Community Energy Strategic Planning

Better Buildings Alliance

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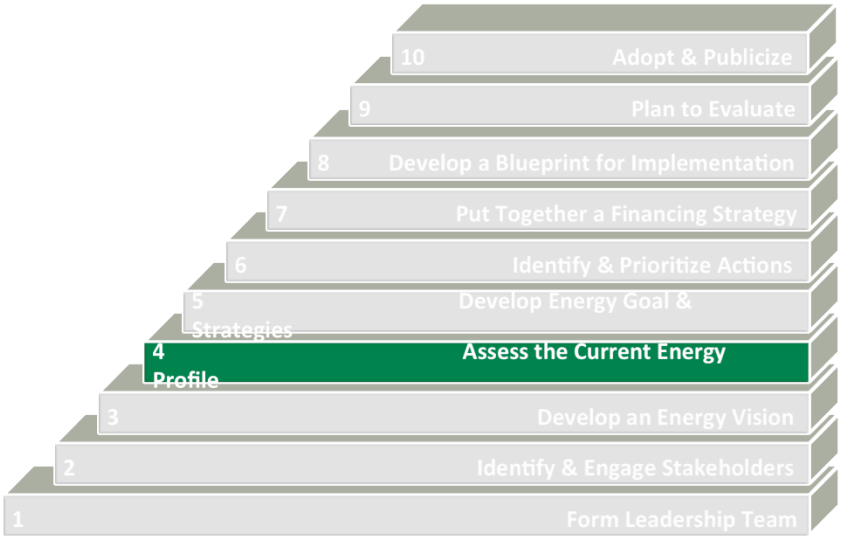
Step 4
Assess the Current Energy Profile

Community Energy Strategic Planning Process



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Step 4: Assess the Current Energy Profile

1. Develop the scope and recruit expertise
2. Assess current energy use and supply
3. Inventory current plans, policies, programs, and projects
4. Identify available human and organizational resources
5. Identify projected future energy use and potential sources
6. Organize and communicate findings

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Ultimately , the goal is to be an informed consumer. Equate to cell phone bill

Understanding current energy use accurately helps us make smart decisions about where we want to go.

Scope: How Detailed Should Your Profile Be?

- High Level Approach
  - Top down, overall energy use
  - Reveals major areas of potential focus
- Detailed Approach
  - Bottom up, building / equipment level energy use
  - Facilitates more prescriptive solutions
- Mixed Approach
  - High level for most information
  - Detailed level for some projects

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Government Scope Data Collection

Data area	High-level	Detailed
Buildings	Energy use by department	Individual buildings' energy use
Infrastructure	Energy use by system (water treatment, street lighting, etc.)	Energy use per facility, street block, etc.
Transportation	Total fleet fuel use	Fuel use by department or vehicle type

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Just to give some context around high-level vs detailed….

Typically, more granular than community scope

Community Scope Data Collection

Data Area	High-level	Detailed
Residential Buildings	Total residential energy use	Energy use by housing type or neighborhood
Commercial Buildings	Total commercial energy use	Energy use by sector (healthcare, office, education, civic)
Industrial Uses	Total industrial energy use	Energy use of specific large users
Energy Supply	Total local supply	Individual supply chains
Transportation	Total fuel use for city	Fuel use by vehicle type

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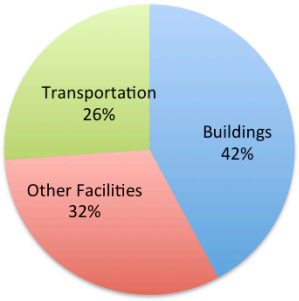
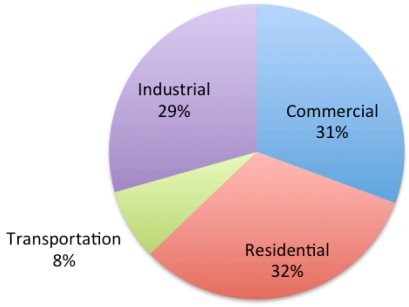
Energy Data Calculator Output

