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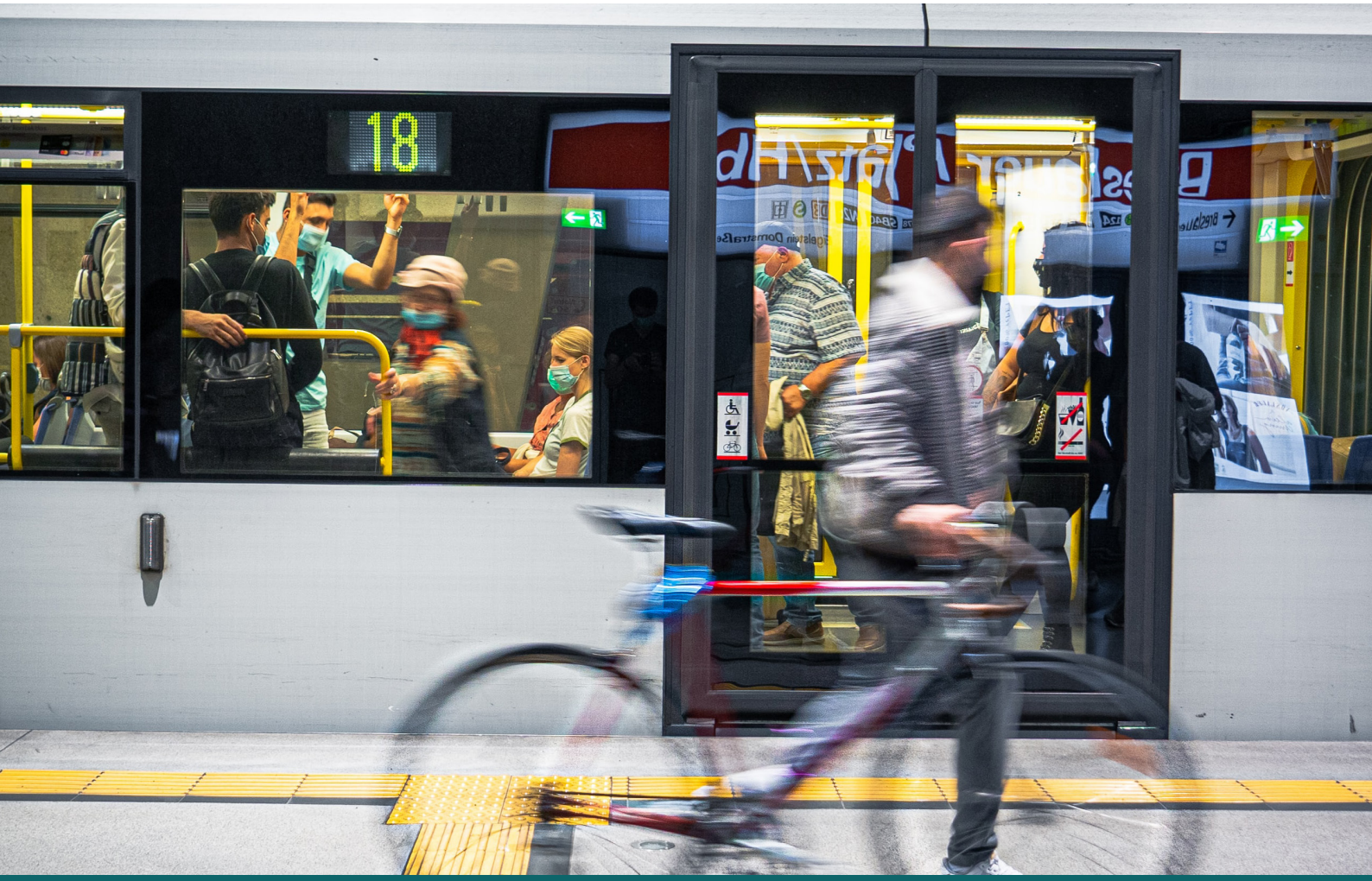


Assessing Transportation Data from Google Environmental Insights Explorer

AN OVERVIEW FOR EUROPEAN POLICYMAKERS

November 2021

INTRODUCTION

Last year, the European Commission launched the European Green Deal, with the ambitious target of making Europe the world's first climate-neutral continent by 2050. As part of the European Conference on Sustainable Cities & Towns **Mannheim2020**, there was unanimous agreement that the European Union's 80,000 towns and cities and their progress are key to achieving Europe's ultimate climate goals.

