September 2019

The California Center for Sustainable Communities, Institute of the Environment, UCLA

THE EFFECTS OF CURRENT ENERGY CONSUMPTION PRIVACY RULES ON THE DEVELOPMENT OF MUNICIPAL GHG EMISSIONS INVENTORIES AND FORECASTS

EXECUTIVE SUMMARY

As California works to reach the 2020 greenhouse gas emissions targets established in the AB 32 Scoping Plan, local and regional municipalities have begun preparing emissions inventories and setting GHG emissions reduction targets as part of their broader sustainability planning efforts. These forecasts are in danger of being substantially distorted by the California Public Utilities Commission's (CPUC) privacy rules governing the publishing of private energy consumption data.

The California Center for Sustainable Communities' (CCSC) experience with municipal-level GHG accounting indicates that unless privacy rules are revised, many of California's municipal governments will be unable to obtain the accurate emissions data which are needed to develop effective climate mitigation policies and plans. As currently written, the CPUC's privacy rules may result in undercounting of emissions in many cases and prevent the identification of certain classes of high emitters.

The Energy Atlas database is the most complete spatial record of building energy consumption in LA County. This tool was used by CCSC to assemble inventories and forecasts of building-related greenhouse gas (GHG) emissions for the LA County Sustainability Plan in the spring of 2019. However, in order for energy consumption data to be published and shared with municipalities for the purpose of GHG accounting, it had to first be aggregated in accordance with the rule (known as "15/15") contained in CPUC Decision 14-05-016. **If data for a particular geography, such as a city or county, does not meet the aggregation rule, the data cannot be shared at that scale and must be redacted, or "masked".**

The data used to develop LA County's GHG emissions inventory required extensive masking. This meant that estimates, based on Energy Usage Intensities (EUIs), had to be used instead, creating significant levels of uncertainty in the municipal GHG inventories and forecasts. **However, the range of differences between EUI based estimates and true consumption values for individual cities within LA County is on the order of -790 to +533 GWh per year for electricity, and -8 to +13 M-therm per year for natural gas**. Municipalities that are home to industrial plants and other large, non-residential consumers of energy are most affected by the current privacy rules.

Given CCSC's extensive experience working with these data, we recommend that the 15/15 aggregation rule be revised. We have conducted analyses proving that other options are possible to maintain customer privacy while improving the accuracy of local data for climate planning. If the 15/15 rule is not revised, significant misreporting will result, undermining the state's efforts.

1 – INTRODUCTION

The California Center for Sustainable Communities (CCSC), at the UCLA Institute of the Environment and Sustainability, has been working for nearly a decade to understand how energy is used in buildings.

As the developer of the UCLA Energy Atlas (www.energy.ucla.edu), we have obtained customer level electricity and natural gas billing data for Southern California Gas (SCG), Southern California Edison (SCE), and the Los Angeles Department of Water and Power (LADWP) service territories, under non-disclosure agreements (2006-2016).

With these detailed data we are able to spatially match building energy consumption to County assessor parcel attributes, such as building use-type, vintage and square footage. These data are treated confidentially in our back-end database, and aggregated for public use in the front-end interactive web atlas. We have also incorporated numerous other sources of geospatial information, including socioeconomic attributes from the US Census, CalEnviroScreen scores, weather data, and more.

Because the Energy Atlas database is the most complete spatial record of building energy consumption in LA County, the CCSC was able to calculate inventories and forecasts of building-related greenhouse gas (GHG) emissions for the LA County Sustainability Plan in the spring of 2019.

However, in order for energy consumption data to be published and shared with municipalities for the purpose of GHG accounting, it must first be aggregated in accordance with the rules stipulated in CPUC Decision 14-05-016. If data for a particular geography, such as a city or county, do not meet the aggregation rules, the data cannot be shared at that scale and must be masked.

The following sections of this white paper provide description and discussion of:

- Current data aggregation rules
- Municipal-level GHG accounting products for LA County
- Impacts of data aggregation rules on GHG accounting
- Implications for GHG emissions targets and municipal climate action plans
- Recommendations for revisions to the current data aggregation rules

2 – CURRENT DATA AGGREGATION RULES – 15/15

The data aggregation rules adopted in CPUC Decision 14-05-016, govern the release of account-level utility billing data for various use cases. This decision designates universities as a unique class of data requestors who may receive customer level building data for research or planning purposes. The rules require that, prior to publishing, universities mask energy consumption for any grouping of customers if:

- The group contains 15 or fewer total customers, OR
- Any single customer's consumption is > 15% of the total consumption of the entire group.

