

Baltimore: Strategic Energy Planning In Charm City

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ABSTRACT

The Baltimore City government's energy vision includes a future where clean, reliable, and affordable energy fuels all of our city operations and community. To achieve this vision, the Department of Public Works' Office of Sustainable Energy (OSE) created a Strategic Energy Management Plan (Energy Plan). This plan sets long term goals and lays out strategies for a financially healthy and environmentally stable city government. Baltimore is pursuing this strategy with a specialized energy team of project managers, energy auditors, engineers, accountants, and financial analysts, whose projects cut across agencies and finds the right combination of quick return on investment and essential capital investments.

OSE's model is distinct for a mid-size city. Funding sources include fees for service to agency customers, grants, and financing with the city's Master Lease program. The fee for service model puts a dollar value on OSE's expertise and ties energy savings to our projects. OSE is involved from project conception to tracking performance over time.

This article is an abridged version of Baltimore's strategic energy plan.

INTRODUCTION

The Department of Public Works' Office of Sustainable Energy (OSE) manages energy for the city government. In 2014, the city spent close to \$57 million on energy. The job of the OSE is to reduce energy consumption and costs, reduce fossil fuel use, ensure a stable energy supply and increase revenues for the City of Baltimore. The Office:

- Conducts energy efficiency and energy generation projects,
- Locks-in wholesale energy and fuel purchase contracts at favorable prices,
- Audits over 3,000 city government utility bills, and
- Supports nonprofit organizations and small businesses in their efforts to become energy efficient.

The city has sustainability and budget initiatives with energy as an important component. However, until now, there has not been holistic energy planning. Energy planning is not only beneficial; it has a direct impact on the city's bottom line. In 2014, the city's electricity bill was \$7 million lower than in 2006. With a strategic direction, planning, and wide support from other city agencies, the city can save much more.

This plan proposes seven ambitious goals to lead Baltimore toward a financially and environmentally sustainable future.

ABOUT THE OFFICE OF SUSTAINABLE ENERGY

As an office of the Director of Public Works, OSE has a dedicated team of engineers, program managers, analysts and accountants. OSE works to reduce energy consumption and save money in city operations, while improving comfort and safety.

OSE pays for its operations and projects through fees for service, grants, incentives, and financing through the city's Master Lease program. This means that the cost of operating the OSE does not burden the city's budget. Since its inception in 2006, OSE has generated \$140 million in capital investment plus \$28 million in grants for both the city and the community.

Our vision is a future where clean, reliable, and affordable energy fuels the City of Baltimore. Our mission is to lead by example as we continually improve the efficiency of city government facilities and fleet, purchase energy from renewable sources and generate our own.

HOW ENERGY IS USED IN BALTIMORE CITY

Baltimore City government energy spending for 2014 was \$56.7 million (Figure 1). The city purchases electricity, natural gas, steam,

chilled water, heating oil and vehicle fuel. This spending ensures that energy is available to 1,000 city structures and 5,000 vehicles and pieces of equipment.

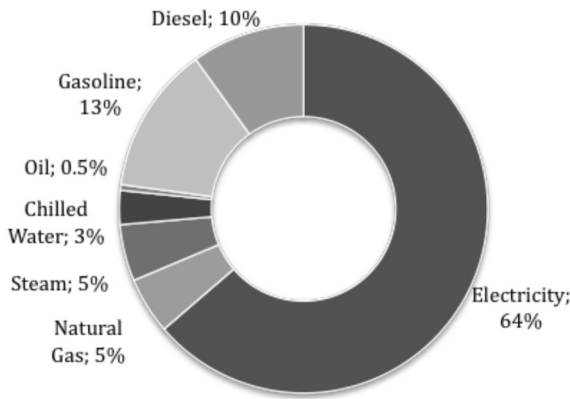


Figure 1. City Government Energy Spending.

The largest electricity user among city agencies is the Department of Public Works (DPW), accounting for over 40% of total expenditures for electricity. DPW operates two waste water treatment plants, three water filtration plants and over twenty water pumping stations. Every day, this infrastructure provides fresh water to 1.8 million residents and businesses in the Baltimore Metropolitan Area and processes up to 250 million gallons of waste water. These services require significant amounts of energy.

STRATEGIES

OSE’s energy strategies are to use less, buy smart, and generate our own.

Use Less

Between 2006 and 2014, OSE completed projects that reduce electric usage by 123 million kilowatt hours—enough energy to power over 1,200 Maryland homes.

The city uses grants, energy performance contracting, master lease funding, and the expertise of its in-house staff to identify and complete efficiency projects.