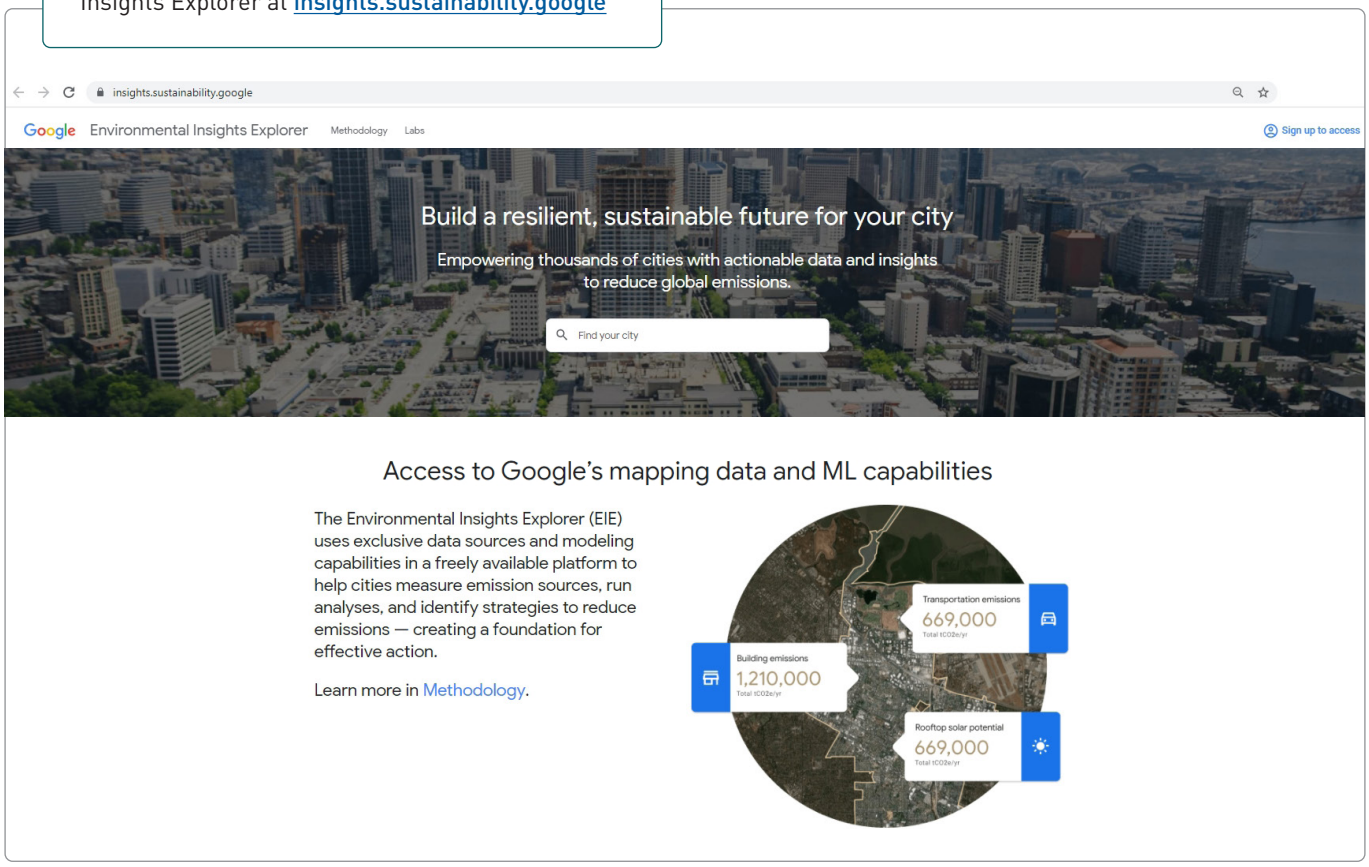
To support these local governments in making breakthrough change, a paradigm shift is required in both the availability and quality of local climate data. Working together with Google, ICLEI Europe has undertaken a comprehensive analysis of the **Environmental Insights Explorer** (EIE) tool to better understand the extent to which it can assist European cities in advancing local climate action and achieving their carbon emissions reduction goals. EIE is a globally consistent, freely available dataset that estimates buildings and transportation emissions as well as solar rooftop potential in cities by harnessing Google's proprietary data and machine learning modelling techniques.[1]

