NOVA | Northern Virginia Community College
Facilities Management

Energy Plan

Oct-20

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Introduction

The Facilities Planning and Support Services (FPSS) department at NOVA formally established its Energy Program in 2016. General goals of this program include reducing energy consumption and cost, improving occupant comfort and sensory experience, and reducing NOVA's environmental impact. Our strategies are numerous and fall into broad categories:

- Closely monitor energy consumption and utility remuneration
- Modernize lighting and lighting controls
- Optimize heating, ventilation and air conditioning systems and controls
- Improve building envelope characteristics
- Develop systems and processes that allow us to identify and solve anomalies quickly

To accomplish these general goals, we have implemented numerous energy conservation strategies. Also, we have established energy reduction goals; 3% reduction for NOVA's highest Energy Usage Index (EUI) buildings and 1% reduction for other buildings.

Leadership Support & Policy

Within FPSS, the Chief Facilities Officer (CFO) created an experienced Energy Team. This team meets monthly to develop energy and water conservation measures, review new project options, build communication paths to Facility Managers and others, monitor ongoing initiatives and address utility demand response goals and implementation options. Continued focus from the CFO ensures programmatic efficiency and alignment with overarching NOVA goals.

NOVA's leadership consistently provides enthusiastic support for our Program including support from the College-wide Environmental and Sustainability Action Committee (ESAC). This Committee offers an exceptional forum for sharing energy program elements, communicating Program goals and their value to the NOVA population, and providing a liaison function among the departments.

Energy Team

We have assembled a highly qualified and experienced energy team consisting of technical experts in the areas of energy efficiency, building energy and control systems, utilities, sustainability and operations. Our team members:

- Kwadwo Gyebi, CEM - Project Manager
- Rob Johnson - Director of Sustainability and Auxiliary Services
- Brad Melton, PE - Energy Manager
- Steve Patterson, PE, CEM, CFM - Chief Facilities Officer
- Miles D. Smith, CEM, CEA, CMVP - Senior Energy Project Manager
- Bill Turner, CFM - Associate Director, Operations

Outreach and Awards

Our efforts continue to increase energy and sustainability awareness of students, faculty and staff. Examples of outreach mechanisms include:

- Periodic Daily Flyer articles
- NVCC FPSS website content
- Energy component included in student orientation (now mandatory)
- Poster Campaign
- Classroom presentations
- Campus events
- Leading by example

NOVA has earned two major energy-related awards since Energy Program inception. NOVA was recognized by the National Capital Chapter of the Association of Energy Engineers (AEE) as the Energy Institute of the Year in 2017 and received the Regional Institutional Energy Management Award in 2019.

2019 Regional Institutional Energy Management Award. From left to right, Dueane Dodson (CBRE-Heery), Cory Thompson (NOVA), Miles Smith (CBRE-Heery), Steve Patterson (NOVA), Bill Turner (NOVA)

Benchmarking & Targets

The table below shows the Energy Use Index (EUI) for NOVA campuses for the 2019 calendar year. This data was developed using a standard report from our energy tracking software. The EUI is a commonly used measure of building energy performance on a per square foot basis. It is typically measured as thousands of British Thermal Units (kBTU) of energy used annually per square foot. All energy consumed by a given building (e.g., electricity and natural gas) are converted to kBTU, summed, and divided by building gross square footage. The Energy Team has developed EUI benchmark values from the U.S. Department of Energy (DoE) Energy Information Administration (EIA), Commercial Buildings Energy Consumption Survey (CBECS). The CBECS EUI values we used represent expected use for similar facilities in the mid-Atlantic region; target EUI is our internal goal for specific buildings. This process allowed us to to identify higher use buildings and target them for energy reduction investigations and projects. Prepared annually, this comparative report allows us to confirm energy reduction progress at targeted buildings, re-evaluate all buildings to identify new Program targets, and generally track Program activities to ensure alignment with our stated mission.

Campus	**EUI (kBtu/sq.ft)**
Alexandria	104
Annandale	88
Loudoun	120
Manassas	85
Medical Education	133
Woodbridge	93
Overall	101

Table 1 - Summary of EUI, calendar 2019

Notes: Values in the **Table 1** excludes parking garages, MA Amphitheatre, and MA Battleview II building.

Demand Side Energy Management

This section provides examples of the many ways we are improving buildings and building systems to reduce energy consumption and cost.