Government Energy Use by Type



Community Energy Use by Sector



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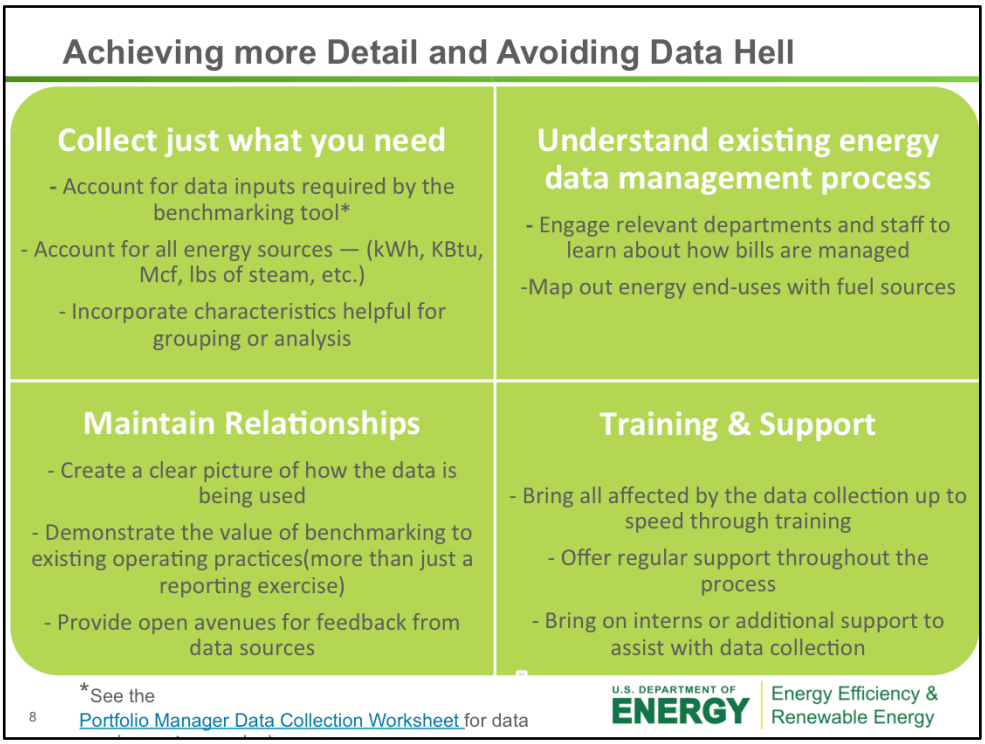

Collect just what you need

- more is not always better, but ensure your data covers all the fields you need for your analysis

Understand the existing process

- Already tracking fuel consumption for GHG inventories? Already managing utility bills for benchmarking? Engage with the data sources to integrate with their existing process

Maintain Relationships

- Data sources are your friends! Show the benefit of sharing data and allow for feedback

Training and support

- Help existing staff feel empowered by the new data, offer training on data collection process

- bring on additional support like interns to assist

ENERGY STAR Portfolio Manager

- Free, web-based tool for benchmarking existing buildings
- Provides benchmarks for all commercial buildings, including:
  - ENERGY STAR energy performance score (1 to 100) for eligible buildings, and
  - Normalized energy use intensities (EUI) for all buildings

