

Improving Empirical Approaches to Estimating Local Greenhouse Gas Emissions

Ari Lattanzi

Sarah Yeager

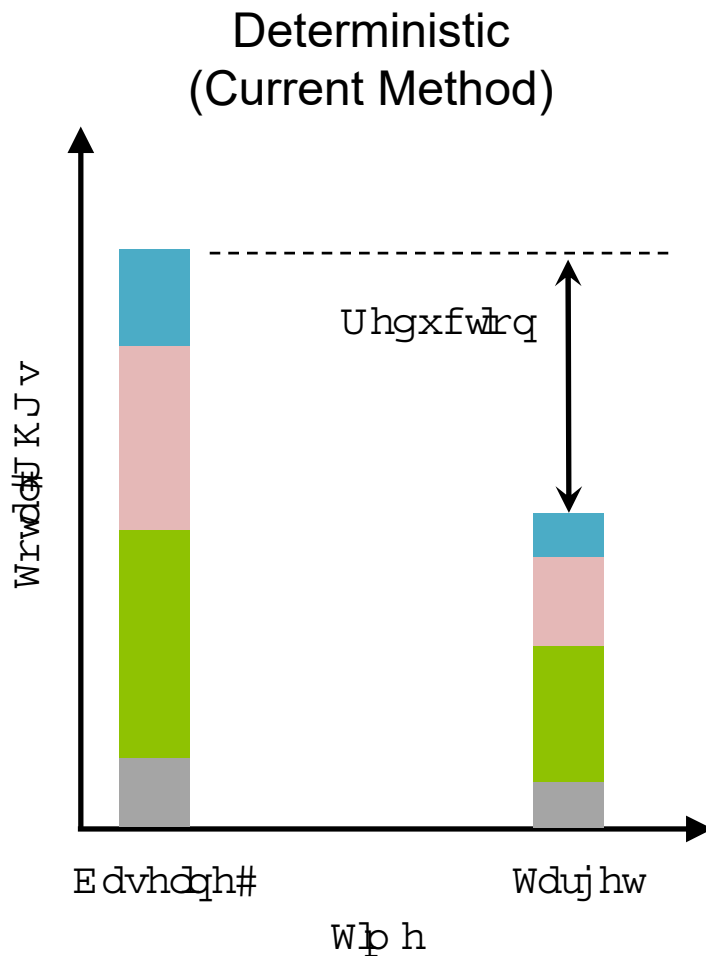
Inês Lima Azevedo

Mike Blackhurst

Accounting for Uncertainty

- The City of Pittsburgh, mentored by the AGU and in partnership with University of Pittsburgh (Prof. Blackhurst) and Carnegie Mellon University (Prof. Azevedo), undertook an effort to characterize greenhouse gas emissions with particular emphasis on uncertainty.