As part of the analysis, ICLEI Europe conducted a technical assessment of EIE's mobility data to investigate how it may be able to support cities in their efforts to reduce local-level transport emissions and promote sustainable urban mobility.

EIE provides detailed data on trips for different modes of transport (biking, walking, private car, bus, metro, motorcycle, etc.) that occur within cities' boundaries, and similarly, for trips that cross city boundaries.

EIE is an evolving dataset and Google has committed to expanding transportation insights to over 20,000 city and regional governments by the end of 2021.[2] Currently, it is available to more than 3,500 cities and local governments across Europe. For city officials, technical experts, and practitioners who are interested in learning more about EIE, the assessment serves as a vital, technically sound resource that discusses the potential of EIE data to benefit European cities on their journey to advance sustainable and low-carbon mobility locally. The full assessment will be available on the **ICLEI Europe website**.

Cities can request data from Google Environmental Insights Explorer at insights.sustainability.google



1 Google is committed to helping 500+ cities reduce 1 gigaton of carbon emissions annually by 2030 as part of its third decade of climate action. (Google The Keyword, 14 September, 2020)

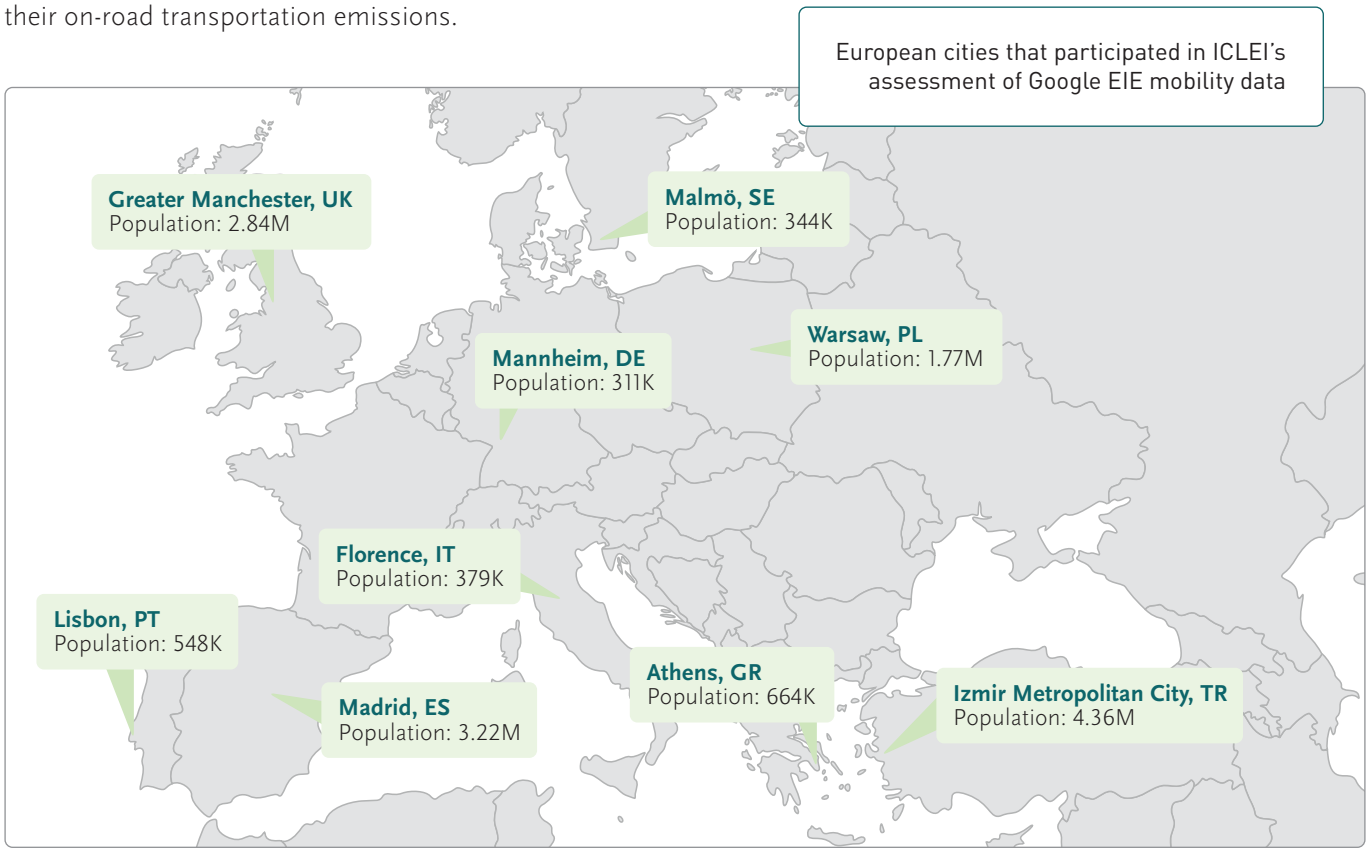
2 Reducing city transport emissions with Maps and AI. (Google The Keyword, 2 November 2021)

