



# Transforming Data into Action

*A report on how benchmarking data can be used to achieve deep energy savings*

**October 2020**





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## About NEEP

NEEP was founded in 1996 as a non-profit whose mission is to serve the Northeast and Mid-Atlantic to accelerate regional collaboration to promote advanced energy efficiency and related solutions in home, buildings, industry, and communities. Our vision is that the region's homes, buildings, and communities are transformed into efficient, affordable, low-carbon resilient places to live, work, and play.

**Disclaimer:** NEEP verified the data used for this white paper to the best of our ability. This paper reflects the opinion and judgments of the NEEP staff and does not necessarily reflect those of NEEP Board members, NEEP Sponsors, or project participants and funders.

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## Executive Summary

Data is a powerful tool for cities and states as they fight the negative impacts of climate change. A key first step to obtaining useful data is going through the benchmarking process to understand how much energy is being used across a jurisdiction's buildings stock. Benchmarking alone, however, will not help cities achieve their climate goals. Additional strategies such as trainings, building performance standards, and public disclosure are all key elements of taking benchmarking data and putting it into action. This report provides insights into these strategies, and others, to drive deeper energy savings across the region.

## Background

Over the past several decades, the rate of global warming has rapidly increased. Our continued reliance on fossil fuels has put our planet and humankind in an unsustainable position. However, together, we are capable of coming up with new solutions to the climate crisis. Ever-advancing technology allows us to track sources of energy consumption and greenhouse gases, the impact that different sectors and practices have on the environment, and the success different solutions have in curbing emissions. With an immense amount of readily available data, we can make smarter choices and craft meaningful policy to make greater strides on mitigating further climate change.

Data can be particularly helpful in the commercial and residential buildings sectors, some of the largest contributors to greenhouse gas emissions. According to the International Energy Agency (IEA), buildings account for nearly 40 percent of carbon dioxide emissions in the United States.<sup>1</sup> Buildings require a significant amount of energy to power heating, ventilation, and air conditioning (HVAC) systems, lighting systems, appliances, and other plugged-in devices. In addition, the act of constructing buildings and actual manufacturing materials that go into construction further increase overall energy usage. Consequently, designing more highly efficient and electrified buildings can lead to significant reductions in carbon emissions. In order to capitalize on this opportunity, cities around the world have begun putting policies in place to monitor and understand energy use and emissions within their building sectors. Energy benchmarking, the most common policy, allows building owners and municipalities to better track building energy consumption and carbon emissions. Once cities have data on their buildings, they can begin developing policies to help achieve energy reduction goals.

## The Key First Step: Building Energy Benchmarking Policies

Building energy benchmarking is the process of measuring the energy performance of buildings and comparing this data to other metric(s) like the performance of similar buildings, exemplary buildings, the same buildings at a previous point in time, or to state and local energy codes. Keeping track of this data allows building owners to understand their own buildings' energy usage and analyze energy and cost savings potential for energy efficiency upgrades and operational changes. Building energy benchmarking can also be a great way for businesses to publicly demonstrate their commitment to green initiatives. Finally, benchmarking is a precursor that has community-wide benefits including creating green jobs, helping achieve greenhouse gas emission reductions, facilitating cost savings, and improving the comfort of buildings.

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<sup>1</sup> <https://www.iea.org/reports/tracking-buildings-2019>



When crafting a benchmarking policy, municipalities should consider their short- and long-term goals and how the policy will help achieve those targets. Benchmarking can be used to establish and track progress towards energy or carbon reduction goals, enable building owners to take greater control of their energy consumption, and identify which buildings are in greatest need of energy efficiency improvements. By strategizing and thinking about the goal of the program, stakeholders will more easily understand the “why” of the benchmarking ordinance, which will also help to inform how data will be collected and used.

Clear goals will help drive decision-making around the design of the benchmarking law. Policymakers must consider, among other things, types and sizes of buildings to include, reporting schedule and software, process for public data disclosure, and non-compliance penalties. The policy must also determine which output metrics to collect and how to report these metrics. Some common metrics include energy consumption (kWh, therms, etc.), energy use intensity (EUI), greenhouse gas emissions, greenhouse gas intensity, and ENERGY STAR score. The metrics collected from all buildings should be identical so that comparison and data analytics are easier. Cities may choose to develop their own software tool to manage data, select a third-party vendor to assist with data management, or utilize an existing tool, most commonly ENERGY STAR Portfolio Manager.