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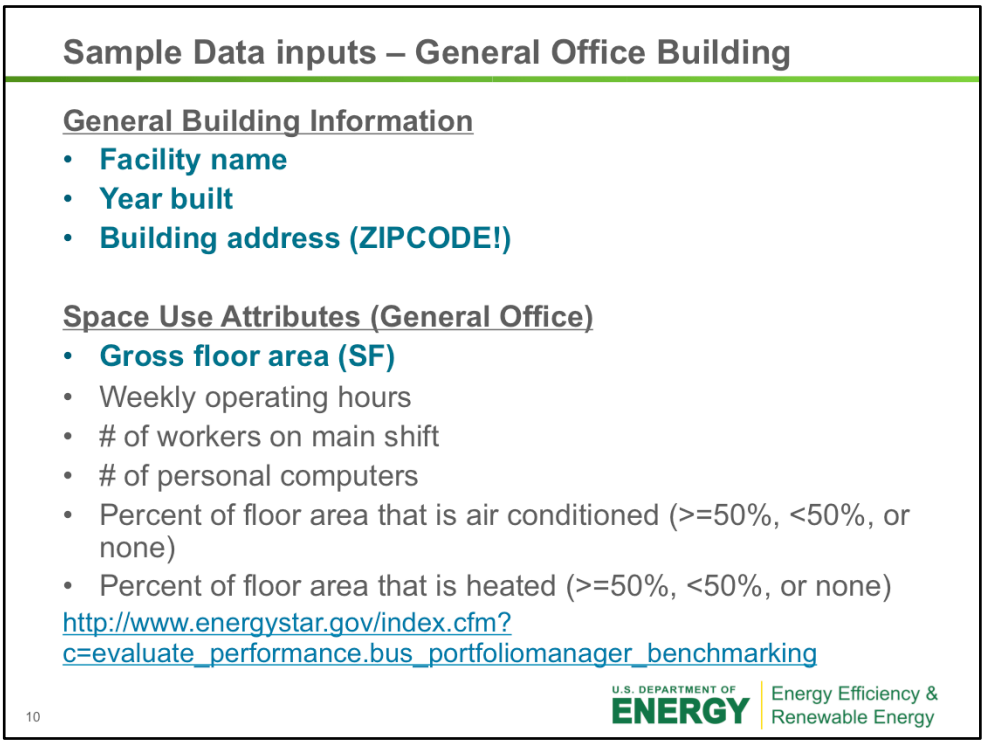
I think most are familiar with Portfolio Manager as a benchmarking option for facilities (including Water treatment plants), so this will be a brief plug. By no means is it the only option, but it is a free web based tool that is nationally recognized and widely used – and if only for the sake of consistency and comparison, is worth considering.

ES just released an upgrade, the screen capture here is a little dated, but the new interface is more intuitive and allows for more embedded quality control and analysis.



I pulled these data requirements from the Portfolio Manager Collection Template. The rough looking link at the bottom links to the benchmarking starter kit which includes the collection template

These fields give an example of the type of information needed to benchmark weather normalized, adjusted, ENGERGY STAR eligible, EUI values for general office building. People often ask what the minimum requirement is for benchmarking a building, and if you just want Portfolio Manager to accept the building information you will need to enter the bold blue values and the space type (ie office). However the other fields are what is used to normalize based on changes in operating characteristics, which is very valuable.

Note that I said that this information will get you weather normalized EUI values, but no meteorological is included. That's where the emphasis on the zipcode comes in. Portfolio Manager uses the zipcode to pull weather data for the building for normalization.

So these are the kinds of fields worth identifying a the beginning of the benchmarking process. Hopefully by having the requirements upfront, collecting the data will be a little less painless. I'll note again, that the Portfolio Manager collection template, found in the benchmarking starter kit at the link below, includes the required information for multiple space types and even provides more information about what those space types are if you click on the names, so it is worth checking out if you are planning to use Portfolio Manager or another tool that uses the same taxonomy.