Lighting

1. **Interior Lighting** – NOVA developed a competitive LED retrofit project contract that resulted in awards to three companies. The five-year contract specifies a comprehensive set of retrofit solutions to address the hundreds of existing lighting fixtures and configurations found across the six campuses and fifty buildings plus outdoor lighting. Our lighting program applied many steps including preliminary financial analysis, technology evaluation, conducting a comprehensive lighting audit, determination of product options and procurement elements, building code issues, conducting a competitive lighting unit contract Invitation for Bid (IFB), and project implementation. We expect to expand the list of options to include T5 retrofits when the retrofit technology matures to meet our high standards.

   NOVA also receives remuneration from our regional electrical grid authority, PJM, for permanent demand reduction. Additive to savings received from improved lighting efficiency, this is a side benefit to the Commonwealth resulting from reduced peak wattage of post-retrofit buildings.

2. **Exterior Lighting** - NOVA Facilities has upgraded all High Intensity Discharge (HID) lighting to more energy efficient light emitting diode (LED) technology in open parking lots, covered parking garages and is continuing the transition along walkways and paths. The objectives for these exterior lighting improvements are to reduce lighting energy costs, reduce maintenance and personnel requirements, and improve security and nighttime aesthetics. The new lighting has already eliminated several chronically under-illuminated parking areas and offers improved after-dark safety for students, faculty and guests.

   At the Manassas campus Amphitheatre area and two wooded paths at the Annandale campus, Facilities was asked to address safety concerns arising from real or perceived low-illumination issues. This request provided Facilities the opportunity to also address maintenance and safety concerns with the existing light bollards. These projects simultaneously accomplished multiple objectives that benefited the College: safety, visibility, improved aesthetics, electricity use and cost reductions, and the allaying of long-term maintenance and material costs and requirements. For all of our lighting projects, Facilities works closely with NOVA Police to ensure new lighting does not negatively impact security camera operations.

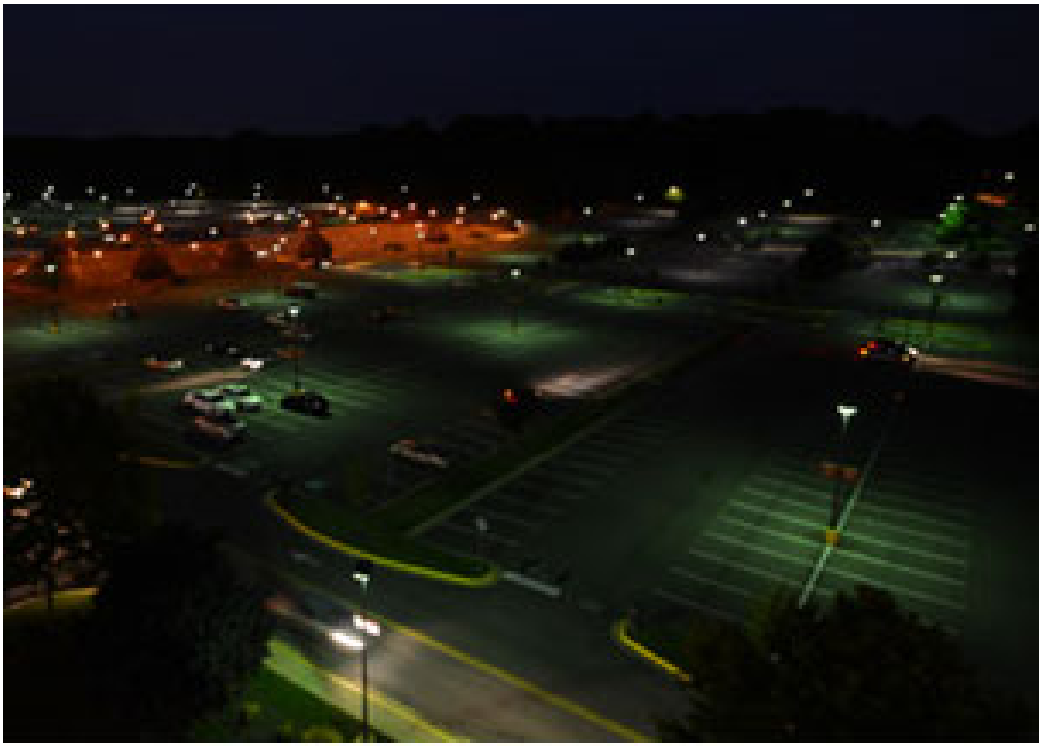

Table 2 - Annandale Surface Lot before LED Retrofit

Table 3- Annandale Surface Lot after LED Retrofit

3. **Lighting Controls** – While some offices, classrooms and conference rooms previously had occupancy sensors in place prior to the retrofit project, many were obsolete or not functioning. The lighting retrofit projects continue to replace failed occupancy sensors with modern technologies and has added hundreds of new sensors to expand coverage of automated light control. We replaced most outdoor lighting controls with astronomical timers, which turn outdoor lighting on and off aligned with sunset and sunrise, respectively. These timers maximize lighting usefulness while minimizing energy consumption.