Once cities determine the goals of their benchmarking policy, they must engage with stakeholders to build support and foster transparency. Local government officials, property owners, real estate developers, and utilities are all essential bodies to include in decision-making. This will ensure that the benchmarking policy has limited pushback. After gathering support for the project, cities can begin crafting the appropriate policy, which is an iterative process to reach agreement among all stakeholders. Once a benchmarking policy is in place, providing the proper training and information for building owners will ensure a successful program. The following table outlines three exemplary benchmarking ordinances and their components:

City	New York, NY	District of Columbia	South Portland, ME
Ordinance	<a href="#">Local Law 84</a>	<a href="#">Clean and Affordable Energy Act</a>	<a href="#">Zoning Ordinance</a> (Article XVII Sec. 27-1701)
Enacted	2009	2008	2017
Municipal	10,000 ft <sup>2</sup> +	10,000 ft <sup>2</sup> +	5,000 ft <sup>2</sup> +
Commercial	25,000 ft <sup>2</sup> +	50,000 ft <sup>2</sup> +	5,000 ft <sup>2</sup> + (district specific)
Multi-Family	25,000 ft <sup>2</sup> +	50,000 ft <sup>2</sup> +	10+ Units (district specific)
Notable Elements	An aggressive square footage threshold: reduced to 25,000 ft <sup>2</sup> by <a href="#">LL133 of 2016</a> , encompassing significantly more buildings. <a href="#">Local Law 87</a> , requires energy audits and retro-commissioning every 10 years.	Starting in 2025, all privately-owned buildings must benchmark under <a href="#">DC Law 22-257</a> .	Benchmarking policy adopted through city’s zoning code and specific to only one business district.

<b>Next Steps</b>	NYC’s Greener Greater Building Plan (GGBP) includes efficiency incentives and programs including a <a href="#">Retrofit Accelerator</a> , <a href="#">Building Energy Exchange</a> , and the Climate Mobilization Act, which includes intense BEPS legislation ( <a href="#">Int. 1253</a> ).	In preparation for the District’s new <a href="#">Building Energy Performance Standard</a> (BEPS), DOEE released the 2018 District median ENERGY STAR scores so building owners can evaluate building EE before 2021, when the BEPS goes into effect.	Partnered with Portland to develop <a href="#">Citywide Climate and Adaptation Plan</a> with measurable actions to move towards 100% renewable energy by 2040 and 80% reduction in GHG emissions by 2050.
<b>Data and Reports</b>	<a href="#">2018 Report</a>	<a href="#">2012-2018 Data</a>	<a href="#">2018 Report</a>

To learn more about developing benchmarking policies, visit [here](#). Small, medium, and rural communities, can see opportunities analysis [here](#). Additional information about benchmarking policies in the region can be found [here](#).

Benchmarking provides a direct route to understanding building energy usage. If data is leveraged properly, benchmarking also serves as a stepping stone towards long-term energy efficiency improvements. Obtaining this data is just the first step in crafting other policies, programs, and educational opportunities to directly impact city-wide energy consumption.

### Next Steps: Turning Data into Action

With sound data comes an opportunity for cities and states to evaluate their sustainability efforts, enact policies, and develop other initiatives that will have lasting impacts on reducing their emissions and energy use. There are a variety of next steps that governments can take once they have obtained robust benchmarking data from their buildings stock. The following section discusses four ways jurisdictions can put their data into action: direct engagement, public disclosure, residential labeling, performance scorecards, and building energy performance standards.

#### Direct Engagement

Cities have several opportunities to directly engage with building managers in order to facilitate energy efficiency improvements. First, **individualized building performance score cards** help building representatives understand how their building efficiency compares to their peers. In addition to providing individual building’s energy efficiency rating, the scorecards can also include details on helpful programs or ways to improve energy performance. These scorecards should link to local programs, utility incentives, and other resources for building owners. This type of feedback and involvement is a great way to work directly with building managers to help them identify performance trends, which leads to an improved understanding of the most effective energy upgrades. In addition, once the recommended efficiency upgrades have been completed, building managers should have the opportunity to get updated score cards. See below for a score card example from Washington D.C.



[PROPERTY NAME]

[PROPERTY ADDRESS]

Gross Square Feet: [PROPERTY GFA]

Portfolio Manager ID: [PM ID]

**[PROPERTY TYPE]**

Thank you for benchmarking your building's energy use in 2018. Share this scorecard with your property's decision-makers to understand more about your building's past performance and comparison to similar [PROPERTY TYPE] buildings in Washington, DC. Program offerings from the DC Sustainable Energy Utility (DCSEU) are detailed below to help you improve your building's performance and decrease operating costs.



