An Introduction to Environmental Insights Explorer

As used by cities and local governments around the world

2024

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About this guide

The path to creating more sustainable cities requires high-quality environmental data. Such data must be collected in a cost-efficient manner, updated regularly, and help enable local governments identify, plan, and track the progress of high-impact interventions. Google's Environmental Insights Explorer (EIE) empowers cities throughout their climate action journeys by delivering core Environmental Insights: Transportation Emissions, Building Emissions, Rooftop Solar Potential, and Tree Canopy coverage. EIE also offers early Experimental Insights for select cities through EIE Labs.

This guide is intended to provide city sustainability professionals with an overview of EIE, its insights, its data and collection methods, and common use cases for cities looking to accelerate progress towards their climate goals.

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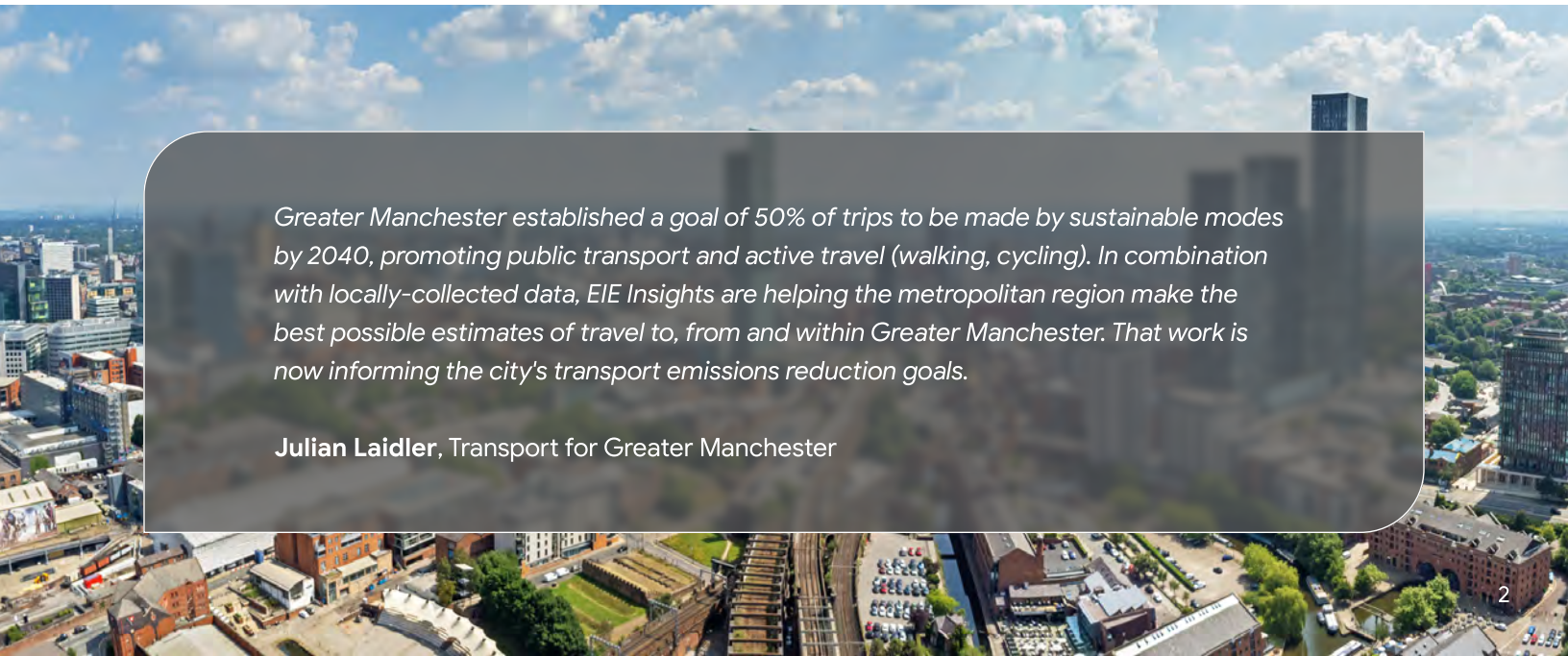
1. What is Environmental Insights Explorer?