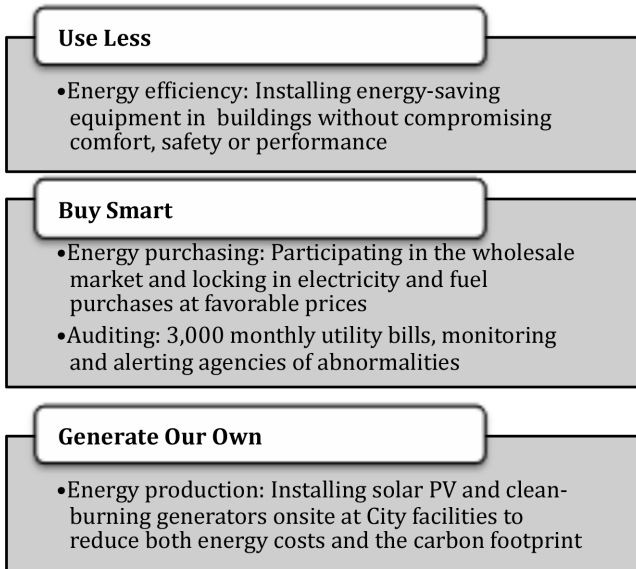


Figure 2. OSE Strategies.

These projects range from a single building, to the comprehensive replacement of street and traffic lights across the city. In 2006, the city entered into an energy performance contract to convert 11,000 traffic lights to LEDs. The entire project cost \$8 million, including on-going maintenance, and had a projected seven year payback. This project resulted in savings, on average, of \$1.6 million per year in reduced electricity bills. Now the city is moving to transition all street lights to LEDs and find other opportunities such as spotlights and sports fields.

Buy Smart

The Office of Sustainable Energy is responsible for purchasing electricity, heating oil, natural gas, diesel, gasoline, steam, and chilled water for city buildings, vehicles and equipment. OSE buys smart by purchasing energy commodities in cooperation with other municipalities, bulk purchasing fuel, and continuously auditing utility accounts.

Together with 23 other Maryland jurisdictions, the City of Baltimore is the member of the Baltimore Regional Cooperative Purchasing Committee (BRCPC). The committee uses a wholesale portfolio program to procure energy and manage costs. The program has proven

very successful in delivering lower costs on a consistent basis by purchasing in bulk and combining administrative costs associated with procurement. In 2014 the City of Baltimore saved \$1.6 million thanks to its participation in BRCPC cooperative purchasing.

The city purchases fuel in bulk. From September 2010 through October 2013, our purchasing approach saved the city more than \$4 million.

The city keeps a constant watch on utility accounts. Office staff catches billing errors, improper rate classifications, “phantom” accounts and other irregularities, saving an average of \$350,000 per year.

The city also applies “Buy Smart” principles to maximizing our benefits from available rebates. OSE has obtained more than \$2.5 million in rebates from the utility, Baltimore Gas & Electric (BGE). These rebates have directly resulted in annual savings of \$1 million. Baltimore was an early adopter in the BGE Smart Energy Savers Program®. The city worked with BGE to identify and aggressively upgrade recreation centers, libraries, charter schools, police stations, the convention center and more. Baltimore was highlighted as a top user of the incentive program and details were posted on their website: <http://www.bgesmartenergy.com/business/customer-spotlights/baltimore-city>.

Generate Our Own

The OSE identifies and installs energy production systems that provide reliable and clean energy. Currently, the city operates a 1MW solar photovoltaic system and three 1MW biogas burning combined heat and power (CHP) engines at the Back River Wastewater Treatment Plant. By owning and generating onsite power, the city gains supply, security and price predictability. In addition, the CHP plant uses methane (digester gas), a by-product of the treatment process, thereby generating renewable energy. CHP generators create both electricity and usable heat.

STRATEGIC GOALS

In June 2013, the Office of Strategic Energy together with Sustainability Commission and Office of Sustainability adopted the following three goals (consistent with City Code, Article 5, 34-7) which were approved by the Maryland Energy Administration.

- Reduce city government electric energy use 15% by 2015
- Increase city government renewable energy 20% by 2022
- Reduce petroleum consumption by the city fleet 20% by 2017

To set a long-term vision, the OSE put forth seven broad, strategic goals which were adopted by the Sustainability Commission and OSE in December 2014. The goals extend and expand the previous set. These goals and accompanying strategies are a road map and also a challenge to Baltimore and other cities.

