The Need for Public Utility Data:

A Case Study on Lexington, MA

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I. Introduction

A. Abstract and Mission

Anthropogenic climate change stands as one of the largest obstacles to the future of our globalized community and thus sustainability has become an increasingly hot topic in the past decades. In order to mitigate the impact of our consumption habits, much of which is tied to our systems of energy consumption, we first need to develop a comprehensive picture of what those trends are with more detailed data enabling more specific approaches. Thus, as awareness regarding the imperative nature of analyzing energy consumption data is becoming more intertwined with the progression of achieving sustainability, town municipalities, such as Lexington, Massachusetts, have begun taking the necessary steps to achieve higher level sustainability. Towns and cities have every reason to engage in the planning of their future energy plans, and many of them are actively trying to understand this matter further. In order to do so, towns and cities need to work with utility providers closely to access the necessary data. In addition, some instructions on how the towns should perceive their utility data should also be provided by utilities. However, the process of getting this necessary information proved to be very difficult.

Our team, along with Ethan Goldman, founder of Power-D City, set out to use the semester to determine whether it would be possible for municipalities to access their utility usage data in order to judge the effectiveness of their climate action plans. In order to do so, we focused on accessing data for energy usage and vehicle emissions, which are indicators of municipalities' greenhouse gas emissions. Despite the importance of this information, utility providers failed to respond to our requests for data helpfully.

B. Overview of Benefits of Accessing Data

As global climate change becomes an increasingly severe threat to communities, municipalities are making it more of a priority to mitigate its effects. Many have developed climate action plans outlining how their municipalities will strive to lower their overall carbon footprint, thus reducing the severity of the effects of climate change within their communities and elsewhere. Lowering CO_2 emissions is typically a good place to start, as atmospheric pollution exacerbates the greenhouse effects and greatly contributes to global warming.

If climate action plans are to succeed, they need to be evaluated to judge whether they are effective and to determine what is ineffective and needs to be adjusted to better implement these plans. Accessing energy data is a necessary step towards evaluating these initiatives because they can show where energy use is being reduced as a result of energy saving efforts and where more effort should be focused. While broad energy data can be useful for demonstrating long-term trends in energy usage, it is not very useful for determining what needs to be implemented in the short run, or for determining what efforts specifically are making a difference.

When residents have had this information they have reduced their emissions. According to Murray and Hawley of Mission::Data, twelve separate studies demonstrated a 6-18% decrease in energy usage when residents had access to their energy data, when that information was coupled with the use of energy saving technologies such as smart controls and actionable feedback.[1] Over 70 million "smart meters" have already been installed by utility companies across the United States to track energy usage on a building-by-building level as of December

[1] Murray, Michael and Jim Hawley. *Got Data? The Value of Energy Data Access to Consumers*: Mission::data Coalition, 2016.

2017, showing that implementing this technology on a large scale is doable and is already in progress in some communities.[2] Using this technology to gather more specific energy usage data can greatly benefit climate action plans that are already in progress and can help climate-focused organizations such as the Mayor's Compact, ICLEI, CDP, etc. to track global climate change mitigation efforts. These resources and data can be pooled to determine where mitigation efforts should be focused in the future to help communities significantly reduce their energy usage as efficiently as possible.

C. Lack of Accessible Information

Despite the importance of this information, highly detailed, building-by-building energy usage data is not available to the public. General information can be found thanks to the efforts of a few organizations and governmental departments, but the data is typically too general to be of any real use for climate planning. Utility providers are privy to more granular data but state privacy concerns as a reason not to share more. Even the Massachusetts Department of Energy Resources does not have more than very general energy use information available. Information did not even seem to be available concerning town-wide data for utilities such as heating oil, which is another source of emissions aside from electrical. This lack of information is a massive roadblock to climate change mitigation efforts, and if climate action plans are to succeed, this problem needs to be addressed.

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[2] Murray, Michael, Laura Kier, and Bob King. *Energy Data: Unlocking Innovation with Smart Policy*: Mission::data Coalition, 2017.

II. The Case of Lexington, MA

A. Overview and Applicability

At the commencement of this project, we were working with the city of Lexington, and the consulting group Power-d.City, to acquire applicable energy consumption data sets, produce detailed consumption analysis, and ultimately produce recommendations for the development of future sustainable energy plans for the town.

Power-d.City is a consulting group co-founded by Ethan Goldman and April Salas with the goal of aiding municipalities address the climate emergency with data driven solutions.[3] Noting that many communities are looking to progress towards 100% renewable energy, Power-d.City is targeting the difficulties posed by understanding the datasets from national, state, or utility-specific areas. These challenges in interpretation pose obstacles to the development of effective and implementable solutions towards decarbonization and sustainability as each community's specific needs require a specific plan that can only be formulated from an adequate analysis of the pertinent data. Power-d.City notes that many towns ultimately face similar challenges toward sustainability and thus seeks to approach each situation as a learning opportunity for the benefit of greater sustainability initiatives. Thus, when obstacles in the acquisition of the necessary energy data for Lexington became apparent, our project shifted towards utilizing this case as an opportunity to emphasize the need of readily accessible data.[4]

Lexington, Massachusetts was the selected municipality of our project primarily because of their pre-existing partnership with Power-d.City and our course instructor, Professor Richard

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[3] "Power-D.City." Power-D. https://www.power-d.city/.
[4] Goldman, Ethan. "Open-Source Community Energy Dashboard" Power-D. https://www.power-d.city/post/open-source-community-energy-dashboard.

Reibstein of Boston University, who lives in the town. Similarly to how Lexington served as a critical case in the initial progress of the American Revolution, we hoped that by producing the requested data analysis for Lexington, our report would similarly serve as an example of what can be accomplished by utilizing energy information for the sustainability revolution.

As per 2019 United States Census estimates, Lexington is a town of 33,132 people, which allows it to serve as a strong comparable example to the rest of the United States, as can be denoted in Figure 1.[5] While a majority of United States incorporated places represent entities with populations less than 10,000 people, Lexington's semi-centrality in this distribution increases its applicability to communities on either end of the spectrum; increasing the potential impact of produced reports. Lexington is comprised of 11,811 households with an average of 2.79 residents per household, slightly greater than the national average of 2.62 persons per household but further indicating the general applicability of information gathered.[6]

Unique to Lexington, however, is the paid position of their Sustainability Director. The position works under the Town Manager's Office and while only implemented as recently as June 1, 2020 with Stella Carr serving as the first official director, indicates an official town effort to pursue sustainability initiatives.[7] Even with the luxury of a full time official in this position, the town was unable to make progress on getting the information needed to put into climate action tracking tools. Lexington is a member of the Global Covenant of Mayors for Climate and Energy, Local Governments for Sustainability (ICLEI), and the Carbon Disclosure Project

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[5] "QuickFacts: Lexington Town, Middlesex County, Massachusetts; Massachusetts." U.S. Department of Commerce. https://www.census.gov/quickfacts/fact/table/lexingtontownmiddlesexcountymassachusetts,MA/PST045219.