Current emissions measurement methods are deterministic



Current GHG emission protocols

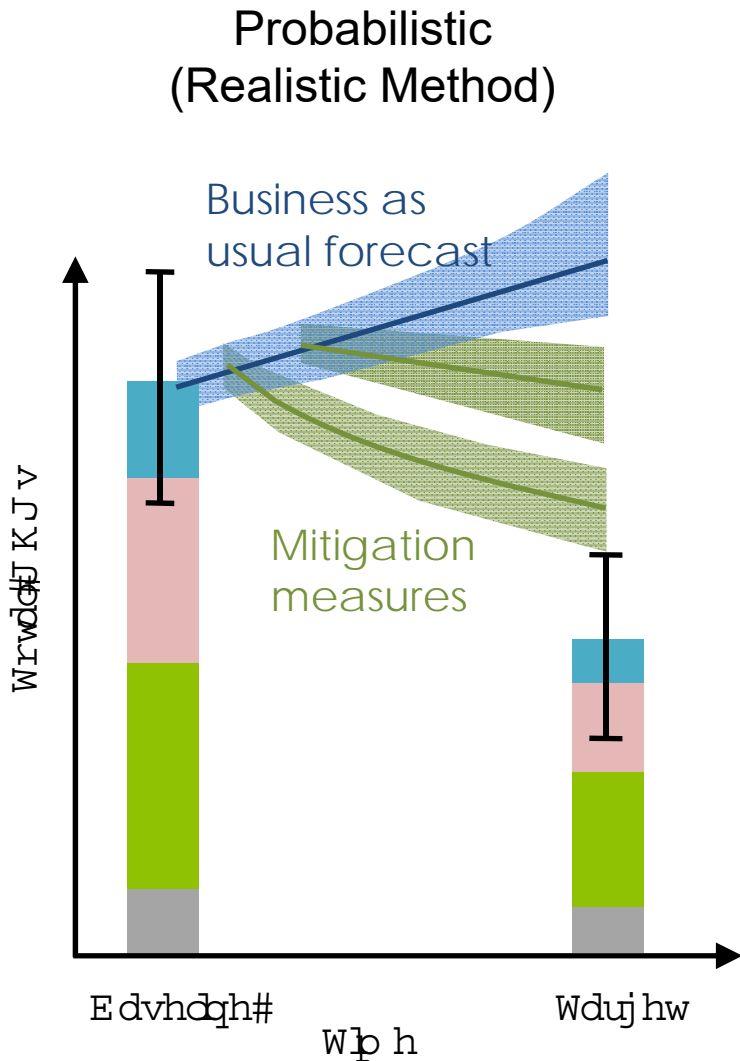
Residential Electricity Consumption *
(Emission Factor * Global Warming Potential)
= MT CO₂e

Residential Natural Gas Consumption *
(Emission Factor * Global Warming Potential)
= MT CO₂e

