



**Better
Buildings®**
U.S. DEPARTMENT OF ENERGY

K-12 Breakout Session

Monday, May 9th from 2:00 - 5:00 PM
Room: Oak Lawn

Agenda

- **2:00**
 - Welcome, Introductions, Program Overview
- **2:15**
 - PART 1: Advancing K-12 Energy Efficiency Strategies
- **3:30**
 - Break
- **3:45**
 - PART 2: K-12 School District Peer Exchange
- **5:00**
 - Adjourn

Program Overview

Program Snapshot

Better Buildings Challenge Snapshot, 2015

Partnership	
Number of Partners and Allies	310+
Square Feet Represented	4.2 billion
New Partners in the past year	60+
Solutions	
Partner Solutions Available for Replication	400+
Results	
Energy Saved (Btus)	161 trillion
Dollars Saved	\$1.3 billion
Avoided CO ₂ emissions (tons)	10.1 million
Funding Committed/Placed	\$5.5 billion / \$5.4 billion
Water Savings (gallons)	2.1 billion

K-12 Snapshot

20 partners

80 million square feet

400+ buildings

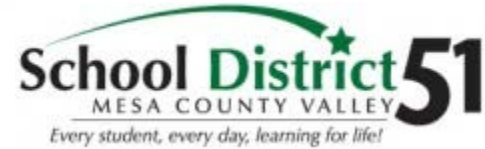
10 Showcase Projects

3 Implementation Models

K-12 BBC Partners



Evergreen Public Schools



CAMAS SCHOOL DISTRICT
A TRADITION OF CARING AND QUALITY



River Trails
School District 26
Inspire to Excel



HUNTSVILLE CITY SCHOOLS
Where Young Futures Take Flight



General Program Updates

- BBC 2016 Progress Report
 - [Link](#)
- New BBC Implementation Models
 - [Douglas County School District - A Lesson Plan in Financing K-12 Energy Efficiency](#)
 - [Portland Public School District - Hybrid Funding Approach](#)
 - [Camas School District - Energy Resource Management Program](#)
- BBC SWAP
 - [Whole Foods Market and Hilton Worldwide](#)

New Webpage!



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CONTENT ▾

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Sector: K-12 School Districts



Energy is an expense schools can reduce to free up educational resources. Energy efficiency offers the potential to redirect significant savings back to educating students, as K-12 schools and higher education institutions respectively spend \$8 billion and \$6.5 billion annually on energy. Energy-efficient schools establish a safe, healthy, and productive environment for learning, offering a unique opportunity to serve as a living laboratory for students to understand and benefit from new technologies first-hand.

Visit our Beat Blog

Better Buildings Challenge SWAP

Better Buildings Summit

Summit Sessions of Interest

- Overcoming Barriers: Deploying High Efficiency Outdoor Lighting
- Workshop - Part 1: Energy Efficiency Finance
- Workshop - Part 2: Energy Efficiency Finance
- Evaluation, Measurement and Verification of Energy Efficiency Programs
- Mobilizing Benchmarking Data to Create New Outcomes
- Building the Infrastructure for Energy Savings Performance Contracting
- Are You Forgetting About Your Rooftop Units? Efficiency for Packaged HVAC

TONIGHT! Sector Networking Event

Monday, May 9th at 5:30pm

The Front Page

1333 New Hampshire Ave NW
Washington, DC 20036

PART 1: Advancing K-12 Energy Efficiency Strategies

Presenters

- Crystal McDonald (DOE) – Moderator
- Rois Langner (NREL) – Plug Loads
- Abdul Majid (Anne Arundel County Public Schools) – Workforce Retention
- Jensen Adams (Kansas City Public Schools) – ESPCs
- Cody Taylor (DOE) – ZEB for Schools

Rois Langner

- Rois Langner is an architectural engineer and building scientist in the Commercial Buildings Research Group at the National Renewable Energy Laboratory (NREL), located in Golden, Colorado.
- Rois has worked at NREL since 2010 on various research projects focused on energy efficiency in commercial buildings, utilizing OpenStudio software to analyze and optimize building design and performance.
- More recently, she has supported the U.S. Department of Energy's Better Buildings Alliance leading the Plug and Process Load technical solutions team, and also leads efforts to support the small commercial building sector in overcoming barriers that inhibit the adoption of energy efficiency solutions.

Abdul Majid

- **Education:**

- Masters in Mechanical Engineering from University of Maryland, College Park

- **Member:**

- ASME (Association of Mechanical Engineers)

- **Certification:**

- EEP (Energy Efficiency Professional)

- **Work Experience:**

- State of Maryland, DHMH, Sr. Mechanical Engineer, 1986-2006
- Anne Arundel County Public Schools, Utility Systems Program Manager, 2006-2016

Jensen Adams

- Energy & Sustainability Manager, Kansas City Public Schools
- Appointed by Kansas City Mayor to serve on Environmental Management Commission
- Served on Advisory Committee to City Manager for NRDC and IMT's City Energy Project with Kansas City
- University of Missouri Extension Council
- Worked for decade as program implementer for efficiency programs with utilities and governments
- Ongoing graduate studies at University of Missouri-Kansas City for Executive Master of Public Administration

Cody Taylor

- Cody Taylor is a Team Lead for Commercial Building Integration in DOE's Building Technology Office.
- He leads the Commercial Market Transformation portfolio, helping markets to more effectively deliver energy efficiency.

PART 2: K-12 School District Peer Exchange

Sector Priorities - Financing

- Tools
 - [Financing Energy Upgrades for K-12 School Districts](#)
 - [Better Buildings Financing Market Solutions Team](#)
 - [Better Buildings Financial Allies](#)
 - Financing Navigator – coming soon
- Best Practices
 - [Douglas County School District - Financing K-12 Energy Efficiency](#)
 - [Portland Public School District - Hybrid Funding Approach](#)
 - [Douglas County School District - Gardnerville Elementary School Modernization](#)
 - Alachua County Public Schools is leasing rooftop space (revenue for school district) for solar PV (funded by investors) to generate power that is sold back to the utility



Sector Priorities– Data Management

■ Tools

- [Better Buildings Data Access Market Solutions Team](#)
- [Energy Data Collection and Tracking Webinar](#)
- [Benchmarking Data Cleansing Webinar](#)



Sector Priorities - Public Engagement

- Tools
- Best Practices
 - [Poudre School District - Strategic Communications and Outreach Campaign](#)



Sector Priorities - Facilities Planning/O&M

- Tools
 - Smart Energy Analytics Campaign – coming soon
- Best Practices
 - [Evergreen Public Schools - Mill Plain Elementary School HVAC Upgrade Project](#)



Sector Priorities - Resource Conservation Policies/Programs

- Tools
 - [Education Initiatives](#)
- Best Practices
 - [Camas School District - Energy Resource Management Program](#)



Sector Priorities - Workforce Training

- Tools
 - [Better Buildings Workforce Guidelines](#)
 - [Buildings Re-tuning Training](#)
- Best Practices