Electricity	Reduce City government grid electric energy use 80% of 2050
Petroleum	Reduce petroleum consumption by City fleet 40% by 2050
Renewable Energy	Install 40MW of renewable energy capacity by 2050
Greenhouse Gas	Reduce GHG emissions from City operations, facilities, and fleet 80% by 2050
Resilient Energy	Secure resilient sources of energy for the City's critical facilities by 2050
Community	Foster energy efficiency and renewable energy use by non-profits and small businesses
Water	Create and implement a City water use reduction plan

Figure 3. Baltimore City's Seven Long-term Energy Goals.

STRATEGIES AND ACTION ITEMS

In order for the OSE to meet the seven strategic goals, annual targets will be incorporated into project selection, management and reporting. The following strategies are designed to incorporate the city's goals into the daily work of the OSE and provide feedback mechanisms to adjust the approach as needed.

Implementation Strategies

This description is summarized from the complete Energy Strategic Plan. Our implementation strategies are to integrate projects across

goals, foster ownership, set mid-term target, engage stakeholders, monitor performance and solicit feedback. In the plan, each tactic is identified as short, medium, or long term.

Goal 1: Reduce Electricity Use

1.1 Benchmark 100% of city's buildings with sizable energy needs in EPA's Portfolio Manager tool.

1.2 Integrate Facilities Maintenance staff in energy efficiency project support through training, preventative maintenance and design of energy improvements.

1.3 Inventory energy efficiency data for all city buildings, including age, make and models of energy equipment, expected life spans and maintenance schedules.

1.4 Implement an integrated planning framework for energy retrofits and maintenance in city buildings.

1.5 Establish an annual target and execute corresponding number of energy retrofits in city buildings.

1.6 Collaborate with private vendors and the utilities to accelerate installation of sub-meters and smart meters in city buildings where systems permit.

1.7 Collaborate with the purchasing function to identify energy efficient equipment and appliance categories to be analyzed and produce a list of the most energy efficient options.

1.8 Generate periodic energy reports to individual agencies and an ongoing newsletter.

1.9 Partner with the finance function to introduce a granular energy budgeting process for the agencies.

1.10 Engage with the Planning Department and other city agencies to include the Strategic Energy Management goals into the capital planning process.

1.11 Organize and promote a series of Energy Summits and topic conferences—bringing stakeholders together to promote the work of the Energy Office, share opportunities, discuss new ideas and emerging technologies.

1.12 Encourage energy conservation among city agencies via energy competition and/or annual awards to departments, individuals or buildings.

Goal 2: Generate Our Own

2.1 Install photovoltaic solar arrays on city facilities or remote sites connected by a virtual net-meter, where economically feasible.

2.2 Install CHP plants at city-owned facilities, where economically feasible.

2.3 Research technological and financial feasibility of renewable technologies. Examples include: solar storage, biomass utilization, local hydro, seasonal switches between energy sources, etc.

Goal 3: Run an Efficient Fleet

3.1 Conduct a feasibility analysis on introducing compressed natural gas (CNG) vehicles to the city fleet.

3.2 Conduct a feasibility analysis and pilot project to introduce electric vehicles (EV) to the city fleet.

3.3 Conduct a feasibility analysis for the potential of introducing a “downtown car pool”—a vehicle-sharing system that would allow multiple departments to access a shared set of vehicles thus reducing the total number of vehicles.

3.4 Assess business needs of agencies’ assigned larger sedans and/or SUVs; pursue replacing them with smaller more fuel-efficient models, where appropriate.

3.5 Design and conduct fuel efficiency awareness campaigns and competitions among city employees.

Goal 4: Reduce Greenhouse Gas (GHG) Emissions

4.1 Incorporate carbon calculations into OSE project prioritization, monitoring, and reporting.

4.2 Inventory all city-owned buildings that use oil-powered boilers and assess the feasibility of switching them to models that use more efficient fuels.

4.3 Propose full cost of ownership (energy, maintenance, and frequency of replacement) and products’ carbon footprint, as additional considerations for equipment and fleet purchases.

Goal 5: Build Resilience

5.1 Pursue real-time energy usage data availability in city-owned critical facilities by installing smart-meters/energy management systems.

5.2 Investigate and pilot technologies for decentralized power gen-

eration and microgrids to supply power to the city and non-city critical facilities.

5.3 In cooperation with the Mayor's Office of Emergency Management, and Disaster Preparedness and Planning (DP3) advisory board, create a list of critical traffic areas and evacuation routes. Use the list to establish priorities in integrating solar powered street lights and traffic signals.

Goal 6: Support Community

6.1 Provide access to low-interest loans and small grants to finance energy efficiency and renewable energy projects for small businesses and non-profits.

