy usage at the plug level. A portion of this work is being funded by customer contributions to Hawaiian Electric Company's Smart Power for Schools Program (SmPS).



Powerscope Load Explorer page

ENERGY MANAGEMENT DATA:

The DOE now provides a Featured Resource (School Electricity Usage) on the Office of School Facilities and Support Services, Auxiliary Services Branch page at the HIDOE intranet portal to make energy usage data available to school staff. The resource may also be accessed directly through any web browser by bookmarking the URL (https://c0abs669.caspio.com/dp/c8ad5000dc870a51a1a84108b98b). Greater accessibility to this information will help all DOE personnel to better understand how energy consumption behavior impacts the electric bills.



Typical School Electricity Usage chart showing the impact of PV solar

(2) PLANS AND RECOMMENDATIONS TO ADVANCE THE NET-ZERO ENERGY GOAL SET FORTH IN SECTION 302A-1510(a), HRS:

PLANS FOR FUTURE NET-ZERO ENERGY CAMPUS (NZEC) DEVELOPMENT:

Current high costs of the technology to implement NZEC strategies, compounded by uncertainties in the longevity of current technology models, have inspired the DOE to adopt a measured approach to achieving the Net Zero goal.

In the initial stage of the Sustainable Schools Initiative, the DOE's focus will be on energy efficiency and conservation due to the well-developed market, with many financing options and more cost-effective savings of these measures. This focus seeks to buy time by accumulating savings from energy efficiency while developing organizational skills in anticipation of escalating developments in the distributed renewable energy resources and energy storage technologies that will probably comprise the bulk of the microgrid systems installed on net-zero energy campuses.

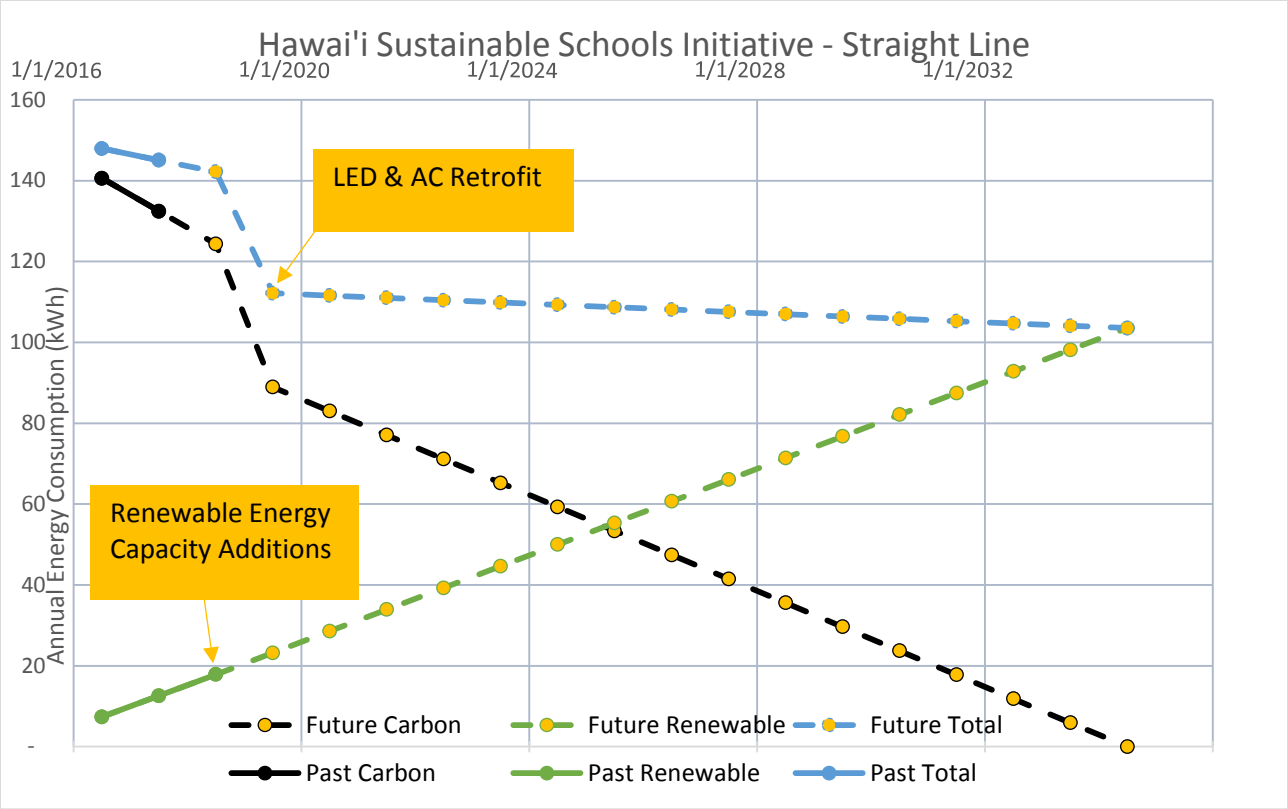
The microgrid market is still in an early stage of development. In this market infancy, financing options are limited due to the unfamiliarity of financial providers with the technologies. Moreover, the grid services market, which can help to mitigate the costs of microgrid adoption, is still nascent.