Normalize for weather, population, built environment

Does not account for inherent uncertainty in values

Current emissions measurement methods are deterministic



Calculate Base Case, High and Low

Literature Review for range of values

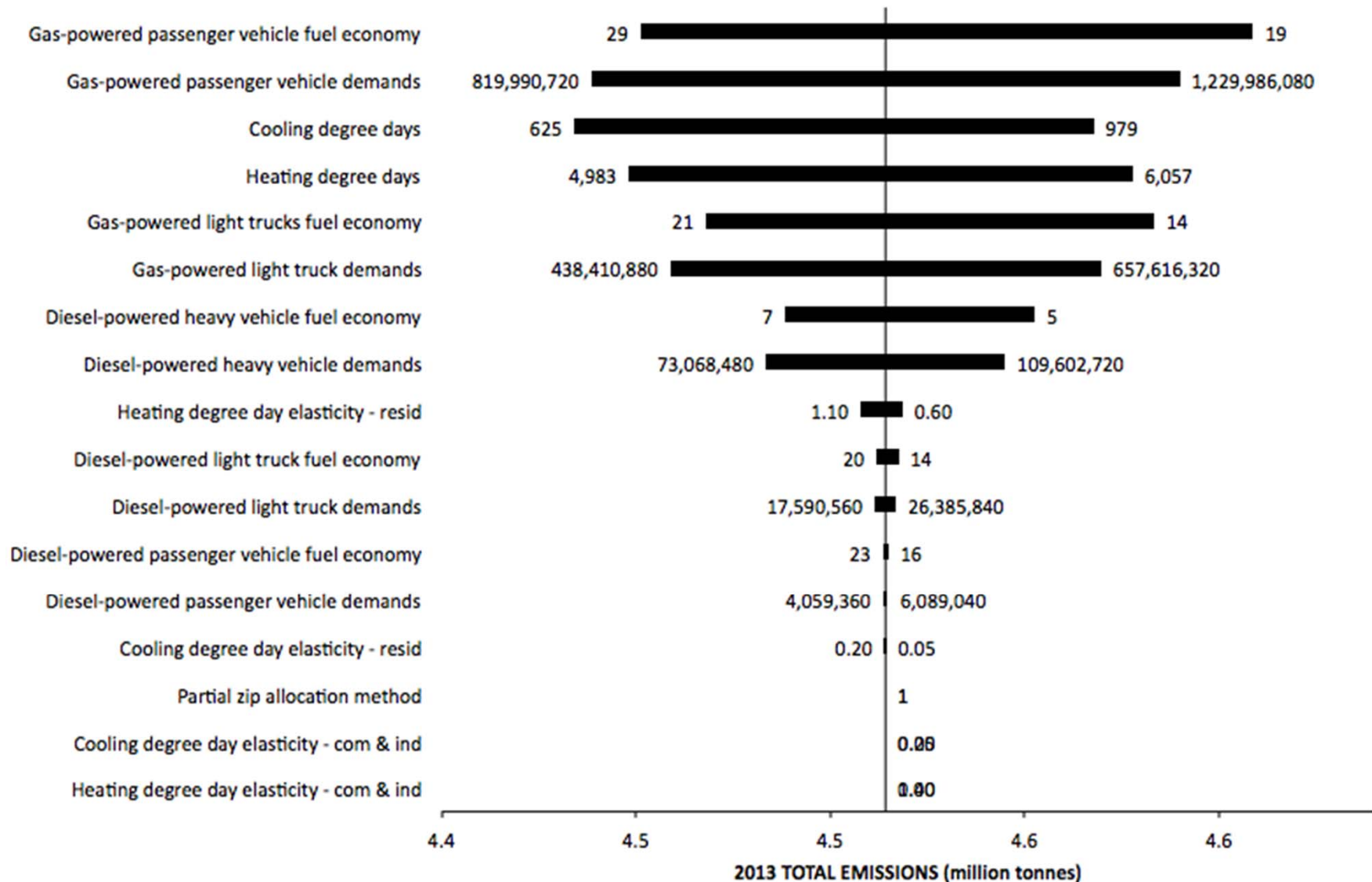
What uncertainty is meaningful?