Sector Priorities - Student Learning and Healthy Environments

- Tools
- Best Practices
 - [Houston Independent School District - Farias Early Childhood Center Retrocommissioning](#)
 - [Indian River Central School District - Indian River Middle School](#)
 - [Camas School District - J.D. Zellerbach Administration Headquarters](#)
 - [Dysart Unified School District - Kingswood Elementary School](#)



Questions and Answers



Thank You

Crystal McDonald

Better Buildings Challenge

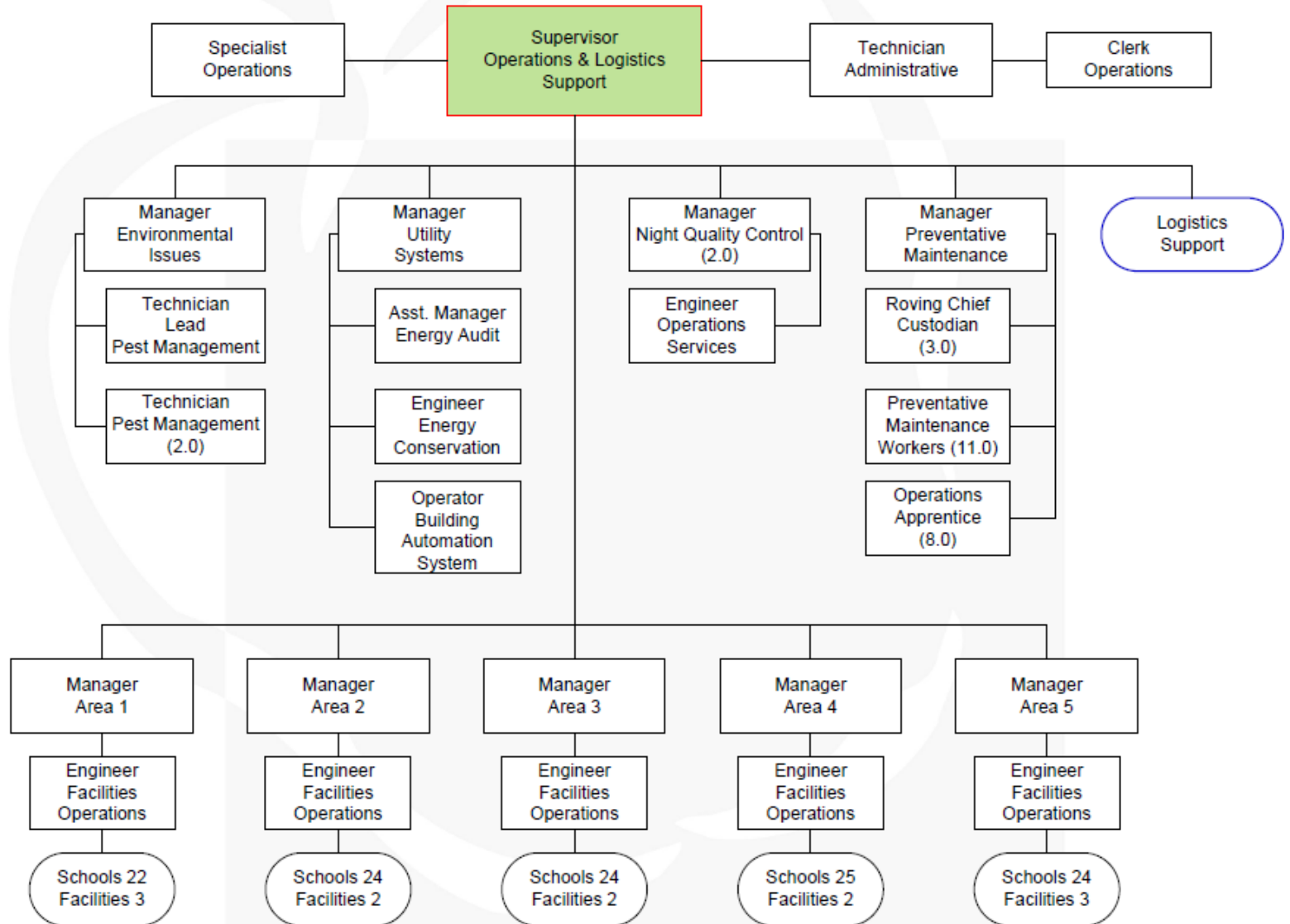
K-12 Sector Lead

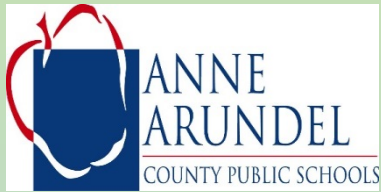
202-287-1799

Crystal.McDonald@ee.doe.gov

Anne Arundel County Public Schools

Operations & Logistics





Anne Arundel County Public Schools

Energy Conservation Division:

- Positions were created due to need for Energy Conservation.
- Division started on 7/1/2012 , separated from Building Management & HVAC Controls.

Mission Statement:

- To explore the root cause(s), and to make suggestions for conserving wasted resources and to explore alternative renewable energy sources.
- Our intent is not to cause any interruption of school related services but to identify wasted energy & water , and conserve precious resources and ultimately stop wasteful spending.



Anne Arundel County Public Schools

Division's Organization:

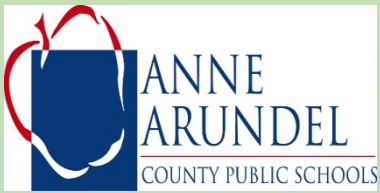
- Managed by Utility Systems Program Manager
- Assisted by (2) Energy Conservation Engineers and '1' Scheduling Assistant
- Manager is also assisted by a part-time Work Study student.

Contact Information:

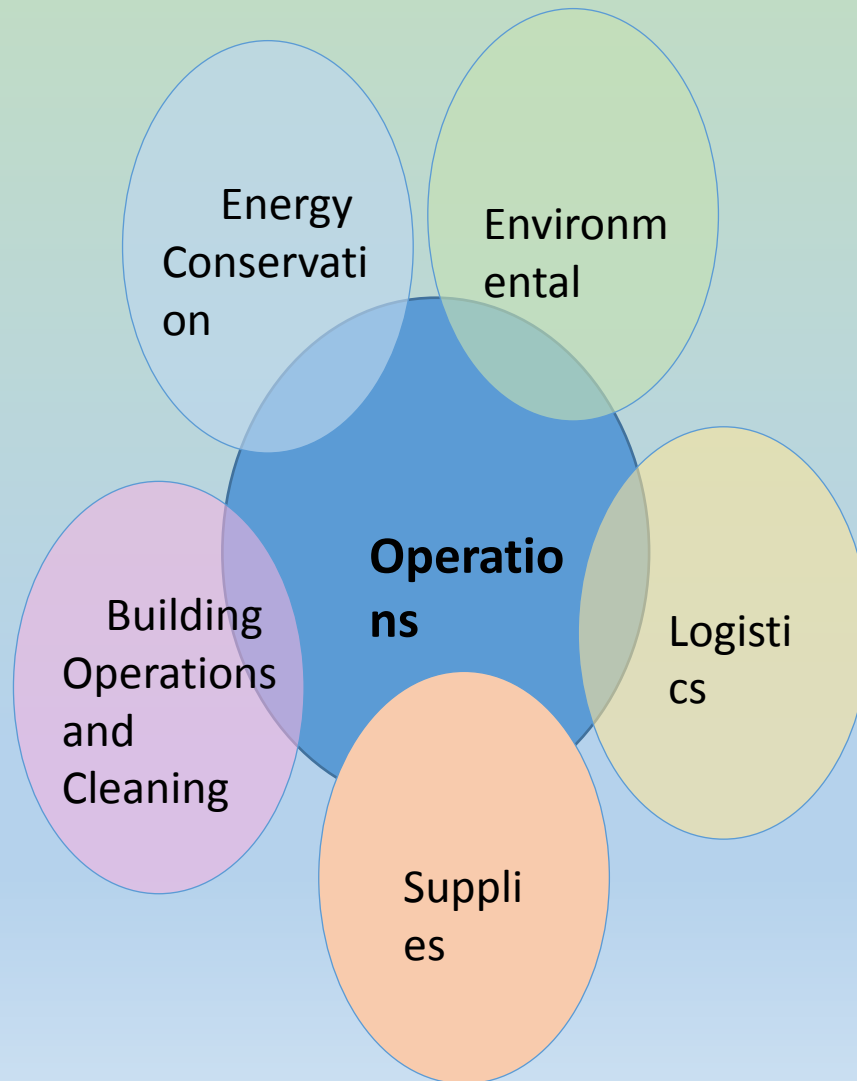
Phone: 410-439-8031

Fax: 410-439-5666

Energy@aacps.org

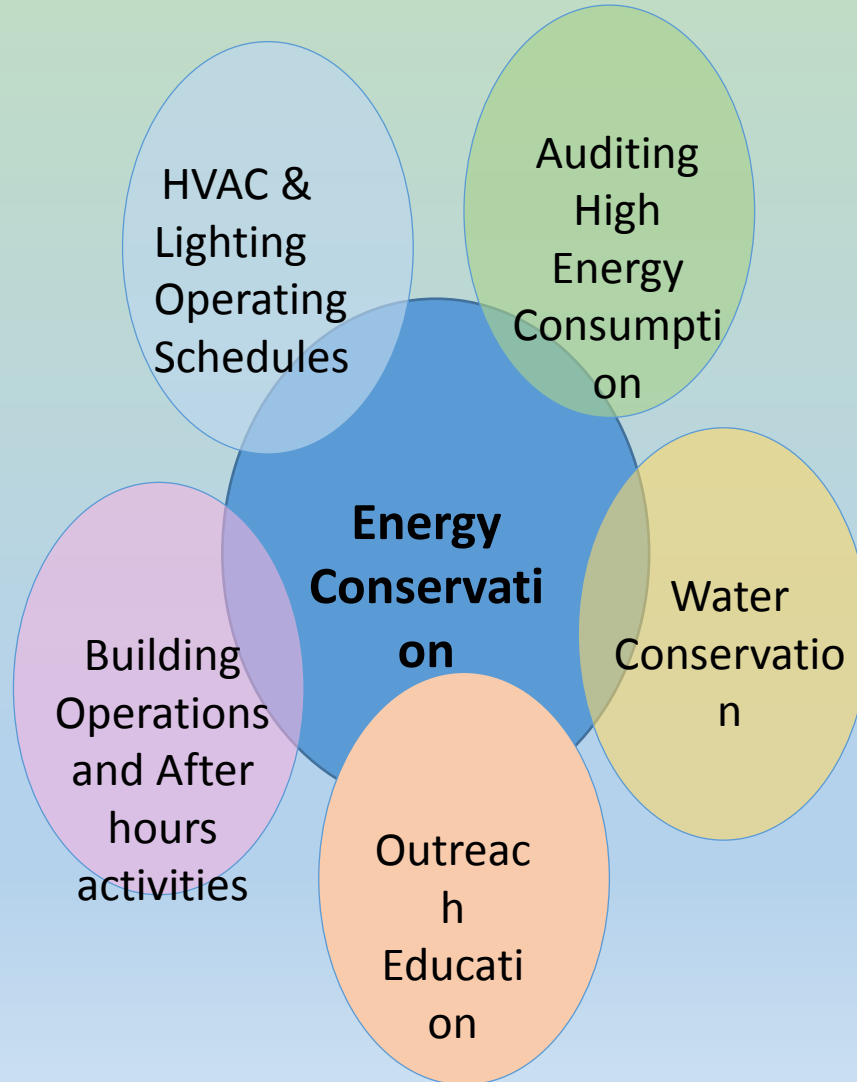


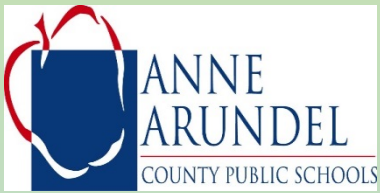
Anne Arundel County Public Schools





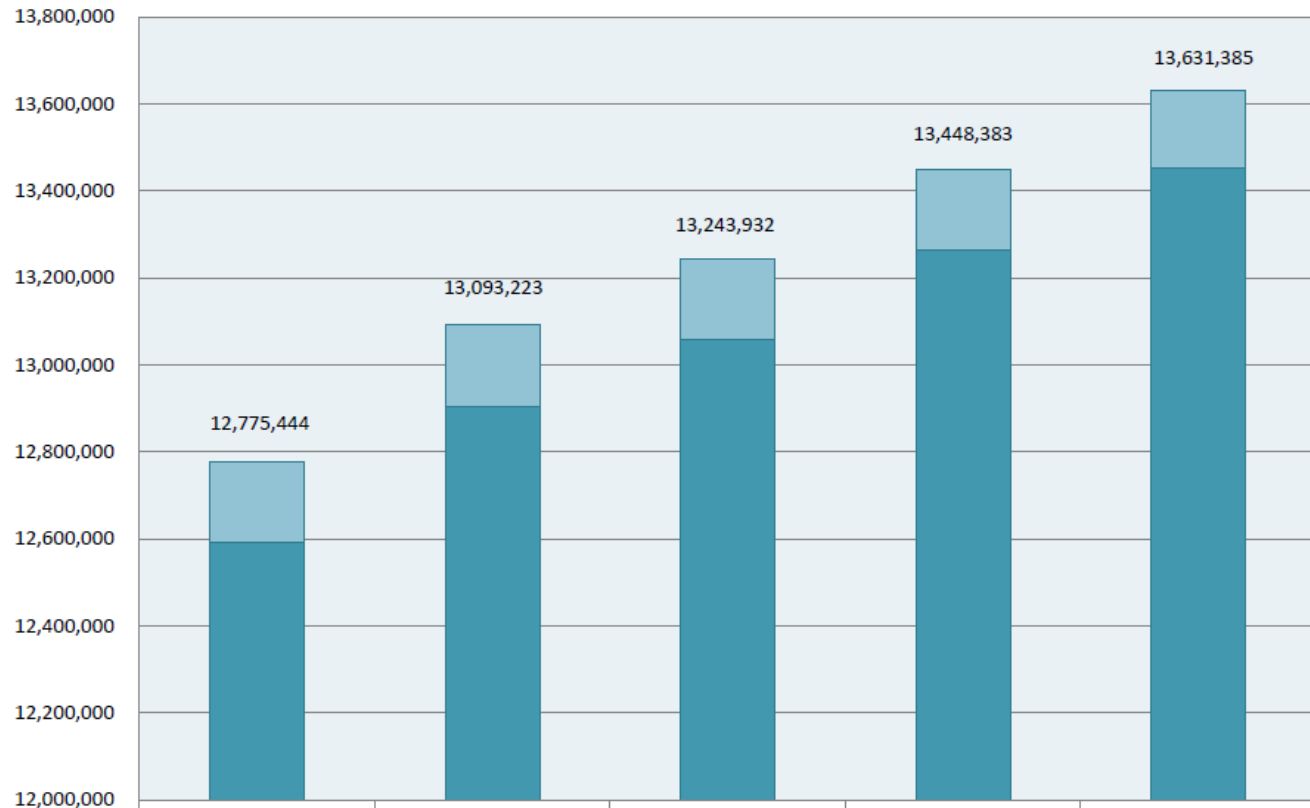
Anne Arundel County Public Schools



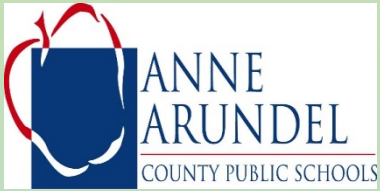


Anne Arundel County Public Schools

**AACPS Total Building Square Footage
2011-2015**

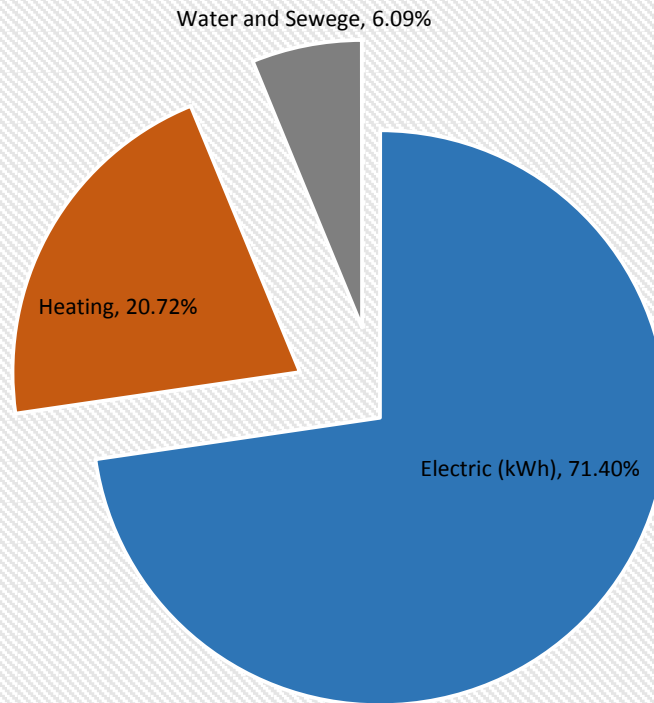


	2011	2012	2013	2014	2015
Relocatable sq.ft.	185,300	188,900	186,350	185,500	179,550
Building sq.ft.	12,590,144	12,904,323	13,057,582	13,262,883	13,451,835



Anne Arundel County Public Schools

AACPS Energy Use, FY 2015



**Approved Utility
Budget For FY
2016: \$24.55 M**



Anne Arundel County Public Schools

Specific Goals:

- Energy Conservation Office is responsible for implementing a variety of strategies to reduce AACPS energy consumption.
- Saving energy in schools buildings and reducing operational energy costs.
- Utility savings and carbon reduction.

Successful Energy Conservation Strategies:

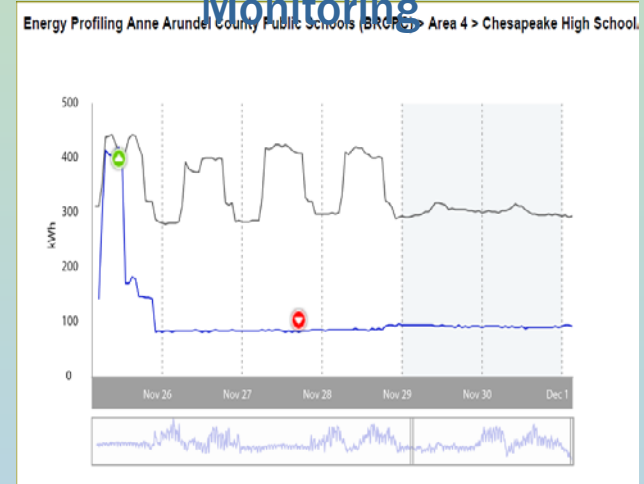
1. ENERGY TRACKING

- **Linked and benchmarked utility data** with Energy Star Portfolio Manager (Department of Energy).
- <https://portfoliomanager.energystar.gov/pm/login.html>
- Recognized by DOE for 100% completion of data on Portfolio Manager in 2014.