Environmental Insights Explorer (EIE) is a freely available data and insights platform that uses exclusive data sources and modeling capabilities **to help over 40,000 cities and regions globally** measure emissions sources, run analyses, and identify decarbonization and climate resilience strategies — creating a foundation for effective action.

With EIE, sustainability professionals around the world can accelerate their efforts toward making their communities more sustainable, resilient, and adaptive to climate change.



Greater Manchester established a goal of 50% of trips to be made by sustainable modes by 2040, promoting public transport and active travel (walking, cycling). In combination with locally-collected data, EIE Insights are helping the metropolitan region make the best possible estimates of travel to, from and within Greater Manchester. That work is now informing the city's transport emissions reduction goals.

Julian Laidler, Transport for Greater Manchester

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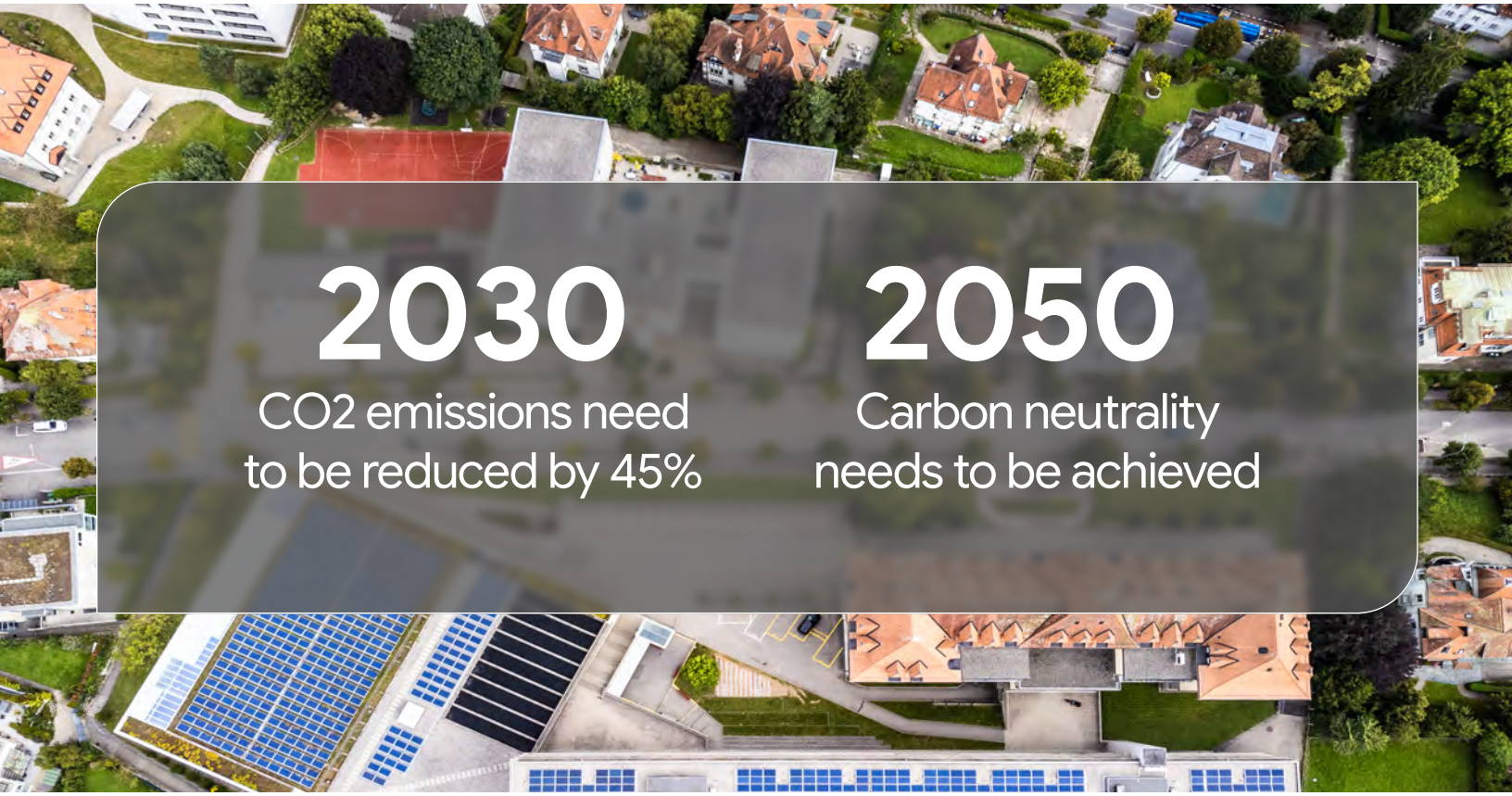
2. Why we created Environmental Insights Explorer

The global state of climate change requires action, and the time to act is now. To keep global warming to no more than 1.5°C — as called for in the Paris Agreement — emissions need to be reduced by 45% by 2030 and reach net zero by 2050.