[6] "Quick Facts: United States." U.S. Department of Commerce. https://www.census.gov/quickfacts/fact/table/US/HCN010212.

[7] "Lexington's First Sustainability Director Begins Work." Town of Lexington Massachusetts. https://www.lexingtonma.gov/home/news/lexingtons-first-sustainability-director-begins-work.

(CDP), and needs to input energy data into the tracking tools that these organizations provide. Yet, even after the privileges of having a full time Sustainability Director and the help of a consulting group, Lexington still struggled to make progress accessing the data necessary for sustainable progress which poses the concern: if a town with all of these beneficial resources is unable to make progress acquiring the necessary data, how are communities without these resources expected to develop their own sustainability initiatives?

B. Our Work

Due to the limited information provided by utility companies, the data based analysis we were able to produce relied exclusively on the generalized information publicly available on the internet. Thus, the produced analysis was general as well and lacked the granularity necessary for developing the targeted initiatives needed for making progress on desired sustainability initiatives.

1. Mass Save Data

Our primary source of data regarding energy consumption for Lexington, Massachusetts was the Mass Save database. Mass Save is a combined effort by the Massachusetts utility providers of Berkshire Gas, Cape Light Compact, Eversource, Liberty Utilities, National Grid, and Unitil with the stated common goal of "helping residents and businesses across Massachusetts save money and energy, leading our state to a clean and energy efficient future."[8] Mass Save as a program is structured to work closely with the Massachusetts Department of Energy Resources and is funded by additional charges placed on the consumer.[9] While Mass Save, as an initiative, is denoted as an aspect as to why the American Council for an Energy-Efficient Economy rated Massachusetts as one of the most energy efficient states in the country, its datasets fail to provide the public with recent, detailed data.[10]

Referring to their datasets on electrical energy consumption by town, the data currently most pertinent to aiding any town in Massachusetts develop a sustainability plan, while marked as revised as recently as March of 2021, is, as of December 2021, missing any information prior

[8] "About Mass Save." The RCS Network. https://www.masssave.com/en/about.
[9] Ibid.
[10] Ibid.

to 2019.[11] Furthermore, the extent of the specificity of this dataset is represented as the broad monthly electrical consumption measured in megawatt hours and is broken down into the general unspecified categories of "Residential" as well as "Commercial & Industrial." As for the available data, some incorporated places note omitted values that are listed blankly as "Municipal" or "Protected" with an embedded hyperlink that fails to operate and thus provide the user any further information. This ultimately indicates that for publicly accessible data, we are structurally limited by the generality and consistency in reporting and thus there should be more cooperation between relevant agencies and utilities to ensure the necessary data is provided to the public. With this dataset of monthly energy consumption by town, we produced two figures which provided limited insight into the status of Lexington as a whole.

First, we sought to compare Lexington to towns of similar populations for the comparison of the proportion of energy consumption divided between commercial and residential, as denoted by Figure 2. From this, we can reach the general conclusion that more energy in Lexington is spent on commercial usage, 76.16%, than on residential usage, 23.84%. Compared to cities of similar sizes, Lexington has a higher proportion of commercial energy usage than most other towns. It is worth noting that for fifteen of the twenty towns featured in our visual model there was "publicly viewable" data but for five there was not. The population data utilized in developing this analysis was imported from the University of Massachusetts Donahue Institute's Population Estimates Program which relies on data from the United States Census Bureau.[12]

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[11] "Monthly MWh Usage Data." The RCS Network. https://www.masssavedata.com/Public/GeographicSavings?view=C#content-for-l.

[12] "Massachusetts Population Estimates Program: Census 2020 Data for Massachusetts." . https://donahue.umass.edu/business-groups/economic-public-policy-research/massachusetts-population-estimates-program/census-2020-data-for-massachusetts.

Perhaps towns with similar profiles could work together to access data and compare progress. But there seem to be more potential benefits for both analysis and recommendations if towns can get more granular data. With more specific data, we could have a better understanding of how energy consumption is divided within these broad categories of residential and commercial. Perhaps with more data municipalities could address important analytical questions such as if certain industry types within the commercial sectors are disproportionately using more energy than others, or others in their industrial sector (looking at national, state or regional values), or whether houses that are rented or owned are having different outcomes, or where incentives for energy efficiency need to be increased. A desirable goal would be to have time-of-use information so that "demand response" programs could be implemented to reduce peak loads. Being able to answer questions of this nature is necessary for recommendations to target actual consumption patterns within the community. Understanding what sectors or areas draw the most power – and when - would allow a community to modernize their grid to adjust to needs and maximize efficiency.

Secondly, considering the majority of Lexington energy consumption was expended on the commercial sector, we looked to compare consumed energy, in megawatt hours, on a monthly basis for the years available on Mass Save, spanning from 2013 through 2019, which can be seen in Figure 3. This graph indicates that consumption follows a generally predictable trend in which it peaks during the warmer months such as August and rests at its lowest points during moderate temperature windows such as late fall in November and mid-spring in April. We can also see that consumption similarly rises slightly during December and January. From this, we can speculate that these patterns in energy demand correlate with the utilization of electrical air conditioning and heating devices. From this, we would recommend Lexington

should prepare their grid to accommodate these fluctuations and could approach this through the installation of strategically placed solar panels and energy reserves. Similarly, we would recommend Lexington look into technologies to reduce energy expended on maintaining building temperatures. However, without more granular data, we fail to know where these approaches would best be targeted or the accuracy of the speculation they are hinged upon. Figure 3 also denotes rather extreme fluctuations for some data points such as November and December of 2013. This appears to be an accounting error where a share of November's consumption was integrated into December's reported totals. However, this inconsistency is emblematic of the deeper issues within the currently available datasets. Similarly to our previous Mass Save analysis, consumption distribution within the commercial sector was unspecified and unavailable to provide a more granular picture of possibly pertinent values such as average hourly load or peak demand rates (controlling peak loads can dramatically reduce energy costs and use). With an understanding of those values, Lexington would be better able to target efforts to meet the consistent and predictable fluctuations of their consumption. They might be able to begin planning micro-grids that would improve resilience as well as reducing emissions and costs, using stored energy to reduce peaks.

Our work with the Mass Save datasets indicates that some of the largest limitations of currently accessible datasets are their generality and inconsistencies in reporting. But it seems the infrastructure exists to provide improved datasets, and towns could be getting more granular information that they need to track climate action progress. While privacy concerns have been raised, it seems there is much that can be provided that would not violate individual rights.