- DOE's Energy Summit Recognition for accuracy of data in more than 85% accounts in 2015.
- **Tracking:**
 - Over 1000 utility accounts electric, Gas, # 2 heating Oil, propane and water.
 - \$24 M in annual Utility bills.



Anne Arundel County Public Schools

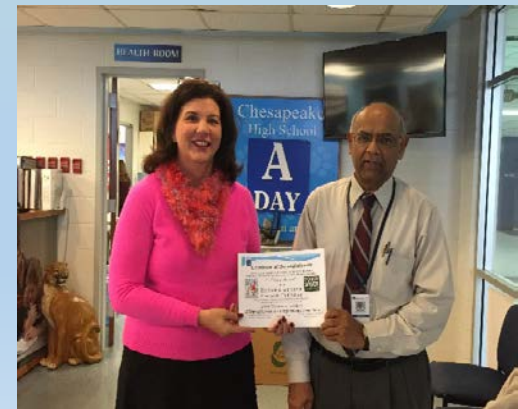
EnerNoc Monitoring



Sample Graph: kWh vs Time

2. HIGH SCHOOL/ MIDDLE SCHOOL / '10' ELEM. SCHOOLS ENERGY COMPETITIONS

- Comparison of energy used during the same time period 2014 & 2015.
- Thanksgiving, Christmas and Spring Break Energy Savings Competitions;
- Total Electricity 89,208 (kWh) and \$ 7,605 saved during 5-Day Break, which is 29.6 % average reduction compared to regular use.
- 12 Days of Christmas Energy Savings Competition; Total Electricity 343,570 (kWh) and \$41,228.31 saved during 12- day winter break for Significant Facilities which is 28.32 % average reduction as compared to regular use in 2014.
- Total Electricity 347,228 kWh and \$41,667.41 saved during 5 day Break which is 33.3 % average reduction as compared to regular use in 2013.
- EnerNoc Real Time energy use monitoring of '50' large size schools.
- During Spring 2014, '2' AACPS high schools won awards for Energy Pledges made at their schools for Alliance to save Energy's Powersavers Challenge, sponsored by Lockheed Martin.
- Three schools received EPA's Energy Star Ratings certificates for 2015 energy use.