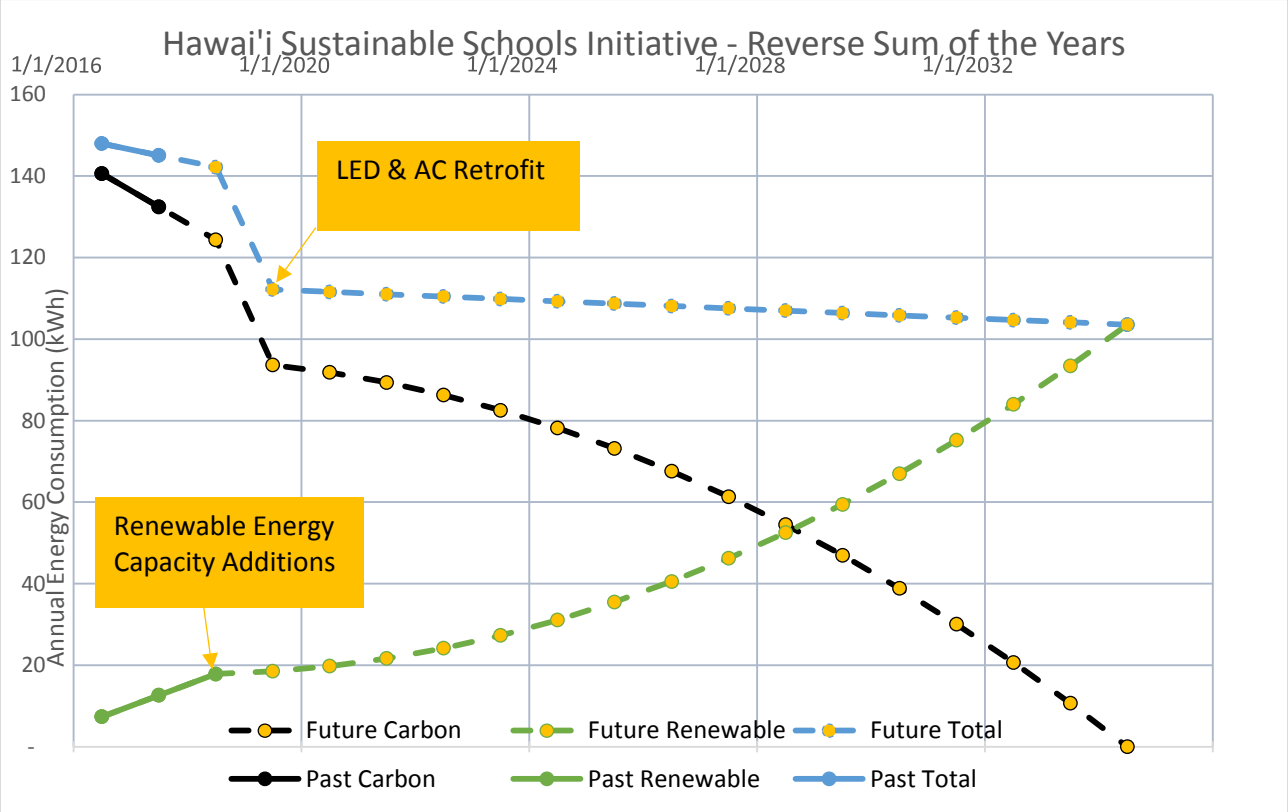
The DOE intends to follow in the wake of the early pioneers. For example, the State of California is conducting various projects to develop microgrid standards, evolve the technologies and grow industry experience and best practices. Although the goal of net-zero energy schools is admirable, it should not be achieved by placing the DOE's primary mission at economic risk.