2. Registry of Motor Vehicles Fuel Consumption Data

In our process of looking for data regarding Lexington's energy consumption, we came across the dataset for Massachusetts Vehicle Municipal Summary Statistics. While not data from energy utilities, a lack of continuous reporting and accessibility to other related data for the municipality encouraged the analysis of other energy consumption that could impact Lexington sustainability plans. The collected data was gathered from the Registry of Motor Vehicles for a project that spanned 2009 to 2014 and has not been updated since.[13] However, its presence indicates the ability for this kind of analysis to be replicated and maintained over time. Referring to Figure 4, we used this data to compare the average daily vehicle emissions per household in Lexington, in metric tonnes of carbon dioxide, versus the household average for Massachusttes from 2009 to 2014. From this, we were able to note that trends for Massachusetts and Lexington started off very similar in 2009 and slowly started to split by 2014 with Lexington emissions dropping below the average of Massachusetts. The produced r squared values for their trend lines were 0.049 for Lexington and 0.107 for Massachusetts, indicating that these were also not good predictors of future emission trends. While this could be in response to Lexington-based efforts to increase public transportation, without more specific data, our analysis is limited to speculation. In order to denote the actual progress of Lexington, or other interested towns, in reducing vehicle emissions as part of possible sustainability initiatives versus greater trends across the larger state, we would need the dataset to be more thoroughly maintained over time. More consistent data sets provide potential for more effective markers of behavioral changes and emission levels. The data used to create this initial dataset exists; motorists must have their cars

[13] "Massachusetts Vehicle Municipal Summary Statistics (Municipal)." . https://datacommon.mapc.org/browser/datasets/330.

inspected every year, and that includes an odometer reading. However, needs to be made public so that projects like this can continue to be developed, marking another example of the difficulty in analyzing how a town could track their climate progress with the data currently available to the public.

C. Accessing More Information

We then made an effort to connect with utility providers for Lexington, (Eversource and National Grid) through phone interviews and emails.

The customer representative at National Grid responded that they do not systematically provide any specific information of a town and only residents of the block could request an average bill of the area. We were only able to get a hold of an investor relation representative at Eversource and he failed to follow up with any additional information.

We then attempted to contact both utility providers through an email request shown in Figure 5. Some important questions we asked include: "What kind of information can a municipality request from you, that might help them to track their progress? Given that there are privacy concerns, are there protocols by which a community can undertake research, protecting anonymity? We have viewed information at Mass Save Data, U.S. EIA and a few other places. It is quite general, and we wonder if there is a way to obtain information broken down further, so that we can understand peak loads better and perhaps learn how we can reduce them. Is there someone that a community can call to help them understand the data you provide? We wonder if a town can receive information about congestion points and where there is capacity for distributed generation, so that a town can know where best to grow solar. Do you engage with communities in long-term energy planning, installing micro-grids, battery storage? Are you planning any joint projects with communities?"

Eversource responded to our inquiries with a link to their website that is already public and only contains general information, as shown in Figure 5. National Grid failed to give any response.

In looking for more information regarding the energy consumption trends of Lexington, we also contacted an Energy Policy Coordinator within the Department of Energy Resources about the presence of datasets for heating oil consumption trends and were told that they have no record of any town-level datasets for heating oil sales let alone data on the percentage of homes with heating oil. While no analysis can be conducted on nonexistent datasets, their absences further exemplifies the challenges in acquiring data that would otherwise be beneficial in assisting the development of sustainability initiatives for communities.

Had the Town of Lexington signed a Memorandum of Understanding that would allow our team to contact the utilities on their behalf, we might have made better progress. Anyone seeking to follow up this line of inquiry should seek this permission from the town they are examining.

III. Data Access

We have assessed the difficulties in obtaining the necessary and timely data for towns and cities to effectively pursue their climate action plans, but there is another hurdle that towns need to jump over in order to maximize the return on their effort. The hurdle is interpreting the data and using the analysis to help address bottlenecks of efficient energy consumption and distribution. With the challenge in mind, we want to assess a few ways that towns can utilize and legislators can help to improve towns' understanding of their data usage.

A. Privilege in Data Access

In an attempt to access and interpret utility data, consultants, or similarly hired staff, can be helpful in providing more detailed reports. However, this requires additional financial investment that not all communities are able to afford.

In our case, Lexington was able to use a consultant (Peregrine) to help guide Lexington through its process. Peregrine was able to obtain more information than the town could obtain if the town asked the utility for it.

The situation with Lexington further proves that consultants or hired staff working on behalf of a municipality or organization may have less pushback when asking about energy use information from utilities. They may be able to acquire more specific information from these companies, but hiring the services to do so may be a luxury that some municipalities cannot afford. In our case, Lexington hired a consultant to produce better energy usage reports, but had to pay for that service. Outside organizations who want to work with a municipality on reducing energy usage or who want to investigate usage may not have the same ability to gather this information.

B. Legislative Action

A community or group working on behalf of one can face a multitude of obstacles in accessing pertinent datasets from utility providers and other relevant entities, as illustrated by our own challenges on behalf of Lexington. The datasets that are publicly available often lack the specificity needed to enable larger scale or more targeted approaches towards sustainability. Even when directly communicating with the relevant organization, these groups can often be hesitant to provide requested information. Thus, it falls to legislators, who can play a pivotal role

in ensuring the ability of a community to access pertinent energy data. The notion of opening data tied to consumer consumption or more granular trends within a town raises concerns about its implementation; especially in the context of privacy. Generally put, people do not enjoy having their personal information shared with others; particularly when it's shared in a publicized dataset that is subsequently scrutinized by analysts for the development of more sustainable practices. While the real impact of having your home's energy data transparently displayed is marginal to an individual's quality of life, as will be reflected in a subsequent case study, the following question is then posed, what does public data really look like? By analyzing two enacted and distinct approaches to this question from opposite sides of the privacy spectrum, it becomes apparent that a middle ground where privacy can be provided and the data can be public.

1. Florida Data

Established in 1912, Gainesville Regional Utilities, based out of Gainesville, Florida, is a city-run multi-service utility that operates under the mission of "owned by the people it serves."[14] Currently the fifth-largest municipal utility in Florida, their utility operations are unique for the accessibility of their database for energy consumption which has enabled the implementation of the incredibly powerful tool 'Gainesville Green.'[15] While still in its beta version, Gainesville Green allows for any user, resident or not, to access a comprehensive by-address database and map of the consumption of electricity, water, and gas consumption as well as the carbon emissions of each residence in Gainesville, as noted by Figure 6. Furthermore, this

[14]"Gainesville Regional Utilities," GRU, accessed December 17, 2021, https://www.gru.com/.
[15]Ibid; "Gainesville Green (Beta)," Gainesville Green, accessed December 17, 2021, https://gainesville-green.com/.

database allows for homes to be compared by proximity, across Gainesville as a whole, and against the larger county of Thornehill. Consumption and emission values can be normalized by square footage to further enable a more thorough understanding of specific consumption and emission trends. The database also references the applicable cooling system which provides a definitive insight on energy consumption fluctuations across months. Our ability to pull up all this information, however, does present noted concerns regarding privacy. This scale of public data could prove to be immeasurably beneficial for assessing energy trends within a city and thus coordinating targeted sustainability efforts but it is to be expected that the implementation of similar systems in other communities across the country may face some level of hesitancy from residents. While there are many forms of public data, this is one of the most extreme cases.