High School Award Presentation

Energy Savings Calculations

Spring Break Energy Savings is based on Total % Electric Reduction (kWh) 2016 to 2014

Ranking	School Name	Type	Total kWh April 2014	Total kWh April 2015	Total kWh March 2016	Total Reduction kWh 2015 : 2014	Total Cost \$ Savings 2015: 2014	Total % Change kWh 2015:2014	Total Reduction kWh 2016:2014	Total Cost \$Savings 2016:2014	Total % Change kWh 2016:2014
1	Chesapeake HS	HS	56,037	29,184	26,538	-26853	\$ 3,222.36	-47.92%	-29499	\$ 3,539.86	-52.64%
2	North County HS	HS	52,784	36,141	25,781	-16643	\$ 1,997.17	-31.53%	-27003	\$ 3,240.40	-51.16%
3	Arundel HS	HS	37,368	19,753	19,049	-17615	\$ 2,113.75	-47.14%	-18319	\$ 2,198.25	-49.02%
4	Broadneck HS	HS	46,301	29,183	26,358	-17118	\$ 2,054.19	-36.97%	-19943	\$ 2,393.19	-43.07%
5	Southern HS	HS	26,150	22,709	14,903	-3441	\$ 412.92	-15.15%	-7806	\$ 936.72	-34.37%
6	Glen Burnie HS	HS	44,555	26,529	29,282	-18026	\$ 2,163.14	-40.46%	-15272	\$ 1,832.67	-34.28%
7	Meade HS	HS	49,523	37,952	35,353	-11570	\$ 1,388.44	-23.36%	-14169	\$ 1,700.34	-28.61%
8	South River HS	HS	54,509	41,494	39,411	-13014	\$ 1,561.71	-23.88%	-15097	\$ 1,811.67	-27.70%
9	Annapolis HS	HS	39,948	28,909	29,403	-11039	\$ 1,324.69	-27.63%	-10545	\$ 1,265.40	-26.40%
10	Severna Park HS	HS	18,741	14,783	13,833	-3957	\$ 474.89	-21.12%	-4908	\$ 588.96	-26.19%
Total			425,915	286,637	259,911	139,277	\$ 16,713.26	34.98%	162,562	\$19,507.46	38.17%

Total High Schools Spring Break Savings

2015: 2016

\$19,507.46

Total High Schools Spring Break Saving

2014: 2016

\$ 16,713.26



Anne Arundel County Public Schools

3. ENERGY PURCHASING

- Participants in Baltimore Regional Purchasing Council (BRCPC) for Electricity and Natural Gas purchase.
- Collective Electricity and Gas purchases strategies to reduce energy supply cost.
- Hedging for Electricity, Natural gas and #2 Heating Oil to save on utilities purchasing.

4. CONSTRUCTION PROJECTS & BGE UTILITY REBATES:

- LED lighting upgrades and utility rebates to AACPS
- GYM lighting upgrades at high schools and Middle schools
- Received \$363,000 in utility rebates from BGE for lighting and HVAC upgrades in the last (3) years.



Gym Lights Before Retrofit



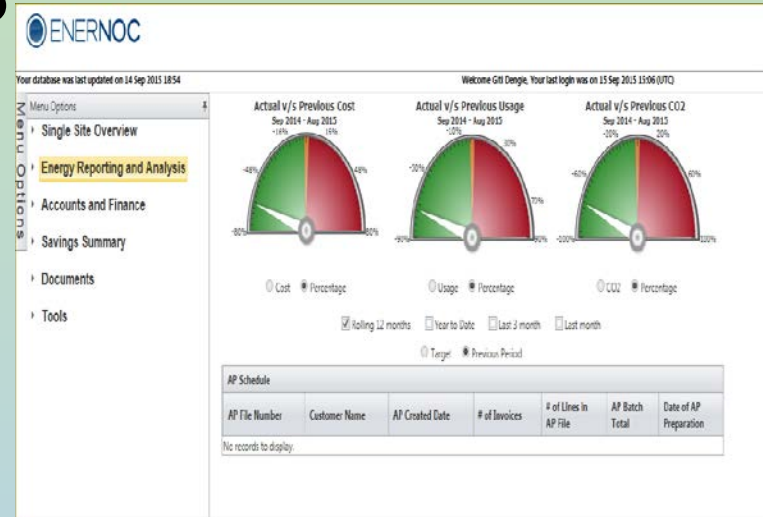
Gym Lights After Retrofit



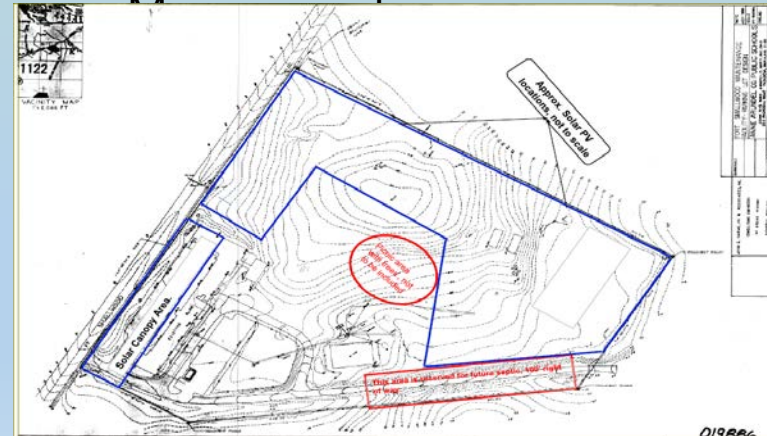
Anne Arundel County Public Schools

5. CURRENT ENERGY INITIATIVES:

- 1 MW Solar Project at Fort Smallwood Complex
- Energy Bill Management for tracking of AACPS utilities
- Future Solar and Other Renewable projects are planned
- Water conservation project
- Energy Star Certifications
- Green School and Green Ribbon applications and professional advice and support to schools
- Broadneck HS, our signature Environmental High School received **Green Ribbon** award this year



