



U.S. DEPARTMENT OF
ENERGY



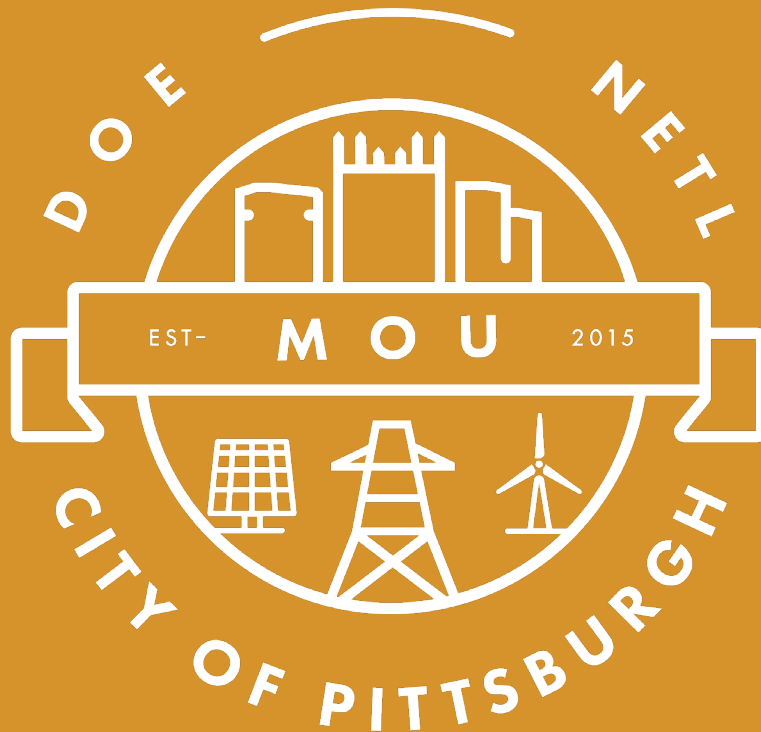
NATIONAL
ENERGY
TECHNOLOGY
LABORATORY

Pittsburgh 2013 Energy Baseline

Consumption, Trends & Opportunities







The U.S. Department of Energy (U.S. DOE) and the National Energy Technology Laboratory (NETL) are working in conjunction with the City of Pittsburgh to transform how energy is produced, transported, and consumed in Pittsburgh. Achieving this vision will require developing solutions which are unique to Pittsburgh: its climate, topography, energy needs, resources, and existing infrastructure. It will also leverage advanced technologies, new business models, and novel infrastructure concepts. The resulting American “City of the Future” will pave the way for other cities seeking to reinvent their energy systems and establish Pittsburgh as a demonstration for energy innovation.

The study area encompasses approximately 165 square miles and a population of 578,000 people in the city of Pittsburgh and adjacent municipalities. The City has its electricity provided by Duquesne Light and natural gas utilities provided by Equitable Gas, Peoples Gas, and Columbia Natural Gas, as well as a few other minor providers.



Population

578,000



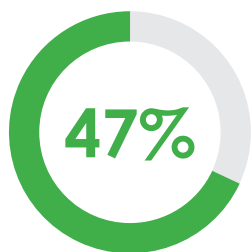
Square Miles

165

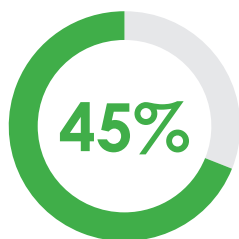
2013 Pittsburgh Energy Usage

The Pittsburgh neighborhoods of Downtown, the Strip District, Oakland, Uptown, Herron Hill, and Schenley Heights consume the most energy in Pittsburgh. Taken together, these neighborhoods constitute 35% of the City's electricity consumption and nearly 50% of all commercial sector electricity consumption in Pittsburgh.

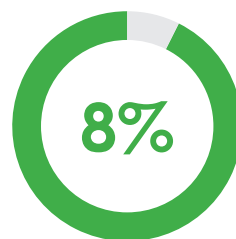
Energy Usage Breakdown



Residential Sector



Commercial Sector



Industrial Sector

Areas of High Residential Natural Gas Usage

32%

of all residential gas consumption is centralized in five ZIP codes, representing over 13 neighborhoods



- North Side Area
- Penn Hills Area
- Hilltop Communities
- Swissvale Area
- Squirrel Hill Area

59.6 Million
MMBtu

Natural gas
and electricity
consumed

2X

Natural gas
consumption vs.
electricity usage

2.5%

Electricity use in
Pennsylvania

9-11X

Variation in natural
gas usage due to
cold winter months

*Figures do not include transportation emissions.