ENERGY STAR score is a normalized 1-100 scale of a building's energy performance against a national dataset of similar buildings, where higher scores signify better energy performance

<p>When comparing your building's 2018 ENERGY STAR score with similar buildings in the District, your building is currently ranked [RNK] out of [TOT].</p> <p><b>[RNK] / [TOT]</b></p>	<p>From 2017 to 2018, your building's Energy Use Intensity (energy usage per square foot) has increased by [EUI]%</p> <p><b>↑ [EUI]%</b></p>	<p>Save [\$SAVINGS] if you improve your building's performance by 20%</p> <p><b>save [\$ SAVINGS]</b></p>
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**Warning! Your property ranks in the lower half of [PROPERTY TYPE] buildings in the District, and your energy use intensity increased from 2017 to 2018. Starting in 2021, you will be required to meet specific Building Energy Performance Standards (read more at [doee.dc.gov/service/beps](http://doee.dc.gov/service/beps)), and you may not be on track to meet those standards. Call DCSEU today for assistance with getting your building on the right track.**

**GET HELP!**

**Improve Your Score & Save Money with These Services Available to DC Building Owners**

- Rebates when you upgrade to efficient lighting, HVAC, refrigeration, and more
- Technical assistance to uncover savings opportunities throughout your building
- Training for your operations and maintenance staff so they can make your building run more efficiently



Call the DCSEU today at 202.479.2222 or go to [www.dcseu.com](http://www.dcseu.com) for more information



DOEE Benchmarking Help Center: 202.671.3300 | [info.benchmark@dc.gov](mailto:info.benchmark@dc.gov)

**Citywide events or competitions** offer a second avenue to encourage building owners to improve their building energy use. The Philadelphia Mayor's Office of Sustainability's "Energy Reduction Race" demonstrates the efficacy of such programs. Kicked off in October 2014, the citywide competition aimed to save energy across the

city’s largest buildings. At the conclusion of the event, the three top-performing buildings were awarded prizes and every property that participated received free building operator training. **The program resulted in an incredible 16.1 percent reduction in energy use in the first year, yielding a massive savings of \$347,000 in just over 12 months.**<sup>2</sup> Varied in their design, competitions can generate significant energy savings and the data collected throughout the event can be used for future benchmarking projects or policy updates.

# ENERGY REDUCTION RACE



## BY THE NUMBERS

**Goal:** Reduce Energy Usage by **5%** in one year.

**39** participants entered

**21** finished the race

**18.4** million square feet of floor area covered

**12** buildings met the five percent goal

**70.1** million kBtus of total energy saved

**8,492** MtCO<sub>2</sub>e carbon emissions saved

Results from the 2016 Energy Reduction Race

Image Source: <https://www.phillybuildingbenchmarking.com/err/>

<sup>2</sup> <https://gresb.com/case-study-great-energy-reduction-race/>



#### Further Direct Engagement Opportunities:

- Workshops on technologies (i.e. ASHP) and compliance
  - Based on benchmarking data and interactions with building owners, jurisdictions may gain insight into any specific technology needs. Hosting an event (virtual or in-person) is a great way to educate others about adopting new technologies and financing upgrades.
- Using benchmarking data to inform energy plans
  - Benchmarking data should be used to develop or update energy plans at the local level, to inform those strategies that are covered in the plan, and to help the city target specific building types in the plan.
- Creating local energy committees (and encouraging energy champions)
  - Energy committees can take on a number of different responsibilities which can increase a community's bandwidth to tackle energy issues. More info on developing an energy committee can be found [here](#).

#### **Public Disclosure**

An extremely important aspect of spurring change from benchmarking data is ensuring that building owners can see and understand what their data means. Typically, cities develop an online data platform that allows the public to view all collected raw benchmarking data. Doing so allows residents and building owners within the city to assess city-wide efforts and take a deeper dive into individual businesses, subdivisions within the city, and more. Publicly disclosing data also fosters trust between cities and their residents, especially important when dealing with legislation and policies that are increasingly stringent.

In addition to publicly disclosing raw data, many cities create online data dashboards, which use visualizations and data analytics to show progress towards achieving their energy goals. In some cases, the tool may also allow people to easily focus on key data points, which can reveal the impact that building energy benchmarking is having without requiring extensive background knowledge or experience analyzing large raw data sets.

Benchmarking policies collect several metrics, so cities must decide which statistics they want to include on their dashboard as not all metrics are of public interest. For example, Philadelphia's office of sustainability created an online platform based on 2018 benchmarking data. The platform allows users to create interactive maps of the city's buildings. Users can filter buildings based on different parameters such as building category (size, type, and age) and energy metric (EUI, ENERGY STAR Score, emissions, etc.). Figure 1 shows a screenshot of the city's interactive map.