As part of Google's commitment to **help reduce 1 gigaton of carbon emissions annually by 2030**, EIE is founded on the idea that access to actionable, high-quality data can help accelerate the world's transition to a low-carbon future and build climate resilience.

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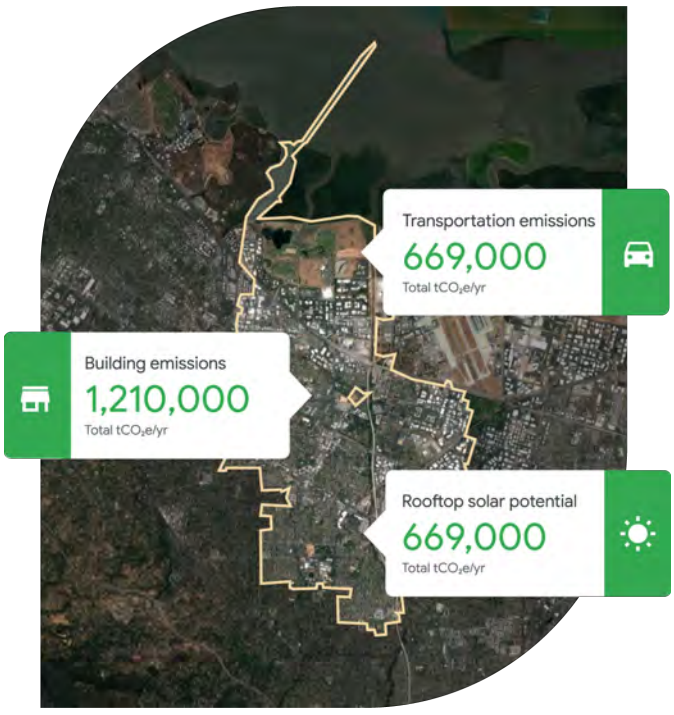
The need for decarbonization & climate resilience

Over half of the global population lives in cities, and urban areas account for more than 70% of global greenhouse gas emissions. As a result, cities have an especially important role to play in the race to decarbonize.

At the same time, local governments must find ways to adapt to the new climate realities in front of them. Heatwaves and wildfires are becoming increasingly common due to rising temperatures. Extreme weather events can disrupt everyday operations, from electricity distribution to food supply chains. Improving climate adaptation, therefore, is an equally urgent task for many city and regional governments.



EIE helps cities make informed decisions, faster

EIE aims to simplify the process of identifying tangible carbon reduction and climate adaptation opportunities by making high-quality, granular environmental data available to sustainability professionals.

Additionally, EIE's interface enables cities to explore and customize emissions targets within the platform, supporting environmental scenario planning at a city or regional level. From measuring and planning to developing climate action initiatives and tracking impact over time, EIE is designed to assist local governments in making their communities more sustainable, resilient, and adaptive to climate change.

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3. Supporting the entire climate action journey

Measure

Use EIE to estimate your city's GHG emissions, identify reduction opportunities, and evaluate your city's current & future level of climate resilience.

Plan

Use EIE to develop decarbonization and climate adaptation strategies and set targets for proposed policy changes or interventions.

Act

Use EIE to direct investment priorities, build support for climate action, and implement policy changes or climate interventions.

Track

Use EIE to monitor the success of sustainability policies and programs targeted at GHG emissions reduction and adapting to the effects of climate change.

> *The story of how nations tackle climate change will necessarily be a story of how we redesign and rebuild our urban environment.*
>
> **Jessica Troni**, Head of UNEP's Climate Change Adaptation Unit

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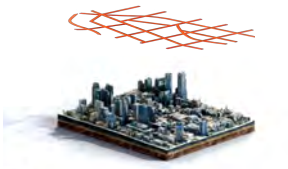
4. What Insights are available?