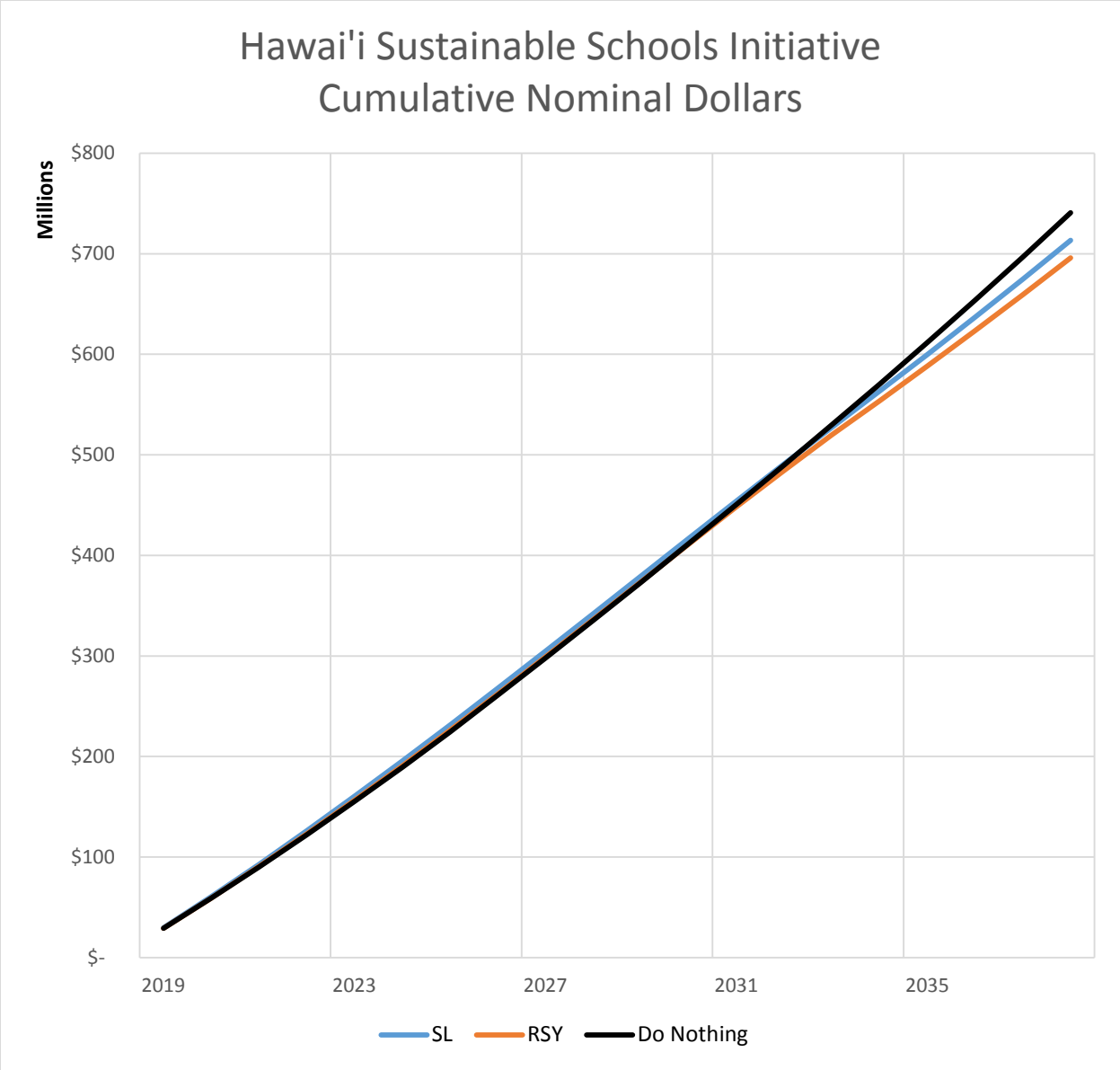
Rather than the straight-line (SL) program schedule advocated in last year's report, current plans for future development will start out slow and accelerate as institutional experience and technological cost reductions lead to higher returns on investment. Although early microgrid development will be more muted than in the SL approach, the net-zero goal will still be achievable within the allotted time frame by taking what may be described as a "Reverse Sum of the Years" (RSY) approach.