This rule is known as the "**15/15 Rule**" and applies to any set of energy customers regardless of how the set is defined: sets may be defined categorically (e.g., industrial), geographically (e.g., a specific city), or by combination of both (e.g., industrial consumption within a city limit).

An additional rule relaxes the requirements for residential customers. If a geographic area or category designation contains only residential customers, the following applies:

- If a set of exclusively residential customers contains > 100 total customers, no percentage limit applies.

3 – MUNICIPAL-LEVEL GHG ACCOUNTING PRODUCTS FOR LA COUNTY

CCSC was recently engaged on the development of LA County's first comprehensive Sustainability Plan (LACSP). Among CCSC's contributions to this project was the calculation of the building-related energy components of the County's GHG emissions inventory. This GHG accounting effort had two separate components:

1) The development of a community-wide GHG Inventory for Los Angeles County. This is LA County's second regional comprehensive GHG accounting effort in the last decade. The LACSP GHG Inventory provides emissions totals for CO_2, N_2O, and CH_4, (measured in CO_2e).

2) The development of a set of Community-wide Business-as-Usual (BAU) GHG Emissions Forecasts. BAU consists of a set of reference case emissions projections. CCSC created BAU projections for the county's municipalities and the county as a whole, spanning 2015-2050.

The LA County Sustainability Office (CSO) requested spatially disaggregated GHG emissions accounting and forecasting at the city level, so that each of the County's 88 incorporated cities and County unincorporated areas would have a separate GHG inventory and BAU forecasts for sustainability planning purposes. This would eliminate the need for cities to create their own GHG emissions inventories and ensure methodological consistency. Many cities, especially smaller ones, do not have the staff capacity to create GHG inventories, nor expertise in GHG accounting.

The Community-wide GHG Inventory and BAU Forecasts account for emissions from the following sectors:

- Stationary Energy
- Transportation
- Waste
- Industrial Processes and Product Use
- Agriculture, Forestry, and Other Land Uses

Building-related emissions are part of the Stationary Energy sector. Stationary sources account for ~40% of the GHG emissions from major cities worldwide.[1] The 2015 LACSP Inventory estimates that building energy use is responsible for 28% of total emissions, while all stationary sources are responsible for 44% of total county GHG emissions.

[1] C40 Cities. (2018 March). *Consumption-Based Emissions of C40 Cities*. Retrieved from: https://www.c40.org/researches/consumption-based-emissions

4 – IMPACTS OF DATA AGGREGATION RULES ON GHG ACCOUNTING

The application of the 15/15 Rule for data aggregation impacted the calculation methods and results for both the building GHG inventory and the BAU forecasts. The following subsections describe the methods used for each product and the errors and uncertainties introduced as a result of compliance with the rule.

4.1 –GHG INVENTORY ESTIMATION METHODS

The GHG Inventory accounts for building-related emissions from the following building use-types in each municipality: residential, commercial, institutional, and industrial. The Energy Atlas data were applied as follows to develop the municipal scale inventory:

- In cases where the energy consumption of a building use-type met the 15/15 Rule within a municipality and was therefore not masked, GHG emissions were calculated using actual energy consumption data from the Energy Atlas. Energy consumption totals for each use-type in the municipality were multiplied by the emissions factors of the utility(s) serving that municipality to yield GHG emissions.

- In cases where one or more of a municipality's building use-types did not meet the 15/15 Rule and was therefore masked, **actual energy consumption values could not be used to calculate GHG emissions.** Table 1 shows the extent of masking for electricity and natural gas consumption for three example cities within LA County. Instead of actual values, the CCSC used the best available alternative method to estimate energy consumption of the masked categories. This entailed using the total unmasked values of the use-type's building area and energy consumption across LA County to generate a characteristic energy use intensity (EUI) per square-foot. The total square footage of the masked use-type's buildings was then multiplied by that EUI to yield an estimate of energy consumption.[2] The appropriate utility-specific emissions factors were then applied to estimate GHG emissions.

Table 1. Electricity consumption (in GWh) and natural gas consumption (in million therms) for three example LA County cities, 2015

	Baldwin Park		Agoura Hills		Compton	
Use-types	GWh	M-therms	GWh	M-therms	GWh	M-therms
Agricultural	Masked	Masked	Masked	Masked	0.12	0.01
Commercial	60.12	1.11	66.66	0.80	75.54	Masked
Industrial	Masked	Masked	Masked	Masked	Masked	Masked
Institutional	Masked	Masked	Masked	Masked	Masked	0.17
Residential	110.43	5.48	72.14	3.65	118.98	8.24
Other	Masked	Masked	Masked	Masked	Masked	Masked

[2] Specifically, the median of the EUIs calculated for all the unmasked instances of the same building use-type.