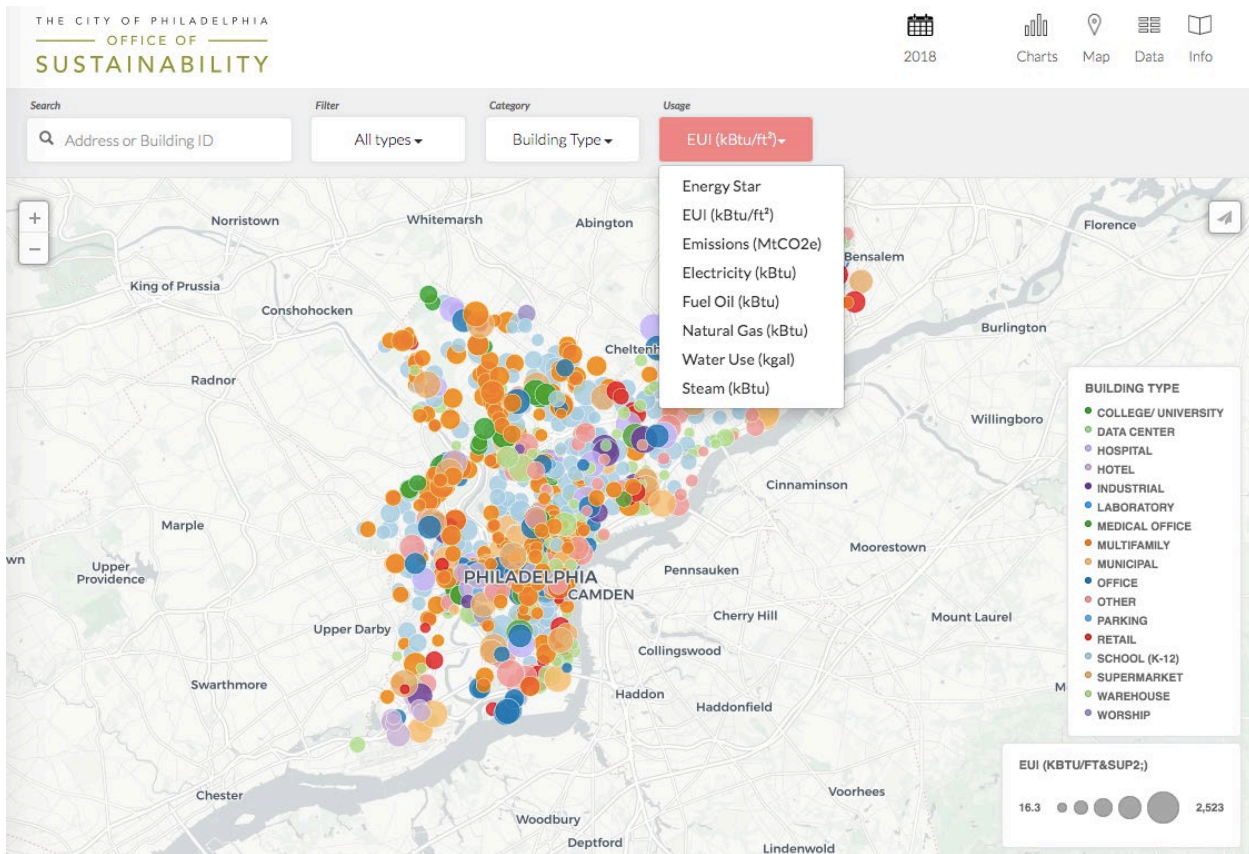


Figure 1: Philadelphia Online Data Dashboard Interactive Map  
[\(http://visualization.phillybuildingbenchmarking.com/#/\)](http://visualization.phillybuildingbenchmarking.com/#/)

New Hampshire and New York each developed energy dashboards to showcase different energy-related data. While they also utilize data from benchmarking policies, the state dashboards are uniquely designed around state-specific focuses. New Hampshire (Figure 2) created a layered map with data on solar projects, biomass facilities, local energy committees, hydro-power contracts, and other relevant fields. These areas are differentiated by specific icons which users can click to learn more about the projects in that area. In addition, users can email their information for inclusion to the map. The platform shares energy efficiency progress with all New Hampshire residents and helps them connect with others to share resources and best practices.