Both approaches achieve the same end, but the RSY development approach takes advantage of the propensity of technology and organizations to improve over time during periods of rapid change.

The charts below compare the two approaches:


Hawai'i Sustainable Schools Initiative - Straight Line
1/1/2016
1/1/2020
1/1/2024
1/1/2028
1/1/2032
160
140
120
100
80
60
40
20
-
Annual Energy Consumption (kWh)
LED & AC Retrofit
Renewable Energy Capacity Additions
Future Carbon
Future Renewable
Future Total
Past Carbon
Past Renewable
Past Total


Hawai'i Sustainable Schools Initiative - Reverse Sum of the Years
1/1/2016
1/1/2020
1/1/2024
1/1/2028
1/1/2032
160
140
120
100
80
60
40
20
-
Annual Energy Consumption (kWh)
LED & AC Retrofit
Renewable Energy Capacity Additions
Future Carbon
Future Renewable
Future Total
Past Carbon
Past Renewable
Past Total



As this last chart makes clear, the RSY development approach winds up being cheaper due to lower installed technology costs, as well as lower operations and maintenance costs.

One other fact can be gleaned from this last chart. Over time, either path to net-zero will ultimately cost less than continuing to operate in a non-sustainable manner.

(3) CHALLENGES OR BARRIERS ENCOUNTERED OR ANTICIPATED IN MEETING THE NET-ZERO ENERGY GOAL SET FORTH IN SECTION 302A-1510(a), HRS:

CHALLENGES AND BARRIERS:

Financing heat abatement

A major challenge to executing the Sustainable Schools Initiative was mitigated by the recent passage of HB957, HD1, SD2, CD1, which became Act 57, SLH 2017. That legislation provided $46,400,000 in loans from the Hawaii Green Infrastructure special fund for the DOE to finance installation costs related to heat abatement at public school. This funding source is anticipated to be fully encumbered by June 30, 2018 so additional funding sources need to be identified to continue the work.

Project and contract management

Managing dozens of contracts and projects, valued in the hundreds of millions, over a span of 17 years will require the DOE to develop skills and information systems in order to achieve an extraordinary level of efficiency and effectiveness. The DOE is developing plans for a sustainable facilities project and contract management system that will streamline and improve on the existing systems planning, contracting and management processes.

Financing the maintenance of DOE-owned energy production and storage facilities

One major area of concern is the maintenance of equipment installed to create net-zero campuses. During its lifetime, this equipment will require planned and predictive maintenance in order to perform optimally as designed. Under Power Purchase Agreements, the equipment is owned, operated and maintained by private party financing agencies. However, models of development that result in DOE ownership of the equipment will require the development of budgeting and financing mechanisms within the DOE to ensure the maintenance of this equipment over its lifetime.

Rebound effect

In all conservation programs, there is a well-recognized phenomenon known as the rebound effect. Due to behavioral and organizational responses, the rebound effect results in realized savings that are less than the full potential savings. Mechanisms to combat the rebound effect are discussed below.

1. **Data monitoring and consolidation**

   Providing users and administrators easy access to continuous live information on energy usage and control over their energy environment leads to improved behavioral response to energy conservation and efficiency efforts. A major component in the DOE's plans is to introduce continuous live monitoring, information delivery and awareness programs.