Even with a relatively small number of use-type categories, the disaggregation of accounts within municipalities into different use-types results in widespread masking, especially among non-residential use-types (Industrial, Institutional, and Commercial).

Many municipalities therefore received GHG emissions data based partially or largely on square-footage/EUI estimates rather than actual energy consumption data from within their boundaries. These substitutions are problematic since they almost certainly cause estimates of building-related GHG emissions to deviate from their true values.

Additionally, the inaccuracy introduced by substituting estimates for masked data cannot be quantified and shared with municipalities without violating the 15/15 Rule. Doing so would require knowing the consumption of the users in the masked categories, which cannot be published or shared – resulting in a kind of catch-22.

Instead, the following method was used to illustrate the potential scale and extent of errors introduced by the masking restrictions: Countywide EUI estimates were created for sectors within municipalities that were *not* masked, and these were compared to the actual consumption data from the Energy Atlas. Such a comparison allows us to show a breakdown of errors by use-type and fuel type that cannot be shown for the masked areas. The results of these comparisons are depicted by the series of histograms contained within Figure 1.

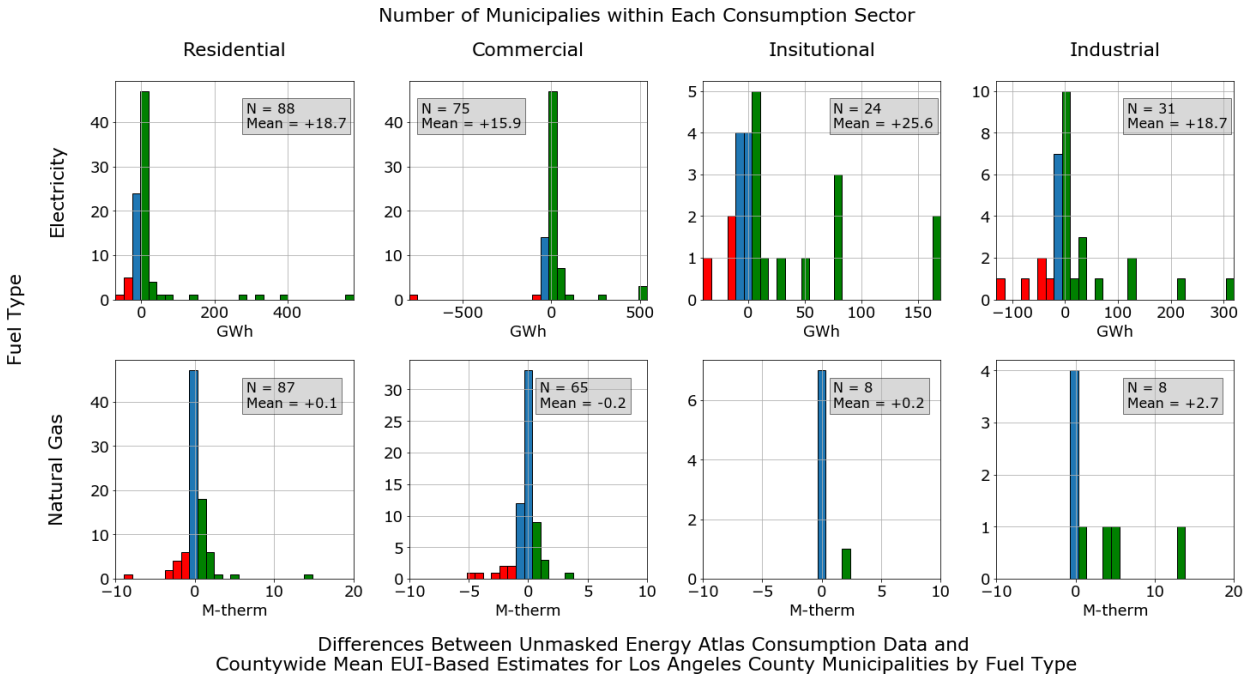

Figure 1: Differences Between Unmasked Energy Atlas Consumption Data and Countywide Mean-EUI Based Estimates for Los Angeles County Municipalities

Within the figure, each column corresponds to a different building use-type category and each row corresponds to whether the data is for electricity or natural gas consumption. The vertical axis is the count (or number) of municipalities and the horizontal axis is the energy consumption difference as described in the figure caption. **Within each plot negative values (red) indicate that the countywide EUI based estimates were significantly (+/- 10%) lower than the Atlas values and positive values (green) indicate that the countywide EUI based estimates were significantly (+/- 10%) higher that the Atlas values.** There are different numbers of records (N) in each plot because the differential rates of masking for the different combinations of use-type and fuel type. Use-

type / fuel-type combinations with higher rates of masking have fewer unmasked geographies for which comparisons can be made.