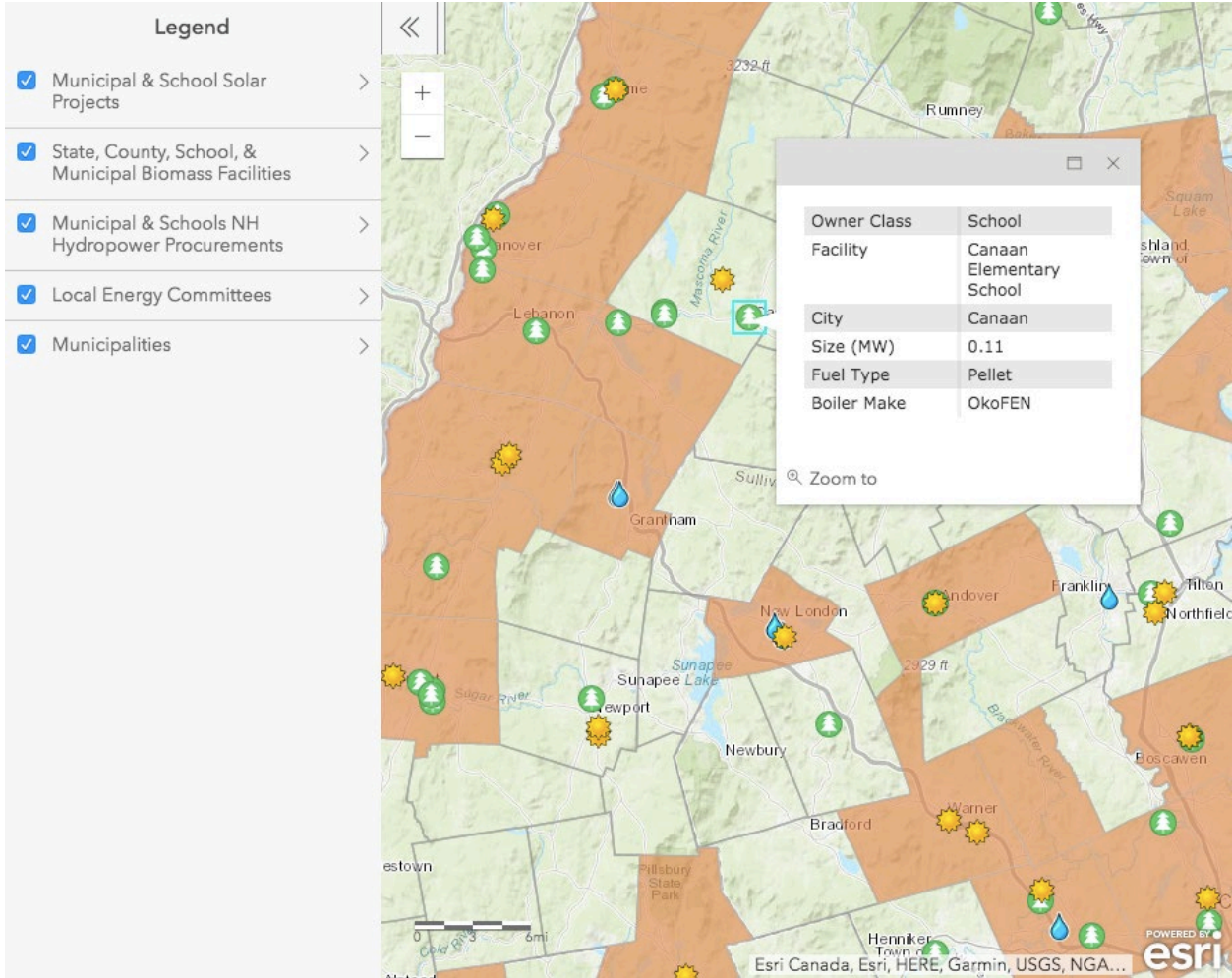


Figure 2: New Hampshire Energy Dashboard

New York’s Clean Energy Dashboard (Figure 3) uses a series of bar graphs to visualize various metrics, including CO2 emissions, electricity savings, and renewable energy generation. The data can be filtered based on either program administrator or primary end-use sector. Users can toggle between various metrics to create different visualizations.