New York City's Mixed Approach

High Level — Assessed consumption citywide

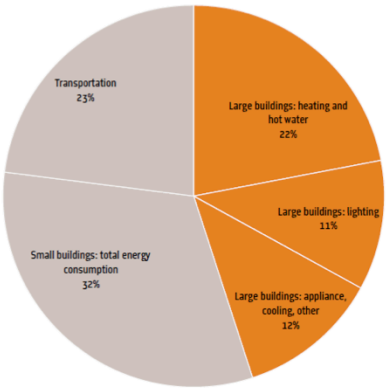
Detail View — Targeted Large buildings for more detailed review

Plan — Developed Greener, Greater, Buildings Plan:

- Annual benchmarking
- Code adoption
- Periodic audits & retro-commisioning
- Lighting improvements and sub-metering

Figure 1: Breakdown of Energy Consumption Citywide

Large buildings account for 45% of New York City's energy use.



Source: NYC Mayor's Office

http://www.nyc.gov/html/gbee/downloads/pdf/nyc_ll84_benchmarking_report_2012.pdf

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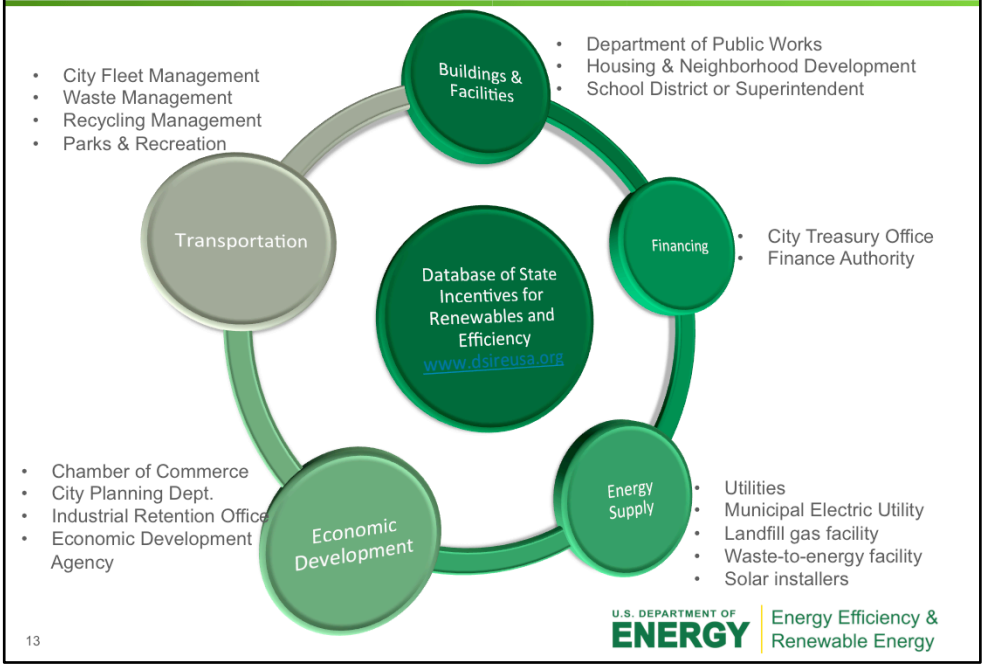
Current Activities: Where to Find Information



- City Fleet Management
- Waste Management
- Recycling Management
- Parks & Recreation

- Department of Public Works
- Housing & Neighborhood Development
- School District or Superintendent

- City Treasury Office
- Finance Authority

- Chamber of Commerce
- City Planning Dept.
- Industrial Retention Office
- Economic Development Agency

- Utilities
- Municipal Electric Utility
- Landfill gas facility
- Waste-to-energy facility
- Solar installers

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Current Activities: Template for Retrofit

Activity:	Implemented Efficiency Lighting Retrofits and Controls
Who:	Department of Public Works
What :	Installed energy efficient lighting and motion sensor controls
When:	2008
Where:	City Hall, TPAC, Fire Academy, and Fire Station #3
Why:	Phase 1 of the City's energy audit identified approximately $500,000 of cost-effective energy and water conservation measures, which were implemented between 2006 & 2008.
Results:	Energy use in relevant buildings decreased by an average of 14%, saving roughly $100,000 annually.
Next Steps:	Continue to deploy efficient lighting in all City buildings, and conduct regular energy audits to identify more energy and cost saving projects.