2. California Data

While Gainesville is an extreme of transparent energy data, there are other approaches which utilize a much more moderate approach regarding privacy. Following a California Public Utilities Commission (CPUC) ruling in 1997 regarding data access in Community Choice Aggregation Programs, the "15/15 Rule" was enacted to ensure customer privacy when personal data is utilized in utility aggregation reports.[16] The 15/15 Rule requires that aggregated data includes a minimum of 15 customers under the additional condition that no one customer's load comprises more than 15% of the pertinent group's energy consumption.[17] This form of data representation allows for a much more granular level of analysis, a more distinct comprehension of energy consumption behaviors while also ensuring a standard of anonymity. While the CPUC

[16]"Aggregated Data Access: The 15/15 Rule in Illinois and Beyond," Elevate Energy, December 4, 2014, https://www.elevatenp.org/wp-content/uploads/1515-Rule-Factsheet-FINAL.pdf.
[17] Ibid.

is working with utility companies to ensure its widespread implementation, their procedures come with a direct objection to the utilization of that data for utility benchmarking purposes, which would consist of the data being used for asset management and market portfolio assessments.[18] The 15/15 Rule is growing in its implementation as it sees inaction in Colorado, Minnesota, and Illinois with the logistics varying depending on the needs and preferences of the region such that Illinois has revised it to a 4/80 and parts of California utilize a similar 15/20 Rule.[19] Regardless of numbers, this model provides a potential future where data is publicized and privacy is respected. However, its utilization is yet to be perfected as major utility providers such as Southern California Edison require an application be submitted by "eligible third parties" for access to datasets of their 15/15 aggregated data.[20]

From the initial success of the 15/15 Rule, California also saw implementation of Integration Capacity Analyses (ICA) in 2019, which is an evolving analytical tool designed to provide hosting capacity analysis, or the feasibility of implementing a distributed energy resource (DER) such as solar into the already existing grid system.[21] With the implementation of the ICA, models regarding how new loads or generation systems will impact the actual grid system can be developed by customers, developers, and regulators alike.[22] With the ICA, a majority of Southern California grid system usage is now publicly available in real time with the foundation of its privacy being the aforementioned 15/15. With these tools, powerful analysis

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[18] Ibid.
[19] Ibid.
[20] "Third Party Data Request Program Fact Sheet for Local Governments," Southern California Edison, accessed December 17, 2021, https://www.sce.com/?MOD=AJPERES&attachment=true&id=1515004572852.
[21] Sky Stanfield, "What Grid Transparency Looks Like," Interstate Renewable Energy Council (IREC), August 20, 2019, https://irecusa.org/blog/regulatory-engagement/what-grid-transparency-looks-like/.
[22] Ibid.

from groups such as the Interstate Renewable Energy Council have found that for the total number of nodes on each utility's respective grid network, 70% of Southern California Edison's, 63% of Pacific Gas and Electric's, and 32% of San Diego Gas and Electric's have zero capacity for a new load; a staggering conclusion with drastic implications for the future ability of California's electrical system to support the mass implementation of electrical vehicles without serious financial burdens associated with the improvement of grid infrastructure.[23] As depicted in Figure 7, the ICA allows for a detailed analysis of grid capacity and usage and provides critical data all while respecting the 15/15 Rule.

3. Massachusetts Data

Data, according to Section 11E of 1997's Chapter 164 of state legislation titled "An Act Relative to Restructuring the Electrical Utility Industry in the Commonwealth, Regulating the Provision of Electricity and Other Services, and Promoting Enhanced Consumer Protection Therein"[24] is to be collected, analyzed, and published by independent system operators (ISOs) for the benefit of "consumers, energy suppliers, [pertinent agencies], and the general court about the operation of [...] markets and any deficiencies in the operation" with the intent to then provide recommendations for improvements.[25] This data is intended to be published with periodic projections of the supply, demand, and price of energy on both state and regional levels.[26] Furthermore, the publication of an annual report regarding the collective energy system via data on generation, transmission, load and capacity. This report is what effectively produced ISO New England which provides a daily snapshot regarding all the aforementioned

[23] Ibid.
[24] "Chapter 164," Session Law - Acts of 1997 Chapter 164, accessed December 17, 2021, https://malegislature.gov/laws/sessionlaws/acts/1997/chapter164.
[25] Ibid.
[26] Ibid.

specificities, and can be seen in Figure 8. This data, however, remains in a heavily aggregated form that fails to provide the needed specificity for targeted sustainability initiatives or grid capacity analysis.

It is only in recent months that the opportunity for effective legislation to increase publicly accessible grid data in Massachusetts has presented itself. As of May 2021, the Department of Public Utility has mandated that all energy utility providers in Massachusetts submit grid modernization plans for advanced metering infrastructure.[27] This kind of grid modernization would allow for incredibly thorough and consistent datasets however, as noted by the Acadia Center, the involved utilities of Eversource, National Grid, and Unitil all have submitted their own plans which involve dramatically different considerations for the utilization and publication of data.[28] With these grid modernization plans forecasted to commence in 2022 at the earliest with some plans accounting for 10 year vision, Massachusetts legislators have a critical opportunity to take effective action to ensure that the public have access to consistent and granular energy consumption.[29]

IV. Recommendations

A. Essential Questions that Need Answers

If the goals outlined here are to be met, a number of questions need to be answered:

1. Where do peak load and congestion points for energy distribution occur in a town?

[27] "Acadia Center Summary and Review of Massachusetts Utilities' Proposed Grid Modernization and Advanced Metering Infrastructure Plans," Acadia Center, September 4, 2021, https://acadiacenter.org/resource/acadia-center-summary-and-review-of-massachusetts-utilities-proposed-grid-modernization-and-advanced-metering-infrastructure-plans/.
[28] Ibid.
[29] Ibid.

2. What direction is fuel usage trending in? How are heating oil and propane being used by residents and businesses, and can that usage be reduced?
3. What do household and town-wide vehicle emission trends look like? How many miles do residents travel on a regular basis?

It should be noted that these are only some of the pertinent questions that are relevant to investigating energy usage and creating mitigation strategies. They are meant to convey the kinds of answers towns should be entitled to to properly measure their sustainability progress. More questions should be asked of utilities and energy-focused organizations in the pursuit of information and questions should not be limited to those we suggested. For example:

1. Where are the best places to install solar, with easy access to the grid?
2. What are the possibilities for transitioning gas systems to district geothermal?
3. What kind of cars have the most emissions?
4. What time of the day should we aggregate the small, implementable reductions in use to bring down peak load demand?
5. Where should we target assistance to improve energy performance?
6. What investments in battery and local generation can best provide need resilience?