EIE offers Environmental Insights to inform sustainability planning across urban mobility, the built environment, and climate adaptation projects. We view these sectors as high priority for decarbonization and mitigating the effects of climate change in cities.

Transportation Emissions 	Annual estimated emissions of all trips — inbound, outbound, and in-boundary — based on Google Maps trends.
Building Emissions 	Estimated emissions from heating, cooling, and powering residential and non-residential buildings, based on Google Maps data.
Rooftop Solar Potential 	Estimated solar energy production potential of all buildings in a city or region based on total sunshine exposure, weather patterns, and roof dimensions.
Tree Canopy 	Estimated tree canopy coverage across cities and regions, based on aerial imagery, AI, and machine learning algorithms.

The need for action

- The transportation sector is responsible for approximately one quarter of greenhouse gas emissions
- Building operation emissions account for 27% (9.9GT) of global emissions
- Extreme heat and drought is expected to impact more than 90% of the world's population, resulting in compounding effects for vulnerable populations

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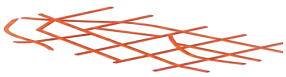
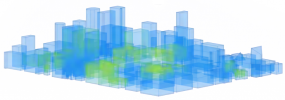
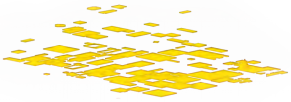
5. The method behind the data

EIE uses unique Google data sources and modeling capabilities to produce estimates of activity, emissions, and reduction opportunities. By surfacing environmental information in a robust platform, we aim to serve sustainability decision makers working on these issues and solutions for cities globally, free of charge. The insights we offer are modeled estimates based on real-world infrastructure and actual measurements of activity, which is the same underlying information that is made available in Google Maps.

Transportation Emissions 	EIE estimates the total amount of CO2 emissions from trips taken into, out of, and within a city or region. Taking into account movement over all major road classifications — from interstates to local roads — we are able to estimate annual vehicle trips by mode and vehicle distance traveled for all trips in a given area.
Building Emissions 	EIE estimates the total amount of CO2 emissions of commercial, residential, and mixed-use buildings within a city or region. We model a building's floor space using data sourced from Google Maps, aerial imagery, and 3D modeling, then combine that value with the energy consumed by the building and emissions associated with that energy usage to calculate total emissions.
Rooftop Solar Potential 	EIE estimates the total amount of energy generation potential from installing solar panels on viable rooftops across a city or region. To determine rooftop solar potential, we use a machine learning algorithm to calculate building shapes, then identify usable roof space using satellite imagery, 3D modeling, and weather data from the National Renewable Energy Laboratory.
Tree Canopy 	EIE estimates the total existing tree canopy density in a city or region. Tree Canopy data is largely sourced and derived from aerial imagery. We trained an AI model to categorize pixels in high-resolution overhead imagery into a number of terrain types, such as "tree" or "road." Tree canopy percentage is estimated as the percentage of pixels in a city or neighborhood that are categorized as "tree."

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6. Environmental Insights Explorer Labs

In addition to our flagship Insights, we're constantly exploring new ways to help cities achieve their climate goals. EIE Labs represents pilot programs available to select cities for further testing and development.

Current Lab Projects

Air Quality

EIE provides select cities with street-by-street air quality data, helping them identify opportunities for improvement. By equipping Google Street View vehicles with air pollution sensors, we've collectively made 500 million air quality measurements. With real-time, hyperlocal modeled air quality intelligence, we aim to make invisible air pollution much more visible.

Cool Roofs

EIE estimates the albedo (solar reflectance) of every rooftop in select cities. We start with surface reflectance measurements taken by satellites at a 10 meter resolution and then use machine learning in combination with aerial imagery to infer the solar reflectance at a higher spatial resolution.