SCOPE OF ASSESSMENT

Policymakers and practitioners face significant challenges in strategically planning and implementing actions due to limited data availability and a lack of quality data.

Nine European cities were selected as a control group because of their climate leadership and climate data availability. Alongside these cities, ICLEI analysed EIE transportation data for each member of the control group. This analysis reflects not only the diverse city-level methodologies and greenhouse gas (GHG) emissions accounting standards that are being used across Europe today, but also highlights the varying datasets and nuances that cities take into consideration to calculate their on-road transportation emissions.

For the analysis, a range of city characteristics from larger and smaller cities and regional or metropolitan areas was factored in. The cities in the assessment include Athens (GR), Florence (IT), Greater Manchester (UK), Izmir (TR), Lisbon (PT), Madrid (ES), Malmö (SE), Mannheim (DE) and Warsaw (PL). All of these cities report their GHG emissions in the CDP-ICLEI Unified Reporting System, which served as a key information source in developing this analysis.



ICLEI Europe worked alongside city representatives through a series of interviews and high-level comparative data analysis to evaluate EIE specifically on:

- Tool functionality
- Emissions accounting methodologies and data sources
- Prospective use cases
- Potential stakeholder engagement processes that could enhance the use of EIE to inform cities' decision-making

The assessment clearly shows that cities are willing to invest substantial effort to harness innovative tools that will allow them to:

- Measure and track GHG emissions
- Establish ambitious climate targets
- Define future pathways to reduce transport emissions and improve the efficiency of local transport systems

ASSESSMENT FINDINGS AND TAKEAWAYS

On-road transport emissions accounting

The first part of the assessment evaluates the various emissions accounting methods that cities employ to calculate their transport emissions and compares them to EIE's own generated data. Key findings include:

- While cities use standardised, methodologically consistent emissions accounting frameworks to develop their GHG inventories, calculation methods used to estimate transport emissions differ from city to city. This yields a level of uncertainty when comparing EIE data to a city's own results, which rely on their local context and data availability.