Current Activities: Template for Policy

Activity:	Green Building Standards
Who:	Department of Housing
What :	Energy performance standard requires new buildings to exceed ASHRAE 90.1 2007 standard by 20%
When:	2011
Where:	All newly-constructed commercial buildings over 10,000 sq.ft.
Why:	High performance buildings will improve the quality of the new building stock being created in the city and will alleviate increasing demands on region's energy supply.
Results:	In first year of implementation, standards affected 400,000 sq.ft. of new building space. Savings projection for this space exceed 20MMBtu annually.
Next Steps:	Continue to educate real estate and development community on the standards.

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Human & Organizational Resources: SWOT Analysis

	Strengths & Assets	Weaknesses	Opportunity Areas	External Threats
People and Organizations				
Government Departments	Strong support for EE & RE at executive levels Effective energy tracking system already in place	Lack of political appetite for increase in debt load	Several equipment leasing and ESCo companies in the region	
Business Community				
Nonprofits & Foundations				
Residents				
Utilities				
Schools	Extensive interest in the value of solar to the curriculum as well as for cost saving	Limited expertise within the school district's facility managers for solar technologies or complicated financing methods	Rapidly lowering prices for solar projects in the area	Protracted economic downturn means continued school budget pressure
Other				

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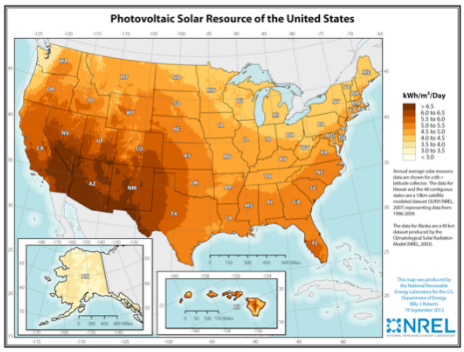
Future Energy Demand & Potential Supplies

- Ask electric & gas utilities
  - Long-term forecast of electricity and natural gas demand in region
  - Long-term plans for building new generation capacity or importing energy
- Consult State Transportation Department/Authority
  - Long-term forecast of vehicle miles traveled, average vehicle efficiency trends, and fuel source trends
- Review your state's most-recent energy plan
- Assess potential alternative energy generation opportunities in region
  - Solar, wind, waste-to-energy facilities, methane capture, hydro, biomass, combined heat and power

Renewable Energy Potential

- NREL's Renewable Resource Data Center (RReDC) provides access to an extensive collection of renewable energy resource data, maps, and tools.
- Biomass, geothermal, solar, and wind resource data for locations throughout the United States can be found through the RReDC.

http://www.nrel.gov/rredc/



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NREL Analysis Tools

- http://www.nrel.gov/analysis/models_tools.html
  - Building Life Cycle Cost
  - JEDI
  - CREST

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Aggregating and Communicating Findings

The Energy Profile Report

1. What is it, and what is it's value?
2. Who is the audience?
3. What should it include?
   - Executive Summary
   - Current energy use and cost
   - Projected future energy demand and supply
   - Related efforts underway
   - Gaps & challenges (from SWOT analysis)
   - Next steps for the CESP process

Knoxville Energy Report

2005 Government Baseline Inventory Results

The City owns and operates close to 100 buildings and 40 parks and athletic fields. There are approximately 1,200 vehicles in the City fleet. Knoxville's roadways are lined by over 29,000 streetlights and traffic signals manage traffic flow at about 350 intersections. City employees drive to work from all over the region, with an average commute of approximately 20 miles round-trip.

The City's public infrastructure, including its employees, enables city government to efficiently manage administrative responsibilities and provide the services, amenities and leadership that Knoxville residents have come to expect.

In 2005, the City of Knoxville spent roughly $7.9 Million on energy—about 4.3% of the total City budget. Total energy, water, and waste costs equaled nearly $8.5 million. Understanding how these costs break down is the first step towards being able to reduce them.