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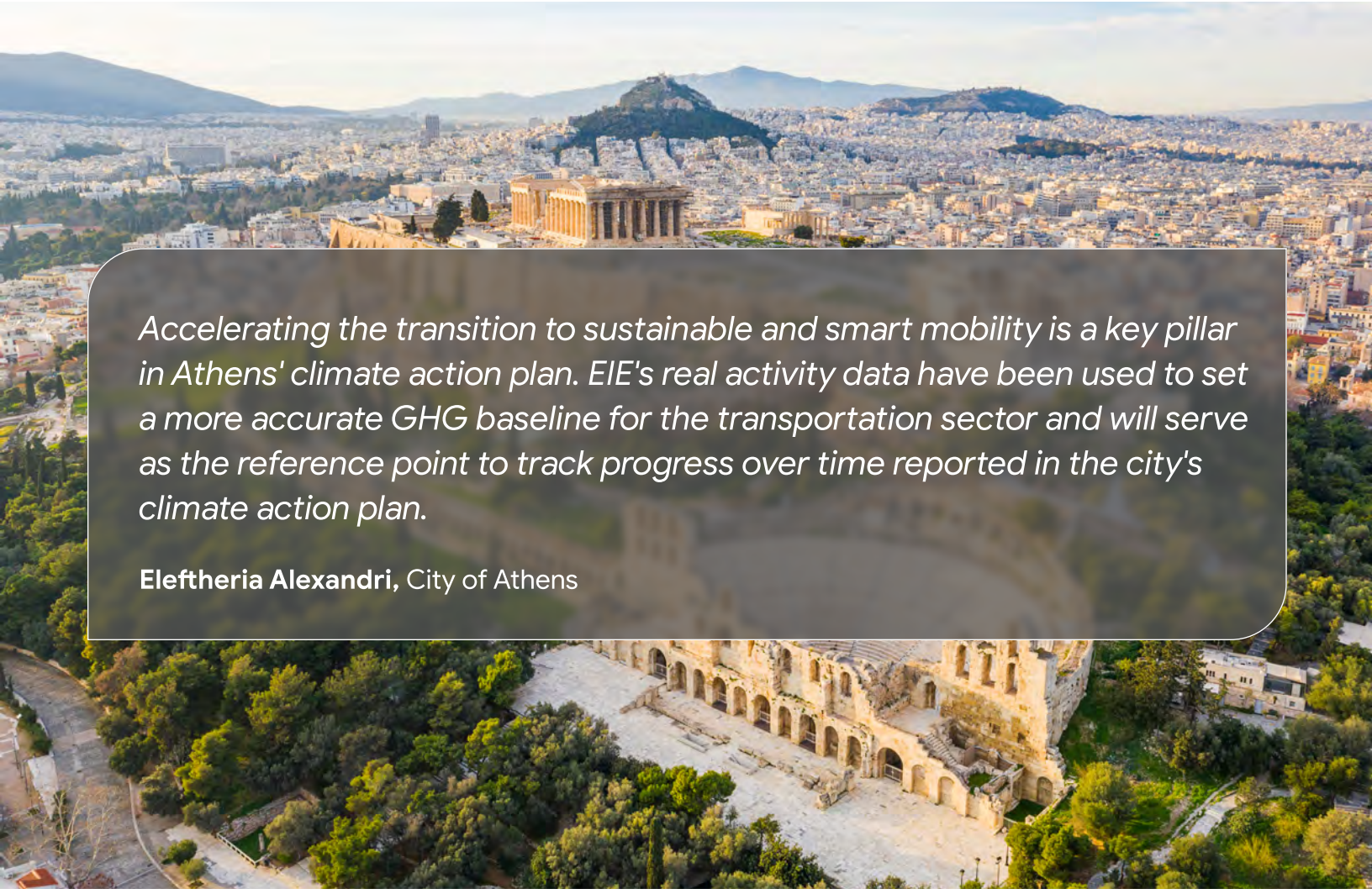
7. How cities use Environmental Insights Explorer

EIE's array of insights is helping cities with varying demographics, geographies, and challenges achieve their climate goals. **In this section, we explore how cities use EIE Insights to:**

- Update greenhouse gas inventories
- Validate assumptions & baselines
- Transition to sustainable mobility & energy
- Improve climate resilience