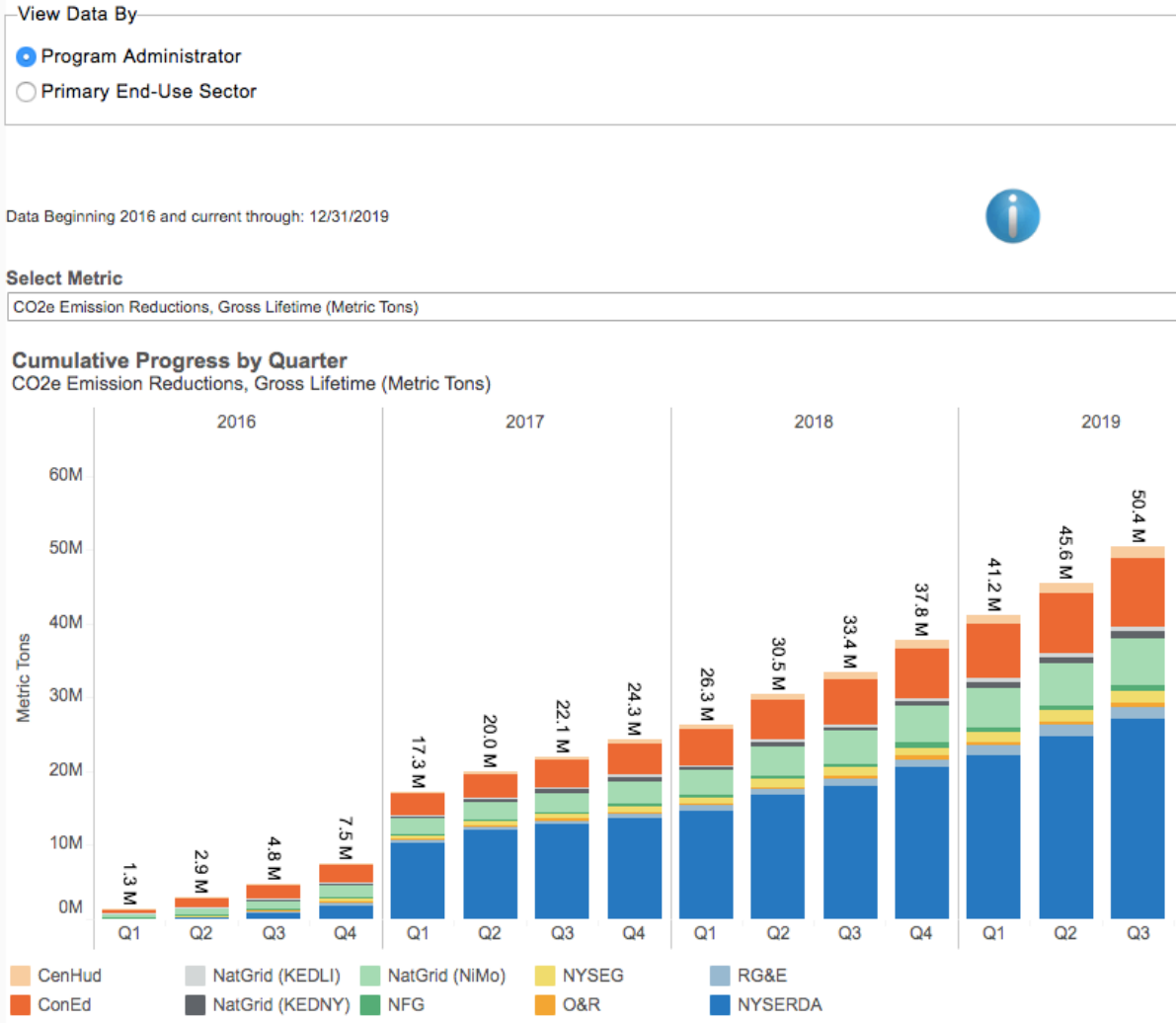


Figure 3: New York Clean Energy Dashboard

Publicly disclosing data through an accessible online platform allows users to truly understand and analyze their jurisdiction’s energy use. The more knowledgeable citizens become, the more invested in local and statewide emissions goals and policies they are. The increased transparency provided by these platforms builds trust between government officials and their constituents, opening the door for even more progress in the future.

### Residential Labeling

A third pathway for transforming benchmarking data into action, residential labeling provides reliable home energy information to interested parties. Home energy labeling offers numerous benefits beyond those directly affecting the real estate market. Labeling initiates cost savings, market transformation, and greenhouse gas emissions reductions. The process also increases demand for home energy assessments and retrofits, helping grow and develop a skilled energy efficiency workforce.

The structure of residential labeling programs varies. First, they can be either voluntary or mandatory. Voluntary structures are typically used for homeowners interested in making energy efficiency upgrades. They are often offered through utility energy efficiency programs and involve a home energy audit and the provision of annual



energy expenditures and consumption information before and after upgrades are installed. Mandatory structures, on the other hand, require all homes complete a home energy label at the time of listing or sale. These programs must be implemented at the city or state level and will generate much higher market participation than voluntary programs.

Mandatory policies are typically designed for the real estate industry through state or local programs and policies. Home energy labels allow buyers and sellers to compare the energy efficiency and performance of various homes and make more informed decisions. Labeling also helps real estate professionals better serve their clients' needs and accurately value homes. Supplying reliable estimates on home energy usage has become increasingly more important as energy prices are one of the largest household expenses.