As the plots show, the use of countywide EUI's to calculate total energy consumption for municipalities resulted in errors ranging between -790 and +533 GWh per year for electricity and between -8 and +13 M-therm for natural gas, depending upon use type and municipality. **These errors are cause for serious concern given that they are on the same order of magnitude as the annual consumption values for cities in LA County** (see Table 1).

4.2 – "BUSINESS-AS-USUAL" GHG EMISSIONS FORECASTS

BAU forecasts of GHG emissions were made for 2050, using 2015 as a baseline year, for the building use-types shown in Table 2 within each municipality.

BAU forecasts depict the expected changes in emissions from various sectors assuming that no further climate mitigation policies are implemented beyond those effective in 2017, and that the population continues to grow based on the Southern California Association of Government's projections. This BAU does, however, account for a gradual reduction of the emissions intensity of the grid based on historic trends.

For each municipality, changes in building-related GHG emissions are a function of the expected changes in building use-types and each type's characteristic energy use intensity (EUI) per unit area.

Table 2. Building use-type categories for the GHG Inventory and BAU Forecasts

GHG Inventory Categories	BAU Categories
Residential	Single-family
	Multi-family & Condo
	Residential Other
	Residential Uncategorized
Commercial	Commercial
	Commercial Uncategorized
Institutional	Institutional
Industrial	Industrial

Data inputs included consumption data from the Energy Atlas, historical data for building square footages from the LA County Assessor's Office, projected population growth figures from the Southern California Association of Governments, and utility-specific emissions factors.

As with the GHG inventory calculations, a workaround estimation was required in many instances to calculate forecasted energy consumption:

- Where the actual energy consumption of the use-types met the 15/15 Rule (i.e., was not masked), the total consumption of the use-type's users in 2015 was divided by the total area of the use-type's buildings to calculate a municipality-specific and use-type-specific EUI per square foot. The building areas in all subsequent years were

then multiplied by the corresponding municipality/use-type-specific EUIs to yield the projected energy consumption.

- Where the current energy consumption of one or more building use-types within a municipality did not meet the 15/15 Rule, and therefore was masked, the county median EUI for the corresponding use-type was substituted instead.

Finally, BAU GHG emissions were calculated by applying utility-specific emissions factors to the projected energy consumption values, assuming that the emissions intensity of grid-supplied electricity declined at a rate of ~2% per year.

It is expected that the magnitude of errors (as a percentage) caused by using EUI assumptions for BAU forecasts would be similar to the errors caused for GHG emissions (although the same test calculations were not run). Furthermore, due to the more granular use-type categories used for BAU forecasts, the frequency of energy consumption data masking will be greater, and therefore the extent of errors due to estimations will be more widespread.

5– IMPLICATIONS FOR GHG EMISSIONS TARGETS AND MUNICIPAL CLIMATE ACTION PLANS

The point of the GHG Inventory and BAU Forecast was to provide each of LA County's municipalities with reference case GHG values and projections so that each city could evaluate their energy efficiency programs and emissions reduction policies. However, the 15/15 Rule proved to be a significant obstacle, forcing the CCSC to resort to estimation methods which introduced numerous, unquantifiable inaccuracies into the results.

The application of the 15/15 Rule prevents policy makers from receiving trackable and accurate estimates of municipal-level emissions, severely limiting their ability to create targets and policies for energy efficiency, GHG abatement and verification. And as long as the 15/15 Rule remains in place, municipalities in LA County and elsewhere will have some unknown portion of their emissions inventories calculated from county-wide estimates, rather than the actual consumption of users within their boundaries.

Furthermore, when one building use-type category is masked, it prevents the reporting of total building energy use within that municipality based on actual consumption data, because this would allow for back-calculating of the masked category. Therefore, even when total building consumption is not masked for a municipality, any masking of a building use type category forces total consumption to include an estimated value, further propagating errors and uncertainties.