6.2 Investigate the feasibility of creating microgrids in low-income communities leveraging net metering rules.

6.3 Expand the number of EV charging stations available to the community, especially direct current Fast Chargers.

CASE STUDY A: SOLAR POWER GROWTH

Baltimore City is capitalizing on State and Federal incentives, grants, and tax credits to support installation and/or purchase of solar power. OSE currently maintains 1 MW of solar at the Back River Wastewater Treatment Plant. The Energy Plan accelerates the adoption of energy generation by the city. By the end of 2015, the city government was reaping the benefits from more than 11 MW.

OSE identifies solar power opportunities based on economic potential. The additional 10 MW of solar was from a power purchase agreement between the city and Constellation Energy. The power was net metered from Harford County, MD, to city accounts with an estimated projected savings of \$13 million over 15 years.

The agreement with Constellation Energy came from a ruling by the Maryland Public Service Commission (PSC) to approve a merger between Constellation Energy and Exelon. OSE and Constellation worked together to evaluate over 300 city and school properties—but ultimately chose Constellation's off-site solar development.

Other projects in development include a power purchase agreement for 2 MW over 20 years and a solar array for up to 4 MW that would be located at a closed city landfill.



Figure 4. Back River Solar Arrays.

Beyond city government, solar is expanding rapidly across the region. Constellation is adding solar to its future headquarters in Baltimore's Harbor East neighborhood and on two Baltimore City public charter schools. Johns Hopkins University, a major institution in Baltimore, has identified opportunities to add more than 10 MW. The PSC required Constellation to build an additional 20 MW of solar across Maryland—that is estimated to save the state \$13 million, a conservative figure.

Many of these projects are providing employment and training to local workers—a priority for Maryland. Constellation is hosting a series of meetings bringing together solar installers and job training organizations.

Baltimore is also working to bring solar to low income communities. The Office of Sustainability (Planning Department), Civic Works, and the Abell Foundation are working with GRID Alternatives, a local nonprofit, to bring solar technology and job training to underserved communities. Already, the partnership has brought solar power to 10

homes in the CARE Community. CARE stands for Caring Active Restoring Efforts, and is a neighborhood in the process of revitalization. Another project brought solar power to the Door Center—a critical community facility that provides support for youth, families and the community, including serving as an emergency food pantry, after school programs, summer camps, and more.

CASE STUDY B: COMBINED HEAT AND POWER EXPANSION

OSE is aggressively seeking city facilities that fit the heat load profile for high efficiency combined heat and power (CHP). CHP projects are attractive for providing an on-site energy source and reducing greenhouse gas emissions associated with each unit of energy consumed. The best opportunities are found at water and wastewater operations due to the high consumption, available heat load, and the criticality of continued operations.

OSE currently maintains 3 MW of CHP capacity at the Back River Wastewater Treatment Plant. This system uses methane created during the digestion process to power the engines.



Figure 5. Back River CHP Engines (Photo By Gene Sweeney, Jr, *Baltimore Sun*).

OSE completed feasibility studies to expand its usage of CHP and has been approved to install two new plants. These projects will total over 2.6 MW and are expected to break ground in 2016.

There has been substantial public and private support in Maryland for the development of new CHP. OSE secured \$5 million in funds from Constellation in support of CHP, \$1.7 million from the local utility (BGE), and almost \$500,000 from the State of Maryland. Baltimore City finances the remainder the cost through a Master Lease or through an Energy Services Company (ESCO).

Beyond the city government, many institutions and companies in Baltimore are turning to CHP opportunities.

BEYOND THE OFFICE OF SUSTAINABLE ENERGY

While OSE focuses on city operations, there are several offices and organizations that contribute to the efficiency of Baltimore's community.

The Office of Sustainability, which sits in the Planning Department, develops and advocates for programs, policies and actions by government, residents, business and institutions that improve the long-term environmental, social and economic viability of Baltimore City. The Office of Sustainability is guided by the Commission on Sustainability. The Commission includes 21 members that represent city, community, labor, and private industry.

The Planning Department considers energy efficiency through enforcement of city construction and major renovation codes, which include the International Energy Conservation Code and the International Green Construction Code.

Baltimore's Housing and Community Development Department has delivered on weatherization and cool roofs across Baltimore.

Non-profits also serve important roles in energy. Civic Works is a Baltimore non-profit that provides education, skills development and community service. Since 1993, Civic Works has weatherized 369 houses, planted more than 25,000 trees, and completed almost 6,000 energy efficiency improvements in households. And that is only one example.