Key Take Away

2013 Pittsburgh Energy Usage



Residential

- Natural gas usage represents 80% of the energy consumed in the residential sector.
- Seasonality usage analysis indicates that residential natural gas consumption is driven largely by heating needs. Overall, residential consumers use substantially more natural gas in cold months.
- Residential electricity consumption analysis indicates that electricity consumption is higher in the suburbs directly adjacent to the large commercial sector of the City.



Commercial

- The commercial sector has a more even split between electricity and natural gas.
- The commercial sector has less of seasonal dependency on natural gas. The peak usage increases by 5 to 7 times during the winter months.
- Consumption of electricity for commercial businesses is more concentrated in the center of the City. Oakland and Shadyside have the highest commercial demand, the center of the City is next in demand.



Industrial

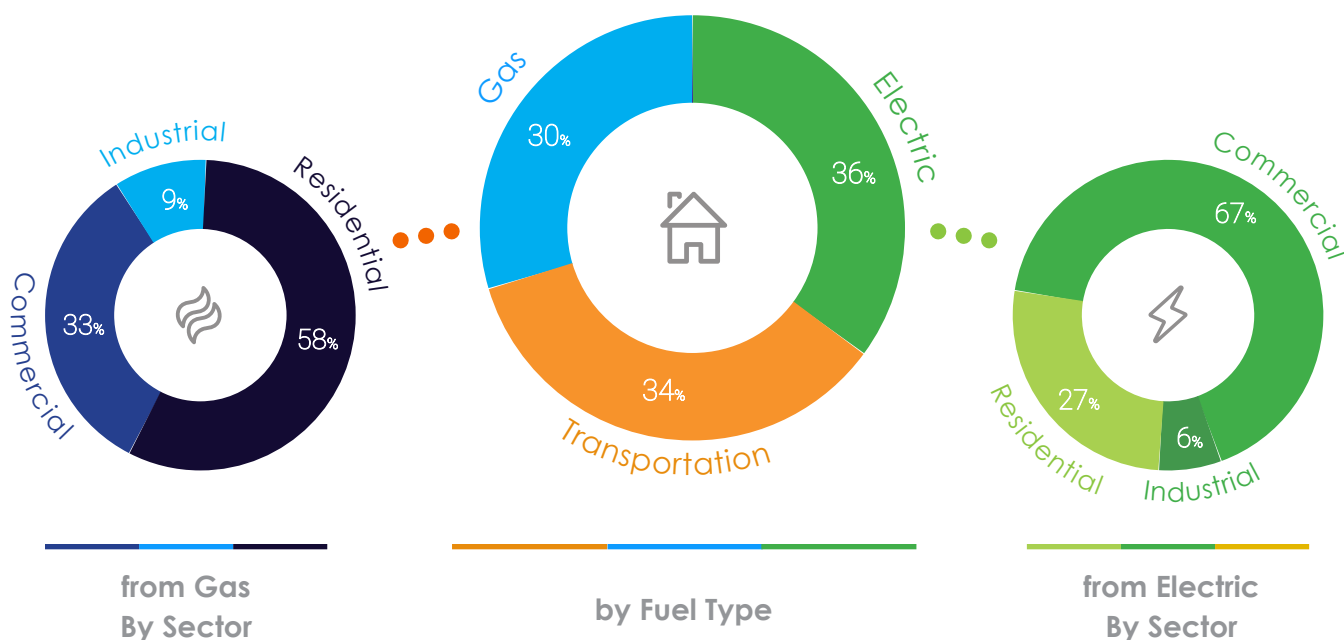
- Industrial energy usage relies heavily on natural gas. Data indicates this being less driven by heating, and more by direct usage of natural gas in industrial processes.
- Industrial consumption was a steady, minor contributor to total consumption throughout the course of the year.
- The industrial sector used over 3.5 times more natural gas than electricity, but only constituted a small percentage of the total consumption of those fuels - 9% and 6% respectively.

GHG Emissions from Energy Consumption

Life cycle analysis (LCA) was performed to better understand the relative greenhouse gas (GHG) emissions associated with energy consumption in the City. This type of analysis examines emissions and impacts throughout the whole energy life cycle. It starts with the extraction of the resource and continues through its conversion to electricity or gas combustion. GHG emissions associated with electricity consumption dominate the climate impacts associated with non-transportation energy use in the City. By comparison, the direct use of natural gas accounted for only 45% of the non-transportation fuel GHG emissions due to its comparably lower GHG emissions profile. This is despite more than twice as much natural gas being consumed than electricity on an energy basis.