Is uncertainty decreasing over time?

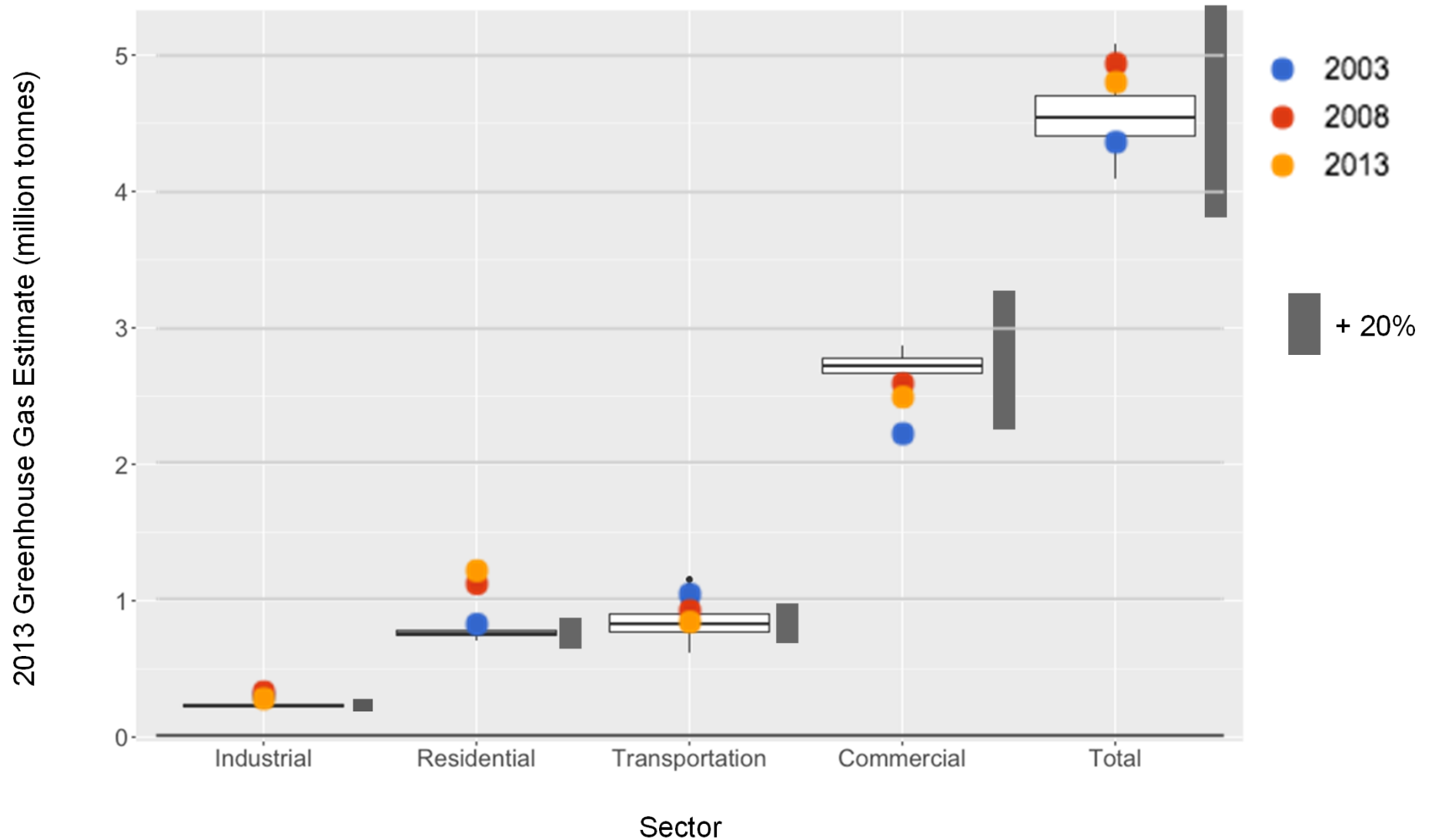
Communicate nuance and identify areas to improve data accuracy