Municipalities need to be deeply engaged, with states and the utilities regulated by the state, in planning energy futures that provide community security as well as allow residents to play their part in combatting climate change. Citizens have the ability to act, as a group, to address this issue, when they use their local governments to assume a role, representing their interests, in the construction of the energy future we need. We ask these questions as examples, to prompt thinking among communities, who will need state

help to organize as a united voice. Utilities have long become accustomed to a particular business plan, but they are to be regulated in the public interest. Foundational changes have occurred, with the advent of community choice aggregation, community solar, and the growth of citizen sustainability committees and municipal sustainability coordinators, now supported to some extent by a federal government push as well, and in some states such as Massachusetts, a decarbonization roadmap. Information is essential for these changes to bear fruit. We hope readers will be inspired to ask more questions and to seek for themselves the information we need to design and measure our efforts, and the best ways for it to be provided and used.

B. Call to Action for Legislators

To avoid struggling through the same process we went through to find our limited information, municipalities and energy-focused organizations need to be supported by a legislature that mandates data sharing for utility information. Utilities should be required to provide current, accurate information about energy usage that can allow legitimate inquiry. Simply not providing it will not aid municipalities, those working on their behalf, concerned citizens, or analysts concerned with energy progress. It is necessary to accomplish the declared decarbonization aims of cities, states, and nations across the world. . The data now provided to consumers can be expanded to be more useful (at present, consumers get an “above average”, “average” or “below average” grade). Is it possible that they could be provided with more useful information, as has been shown to lead to reductions, in other communities? Utilities should be required to dedicate services to help customers understand their usage data at an individual and town level, to bridge the gap between consumers and energy experts. The Department of Public

Utility's plan for further grid modernization must continue with its efforts to implement advanced metering infrastructure to aid data collection efforts. Much supporting legislature to help meet these goals should be considered on behalf of these municipalities, so that the many opportunities for energy progress on the local level, through active engagement in the development of our joint energy future, can be captured.

V. Conclusion

In conclusion, we want to stress the difficulties for towns and cities to smoothly pursue their climate action plans due to obstacles aforementioned and raise legislators' awareness on the urgency and importance of being able to access timely, current, and specific energy usage data.

Some courses of action include:

1. Requiring utilities to provide the best available energy usage data in ways that aid progress in energy transition, engaging towns in a joint effort to plan our energy future, as part of basic utility service.
2. Requiring utility providers to dedicate services to aid in analysis of utility usage data for the purpose of targeting energy reduction efforts, as part of their responsibility as entities regulated in the public interest.
3. Continuing the Department for Public Utility's plan for grid modernization, including providing capacity for Distributed Energy Resources and more useful information through advanced metering.

We hope that this small project helps to open up dialogues and spark conversations. We would like to see the current situation for towns and cities change, so that they can successfully monitor and pursue their climate action plans. These dialogues are important in corporate, academic, and legislative contexts, as this is a widespread problem that requires collaboration

and cooperation from all involved parties if it is to be solved. Information is the most critical resource for change to be implemented and we need to take actions right now to start and facilitate the process.

VI. Figures

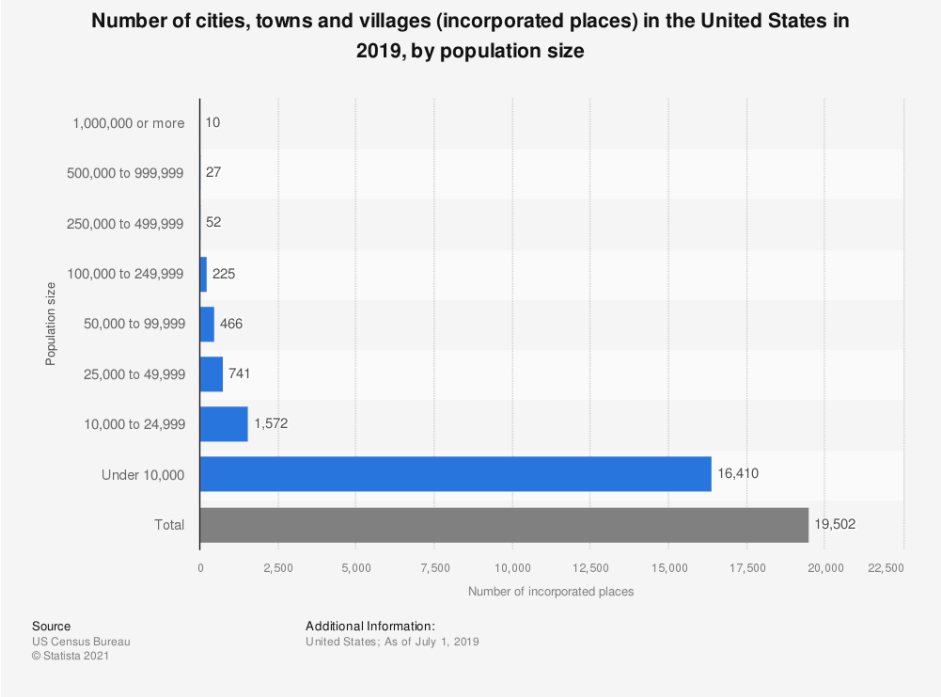

Figure 1. Produced with data from 2019 data from the United States Census Bureau, depicted is the distribution of registered incorporated places binned by population size, with Lexington, MA representing one of the 741 entities in the 25,000 - 49,999 range.[30]

[30] Statista Research Department. "Number of U.S. Cities, Towns, Villages by Population Size 2019." . Accessed Dec 16, 2021. https://www.statista.com/statistics/241695/number-of-us-cities-towns-villages-by-population-size/.