The 2005 Government Baseline Inventory provides a snapshot of energy and water consumption, waste disposal, and emissions generation by city government's network of buildings, facilities, vehicles, and employees.

In 2005...

BUILDINGS

Knoxville's municipal buildings and facilities consumed:

- 32.6 million kWh of Electricity
- 569.1 thousand therms of Natural Gas
- 85.8 million gallons of Water

Total Energy Consumed: 166,954 million British Thermal Units (BTU)
Total Energy and Water Cost: Over $3.7 million
Total Greenhouse Gas (GHG) Emissions: 26,993 tons CO_2 equivalent (eCO_2)

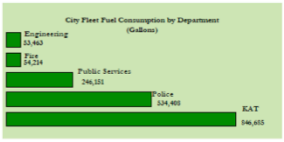
Each day about 3,000 people—1,500 City of Knoxville and Knox County employees and 1,500 visitors—work at or visit the City County Building, which houses offices and meeting spaces as well as judicial courts and the county jail. The bulk of local government operations, the City County Building consumed 59,297 million BTUs of energy and 17.5 million gallons of water in 2005. The 2005 utility bill—including waste disposal costs—for the building totaled $1,056,000. The City's share was approximately one-third, or $364,229. To help offset the eCO_2 emissions from City facilities such as the City County Building, the City purchased a total of 3,000 TVA Green Power Switch Blocks.

FLEET

Knoxville's fleet vehicles and equipment traveled the equivalent of approximately 27.6 million miles over the course of the year and consumed approximately:

- 897,300 gallons of Gasoline
- 179,850 gallons of Diesel
- 645,850 gallons of Biodiesel (B20).

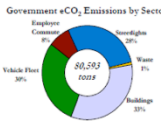
Total Energy Content of Fuel: 309,173 million BTU
Total Fuel Cost: $3,046,328
Total GHG Emissions: 23,812 tons eCO_2



EMPLOYEE COMMUTE

City employees drove approximately 9.6 million miles during commutes to and from work and consumed approximately 589,000 gallons of fuel. The cost of fuel for employee commutes is not included in the Government Inventory (because the City does not pay the bill), though we have chosen to include the associated emissions. There is no city government without city government employees, and we each are responsible for our own commutes.

GHG EMISSIONS



WASTE

Approximately 1,237 tons of non-recycled waste was generated and thrown away at City-owned facilities in 2005. At the City-County building, employees recycled about 49 tons of paper and cardboard, but sent 84 tons of garbage to the landfill. Approximately 23 tons were recyclable materials that could have been diverted from the waste stream.

STREETLIGHTS

Streetlights and traffic signals accounted for one of the City's largest energy expenditures in 2005. The 29,630 streetlights consumed 26.8 million kWh of electricity at a cost of over $1.3 million, and the traffic signals at 350 intersections consumed 4.3 million kWh at a cost of $209,000. KUB charged an additional $1.5 million for maintenance and repairs to the streetlight system.

What is eCO_2? Different greenhouse gases—like carbon dioxide (CO_2), methane, and nitrous oxide—warm the atmosphere at different rates. eCO_2 is a common unit that accounts for the atmospheric impact of each gas relative to that of carbon dioxide and allows all greenhouse gas emissions to be quantified using a single number.