Determine whether reduction is significant or within margin of error

What's driving uncertainty?



Does unmeasured uncertainty in emissions matter?



Implications

The combination of uncertainty in both the emission factors and the consumption data can overshadow any apparent trends in deterministic calculations.

Probabilistic calculations allow for better understanding of available data and how to improve quality moving forward

Recommendations

It is our recommendation that Cities revise how GHG goals are framed. Concrete measurements should be used to track progress towards goals.

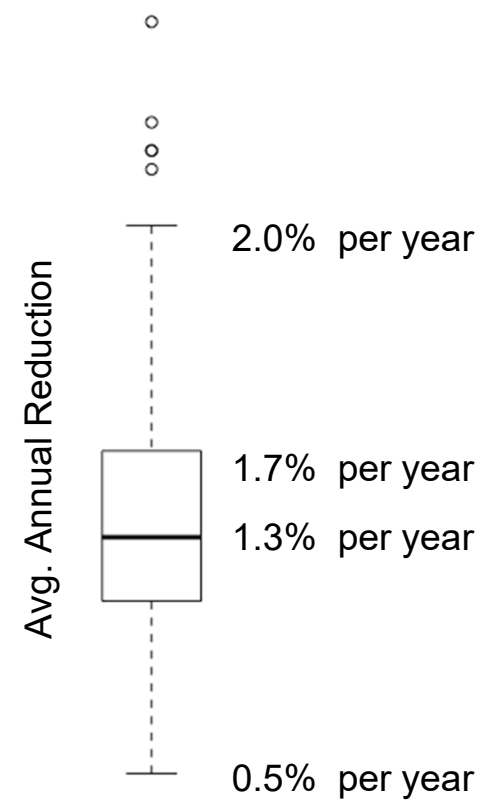
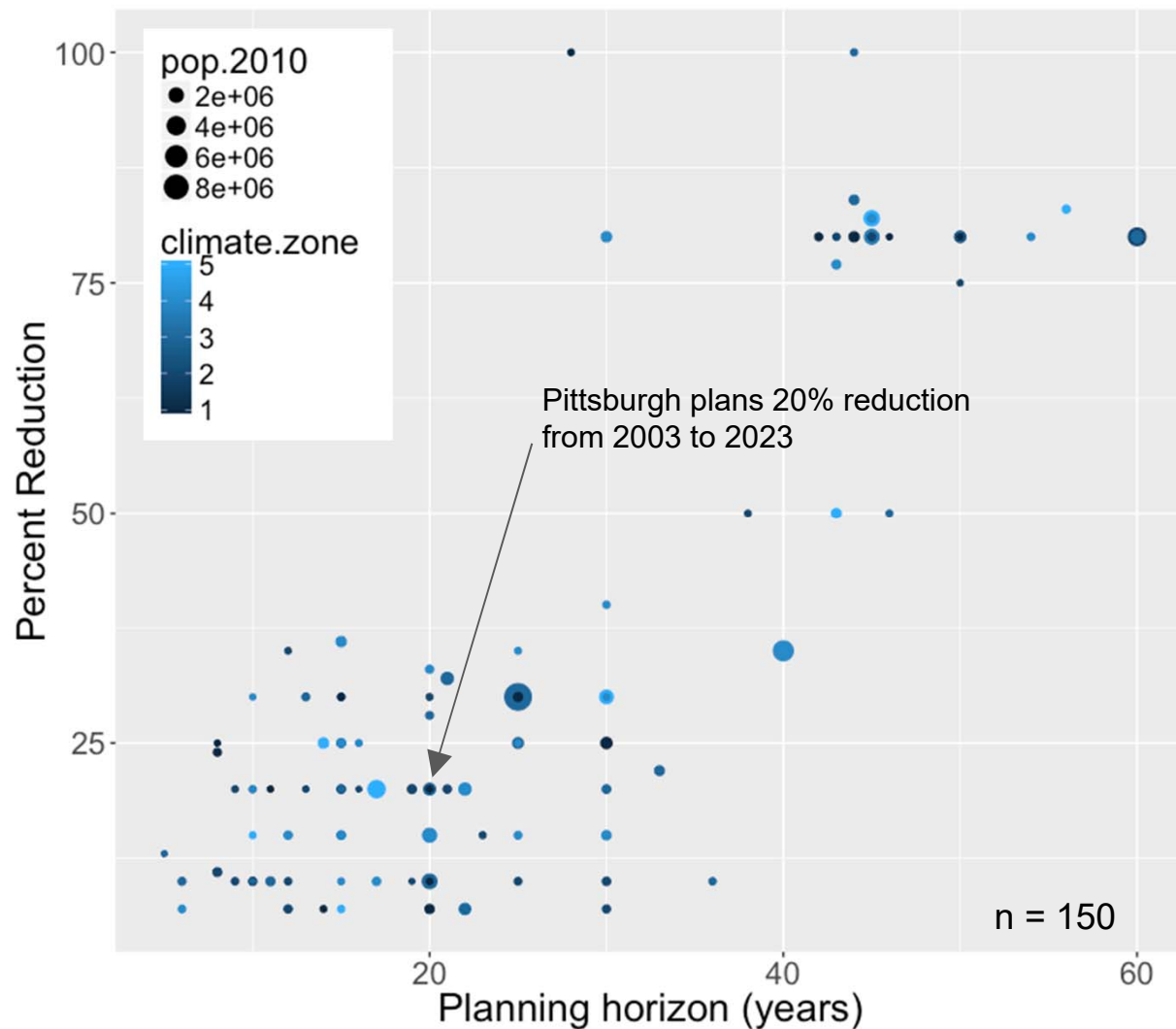
As further GHG Inventories are completed, steps should be taken to decrease uncertainties in data collection and communicate unavoidable uncertainties.