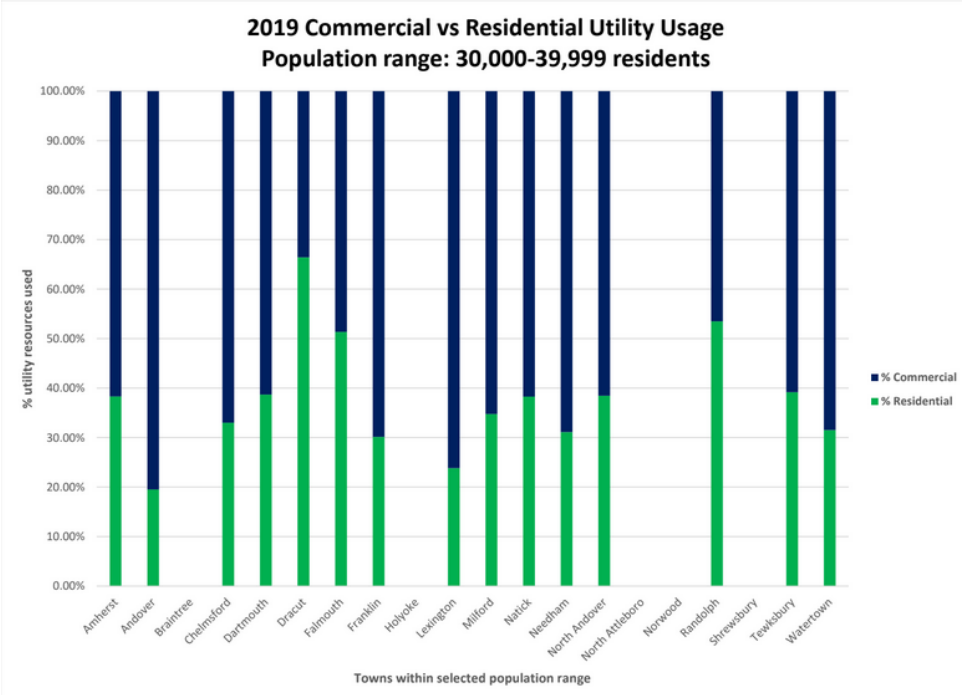

Figure 2. A comparison of Lexington, MA against 19 other cities of similar populations for the proportion of energy consumption between commercial and residential uses. Data was acquired from Mass Save and the University of Massachusetts Donahue Institute's Population Estimates Program.

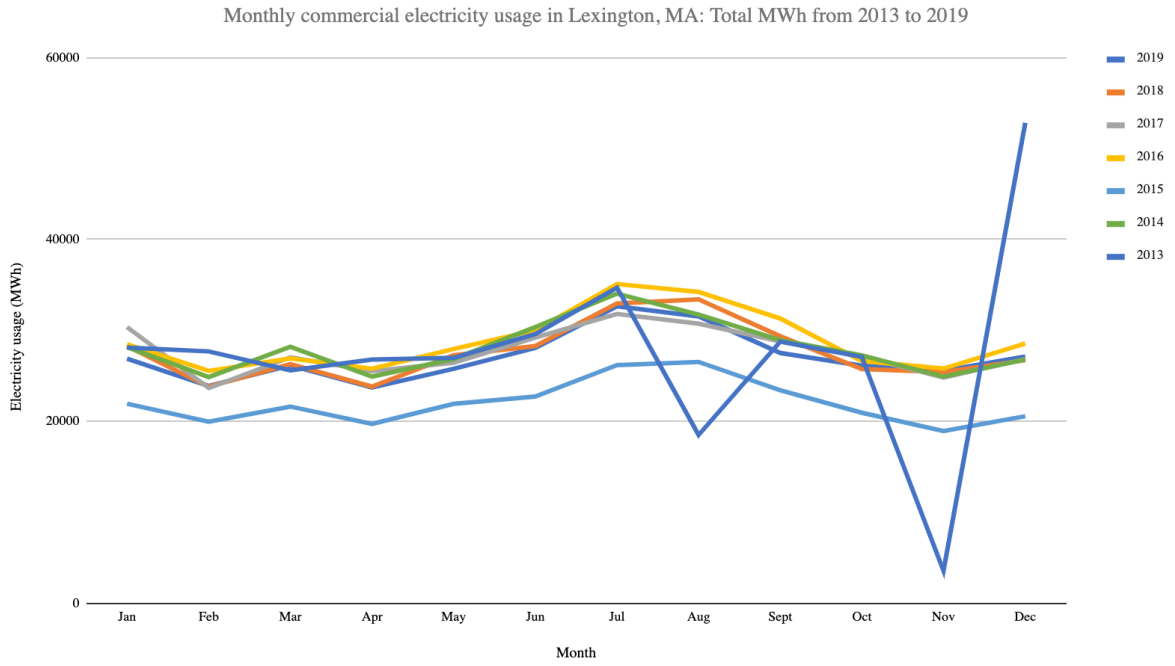

Figure 3. A comparison of monthly energy consumption for Lexington's commercial sector, measured in megawatt hours, and spanning 2013 to 2019. Data was acquired from Mass Save.

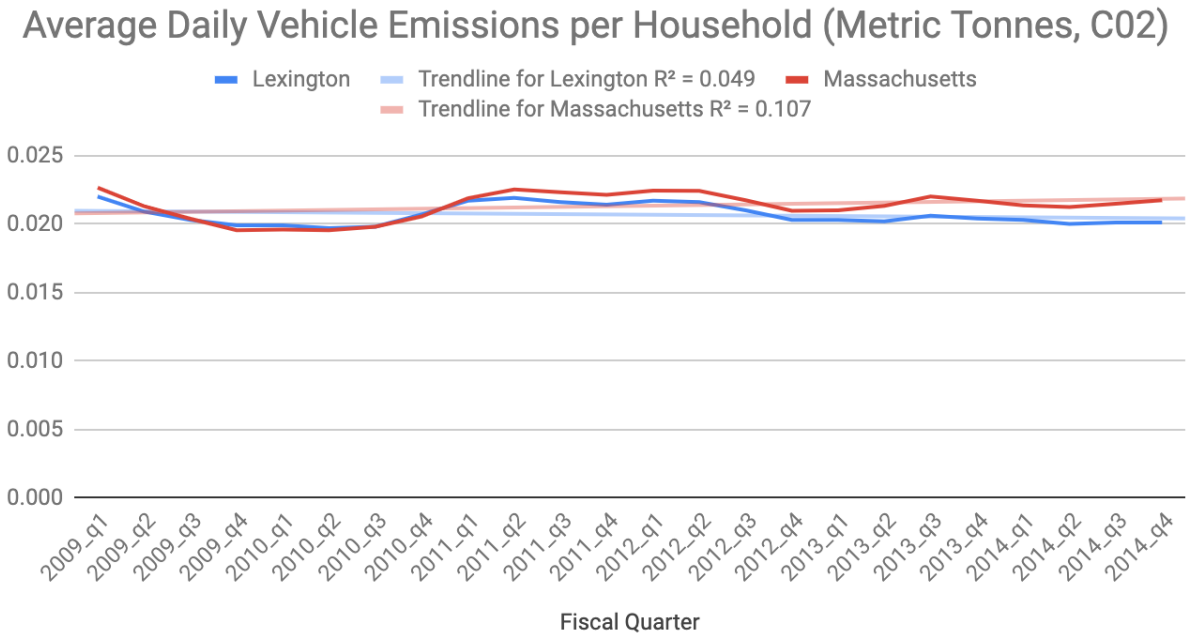

Figure 4. A comparison of Lexington to the rest of Massachusetts for average daily vehicle emissions, as denoted by metric tonnes of carbon dioxide, over the time span of fiscal quarters. Additionally, included are the trendlines for each with their corresponding r squared values at the top. This data was collected from the Massachusetts' Registry of Motor Vehicles.