AACPS Utility Bill

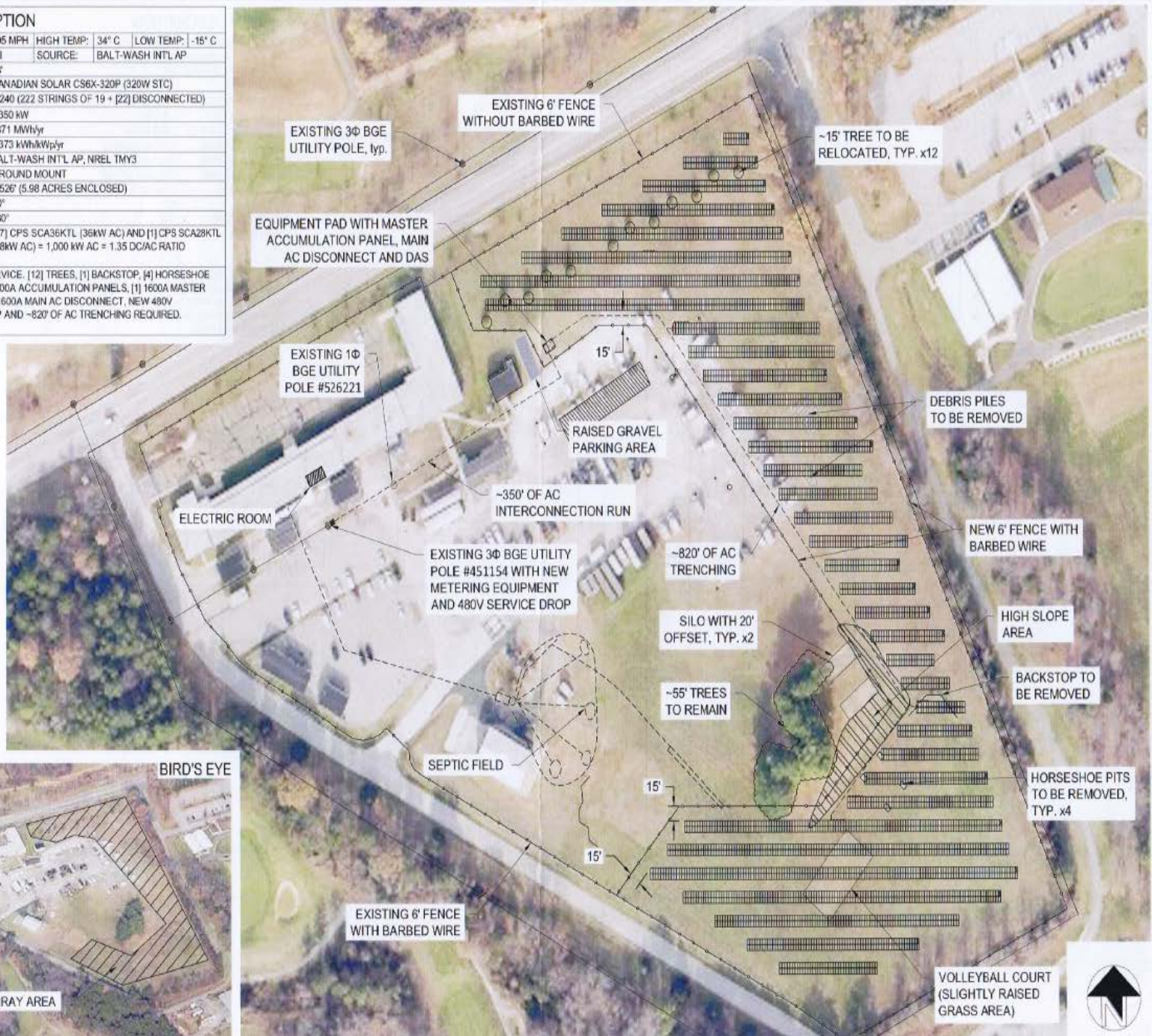


AACPS Solar Project Site @
9034 Fort Smallwood Rd,

SYSTEM DESCRIPTION

DESIGN WIND SPEED:	105 MPH	HIGH TEMP:	34° C	LOW TEMP:	-15° C
EXP. / OCC. CATEGORY:	B/I	SOURCE:	BALT-WASH INT'L AP		
ELEV. (ABOVE SEA LVL):	18'				
MODULE TYPE:	CANADIAN SOLAR CS6X-320P (320W STC)				
MODULE QUANTITY:	4,240 (222 STRINGS OF 19 + [22] DISCONNECTED)				
SYSTEM SIZE (DC):	1,350 kW				
ESTIMATED YIELD (AC):	1871 MWh/yr				
SPEC. PROD. RATIO:	1.373 kWh/kWp/yr				
WEATHER STATION:	BALT-WASH INT'L AP, NREL TMY3				
MOUNTING SYSTEM:	GROUND MOUNT				
FENCE LENGTH:	2,526' (5.98 ACRES ENCLOSED)				
TILT ANGLE:	20°				
ARRAY AZIMUTH:	180°				
INVERTER(S):	[27] CPS SCA36KTL (36kW AC) AND [1] CPS SCA28KTL (28kW AC) = 1,000 kW AC = 1.35 DC/AC RATIO				

NOTES: 208V, 800A, 3Φ SERVICE, [12] TREES, [1] BACKSTOP, [4] HORSESHOE PITS TO BE REMOVED, [2] 800A ACCUMULATION PANELS, [1] 1600A MASTER ACCUMULATION PANEL [1] 1600A MAIN AC DISCONNECT, NEW 480V DEDICATED SERVICE DROP AND ~820' OF AC TRENCHING REQUIRED.



ANNE ARUNDEL COUNTY PUBLIC SCHOOLS
 9034 FORT SMALLWOOD ROAD
 PASKADENA MD 21122

REVISONS

12.22.15	REVISED SYSTEM SIZE
12.22.15	CHANGED TILT ANGLE AND ROW SPACING
02.24.2016	REVISED CHANGING STRINGS

PROJECT NUMBER: 15-B051

DESIGNED BY: DE3

DRAWN BY: CJC

DATE: 02.24.2016

SCALE: 1" = 110'

PV1

Facilities / Directorate

9034 - Ft. Smallwood Road

Solar Project Synopsis

Bid Details:

- Bids Advertised: 4/16/2015
- Bids Opened: 5/28/2015
- Contract Awarded: 2/3/2016
- PPA Provider: Standard Solar Inc. (Rockville, MD)

Design and Construction:

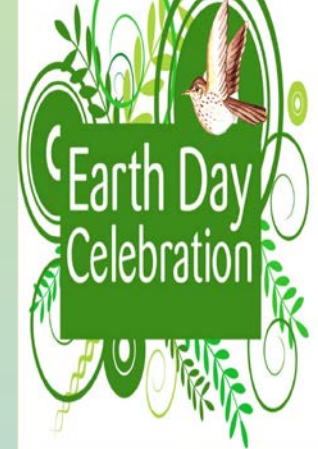
- Facility Geotechnical Surveys: Currently in progress
- Design Drawings Due: 5/20/2016
- Anticipated Start of Construction: 6/15/2016
- Anticipated End of Construction: 9/30/2016

Benefits at a Glance:

- Entire Ft. Smallwood Complex will get off the BGE grid for electricity use.
- A minimum of 10 additional school accounts will be provided electricity from this solar project.
(Net Metering Strategy)
- A minimum of \$900K in purchase savings, over the length of the project.

For More Information Please Contact
Abdul Majid: (410)-439-8031

AACPS Recognition



BROADNECK HIGH SCHOOL AND AACPS EARN NATIONAL HONORS FOR ENVIRONMENTAL INITIATIVES

Posted on [April 22, 2016](#) by [AACPS Communications Office](#)

Managing Director of the White House Council on Environmental Quality Christy Goldfuss joined U.S. Secretary of Education John King today to announce that **Broadneck High School** is a 2016 U.S. Department of Education Green Ribbon School (ED-GRS). In addition, Anne Arundel County Public Schools is among the 2016 U.S. Department of Education Green Ribbon Schools District Sustainability honorees.