A number of cities and states have already developed residential labeling programs. Massachusetts, Connecticut, Chicago, Illinois, and Berkeley, California all have labeling programs. And there are many existing resources that make the process of creating these programs easier. For example, the [Home Energy Labeling Information eXchange](#) (HELIX) facilitates the consolidation of energy data in a single platform available to the real estate market. Created with stakeholder input and support from the U.S. Department of Energy, the platform fills the need for a system to transmit data directly from sellers trying to market their homes to real estate listings that buyers use to compare them. Once data is available and approved by sellers, HELIX is capable of automatically populating real estate listings – whether they are accessed through Local Multiple Listing Services (MLS) or portals like Zillow and Trulia – with home energy information from Home Energy Score, RESNET HERS, green certifications, and solar PV.

HELIX is built off the Standard Energy Efficiency Data (SEED) Platform, but is used for residential buildings only. HELIX supports state and local policies with flexible data management, tracking progress, and providing access to all residential labeling programs and solar PV data in one place. The tool can be used to support both voluntary and mandatory policies.

#### **Energy Estimator – Powered by HELIX & ClearlyEnergy**

Developed by NEEP and [ClearlyEnergy](#), Energy Estimator generates baseline home energy costs broken down by consumption category. This tool utilizes ClearlyEnergy's proprietary automated energy modeling (AEM) software and leverages solar PV data and verified energy models (i.e. U.S. DOE Home Energy Score and RESNET HERS Index) stored in HELIX. Homeowners can improve the accuracy of baseline estimates by adding utility bill information and detailed home energy and insulation features. Once all data is entered, Energy Estimator formulates a home energy report that includes links to product sites, energy professionals, and appliance incentives. States and communities can utilize the tool to simplify management of voluntary or mandatory labeling policies and energy disclosure ordinances.

*For more information, visit the [Energy Estimator](#) webpage*

### ***Building Energy Performance Standards***

[Building Performance Standards](#), or BPS, are policies which require building owners to meet certain energy targets in an effort to reach city-wide emissions goals. Policymakers rely on quality benchmarking data, including building EUI and ENERGY STAR scores, to construct effective performance standards. Benchmarking data serves



as the baseline for BPS and allows policymakers to understand the current building stock's emissions, which leads to the crafting of appropriate compliance measures and goals. Over time, these policies become stricter, driving continuous and long-term improvement within a building stock's energy use.

In order to implement a BPS, policymakers should first identify short-term and long-term climate and energy goals. Delicate consideration must be taken to ensure that BPS targets are stringent enough to reach climate goals but not so tough that building owners become overburdened by compliance costs. As they did for benchmarking policies, policymakers must first determine target timelines and climate goals and then decide which buildings are covered by the policy and how they must comply with standards. Typically, the type of building that must comply is based on either size or emissions. Depending on the city, selecting which buildings must comply will vary, as the goal is not to incorporate the most buildings but rather to capture the largest percentage of emissions. In some cases, a sum of smaller buildings can actually encompass more overall emissions than a sum of larger buildings. On the other hand, emissions-based thresholds inherently target highest emitters. While emissions-based thresholds can be easier to implement and more cost-effective to manage, they are only successful after multiple years of benchmarking data has been collected to serve as a base.

BPS typically have two different design structures. First, cap-and-trade programs allow buildings within compliance to sell their excess energy allowance to buildings above compliance. Consequently, the program incentivizes low energy consumption. Baseline programs, on the other hand, hold each building individually responsible for meeting an energy use or emissions reduction goal based on a determined baseline year.

### Building Energy Analysis Manager - BEAM

One challenge that communities may face with the adoption of a BPS is incorporating a software system that manages data and tracks compliance. These software systems would be cost-prohibitive, especially for smaller cities. To overcome this obstacle, NEEP is working alongside Clearly Energy to develop a customizable software solution called BEAM to help cities and states measure and manage building energy policy goals.

BEAM has a flexible structure to accommodate various policy and ordinance program designs: covered building size, timeline, unit of measure, allowed compliance pathways, and flexibility mechanisms. The objective is to create an affordable registry with traceable compliance units that will help cities and states achieve their energy goals.

The Standard Energy Efficiency Data (SEED) Platform and Home Energy Labeling Information eXchange (HELIX) provide the base software infrastructure to manage these ordinances. The SEED Platform stores building energy and emissions data at the building and tax lot level. HELIX has developed several additions to SEED useful to managing BPS: building certification and prescriptive measures management, extended and customizable quality assurance, labelling, and automated links to external services.