Climate Action Tracking Inquiry 2021-2022

Mengze Han Nov 16
to macommunityrelations, me

Good Morning Officer,

We are Jenny Han and MJ Taylor, Boston University students working on a project for a new organization called POWER-D City that is helping communities to understand their energy use and track their climate action progress. We have a general question about the information that you have, that might be used by communities for this purpose. What kind of information can a municipality request from you, that might help them to track their progress? Given that there are privacy concerns, are there protocols by which a community can undertake research, protecting anonymity?

We have viewed information at Mass Save Data, U.S. EIA and a few other places. It is quite general, and we wonder if there is a way to obtain information broken down further, so that we can understand peak loads better and perhaps learn how we can reduce them. Is there someone that a community can call to help them understand the data you provide?

We wonder if a town can receive information about congestion points and where there is capacity for distributed generation, so that a town can know where best to grow solar. Do you engage with communities in long-term energy planning, installing micro-grids, battery storage? Are you planning any joint projects with communities?

Would the company be interested in having this discussion, so that we can inform interested communities that they may reach out to you, to better understand their energy use and find opportunities to help meet their own and the state's climate action goals? Is there a way that a community should begin this conversation with you?

Please call me at [redacted] or (MJ at [redacted]) if you would like to discuss this, or let me know when I might contact you. To be clear, we are asking a general question, about the information communities can obtain and the initiatives you might be implementing, we are not asking for you to send the information to us.

Thank you so much for your time. We look forward to hearing from you!

Best Regards,
Jenny & MJ

MACommunityRelations Nov 18
to Mengze, MACommunityRelations, me

Thank you for your inquiry. I believe that Eversource's Sustainability Report will supply the answers to your questions. This information is available on our web page and can be found:

https://www.eversource.com/content/wma/about/sustainability/focus-areas/sustainability-report

Figure 5. Screenshot of an email sent to a general inquiry address at Eversource. The link provided was a general one already available to the public and without any specific information on it.

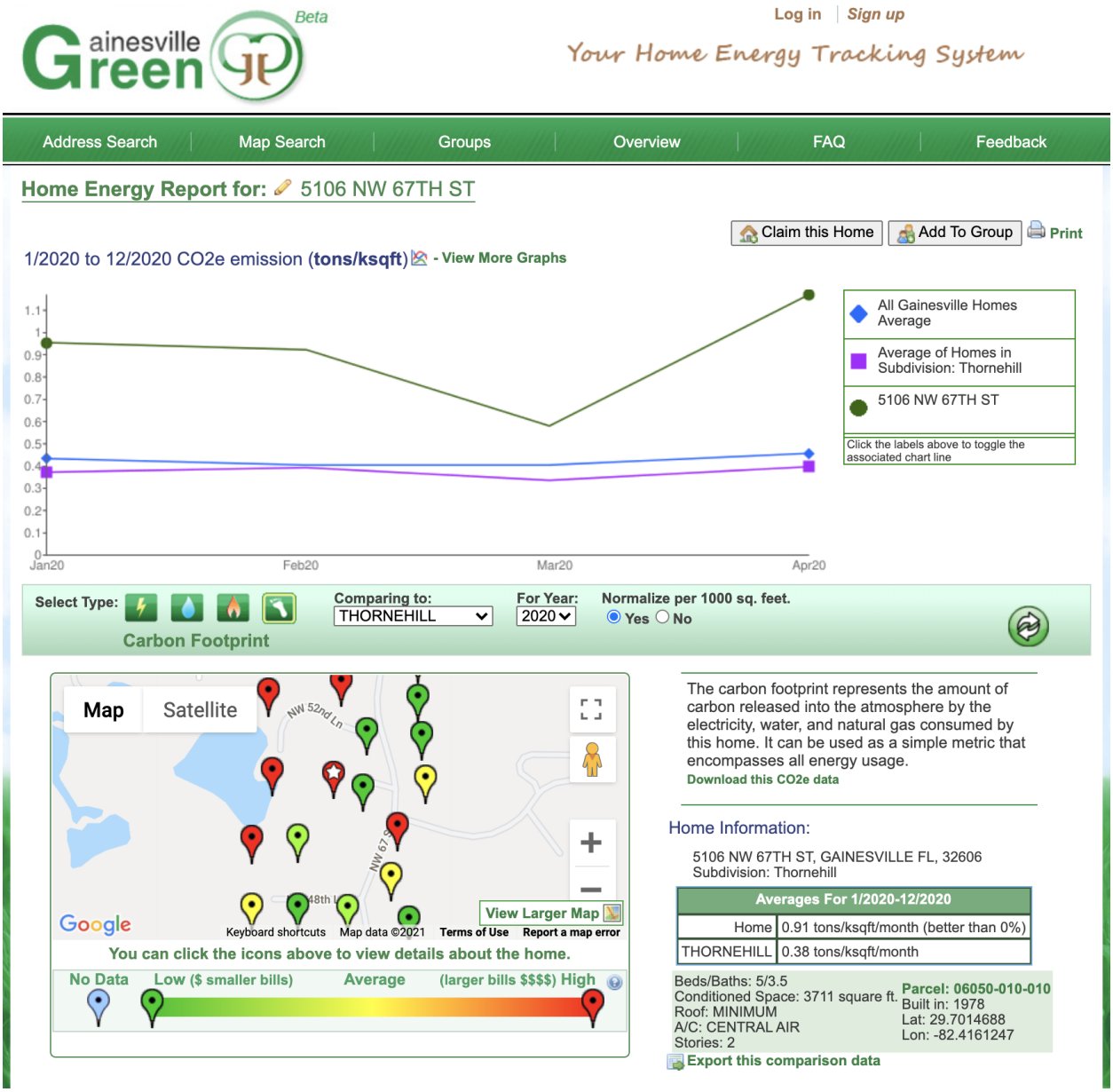

Figure 6. A screenshot of an example data result for a residence in Gainesville, Florida where the home's consumption of electricity, water, and natural gas are recorded along with its carbon emissions.[31]

[31] "Gainesville Green (Beta)," Gainesville Green, accessed December 17, 2021, https://gainesville-green.com/.