   Seven of our buildings were provided with lighting control systems at construction. These systems vary in capabilities and breadth across the building, but all provide some level of occupancy scheduling and dimming control. Our experience is the more complex the lighting control system, the less effective it becomes over time. Complexity leads to higher maintenance and training costs. As a result, we work toward simple, local lighting controls such as local occupancy sensors.

EMS

Energy Management Systems (EMS) are an essential energy management component at NOVA. These systems provide computerized and centralized control of building Heating, Ventilation and Air-Conditioning (HVAC) and other systems. EMS objectives include improved occupant comfort and health, efficient system operation, reduction of energy consumption and operating costs, and extended equipment lifespans. A building controlled by an EMS is often referred to as an intelligent building, or "smart building." These systems significantly reduce energy consumption by properly regulating temperatures within our buildings, controlling “free-cooling” systems, providing shut-down of equipment when not needed, and optimizing complex building systems.

NOVA applies EMS in over 34 of our 50 buildings. To keep pace with continually improving technologies and changes to building occupancy, use and layout, we continually install, modify, upgrade and replace our EMS systems.

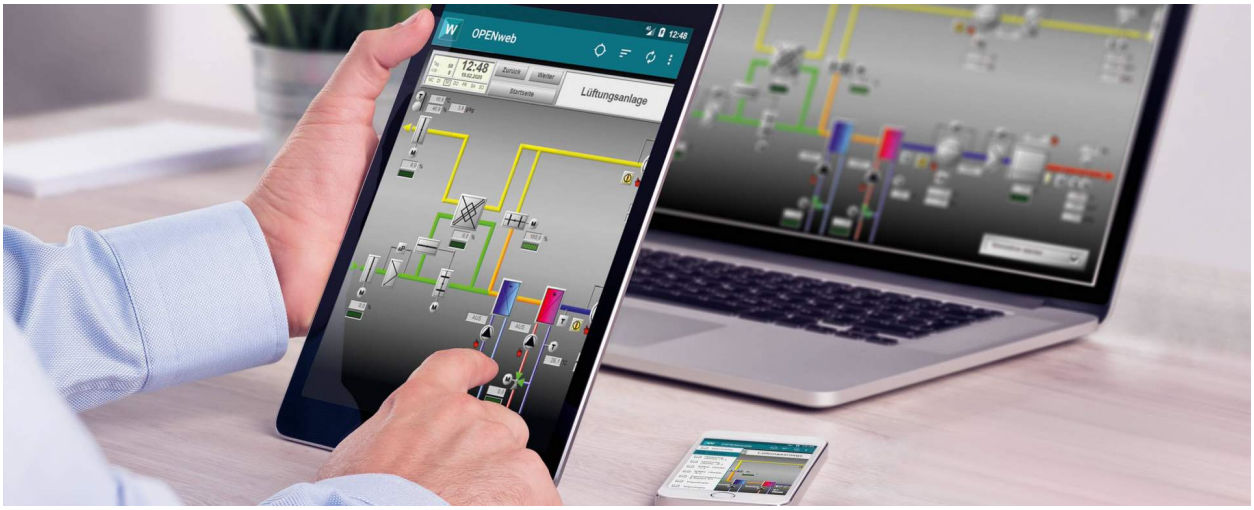

Table 4 - EMS (typical)

1. **Recommissioning & Retuning** - Recommissioning is a formalized process for testing energy management systems (EMS) to confirm that systems are working properly and software is programmed properly. Retuning is a generally one-day process to quickly test building systems.

   We recommission EMS on an ongoing basis through our control system service contracts and we occasionally procure trained commissioning agents and engineers to ensure that all systems and subsystems are reviewed. Our retuning efforts are designed to quickly assess programming and other system attributes, and to make minor corrections and improvements while on site.

2. **HVAC** – Facilities formed an Energy Management System (EMS) Trades Committee consisting of Facilities Energy Team members, campus facility managers, and senior HVAC staff to ensure they remain current regarding upcoming changes at the campus level and maximize the benefits new systems will provide to the college.

   In addition, an HVAC Trades Committee was formed by to improve technician training for the various systems in place at each campus. The intent of this group is to broaden the skillsets of the HVAC staff and provide retention and advancement of our dedicated technicians.