  Of the nine city participants in the assessment, six cities use top-down approaches based on fuel consumption data, and three use bottom-up approaches relying on emissions accounting models based on transport activity data, such as the number and type of vehicle, occupancy factors, fuel efficiency, and survey data. Further observations include:

  - **Cities using top-down approaches signalled an openness to explore EIE further to help improve their current calculation methods** leveraging the bottom-up datasets provided by the tool.

  - **Cities using a bottom-up approach recognise that EIE can potentially support them in the validation and improvement of current calculation methods and modelling processes**. For example, EIE data can be used to complement, improve, or validate their vehicle kilometres travelled (VKT) estimations.

  - **Cities using national data sources to estimate transport emissions can benefit from access to EIE data** as it offers the potential to develop more accurate bottom-up approaches and/or to validate top-down assumptions.

- In instances where there were differences between EIE and city-applied emissions data, these could be attributed to several possible causes:

  - **City boundary differences**: Certain cities' geographical boundaries differed more than others when compared to those in EIE, which meant there were also discrepancies in population counts and the scope of estimated emissions.

> *"CO_2 emissions data offers information about our way of life and the choices we make as governments, companies, and citizens. Google EIE can definitely help cities achieve higher standards regarding emissions data quality, and could serve as an alternative data source offering further confirmation of existing data with high spatial resolution."*
>
> **Rui Dinis**
> Climate Advisor, Lisboa E-Nova (Lisbon Environment and Energy Agency)

> *"Google EIE represents a powerful tool for cities to test and complement existing data sources and analysis tools. Offering a different approach to emissions estimation based on big data, it can provide a unique opportunity for cities to explore trend analysis and comparison with other cities. The transition to a greener future is boosted by widely available data."*
>
> **Alessandra Barbieri**
> Fundraising Office and EU Projects Manager, City of Florence

  - **Quality of local data**: Data quality issues may result from each city measuring and modelling their transport emissions based on different methods and activity data. EIE leverages real activity data inputs from Google Maps paired with machine-learning modelling that is consistently applied to all of its data, i.e., a truly bottom-up approach.

  - **Other causes include**: Difficulty in comparing EIE calculations equally with top-down approaches and hybrid or custom approaches, and the fact that EIE applies emissions factors derived from regional assumptions, which are likely to be less accurate than those used by the cities. Further research is recommended, employing a larger sample of European cities, especially those with local governments that utilise a bottom-up approach similar to EIE's emissions calculation methodology.

As seen in the table below comparing Google EIE and city inventory data, there may be differences in the findings owing to the causes noted above.

Data comparison between on-road transport emissions from Google EIE and city inventories as reported in the CDP-ICLEI Unified Reporting System.

CITY AND YEAR	EMISSIONS FROM CITY INVENTORY (TCO_2E)	GOOGLE EIE EMISSIONS (TCO_2E)	DIFFERENCE BETWEEN EMISSIONS (PERCENTAGE)
Cities calculating emissions under top-down approach (2018, 2019)			
Athens (2018)	844.669	832.445	↓ 1,5%
Athens (2019)	981.985	894.402	↓ 8,9%
Greater Manchester (2018)	3.719.583	3.957.636	↑ 6%
Lisbon (2018)	756.181	1.655.924	↑ 118%
Malmö (2018)	315.186	628.776	↑ 99,5%
Malmö (2019)	330.377	683.784	↑ 107%
Florence (2018)	462.742	429.000	↓ 7,9%
Izmir Metropolitan City (2018)	5.278.046	2.959.912	↓ 44%
Cities calculating emissions under bottom-up approach (2018)			
Mannheim (2018)	656.953	305.507	↓ 54%
Warsaw (2018)	1.790.517	2.905.286	↑ 62%
Madrid (2018)	2.653.340	3.732.742	↑ 40%

1 Athens and Malmö have emissions data available for 2018 and 2019; other cities only have 2018 data available. (EIE has emissions data for 2018 and 2019)