Evaluating the GHG emissions over the entire energy life cycle gives a more complete picture of the relative climate impact of the energy consumption, as well as insights into opportunities for emissions reductions.

2013 Greenhouse Gas Emission Breakdown



*Transportation emissions are estimated should be considered only to be of this general order of magnitude

Key Take Away

GHG Emissions from Energy Consumption



- Life cycle emissions from natural gas and electricity usage totaled 6.7 million tons of carbon dioxide equivalents (CO_{2e}) in 2013.

- Electricity usage was the largest source of emissions at 55%, particularly in the commercial sector totaling 37 % of Pittsburgh's overall GHG emissions.



- Natural gas usage in the residential sector was the second largest source of emissions, accounting for 26% of total emissions in the city.



- Emissions associated with space heating are likely to constitute between 17% and 25% of total emissions when both the residential and commercial sectors are considered.

- The impact of electricity usage is high despite a regional GHG emissions profile for electricity that is slightly lower than the national average.

*Figures do not include transportation emissions.



Opportunities for Energy Savings & Emission Reductions

Residential and commercial sectors have different energy use characteristics, representing different opportunities for energy savings and emissions reductions.

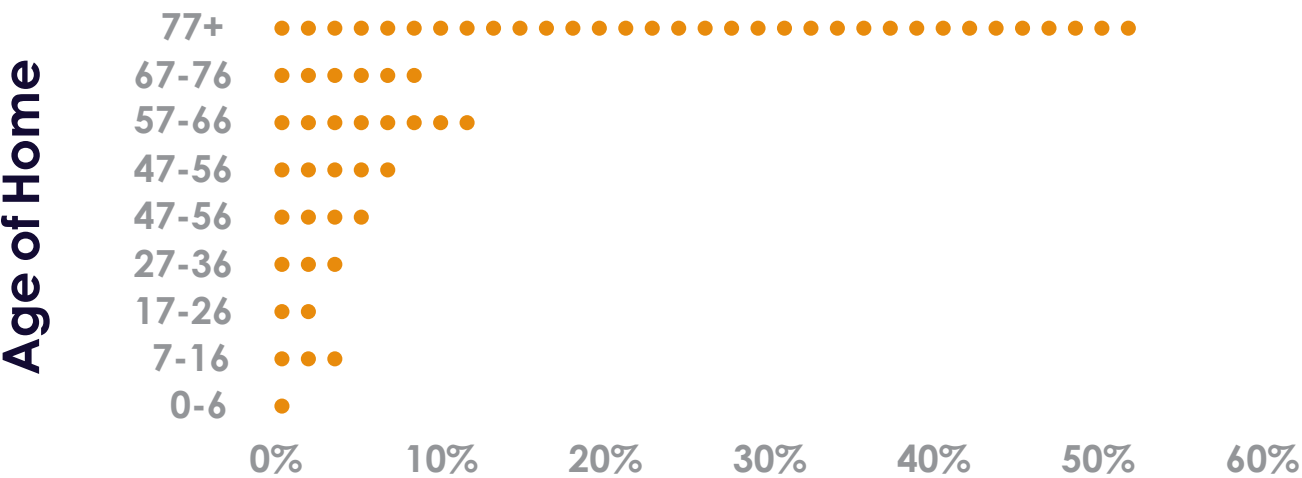
Residential Energy Savings

- 68% of natural gas consumption in the residential sector is home heating related, equating to an estimated 17% of total non-transportation energy usage for the City.
- Nearly 53% of homes in the Pittsburgh area were constructed before 1940 and roughly 75% of homes were constructed before 1960. Home updates and audits present an opportunity for residential communities in Pittsburgh.

Commercial Energy Savings

- The commercial sector electricity usage constitutes 37% of total non-transportation energy usage in the City, and an estimated 25% of total overall energy usage.
- 48% of commercial electricity is consumed in three contiguous zip codes. These localities could be proposed “energy districts” to help reduce energy consumption.