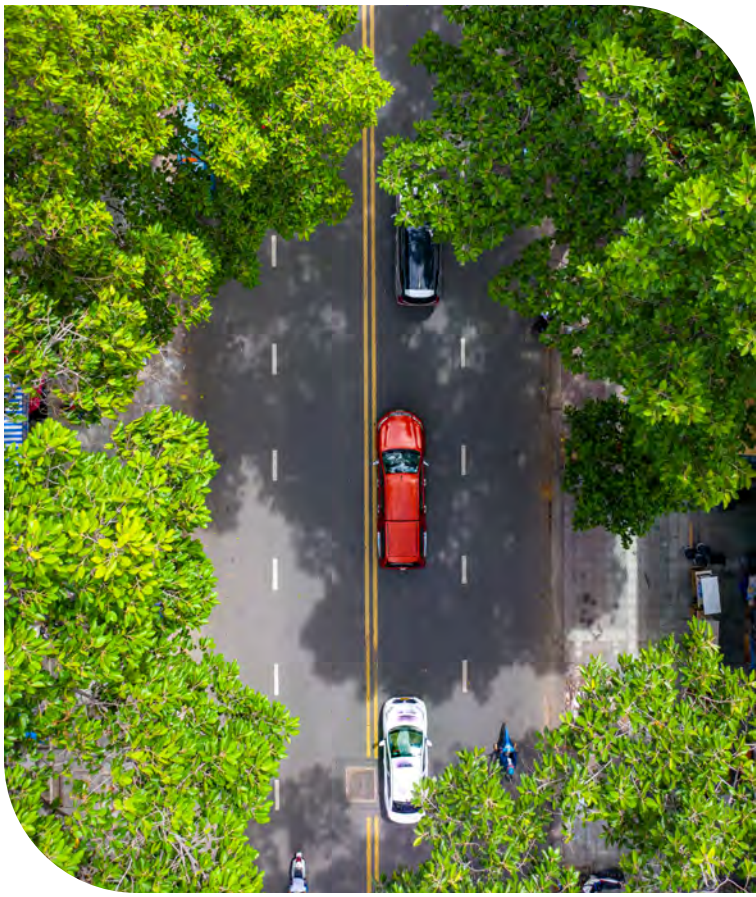
Accelerating the transition to sustainable and smart mobility is a key pillar in Athens' climate action plan. EIE's real activity data have been used to set a more accurate GHG baseline for the transportation sector and will serve as the reference point to track progress over time reported in the city's climate action plan.

Eleftheria Alexandri, City of Athens

Update GHG inventories and set carbon reduction goals

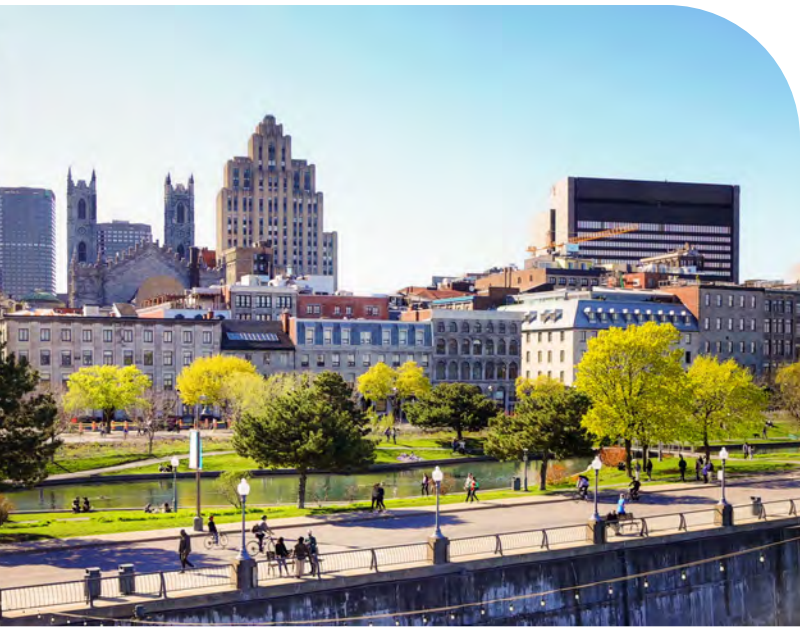
Calculating a greenhouse gas (GHG) baseline, or inventory, is often the first step a city makes toward climate action planning. GHG inventories can help prioritize investments in the most impactful areas, as they identify significant emission sources. Calculating a GHG inventory is a complex undertaking that requires accurate citywide data; however, access to high-quality data can be an obstacle in this process.

EIE's machine-learning-based tools save local governments considerable time and money and deliver comprehensive, high-quality environmental data. Once a GHG inventory has been updated with the help of EIE's Insights, cities can take steps to measure the progress they are making against their GHG baseline.