2 Izmir Metropolitan City and Madrid's geographical boundaries differ from those used by Google EIE.

ASSESSMENT FINDINGS AND TAKEAWAYS

Modal split calculations

The second part of the assessment evaluates the extent to which EIE data can support modal split calculations and enhance the effectiveness of local transport planning efforts. Key findings include:

- **Cities tend to use detailed but infrequent and non-periodic surveys to collect local mobility data to inform their transport reporting**. There are differences, for example, in the years that surveys are undertaken and the understanding of trips by different modes (namely multiple modes for one trip). Furthermore, limitations in current practices were identified in discussions with cities, such as the ability to collect data for those who are not residents in a particular city, and may not be surveyed but travel within the city's boundaries. This makes it challenging to define precise conclusions and compare results.

  EIE mobility data, on the other hand, has the advantage of being able to provide detailed trip data for resident and non-resident activity on an annual basis.

- **Initial observations emerging from the comparison of city and EIE data show different patterns related to specific modes of transport**. For instance, the proportion of bus trips is higher in city data than compared to EIE data. Conversely, the proportion of walking trips is higher in EIE data than city data for all of the cities in the assessment. Further research into these differences and analysing them in detail together with city transport departments is highly recommended.

- **EIE supplies detailed data on private car trips that occur within and outside of city boundaries**. When comparing EIE data to the cities that participated in the report, the proportion of EIE car trip data varies across cities. It appears to be higher than city data in some cases, and lower than city data in other cities, which likely reflects the error bars and data quality levels associated with traditional methods and datasets. Further research investigating the balance and makeup of in-boundary versus cross-boundary trips, which could influence modal split and the meaningfulness of drawing comparisons between cities, is recommended.

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"In order to be effective in accelerating sustainable mobility and related climate action at the local level, we need access to current, reliable data that provide us with an evidence base. In our digital world, this also means exploring new sources of information to support related decision-making processes. We encourage local governments in Europe to examine the Google Environmental Insights Explorer (EIE) tool which, in combination with existing local knowledge and data sources, holds great potential for enhanced climate action."

Wolfgang Teubner
Regional Director,
ICLEI Europe

Image: Pixabay / User322212
Cover image: Unsplash / Mika Baumeister

EIE POTENTIAL TO REDUCE TRANSPORT EMISSIONS AND ENHANCE SUSTAINABLE MOBILITY PLANNING

EIE is a valuable new tool that can provide significant benefits to reduce emissions from transportation and to enhance sustainable mobility planning efforts.

Environmental, climate and transport planning departments across the nine European cities involved in the assessment viewed EIE as a promising new tool that will be able to supplement their current library of assets. It provides a unique source of transportation data that requires particular attention for inclusion in sustainable mobility planning processes. Below are potential ways that cities can use and benefit from EIE:

EIE POTENTIAL	CITY APPLICATION AND IMPACT
Support implementation of ambitious climate action	Cities participating in the analysis are currently reshaping climate planning processes to meet new ambitious goals by 2030 or 2050. These cities confirm that continuous access to yearly EIE transportation data is an attractive opportunity to tap into new data-driven processes in the long run. This access can support the performance assessment of actions that reduce transport emissions inline with local transport and sustainable urban mobility planning strategies.
Bolster Sustainable Urban Mobility Plan (SUMP) efforts	All participant cities that are working on the development of their Sustainable Urban Mobility Plans (SUMP) are likely to find more valuable avenues to test and explore EIE data by employing EIE data related to trips and kilometres within and outside of city boundaries.
Optimise GHG emissions accounting	EIE offers new data that could help cities reduce the time and effort required to develop GHG emissions inventories, especially for on-road transport (scope 1 - direct emissions). EIE transportation data is freely available, easily accessible, and updated on an annual basis. It can assist cities in optimising their emissions accounting processes, and offers some cities the possibility to reduce the typical two-to three-year development time needed to compile an inventory.
Access multiple modes of transport in one place	EIE provides standardised mobility data regarding passenger trips and kilometres, as well as on-road transport emissions data. This can help cities to understand and design measures to facilitate a modal shift towards cleaner and more sustainable modes of transport like biking and walking, or to promote the use of public transport.
Harness a new source of data when limited information is available	City participants perceive EIE mobility data as a new and detailed data source that yields novel insights about mobility patterns at the local level. They showed significant interest in the use of the data for modal split calculations, particularly those that have limited internal resources to develop their own mobility surveys. Cities want to better understand EIE data and methodologies to model errors in their approaches, but also to be able to evaluate the possibility of switching over to EIE altogether.
Unlock the ability to view insights, compare data across jurisdictions, and employ it for international benchmarking	All of the city participants mentioned that EIE was easy to use and contributed to better local sectoral and cross-boundary analysis. Cities can also use EIE data to supplement their internal tools; perform more specific data cross-checking analysis; and support monitoring and verification processes for transport emissions reduction and sustainable mobility actions. This could bring new insights to transport planning departments and enhance regional cooperation between various public authorities and transport providers. Additionally, EIE's ability to gauge sectoral city-level emissions or modal split data internationally, and communicate these via a centralised platform, shows great promise for more consistent, accurate benchmarking. With the tool, cities can evaluate, compare, and understand mobility patterns and emissions generation sources from other similar cities in Europe and beyond.

FUTURE OPPORTUNITIES

EIE's ability to provide detailed and timely access to transportation emissions for all modes of transport is game-changing.

However, more European cities need to access and review EIE data in order to realise its true potential. Cities must consider new data sources like EIE that are readily available not just for the purposes of staying informed or gauging the integrity of existing methods and processes, but more importantly, to accelerate climate action.

Greater understanding of the tool among a larger community of users including universities, consulting firms and research organisations that work directly with cities is therefore needed to foster the use of EIE and promote collective action. ICLEI Europe recommends further research and additional assessments in the following areas:

AREAS FOR FURTHER EIE ANALYSIS	RESEARCH FOCUS AND GOALS
Impact analysis of geographical boundaries in emissions calculations	Better understand how city boundary differences in EIE impact emissions data. It will bring more clarity to existing data gaps and to help identify opportunities for improvement towards standardised comparative analysis. Specific emphasis would be placed on better understanding of mobility patterns and emissions, with emphasis on in-boundary and cross-boundary trips.
Injection of cities' own data into EIE modelling schemes to better assess deviations and correlations	Cities have different sources of data that could be utilised as input to refine Google EIE emissions calculations; for example, vehicle kilometres travelled data, local emissions factors, or vehicle occupancy data. This work could bring further insights to practitioners interested in using EIE for analysis and/or planning purposes.
Analysis of emissions data gaps per mode of transport	Comparative analysis of emissions per mode of transport to better understand data differences and support the development of new EIE-specific validation processes. An evaluation of the value EIE could bring to cities regarding scope 3 emissions could also be an interesting avenue to explore as part of this effort.
Testing EIE with transportation planners (deep-dive reviews)	Transport planners play an essential role in local sustainable mobility. Further work to analyse EIE data from a transport planning perspective, including possible new features, will be key to advancing the adoption of the tool throughout Europe. Providing advice on the use of EIE and its related methods to transport planners would raise the profile and utility of EIE data.

In summary, **Google EIE proves to be a promising tool that can support cities' ambitions to reduce emissions in the transport sector and to promote sustainable urban mobility**. ICLEI Europe recommends that cities and regions that have challenges in developing their GHG inventory and/or lack mobility data try EIE. Cities with existing inventories are also encouraged to report on EIE, if applicable, to allow for easier comparisons across European cities and to foster a more peer-to-peer experience.

ICLEI Europe will continue to facilitate additional exchanges with cities and further research with community interest groups to ensure local contexts are reflected in EIE's evolving datasets.

→ Stay tuned for the full technical assessment and specific city data comparisons with EIE, which will be available on the ICLEI Europe website.