Distribution of Age of Homes in Pittsburgh



Key Take Away

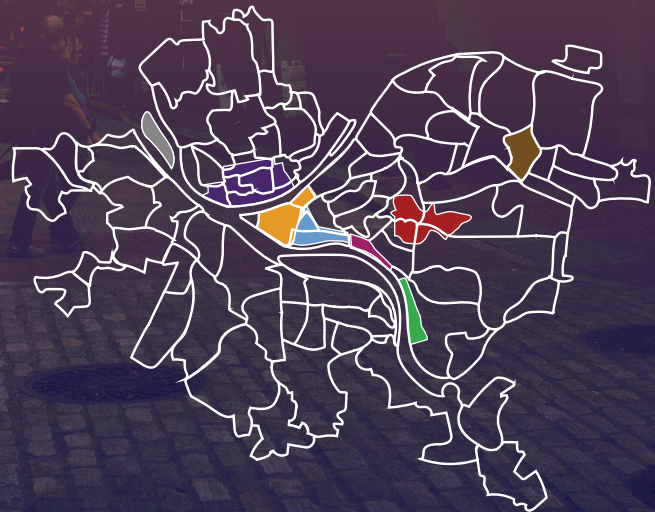
Opportunities for Energy Savings & Emission Reductions

This study has used residential, industrial, and commercial sector data of electricity and natural gas consumption from 2013 to analyze consumption and emission patterns in Pittsburgh and surrounding areas. Evidence-informed recommendations for energy savings and emission reductions can be leveraged by examining the results.

Energy Districts*

Pittsburgh's focus on energy districts is based on the increasing global recognition of the value that district-scale energy systems can bring. Designing systems around the energy needs of a neighborhood or city allows developers to take advantage of local resources, infrastructure, and other regional features. While these systems may require more up-front engineering, they can be made to be highly efficient and often more cost effective than traditional technologies.

Pittsburgh has several existing district energy systems in which a central facility generates steam, hot water, and/or chilled water that is then piped to residential or commercial consumers, just as a utility would provide water or natural gas. These "energy districts" are currently independent, run by different entities, and have diverse characteristics.



- | | |
|---------------------------------|-------------------------|
| Northside Energy District | 2nd Avenue Microgrid |
| Uptown Energy District | Larimer Energy District |
| Oakland Energy District | Brunot Island Microgrid |
| Downtown Energy District | Woods Run Microgrid |
| Hazelwood Green Energy District | |

Opportunities for Energy Savings & Emission Reductions

Commercial

Opportunities for future energy districts should correlate to the City's "hot-spots" identified in the Pittsburgh 2013 Energy Baseline Consumption, Trends & Opportunities report. These districts can be heterogeneous and tailored to the energy footprint and needs of the district.

The City has a robust energy innovation ecosystem, with numerous institutions focused on technology development. One initiative, which is already having an impact on energy usage in the commercial sector, is the Pittsburgh 2030 District. The Pittsburgh 2030 District has enrolled approximately 70 percent of the real estate square footage in Downtown, Oakland, and the Northside - densely populated and energy intensive sections of the City. This program is one of many that are structured to make a large impact, as well as ensuring the City continues to be recognized as an innovator in the field of energy use.

Residential

Home heating is the major use for natural gas in Pittsburgh. Potential technology solutions should focus on home heating energy savings and emissions reductions.



Adding insulation to windows, window seals, internal/external insulation, etc.



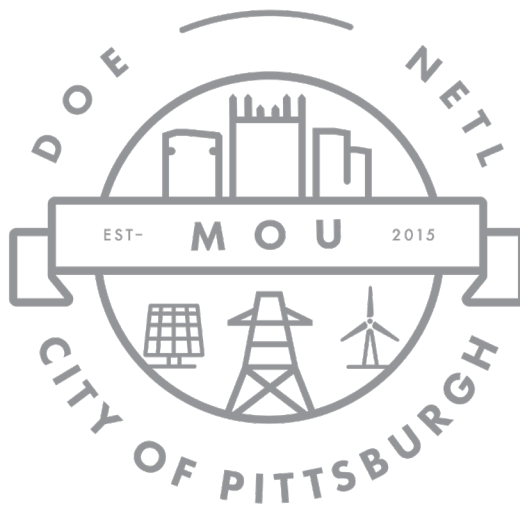
Investing in alternative energy sources like solar, geothermal, etc.



Ensure heating devices are state of the art and running at maximum efficiency

* An energy district is an area within a City – such as a neighborhood or city block – where energy services are shared. The energy district of the 21st Century can take many forms, from the traditional combined heat and power (CHP) system providing district heating, cooling, and electricity, to a micro-grid that has integrated renewable energy electricity generation and battery storage.





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