A project advisory committee is helping to inform the project to ensure it is meeting its intended goals. A select number of cities will be pilot testing the tool in 2021.

New York Exemplar	Tokyo Exemplar
<p>New York City developed OneNYC 2050 as a comprehensive strategic city plan, covering areas ranging from equity issues to the climate crisis. The strategy sets a goal of reducing city-wide greenhouse gas emissions by 40 percent by 2030 and 80 percent by 2050 (with a baseline of 2005) through the development of the Greener, Greater Buildings Plan (GGBP). The GGBP is comprised of four local laws with an emphasis on energy efficiency policies:</p> <p>Local Law 84 (<b>LL84</b>) – requires all large buildings to disclose their energy and water consumption (benchmark) annually.</p> <p>Local Law 85 (<b>LL85</b>) – requires buildings to strictly adhere to local energy codes for retrofits and new construction.</p> <p>Local Law 87 (<b>LL87</b>) – requires buildings to undergo an audit and retro-commissioning every 10 years.</p> <p>Local Law 88 (<b>LL88</b>) – requires all large and commercial buildings to comply with current energy codes when applying lighting upgrades or installing electric sub-meters.</p> <p>After establishing a robust set of data-driven policies, New York City then turned its data into action through <b>NY Int. 1253 (Climate Mobilization Act)</b>, a building energy performance standard ordinance. The NYC BEPS utilize a baseline compliance design, measuring emissions reductions based on the year 2005. The standard also has a rolling compliance period which encompasses greater emissions as the years go on. Stricter compliance through time is measured through carbon intensity limits that will require improvements by the bottom 20 percent of worst performing buildings in the initial 2024-2029 compliance period and by the 75 percent highest GHG intensity buildings in the 2030-2034 compliance period. The compliance method is primarily data driven but allows specific prescriptive measures for certain building categories.</p>	<p>An additional example of a successful BEPS design comes from Tokyo, Japan. A summary of this policy is as follows:</p> <p>Law: Energy Conservation Law Japan</p> <p>Prior Data Collection: CO<sub>2</sub> Emission Reporting Program (for existing buildings) and Green Building Program (for new buildings) beginning in 2002 (eight years before the first BEPS compliance period)</p> <p>Climate Goals: 25% reduction in GHG emissions and 20% reduction in energy consumption by 2020 from baseline 2000</p> <p>Threshold: CO<sub>2</sub> emissions</p> <p>Compliance: Flexible prescriptive measures</p> <p>Compliance Period: 2010-2019 with two five-year compliance periods</p> <p>BEPS Design: Cap-and-trade (excess compliance can be banked for future use and allowances can be traded)</p> <p>For more information: (<a href="https://www.eu-japan.eu/sites/eu-japan.eu/files/Nishida.pdf">https://www.eu-japan.eu/sites/eu-japan.eu/files/Nishida.pdf</a>)</p>



Implementing a benchmarking policy is a great step towards sustainability. Still, benchmarking is not a stand-alone initiative. Instead, benchmarking serves as a jumping off point for tackling larger environmental and energy issues. When paired with other policies, benchmarking serves as a critical support and guiding source of data for meeting larger goals. In locations where benchmarking and disclosure policies have already been established, cities, utilities, service providers, and technology developers are using the data in creative and impactful ways to drive energy use and greenhouse gas emissions reductions. Harnessing benchmarking data to improve building energy efficiency will help usher in the sustainable cities of the future, creating local jobs, reducing utility bills, improving resiliency, increasing property values, and making buildings healthier for occupants in the process.

## **Additional Resources from NEEP**

### [Building Energy Benchmarking Dashboard](#)

The Building Energy Benchmarking Dashboard is an interactive tool that displays key data collected through benchmarking efforts at the state and local level throughout the Northeast and Mid-Atlantic region. The dashboard shows impacts and trends that benchmarking policies have relative to the amount of benchmarked building space (i.e. number of buildings and square footage) and the actual energy and associated greenhouse gas emission reductions (i.e. EUI, ENERGY STAR score, and GHG emissions).

### [Building Energy Benchmarking Toolkit](#)

This toolkit streamlines the information-gathering and development phase of a benchmarking program so that communities can more efficiently and effectively adopt a program that meets the needs of the greater community to reduce energy consumption and greenhouse gas emissions.

### [Building Energy Performance Standards Policy Considerations](#)

This brief provides an introduction to building energy performance standards and the different policy elements, such as goals, compliance thresholds, and compliance methods that need to be fully considered by adopting jurisdictions.

### [Benchmarking Policy Guide](#)

This brief provides jurisdictions with a breakdown of the common policy considerations involved in benchmarking programs.