Demand Response

NOVA is located in the Commonwealth of Virginia which, from a U.S. electrical grid perspective, is within the PJM region. As part of its load management initiatives, PJM offers Demand Response (DR) programs to manage peak electrical loads at the regional level. PJM sends out notifications to customers, for quickly reducing electrical load to ease electricity transmission system stress due during system peak load conditions.

Since 2017, NOVA has participated in the regional electrical grid authority (PJM) Emergency Capacity Demand Response Program. This program is administered through the Virginia Department of Mines, Minerals and Energy Contract.

NOVA receives payments based on the actual load reduction measured in kilowatts (kW). See table below for the historical performance.

PJM also provides payments to customers for implementing electrical energy savings projects that result in permanent electrical demand reduction.

Year	# Accounts	Contracted Load Reduction (kW)	Actual Load Reduction (kW)	Payment
2014	0	0	0	$0
2015	0	0	0	$0
2016	0	0	0	$0
2017	6	1,269	1,091	$36,636
2018	6	1,503	113*	$5,269
2019	6	1,508	1,940	$37,424
2020	9	1,651	Pending	$39,202
To Date				**$118,531**

Table 5 - Summary of NOVA Demand Response and Payments

* Influenced by totalization of electric meters.

Building Envelope

Walls, windows, doors and roofs constitute the building envelope. We find great value in studying building envelopes using thermographic technologies to uncover infiltration issues, missing insulation, potential water leaks, and other energy loss and intrusion problems. Once formerly hidden issues are exposed, we enact repairs using in-house facilities personnel or initiate projects to address larger issues.

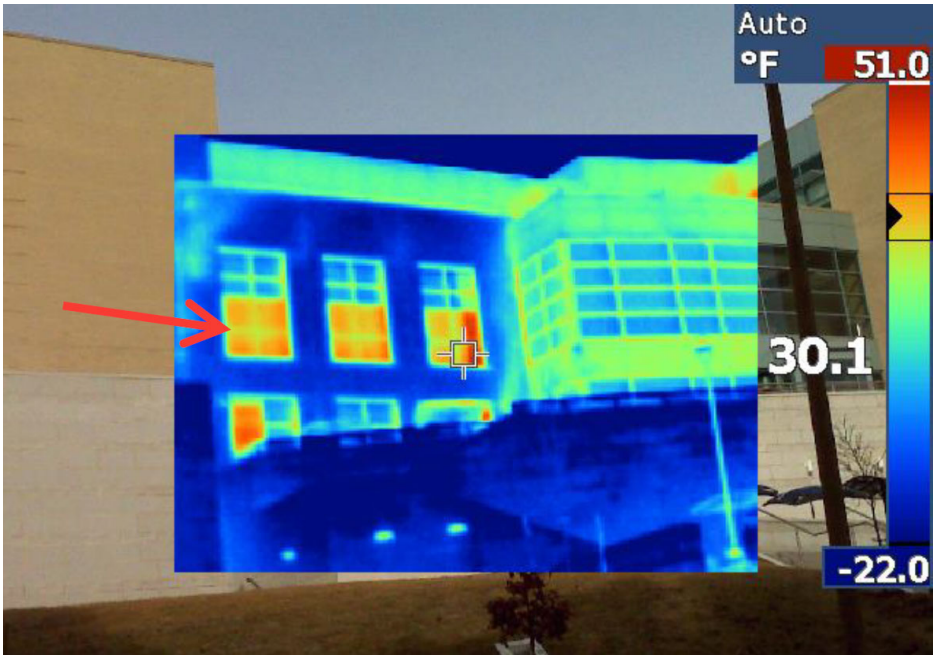

Figure 1- Thermographic image of a NOVA building

Supply-Side Management

This category relates to purchasing of energy commodities. We strive to reduce energy and water usage, but we also want to procure our energy and water commodities at the lowest possible prices.

Electricity

1. Meter Totalization – This is a contractual tool whereby the customer (NOVA) requests that the electric utility mathematically combine metered accounts. While the result does not reduce energy consumption, it does significantly reduce the cost paid for the electricity demand component. All eligible campuses have now been totalized (Alexandria, Annandale, Loudoun and Woodbridge).
2. Contracts Review - We regularly review our utility accounts to ensure that contracted values and other rate elements and invoicing are accurate and current. This has resulted in significant savings from identification of longstanding errors and subsequent contract modifications. Highlights include a major reduction in electrical Contracted Minimum Demand (CMD) at MEC and a rate change for Alexandria Beauregard Garage made possible by our LED lighting retrofit.

These successes have no expiration date and are reducing our utility expenditures by well over a quarter million dollars every year.