The most frequently masked use-type categories are also the highest energy consumers; industrial, commercial, and institutional. Substitution of EUIs within these categories is especially problematic in instances where municipality-specific energy usage intensities are significantly higher or lower than the county medians. This is not only because substitution of EUIs produces especially flawed projections in such cases, but also because such substitutions may lead municipal decision-makers to incorrectly prioritize abatement of emission sources.

Because BAU projections must be calculated at a more granular scale than emissions inventories, these projections are even more likely than emissions inventories to include masked data, thereby increasing the extent of inaccuracy due to estimated values.

More frequent masking of use-types with the highest rates of consumption and GHG emissions is also undesirable from an equity standpoint. The reasons for this are two-fold. First, poorer areas of the county tend to be where major industrial and commercial consumers are located, and their presence often masks total municipal energy consumption. Secondly, industrial, institutional, or commercial use-types are masked more frequently than residential ones, meaning that municipalities home to prolific non-residential consumers will, on average, receive less accurate building emissions figures. Without accurate information about the magnitude of emissions and their projected growth, municipal governments cannot devise policies to reduce emissions from classes of large consumers within their jurisdictions, or push for the adoption of emissions reduction policies at higher levels of government in cases where local, unilateral action is infeasible.

Thus, the effect of the 15/15 rule is to significantly reduce the usefulness and relevance of emissions projections. The structure of the rule also makes it especially difficult to target the most energy intensive building use-types, since the consumption of these users is most frequently masked. This is an example of state policies at cross purposes.

6 – RECOMMENDATIONS FOR REVISIONS TO THE CURRENT DATA AGGREGATION RULES

The CPUC's 15/15 Rule was developed at a time when disaggregated building energy was not available and there was no ability to test the rule's effect on accuracy of reporting. Now, with extensive experience implementing the rule, it has become clear that it leads to potentially serious distortions in GHG emissions reporting.

CCSC has used its cache of historical account level consumption data to systematically evaluate the implications of implementing large number of different potential alternative privacy rules (15/15, 10/20, 20/10, 15/50, 50/50, …etc.). On the basis of this investigation, we have discovered that, within dense urban environments, the dominant source of masking is the 15% threshold limit on the fraction of consumption within a group represented by its largest single customer. Consequently, we believe that a more balanced and useful approach would be to raise both thresholds significantly.

For example, raising the minimum individual customer consumption fraction threshold to 50% would reduce the need for data masking due to the presence of a small number of very high volume consumers. Concurrently, raising the minimum number of customers to 50 would also provide smaller users with a stronger guarantee of anonymity than does the current 15 customer limit. This is because the larger the number of customers, the greater the potential range of consumption is within the group, and the less likely that any one customer's consumption can be estimated.

The need for energy consumption masking disadvantages smaller users as they become invisible to policy makers relative to EE or other improvements; it can also mean disadvantaged communities are less able to address energy use, as they are often the communities that host high consumption industries.

7 – CONCLUSIONS

Lessons learned from preparing disaggregated LA County GHG inventories and forecasts should give state regulators and municipal governments cause for concern. The difficulties encountered by the CCSC exemplify what other municipalities in California can expect if they undertake similar efforts.

Applying the aggregation rules introduced significant errors in emissions reporting and implies that cities cannot adequately and accurately plan for GHG emissions reductions. This situation seriously jeopardizes state and local efforts to reduce emissions.

LA County was only able pursue GHG accounting disaggregated to the municipal level because of the existence of the Energy Atlas database. But even with such a high-quality spatial record of energy consumption, current CPUC privacy rules make it impossible to produce accurate estimates of building-related emissions. This is true for any geography, from cities and counties to the state as a whole.

The 15/15 Rule should therefore be changed in favor of an alternative that continues to protect customer privacy, but at the same time can more accurately reveal emissions by building type within a jurisdiction. While a 50/50 rule may seem less restrictive, in fact it is more protective of privacy than 15/15 and enables insights into building energy use at a useful level for GHG emissions inventories and targeting programs.

Greenhouse gas (GHG) inventories and emissions forecasting are essential tools for environmental and economic planning. If environmentally significant GHG mitigation targets are to be met equitably and at minimum cost to society, the use of high-quality data for accounting purposes is critical, since they are the basis for highly consequential policy decisions. The use of incomplete or flawed data to prepare inventories and emissions forecasts will inevitably result in the misallocation of public resources, a loss of trust and interest in a publicly managed energy transition, and worst of all, the squandering of opportunities to make significant progress towards mitigation targets.