   The DOE will be working with Natural Resources Canada, an agency of the Canadian government, to utilize the RETScreen Expert software to conduct renewable energy technology feasibility studies and continuous energy performance tracking on all Hawaii school facilities. RETScreen Expert provides access to the National Aeronautics and Space Administration (NASA)

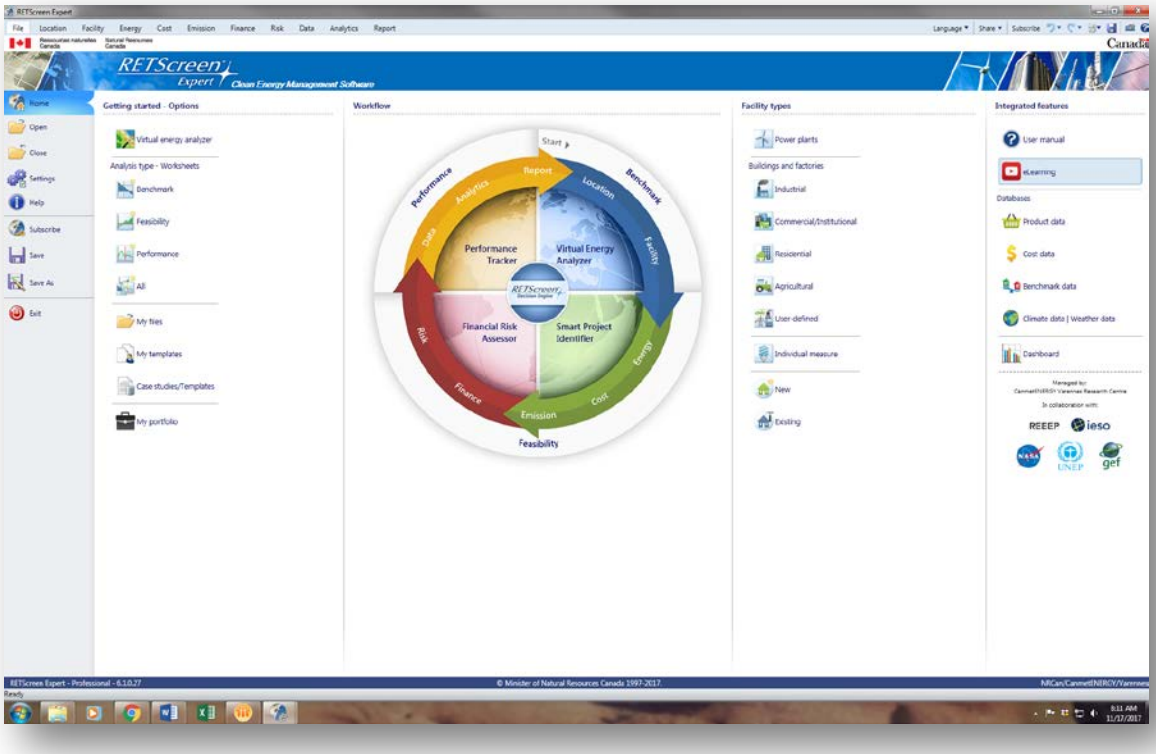
climate and weather data, as well as cost and technical specifications from an extensive technology database. RETScreen Expert has a portfolio analysis mode that aggregates performance data from individual sites to provide perspectives by region and facility type. An automated report generator can produce different report versions each aimed at a specific stakeholder group.

2. Automated control systems

Automating control of energy systems at school facilities can have savings benefits that far exceed the cost of these systems. Most energy waste comes about because human control over long term periods can be uncertain and difficult to maintain.

3. Hiring and training of personnel

Conservation efforts must involve staff hiring and training programs that make energy conservation an integral part of every facilities-related position in the DOE.