Find More Online

- [Link to Model](#)
- [Link to Data](#)
- [Link to Project Page](#)
- White Paper and clean model will be hosted on AGU TEX project page

additional slides for reference

City Greenhouse Gas Reduction Targets



Ref: ICLEI 2010

Pittsburgh Greenhouse Gas Inventories

- High uncertainty in previous inventories, but incalculable
- Sources of uncertainty
 - consumption data & assumptions
 - emission factors
 - lack of documentation
- Difficult to draw conclusions

Normalization

IPCC - Global Warming Potential (GWP)

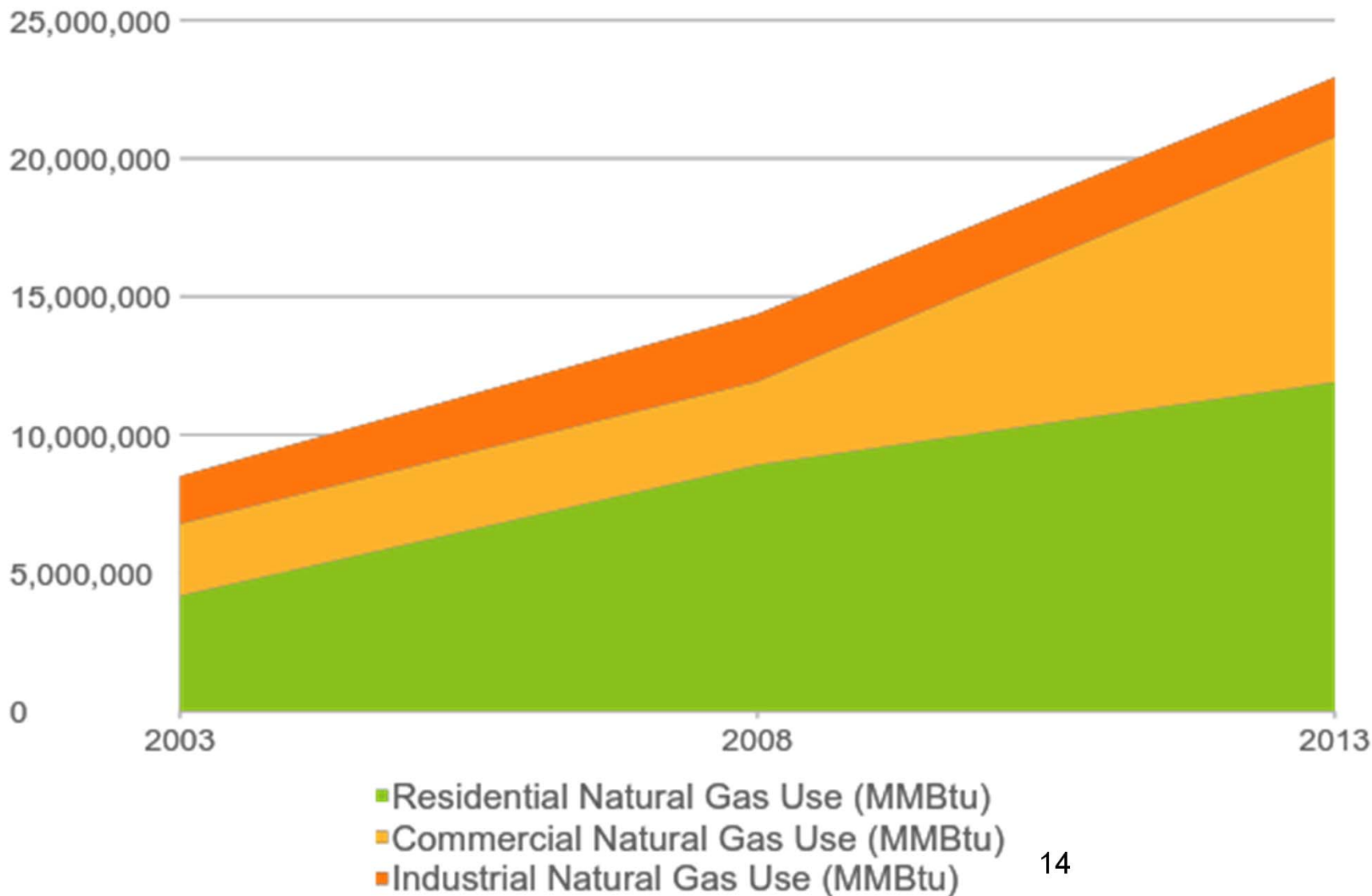
Weather - degree days

Population - per capita