This award is a great honor and speaks volumes about the power of matching our academic efforts to the needs of our students and community," said Melanie Parker, Coordinator of Environmental Literacy and Outdoor Education for AACPS. "This is a testament not only to the great persistence and balance that our staff and students display in their efforts to truly make a difference, but in the teamwork that exists in initiatives that explore things like alternative energies, waste reduction, and other green practices."

Broadneck High School and AACPS were nominated for the awards by the Maryland State Department of Education. Sligo Middle School in Montgomery County is the lone other Maryland honoree.

"Sligo Middle, Broadneck High, and Anne Arundel County Public Schools have taken a long-term, broad-based approach to environmental learning and stewardship," Gov. Larry Hogan said in a statement after the awards were announced. "I offer my sincere congratulations and encourage them to continue their tireless work to make Maryland and their local communities better places to live."

Interim State Superintendent of Schools Jack R. Smith also acknowledged the honorees, saying "Maryland schools have been at the leading edge in their commitment to environmental education and to practices that will sustain our world for future generations. These nominees represent the important work taking place throughout our State."

Recognized largely for its innovative Environmental Literacy Signature Program that weaves environmental stewardship and consciousness into the curriculum, Broadneck High School's entire school community is impassioned to restore local waterways, save the Chesapeake Bay, and bring more awareness to these efforts.

In AACPS, more than half of AACPS' schools have earned state green school status and all newly-constructed schools meet state

KANSAS CITY

PUBLIC SCHOOLS



ESPC Lessons Learned

K-12 School District Peer Exchange

DOE Better Buildings Summit '16

May 09, 2016

Kansas City Public Schools

- Founded in 1867. Building stock spans 1904 to 1994.
- 16,700 students; 2,300 teachers and administrators
- 40 active facilities, at 4 million square feet
- Elected board, Superintendent, Chief of Operations, Facilities
- Office of Energy and Sustainability

Energy Services Performance Contract

- Comprehensive
- Competitive
- Targeted
- Responsive

- \$30 million over all facilities
- Measure mix includes:
 - Lighting
 - Water
 - HVAC
 - Building Automation System
 - Energy Management / Meters
 - Re-commissioning
 - Evaluation
 - Preventative maintenance
 - Staff skills assessment
 - Supply side savings
 - Behavior program
 - Promotion

Lesson Groups

- Investment Grade Audit
- Contract Negotiation
- Measure mix
- Pricing vs. cost
- Scheduling
- Incentives
- Measurement & Verification

Highlight Lessons

- IGAs should include supporting audit documentation.
- Engineering design fees should reflect measure.
- Strive for a 15 year payback and leverage measure mix. Re-commissioning with a flexible major and minor repair allowance. Consider measure persistence strategy.
- Competitive bidding within an ESPC promotes supplier diversity, and proves costs.
- Start with fast payback measures, start with small packages. Involve utilities.
- Build in meter project.

Thank you.



Better Buildings Alliance: Plug and Process Load Technical Team

Rois Langner, NREL

Technical Lead, Plug & Process Load Technical Solutions Team

BBA PPL Team Goals



Members work with DOE's network of research and technical experts to develop and deploy innovative, cost-effective, energy savings solutions.

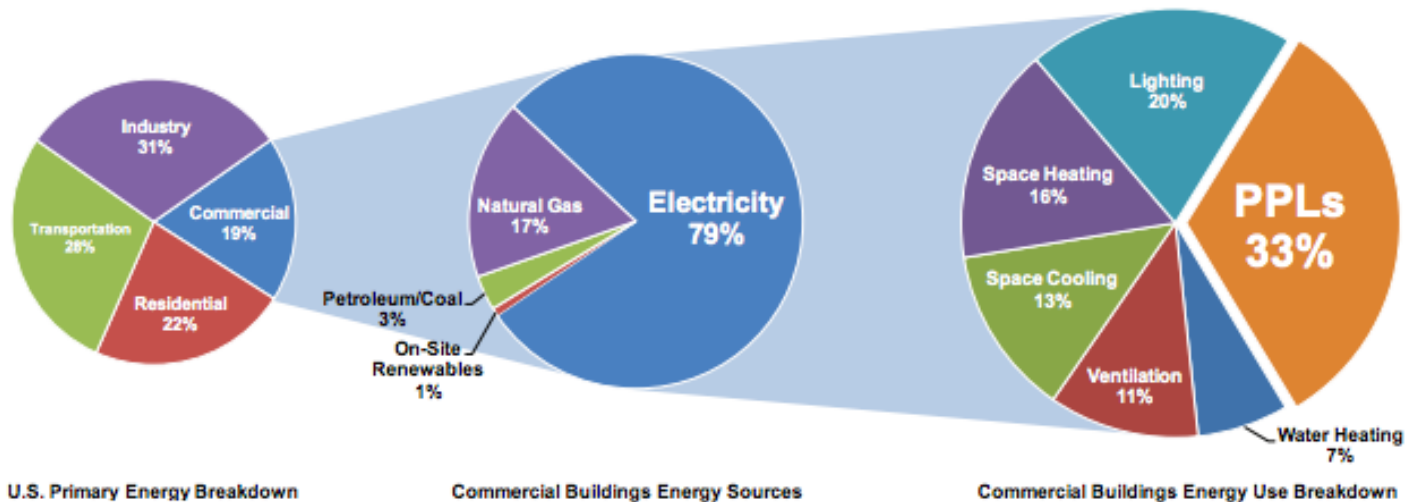


Figure 1. PPLs account for 33% of the total energy consumed by commercial buildings. Graph by Chad Lobato, NREL; Data source: DOE (2010)

Why PPLs?

PPLs account for an increasingly large percentage of a building's energy use

Reduce PPL energy use by:

- Assessing PPL energy consumption
- Selecting appropriate control strategies
- Exploring efficient PPL design solutions
- Identifying utility incentives
- Institutionalizing policies and procedures for PPL energy reduction



Figure 5. Diagram of an example low-energy workstation.
Illustration by Matthew Luckwitz, NREL

Available PPL Resources

- Fact Sheets
- Technical Reports
- Presentations
- Case Studies
- Technical Specifications
- How-To Graphics
- List of Utility Incentives

ADVANCED POWER STRIPS (APS)
HOW TO USE IN AN OFFICE SETTING

Each APS has three outlet types for equipment with various electricity needs:

- Primary Outlet** (COMPUTER/LAPTOP): The primary outlet acts as the "control" or "master" outlet because it turns off the power to secondary outlets when the device connected to it is turned off. The primary outlet typically powers your computer's central processing unit because most other devices connected to the power strip at an office desk depend on your computer for their functionality. For example, you need to turn on your computer to use your monitor and to print documents.
- Secondary Outlet** (MONITOR, PRINTER, DESK LAMP): The secondary outlets act as the "controlled" outlets and typically power peripheral devices, such as your computer monitor, desk lamp, and printer. When the device connected to the primary outlet is turned off, the power will automatically be shut off for the device connected to the secondary outlets. For example, turning off your computer automatically shuts off the power to your monitor or printer. The amount of energy you save with an advanced power strip depends on the energy usage of the devices connected to the secondary outlets.
- Always-On Outlet** (LANDLINE PHONE, FAX, MINI FREDGE): The always-on outlets are not controlled by the primary outlet. Important office desk devices, such as landline phones and fax machines, that are plugged into the always-on outlet will receive constant power regardless of the primary outlet device.