City Government eCO_2 - Top Ten
Total City GHG Emissions from Energy = 79,889 tons eCO_2
Total City Energy Costs = $7.9 Million

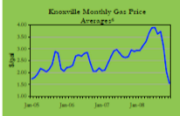
Source	eCO_2	% of Total CO_2	Cost	% of Total Energy Cost
Street & Traffic Lights	22,771	28.5%	$1,511,508	19.2%
Police Fleet	11,345	14.2%	$896,085	11.4%
KAT Fleet	6,985	8.7%	$1,198,686	15.2%
Employee Commute	6,314	7.9%	$0	0%
Convention Center	5,335	6.7%	$618,822	7.9%
City County Building	3,619	4.5%	$331,340	4.2%
Public Services Fleet	2,600	3.3%	$472,434	6.0%
World's Fair Park	1,973	2.5%	$189,552	2.4%
Safety Building	1,912	2.4%	$178,690	2.3%
Civic Coliseum	1,572	2%	$171,704	2.2%

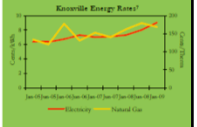
The entities above are responsible for 80% of City Government's total eCO_2 emissions from energy consumption (not including waste-related emissions) and 70% of its energy costs.

Energy Costs

The cost of energy is rising and becoming harder to predict.

National average gas prices rose steadily by approximately 140% between January 2000 and December 2007 then spiked to $4.11/Gal. in July 2008 and plummeted to $1.65/Gal. before the end year.[1] Within six months, global prices for a barrel of crude oil hit both a five-year high of $145 and a five-year low of $30.[1] Electricity and natural gas costs in Knoxville have increased. TVA's 20% rate increase in October of 2008 was the biggest since 1974 and primarily triggered by the rising costs of coal and natural gas.[2] Less than two months later, TVA announced that rates would fall back by 6% in January of 2009.[3] As residents, businesses, and organizations seek to budget for transportation, heating, and electricity costs, the probability of future rate increases and price volatility underlines the necessity of reducing energy consumption.





Knoxville Energy Report

Strategic Plan

Knoxville City Government

This section describes ongoing efforts and new opportunities for the City of Knoxville to reduce energy consumption, costs and associated emissions, and to increase the overall environmental sustainability of city government operations.

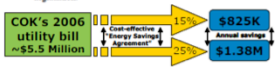
As we in city government work to make Knoxville a more sustainable community overall, it is important that we first look at ourselves. Numerous city departments, including Engineering, Public Services, Fleet, Purchasing, Community Development, Parks, KAT, and Policy & Communications have been involved in determining how best to implement sustainability objectives through city policies and practices.

Though city government GHG emissions are only a small portion of the community's total, we have an essential role to play in leading by example.

Municipal Initiatives

Reduce energy and water consumption at all city facilities.

- The City has contracted with energy services company AMERESCO to audit current energy and water consumption and propose cost-effective efficiency and renewable energy upgrades at all facilities.
- Using a performance-contracting model, we plan to finance some or all of the upfront costs of the upgrades with the energy and water savings produced over time.
- By implementing all cost-effective efficiency measures, we can reduce annual energy and water consumption at city facilities by as much as 15-20% and earn Energy Star[13] and/or LEED[14] certifications on select buildings.
- Anticipated energy conservation measures (ECM's) include lighting system retrofits, water heater upgrades, building envelope enhancements, solar power generation, replacing HVAC electronic control systems and more.
- Additional benefits are expected to include better integration of building systems maintenance, improved indoor air quality and occupational conditions, and reduced mechanical and structural degradation.



Improve the efficiency of traffic signals and streetlights.

- The City's Engineering Department has replaced about 45% of all traffic signals with LEDs (light emitting diodes) and plans to complete the transition during the summer of 2010. Because LEDs use ~90% less energy than traditional incandescent traffic signals[15] and require less maintenance, we expect this project to produce a total cost savings of over $280,000 per year.
- We are working with TVA, KUB and the Electric Power Research Institute (EPRI) to conduct a pilot test of LED streetlights in downtown Knoxville. The pilot will help determine our best options for making the transition to the next generation of streetlights.

Build new facilities that are energy efficient, environmentally friendly and cost less to operate.

The new TRANSIT Center will feature geothermal and solar energy. It will integrate recycled materials and showcase a green roof.