Validate existing assumptions, data, and baselines

Powered by Google's proprietary data, EIE offers cities access to detailed and regularly-updated Environmental Insights. As a result, cities often use EIE to modify and compare their existing assumptions, data, and GHG baselines. Furthermore, cities are able to evaluate progress toward achieving sustainability goals and are equipped with the resources to set realistic targets going forward.



Develop sustainable mobility plans and encourage low-emission travel

EIE's multimodal Insights can inform city investments in initiatives that spark sustainable transportation behaviors, such as increasing bicycle lanes, encouraging more walking, incentivizing rideshare programs, and more. By monitoring trends and changes across pedestrian, bicycle, public transit, and private vehicle travel, cities can monitor how well their low-carbon transportation interventions are succeeding over time.

> *On its journey to Carbon Neutrality, Izmir Metropolitan Municipality is using Google EIE transport emissions and trips data to better understand their transport sector carbon footprint and the mobility patterns of their citizens. The insights will inform Izmir's mobility strategy which focuses on reducing private transport trips, increasing active mobility (walking and cycling) and encouraging the use of low-carbon public transport. The annual updates that are being published on EIE allows the Metropolitan City to track their progress over time.*
>
> **Çağlar Tükel, PhD,** Izmir Metropolitan Municipality

Improve uptake of solar energy

Rooftop solar is an important component of the transition to renewable energy. Alongside residential installations, solar panels can be installed on commercial buildings to generate additional energy. Used in conjunction with EIE's Building Emissions data, our Rooftop Solar Insights helps identify districts with the best solar energy generation capability, develop incentive programs to encourage solar panel installation, and track energy generation and consumption over time.

Analyze the impact of the pandemic on city traffic

COVID-19 caused an overnight shock to many aspects of everyday urban life. In particular, the pandemic had both immediate and longer term impacts on mobility behavior. For example, at the height of the pandemic, commuter activity decreased as regions went into quarantine and more people began working from home, while biking and walking became popular ways to safely exercise and commute through cities.

Using EIE, urban planners can explore and analyze the traffic trends and patterns that emerged in their city during and after the pandemic to establish updated mobility policies. For example, some cities identified opportunities for establishing low-emission zones, creating new bike lanes, and incentivizing public transit use.

Identify and improving extreme heat zones

Trees provide numerous benefits to urban areas, including providing shade along sidewalks, managing stormwater runoff, and improving resilience to urban heat. City planners can use Tree Canopy to identify which neighborhoods would benefit from additional tree planting investments to reduce urban heat islands.

Heat islands are urban areas that experience higher temperatures due to structures that absorb heat from the sun, such as roads or dark-colored rooftops. They are often disproportionately located in low income communities and communities of color, where there may also be less access to air conditioning. Painting dark-colored rooftops with a lighter color that reflects sunlight can reduce the internal temperature of a building, which results in lower AC consumption rates and lowers the building's total energy consumption. Our Cool Roofs project helps planners identify rooftops with low surface reflectivity throughout a city or region.

8. What are the next steps for my city?

Thank you for reading our introductory guide to Environmental Insights Explorer. Here are the next steps your city can take to start accessing our data, all for free.

Step 1. Request Access: As a government employee, you can request access to your city's data here if you haven't done so already. (If you're not a government employee, you can still register your interest & keep up with EIE here).

Helpful tip

Using your government email address associated with a Google Account will help us verify and approve your access to EIE's Insights Workspace and get you access to your data faster.

a. If you're not sure whether you have a Google Account, visit Help → Create a Google Account and follow the instructions to "Check if you already have a Google Account" associated with your organization-provided email address.

b. If not, follow the steps to create a Google Account under the "Use an existing email address" heading.

Step 2. Get to know your workspace: After receiving access, you can start exploring your city's data. We recommend watching our EIE tutorial playlist to help you get started.

Step 3. Invite your team members: Rather than have your colleagues request separate instances of your city's workspace, we encourage you to invite your colleagues to view your workspace through the share button.

Step 4. Start exploring: Start exploring your city's Environmental Insights and begin the journey of incorporating EIE's data into your climate action planning.

To learn more about Google's sustainability efforts, view:

- Our website
- Our blog
- Our social
- Our sustainability page

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