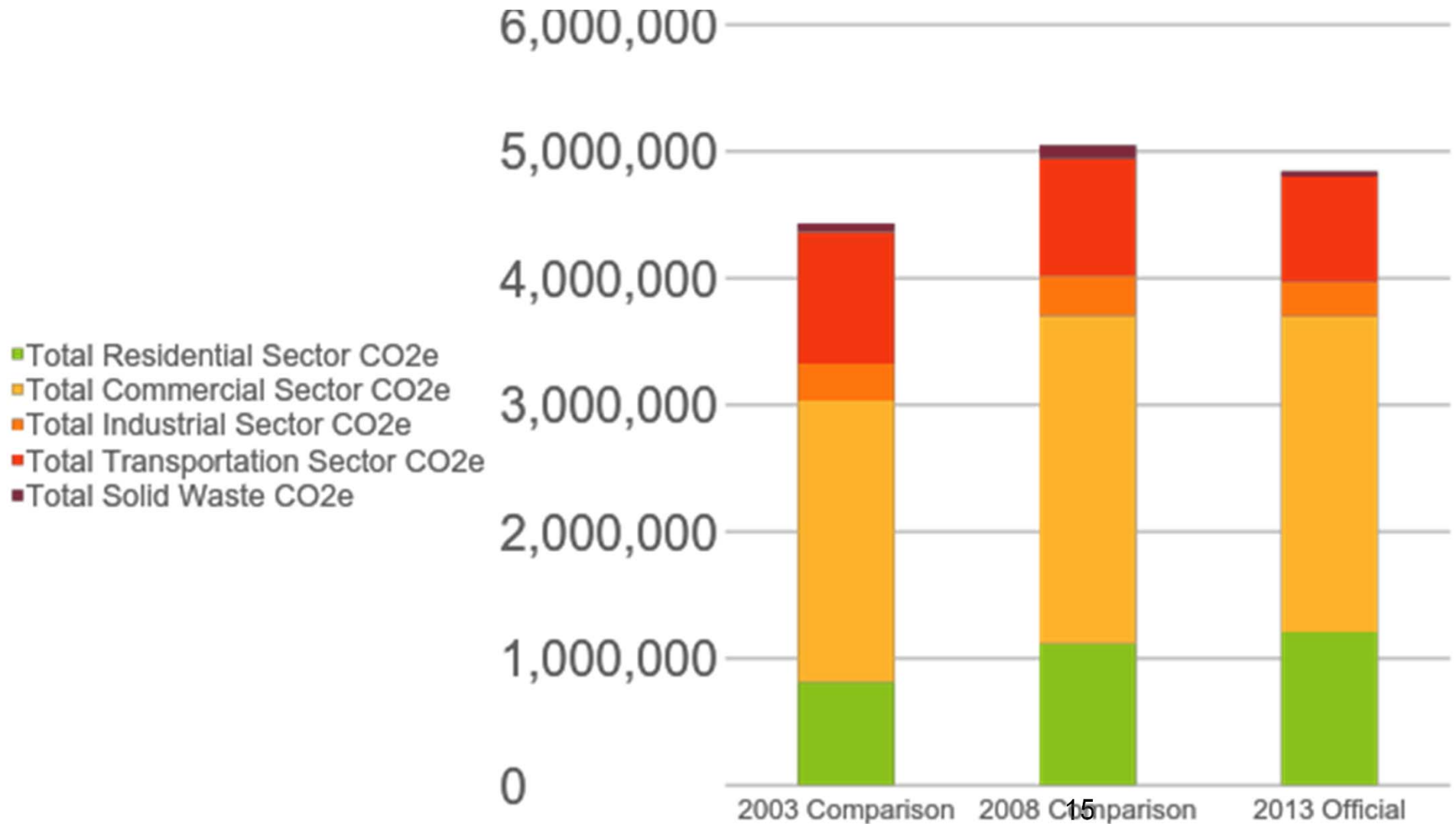
Built Environment - square feet

Unable to normalize for uncertainty/bad data

Apparent Trend in Natural Gas

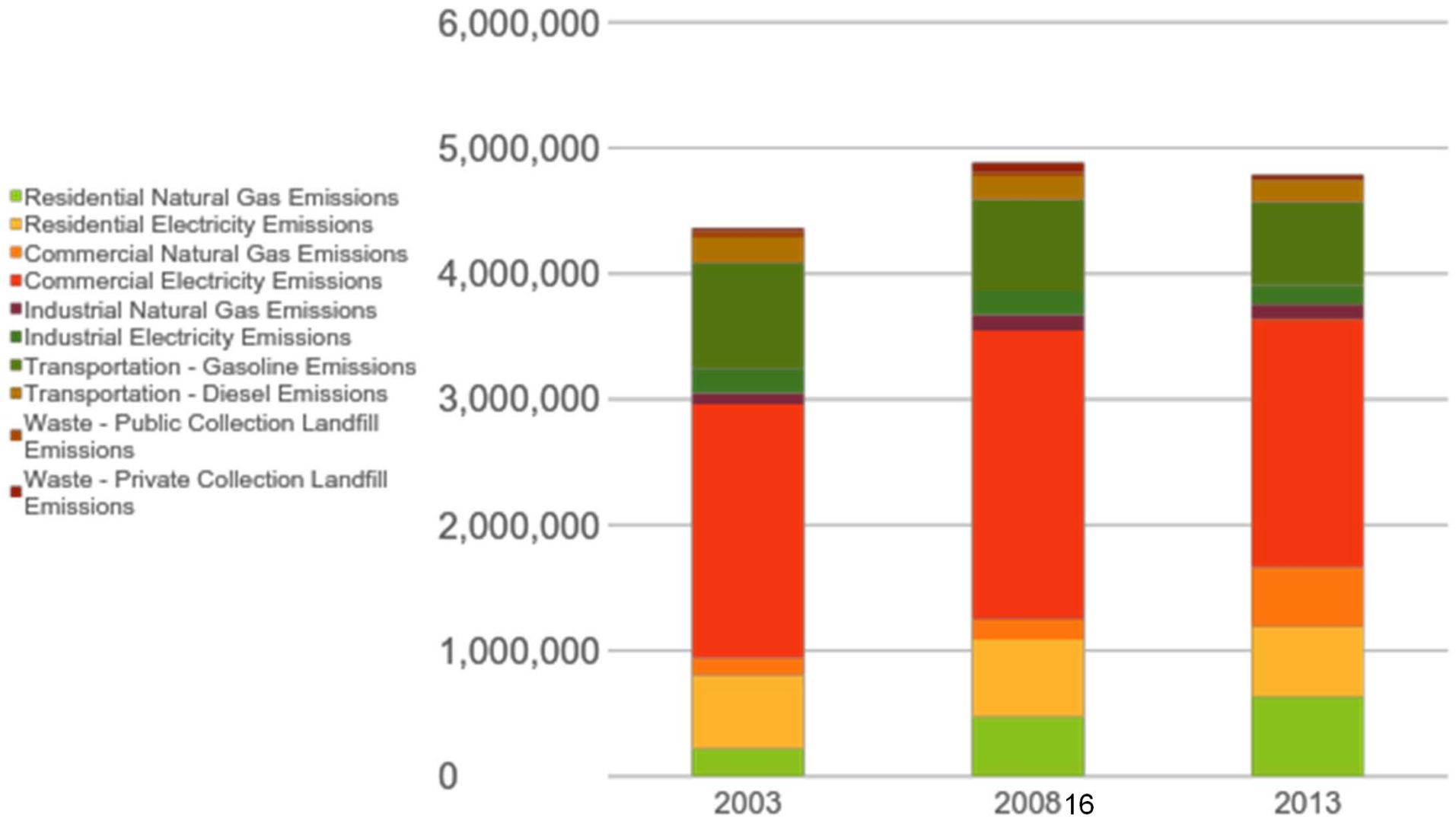


Absolute Emissions



2003 Comparison 2008 Comparison 2013 Official

Weather Normalized Emissions



No Grid/MPG Change