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC. NREL/PG-600-4480 - March 2015

DECISION GUIDE

Healthcare Solutions	Priority	Complexity	Cost	Energy Savings	Payback	PROJECT TYPE											
						Office	Healthcare	Manufacturing	Retail	Education	Government	Multi-Family	Commercial	Industrial	Utility	Other	
Turn Off Campaigns	S	Low	Low	High	Low	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Advanced Power Strips (APS)	S	Low	Low	High	Low	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Upgrade Equipment with Low Energy or ENERGY STAR Certified Equipment	SS	Low	Low	High	Low	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Use Built-In Low Power States	S	Low	Low	High	Low	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Design Strategies for Consolidating Plug and Process Loads (PPLs)	SSS	Low	Low	High	Low	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Integrate PPL Controls with Other Building Systems	SSS	Low	Low	High	Low	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Additional Commissioning and Control Systems	SSS	Low	Low	High	Low	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Click here to view the legend.

Additional resources for PPL control strategies:

- Healthcare Energy Efficiency Handbook
- Energy Efficient and Connected Buildings in Government
- Advanced Energy Design Guide for Small Business and Multifamily Buildings
- Advanced Energy Design Guide for Large Buildings
- Advanced Energy Design Guide for Large Buildings
- Advanced Energy Design Guide for Large Buildings
- Advanced Energy Design Guide for Large Buildings
- Advanced Energy Design Guide for Large Buildings

Learn more at energy.gov/betterbuildings

Featured Publications:

- [Decision Guides](#) for PPL Controls
- Assessing and Reducing PPLs in [Office](#) and [Retail](#) Buildings
- [Technical Specification](#) for Advanced Power Strips (APSs)
- [How To](#) Use APSs in an Office Setting
- [Utility Incentives](#) for APSs
- Myth-Busting Rumors About APSs

Strategies

Break Rooms and Kitchens

- Refrigerators**: Refrigerators in break rooms and kitchens, implement the following strategies to reduce energy consumption:
 - Remove underused refrigerators to save 140-580/year/ refrigerator.
 - Replace aging, inefficient refrigerators with the most efficient (Energy Star) refrigerators to save 140/year/ refrigerator.
 - Consolidate multiple mini-refrigerators into a full-size refrigerator to save 150/year/mini-refrigerator.
 - Use glass door refrigerators with automatic closed door sensors to save 160/year/glass door refrigerator.
- Other Appliances**: Items such as coffee pots, toasters, and microwaves that have freon-based panels leak freon light emitting diodes or displays to save 15/year/ item. Items with electrical outlet covers as they are turned during nonbusiness hours to save 15/year/item.

Vending Machines: Vending machines have an approximate energy cost of \$300/year/ refrigerated machine. Implement the following strategies to reduce vending machine energy consumption:

- Remove underused machines to save 150/year/machine.
- Replace aging, inefficient vending machines with the most efficient equipment to save 150/year/machine.
- Remove the display lighting to save 160/year/machine.
- Implement a load-managing device (Dew et al., 2003) to save 150/year/machine.
- Set contractual requirements for vendors to only deliver, energy-efficient vending machines that have a load-managing device pre-installed.

Drinking Fountains:

- Disconnect or remove drinking fountain coolers and bottled water coolers.
- Replace aging drinking fountains and bottled water coolers with nonrecycled drinking fountains to save 150/year/coolers.

Phones:

- Replace standard phones with low-power (2-W maximum voice use) internet protocol (VoIP) phones to save 150/year/phone.

Power management setup on desktop

Figure 3. Diagram of an example low-energy workstation. Reprinted by permission from NREL.

Better Buildings
U.S. DEPARTMENT OF ENERGY

Technical Specification for Advanced Power Strips
Version 1.0
December 30, 2014

U.S. DEPARTMENT OF ENERGY

PPL Solutions

- Messaging, or Turn it Off! Campaigns
- Advanced Power Strips
- Upgrade Equipment with Low-Energy or ENERGY STAR®-Certified Equipment
- Use Built-In Low Power States for Equipment
- Design Strategies for Consolidating PPLs
- Integrated PPL Controls with Other Building Systems
- Submetering and Control Options



Illustration by Marjorie Schott, NREL



Upcoming Projects & Events

Upcoming Projects:

- Technology & behavioral study comparing thin-client/server-based computing systems to traditional computing systems



Ongoing PPL Events:

- Bi-Annual BBA PPL Technical Team Calls
- Conference sessions
- Continually update resources on BBA PPL website



Join the BBA PPL Tech Team

PARTNERSHIPS

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[Better Buildings Initiative](#) » [Better Buildings Alliance](#) » [Plug & Process Loads](#)

Technology Solution: Plug & Process Loads



Plug and process loads (PPLs) consume about one third of primary energy in U.S. commercial buildings. As buildings become more efficient, PPL efficiency has become pertinent in achieving aggressive energy targets. Through the PPL technology solutions team, partners participate in a platform to share experiences and learn from their peer, and work together to create resources on PPL energy reduction strategies and their applications, covering a wide variety of electronic, computer, refrigeration, and cooking devices, including equipment essential to information processing, medical treatment, and food service businesses.



U.S. Primary Energy Breakdown

Industry	31%
Commercial	19%
Residential	22%
Transportation	28%

Commercial Buildings Energy Sources

Electricity	79%
Natural Gas	17%
Petroleum/Coal	3%
On-Site Renewables	1%

Commercial Buildings Energy Use Breakdown

PPLs	33%
Lighting	20%
Space Heating	16%
Space Cooling	13%
Ventilation	11%
Water Heating	7%

Take Action
Participate in expert-led technology teams, test out an implementation model, join a technology campaign, or take part in a technology challenge or demonstration.

[Join Alliance Activities](#)

Events Calendar
Better Buildings partners participate in webinars, peer-exchange calls, meetings, and industry workshops and conferences. Browse upcoming events and opportunities to participate by month.

[Get Involved](#)

Find a Partner
Through the Better Buildings Alliance, over 200 public and private sector organizations across the country are working together to share and replicate positive gains in energy efficiency.

[View Partners](#)

Join the BBA PPL Tech Team

Featured Solutions



[Decision Guides for Plug and Process Load Controls](#) Guidance

The decision guides found in this resource were created to help building owners find the right control strategy for PPLs in their buildings.

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[Technical Specifications for Advanced Power Strips \(Version 1.0\)](#) Specification

This specification provides detailed selection criteria for five major APSs, and sets standards for modeling APSs. It is intended to help those who procure APSs select the most effective models for their commercial buildings.

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[How To Use Advanced Power Strips in an Office Setting](#) Fact Sheet

Each advanced power strip has three outlet types for equipment with various electricity needs. This infographic describes the uses for each outlet type.

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[Assessing and Reducing Plug and Process Loads](#)

Using the process and strategies outlined in this Laboratory (NREL) was able to drastically reduce

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[Assessing and Reducing Plug and Process Loads](#)

This brochure provides an overview of PPLs in retail and effectively reduce their energy impact.

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Thank you!

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