In 2015, STAR Communities recognized Baltimore as a five star community. STAR, Sustainability Tools for Assessing & Rating Communities, is a non-profit that administers the nation's first certification

program for local sustainability. This includes categories in built environment, climate, energy, economy, jobs, education, arts, equity, health, safety and natural systems. Baltimore's scores in energy management pushed the city to the top.

CHALLENGES

While the Office of Sustainable Energy has the tools and expertise to meet strategic goals laid out in this article, Baltimore's long-term energy planning is impacted by broad trends listed below, some of which are beyond the Office's influence. As the energy plan is reviewed every five years, these factors will be evaluated and adjustments will be made as needed.

Macro-economic Factors

If the prices of conventional energy such as natural gas remain at historic lows, the financial case for renewables will weaken. Alternatively, if fossil fuels increase in price, renewable energy and energy efficiency efforts will become more attractive from a monetary perspective.

Policy

Energy policy on the national, local and state levels has an impact on the ease of achieving these goals. For example, Maryland's renewable portfolio standard is driving the purchase of clean energy in the State. OSE relies on the continuation of progressive energy policy by setting increasingly ambitious mandatory goals and providing multiple financial incentives to pursue energy efficiency.

City Size

Baltimore's population has remained relatively stable in the past decade. Mayor Stephanie Rawlings-Blake has set a goal to bring 10,000 new families into the city. This influx of residents will increase energy demand.

Local Champions

OSE cannot achieve these goals in isolation. Energy management competes for attention and resources. For radical change to take place, energy needs to be managed holistically on the city-wide level and needs to be embedded into the capital planning process.

RELATED PLANS

These plans and strategies are part of the success of the energy strategic plan.

- **Change to Grow: a Ten-Year Financial Plan for Baltimore** was signed by Mayor Rawlings-Blake in 2012 to build a strong fiscal foundation for our city. Innovative, resource-efficient government is one of the main goals of the plan. Energy efficiency and clean energy generation projects not only make the city operations more fiscally responsible, they also create skilled jobs and attract businesses to our communities.
- **Baltimore's Sustainability Plan** was adopted in March 2009. It outlines seven priority themes and 29 goals to realize a clean, healthy, efficient, green, mobile, aware and invested community. Multiple themes relate directly to the goals of the OSE. While the Baltimore Sustainability Plan is a broad, comprehensive strategy for the entire community, this Energy Plan is a targeted effort focusing mainly on city-owned facilities and infrastructure.
- **The Climate Action Plan (CAP)** was adopted in 2012 with the goal of achieving a community-wide 15 percent GHG emissions reduction by 2020. This Energy Plan is addressing the government operations portion of reducing the total GHG footprint of the city.
- **The Disaster Preparedness Project and Plan (DP3)**, adopted in 2013, addresses hazards such as excessive heat, flooding and blizzards while preparing the city for future threats such as water level rise in Baltimore Harbor. Secure and resilient energy is vital for proper disaster preparedness.
- **The DPW Strategic Plan**, adopted in 2014, lays out six broad goals aimed at supporting the environment and health of our city and region. This Strategic Energy Management Plan directly supports the "Environment and Public Health" and "Financial Sustainability" objectives in the overall DPW document.

ABOUT THE AUTHORS

Mr. Theodore Atwood has over thirty years of international experience developing clean energy technology projects for both the government and private sector. He currently is head of the Office of Sustainable Energy, in the Department of Public Works. Mr. Atwood is a leader in forward-thinking energy strategies for commodity purchasing and energy efficiency. Mr. Atwood holds Masters degrees in Chemical Engineering from the University of California, Berkeley, and in Business Administration from Johns Hopkins University.

Mr. William Merritt brings over 42 years of experience in energy and economic and community development. His work includes launching an alternative energy start-up company, managing a development loan program, and various public-private developments. He serves as Program Manager for the Office of Sustainable Energy for energy efficiency and production. He earned bachelor and graduate degrees from the University of Dayton.

Ms. Julia Kalloz (C.E.M., LEED AP) has nine years of experience in energy and environmental analysis and consulting. As energy program analyst for the City of Baltimore, she manages the measurement and verification of city energy projects and performance contracts—as well as analyzing trends and developing new projects. She holds a bachelor from Villanova University and a graduate degree from The George Washington University.

OSE thanks **Ms. Gina Melekh**, the primary author and analytical oversight of the Energy Plan while in Baltimore as a Climate Corps Fellow with the Environmental Defense Fund (EDF). Ms. Melekh is a graduate of Presidio Graduate School.

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