RETScreen Expert analysis launch screen

RETScreen - Location **Subscriber: Hawaii State Department of Education - Professional**

Site reference conditions

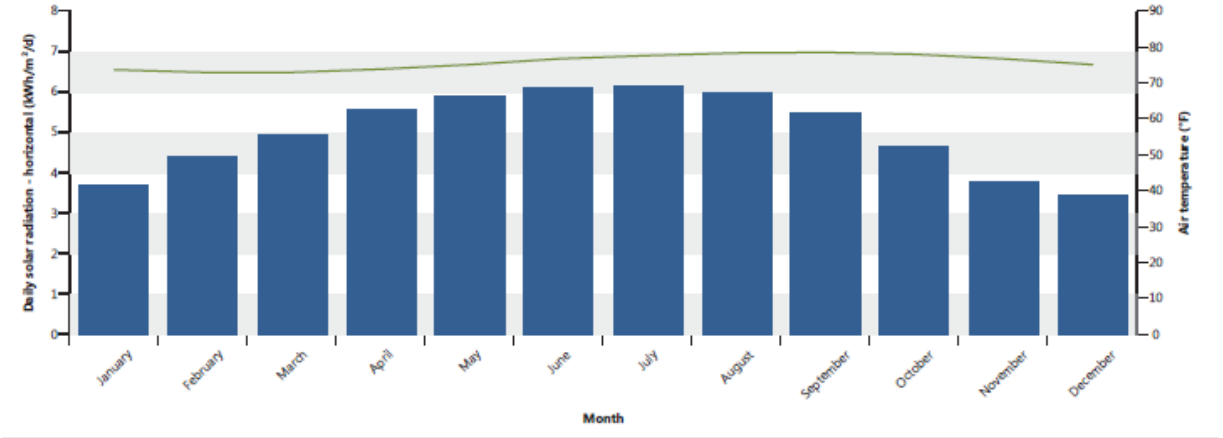
Climate data location: United States of America - Hawaii - Wheeler AFB 810.1 | Facility location: United States - HI - Haleiwa

Legend
- Facility location
- Climate data location

	Unit	Climate data location	Facility location	Source
Latitude		21.5	21.7	
Longitude		-158.0	-158.0	
Climate zone		1B - Very hot - Dry		NASA
Elevation	ft	827	49	Ground – Ground
Heating design temperature	°F	68.9		NASA
Cooling design temperature	°F	79.9		NASA
Earth temperature amplitude	°F	2.7		NASA

Month	Air temperature	Relative humidity	Precipitation	Daily solar radiation - horizontal	Atmospheric pressure	Wind speed	Earth temperature	Heating degree-days 64.4 °F	Cooling degree-days 50 °F
	°F	%	in	kWh/m²/d	in Hg (0°C)	mph	°F	°F-d	°F-d
January	73.8	70.9%	1.85	3.68	30.0	12.8	75.8	0	737
February	73.0	71.2%	1.59	4.41	30.0	12.2	75.2	0	645
March	73.0	72.3%	2.19	4.96	30.0	14.1	75.3	0	714
April	73.9	72.8%	0.76	5.58	30.0	13.7	75.7	0	718
May	75.2	73.6%	0.49	5.91	30.0	12.8	76.7	0	781
June	76.8	73.9%	0.29	6.13	30.0	13.4	78.0	0	805
July	77.7	74.9%	0.36	6.16	30.0	13.4	78.7	0	859
August	78.4	75.0%	0.67	5.97	30.0	12.7	79.6	0	882
September	78.6	74.7%	0.43	5.51	29.9	11.0	80.3	0	859
October	78.1	74.2%	1.42	4.67	30.0	11.5	80.0	0	870
November	76.8	73.3%	1.91	3.78	30.0	13.0	78.7	0	805
December	75.2	71.1%	2.53	3.46	30.0	13.1	77.0	0	781
Annual	**75.9**	**73.2%**	**14.50**	**5.02**	**30.0**	**12.8**	**77.6**	**0**	**9,456**
Source	NASA	NASA	NASA	Ground	NASA	NASA	NASA	NASA	NASA
Measured at					ft	32.8084	0		