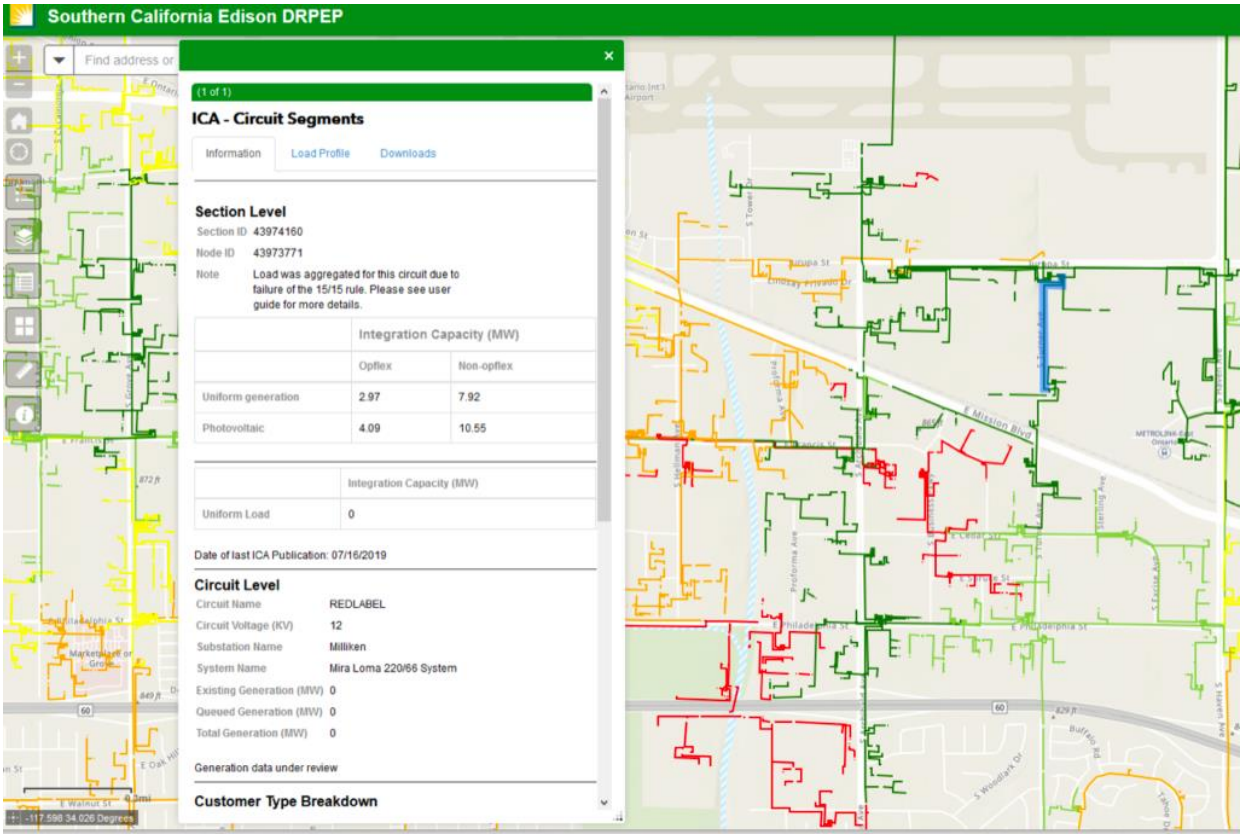

Figure 7. A screenshot of what data under the 15/15 Rule looks like in practice with energy consumption information from Southern California Edison.[32]

[32] Sky Stanfield, "What Grid Transparency Looks Like," Interstate Renewable Energy Council (IREC), August 20, 2019, https://irecusa.org/blog/regulatory-engagement/what-grid-transparency-looks-like/.

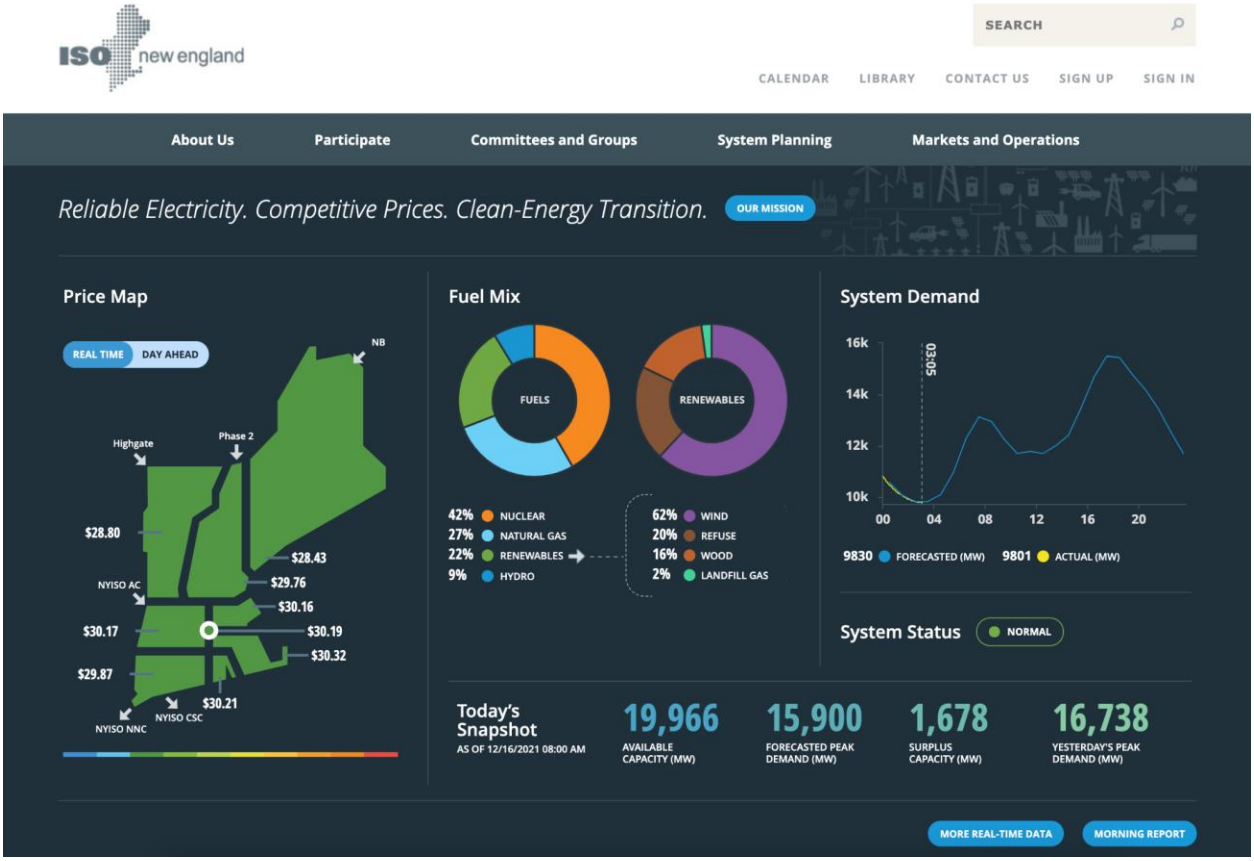

Figure 8. A screenshot of ISO New England which provides a live snapshot of aggregated grid data for all of New England.[33]

[33]"ISO New England," ISO New England, accessed December 17, 2021, https://www.iso-ne.com/.

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