- The new Knoxville Area Transit (KAT) Downtown Transit Center will be the City's first LEED-certified building. It will reduce energy use by 42% and water use by 30% versus a comparable, code-compliant building.
- *Next Step: Adopt a policy that requires LEED certification for new construction of municipal buildings larger than 5,000 ft² or costing more than $2 million.*

Strategic Plan

Knoxville Community

The City of Knoxville's organizing goals during Mayor Haslam's first term were about building stronger, safer neighborhoods, providing reliable city services at a competitive price, developing an energized downtown, and creating more and better jobs. During the second term, we have positioned sustainability objectives alongside each of these goals.

Sustainable development, or economic growth that meets the needs of present generations without compromising the ability of future generations to meet their own needs, is the type of development we are pursuing in Knoxville. By taking stock of our community's strengths as well as its weaknesses, we can establish a blueprint for investing in Knoxville's future in ways that preserve the environment and produce economic opportunity.

The energy efficiency of a community, the quality of its air and water, its level of traffic congestion – all of these are characteristics that impact value and livability. The measures outlined in this section will increase Knoxville's value while reducing its contribution to global climate change.

Community Initiatives

Reduce transportation-related fuel consumption and emissions.

- The City's planning and development efforts are aimed at increasing density (residential, commercial, and industrial, where appropriate) in the central city, reducing travel distances for regular trips. They also incorporate "complete street" designs that facilitate walking, biking, or using public transit.
- KAT's strategic planning efforts, including the Transit Development Plan due out in 2009, seek to improve the coverage, convenience and efficiency of Knoxville's public transit system.
- The City will continue to expand and connect Knoxville's network of parks and greenways.
- *Next Step: Catalyze market development for alternative fuel vehicles, including electric vehicles. Engage in partnerships intended to break down barriers that hinder local growth in alt-vehicle ownership.*
- *Next Step: Support commuter-oriented programs such as SmartTrips*

Redevelopment plans for conserving neighborhoods like Downtown North, the South Waterfront and the Cumberland Avenue Corridor demonstrate sustainable design and planning. Looking to enhance opportunities to live, work, and play in the heart of the city, these projects blend vibrant economic activity with attractive streetscapes and healthy natural environments. Form-based codes promote a mix of uses and development of energy efficient and environmentally friendly structures; complete streets encourage alternative means of transportation such as walking and biking; and innovative storm water management and landscape designs model best practices. Most importantly, these projects are revitalizing Knoxville's urban core by reusing existing buildings and infrastructure, which avoids waste of materials and energy and prevents further sprawl.

Improve the energy efficiency of local homes and buildings.

- The City's Community Development Department and housing partners are institutionalizing energy-efficient and environmentally friendly building practices in affordable home construction and renovation projects.

Recognizing the lasting value of improving the energy efficiency and sustainability of low-income homes, the City of Knoxville's Community Development Department is hard at work integrating sustainable principles into its housing programs. The City has committed to achieving Energy Star certification for all city-funded affordable housing construction and renovation projects. Using Empowerment Zone funds, Knox Housing Partnership and the Knoxville-Knox County Community Action Committee built a set of seven homes in the Five Points neighborhood that received LEED Gold Certification from the US Green Building Council in recognition of the homes' exceptional energy efficiency and environmental sustainability. They are the first affordable homes to be certified LEED-Gold in the nation. This project has set a new standard for affordable home construction in Knoxville.

- The City's Buildings Department adopted the International Code Council's most recent commercial and residential energy codes. This is first time Knoxville has ever had an energy code.
- *Next Step: Establish programs to strategically invest Energy Efficiency & Conservation Block Grant dollars and other funds in advanced weatherization, renewable energy, and energy efficiency repairs and replacements for Knoxville's buildings and homes.*

Step 4: Tips & Tools

Tips

- Look for pro bono help
- Use as a professional development exercise
- Hire consultants jointly with surrounding communities

Tools

- Energy Data Calculation and Summary Tool
- Activity Inventory Template
- SWOT Analysis Worksheet