Totalization Savings								
Campus	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Current Annual Savings**
AL	$ -	$ -	$ 17,689	$ 39,219	$ 48,113	$ 48,113	$ 48,113	$ 48,113
AN	$ 59,775	$ 59,775	$ 59,775	$ 59,775	$ 59,775	$ 59,775	$ 59,775	$ 59,775
LO	$ -	$ -	$ -	$ 35,848	$ 71,697	$ 71,697	$ 71,697	$ 71,697
MA	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
MEC	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WO	$ -	$ -	$ -	$ -	$ 68,913	$ 68,913	$ 68,913	$ 68,913
Totals	$ 59,775	$ 59,775	$ 77,465	$ 134,843	$ 248,498	$ 248,498	$ 248,498	$ 248,498

CMD and Rate Change Savings								
Campus	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Current Annual Savings**
AL	$ -	$ -	$ -	$ -	$ 2,911	$ 2,911	$ 2,911	$ 2,911
AN	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
LO	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
MA	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
MEC	$ -	$ -	$ -	$ -	$ 41,342	$ 41,342	$ 41,342	$ 41,342
WO	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Totals	$ -	$ -	$ -	$ -	$ 44,253	$ 44,253	$ 44,253	$ 44,253
Grand Totals	**$ 59,775**	**$ 59,775**	**$ 77,465**	**$ 134,843**	**$ 292,752**	**$ 292,752**	**$ 292,752**	**$ 292,752**

Table 6 - Utility Contract and Rate Savings

Natural Gas

Leveraging a Commonwealth of Virginia State contract has allowed us to realize significant savings on natural gas purchases.

Water & Sewer

NOVA investigated and then implemented numerous projects to reduce wastewater charges for devices and systems that consume water but do not discharge into the sanitary sewer system. Referred to as "deduct meter" projects, the scope included cooling towers and landscape watering. This effort returns significant, ongoing savings.

Data Management

1. **Analytics** - NOVA is pursuing the development of a cutting-edge HVAC and energy data analytics platform. Goals include building the capability to simultaneously review data from disparate sources and identify patterns that can lead to waste identification and problem resolution. Challenges include integration of the many EMS we maintain, difficulty in finding Analytics expertise in the marketplace, and many others. Analytics will have many inputs including weather, HVAC system component status and readings, and usage details from interval data and submeter data.
2. **Utility Meter data** – Meter interval data (e.g., 30-minute intervals rather than monthly invoice values) is key to understanding when, and ultimately why, energy is being used at the meter level. This is an important tool to identifying problems that would otherwise remain hidden and unaddressed.
3. **Sub-Meters** - These add the "where" to the "when" and help the energy analyst pinpoint the source of energy waste.

Energy Plan Integration

This section provides information about how we are incorporating our best practices and technology platforms across all campuses and all work to ensure that we are implementing our Energy Plan consistently.

1. **Facility Design Guidelines** – Our department created this document to capture best practices and preferences. As part of this we developed standards for Building Automaton Systems, lighting, types of HVAC systems, HVAC filtration, and plumbing fixtures.
2. **Capital & Non-Capital Projects** – Follow Design Guidelines for proposed or modified systems.
3. **Service Contracts** – we have re-written all relevant service contracts to include optimization of system performance while performing preventative maintenance. Also, requiring contractors to recommend improvements to systems to improve energy efficiency.

Technologies

It is important that NOVA remain aligned with new technologies to ensure that our plan is prudently updated. However, new technologies that are unproven or originate from companies at risk are generally unsound investments. We scrutinize when and with whom we commit funds in an effort to

achieve high returns at low risk. An example of this is the substantial research we dedicated to Light Emitting Diode (LED) technology and companies before developing our unit contract solution sets. In addition:

1. We have strategic plans already in development, developed or deployed for:
    a. Centralized HVAC building controls and programming
    b. Other controls and programming
    c. Lighting
    d. Backup power generation
    e. Building Systems - Continuation of Operations Plans (COOP)
2. We monitor the marketplace for technology improvements and breakthroughs in:
    a. Lighting and lighting controls
    b. Battery technologies
    c. Renewable energy technologies
    d. System and building controls technologies
    e. Motor and battery vehicle technologies

Summary

NOVA's Energy Plan is robust, ongoing and provides great value to NOVA and the Commonwealth of Virginia. Our persistent diligence with regard to energy and water consumption and cost safeguard taxpayer expenditures while promoting health, safety, comfort, aesthetics and the protection of our environment. Our dedicated Energy Team is unrelenting in our quest to optimize systems and find new opportunities to do what is right for NOVA staff, students and guests.

Attachments:

1. Energy & Sustainability Policy - https://www.nvcc.edu/policies/policies.aspx?num=306