Climate data

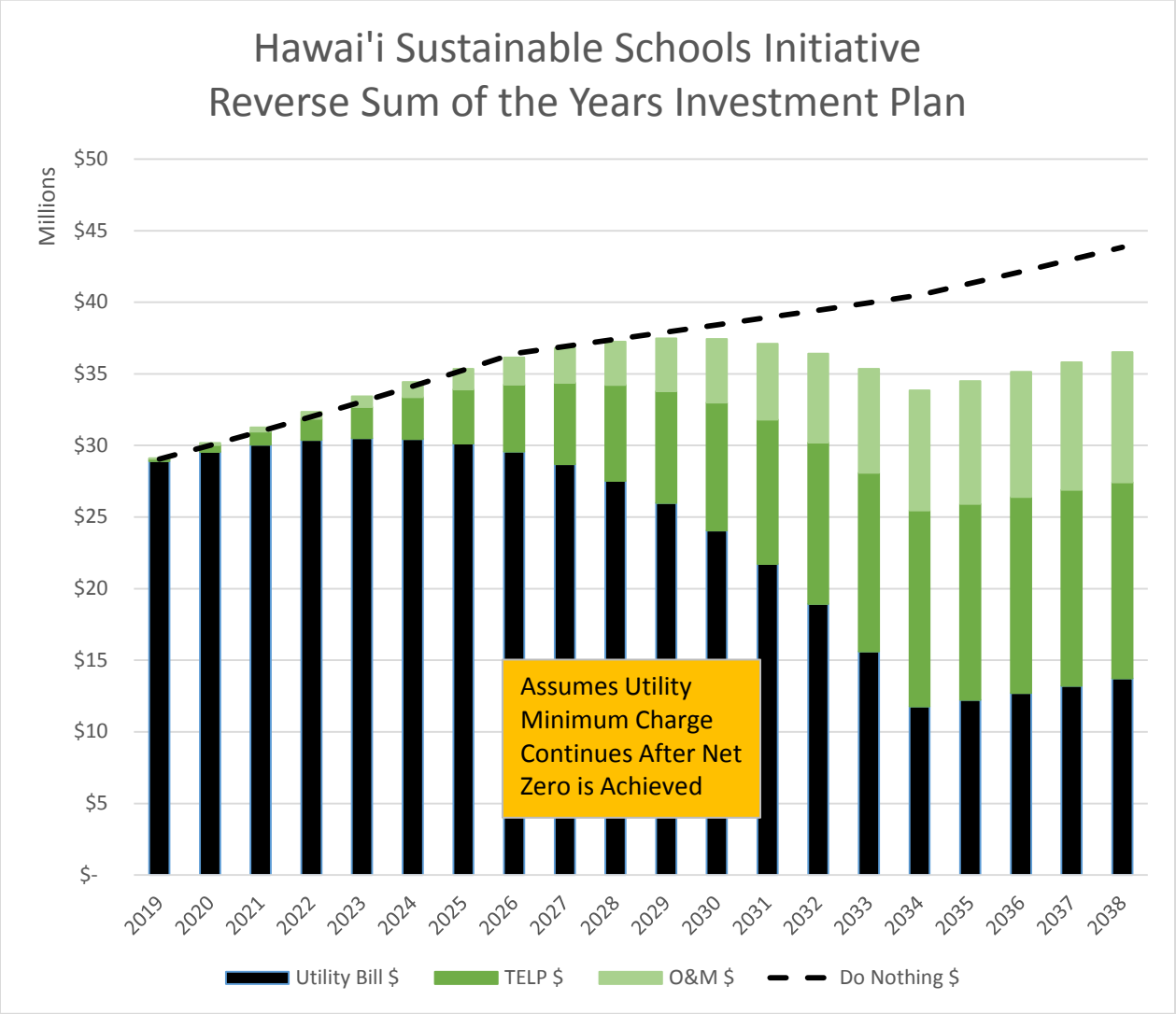


Legend: Daily solar radiation - horizontal | Air temperature

ECONOMIC CONSTRAINTS:

Due to structural impediments, primarily due to the minimum bill component in current electric tariffs, the DOE will probably not be able to realize the full economic benefits of achieving net-zero status for its facilities. Even after the net energy from utility sources has been reduced to zero, the minimum bill for remaining connected to the electrical grid may be on the order of 30% of our current electricity bill. There does exist the possibility that, should regulatory proceedings provide the opportunity for school facilities to offset some of the minimum bill by providing grid services, this economic constraint may be mitigated.

The chart below depicts anticipated DOE annual energy expenditures from FY 2019 through FY 2038.



Find current and past DOE Reports online at:

http://HawaiiPublicSchools.org