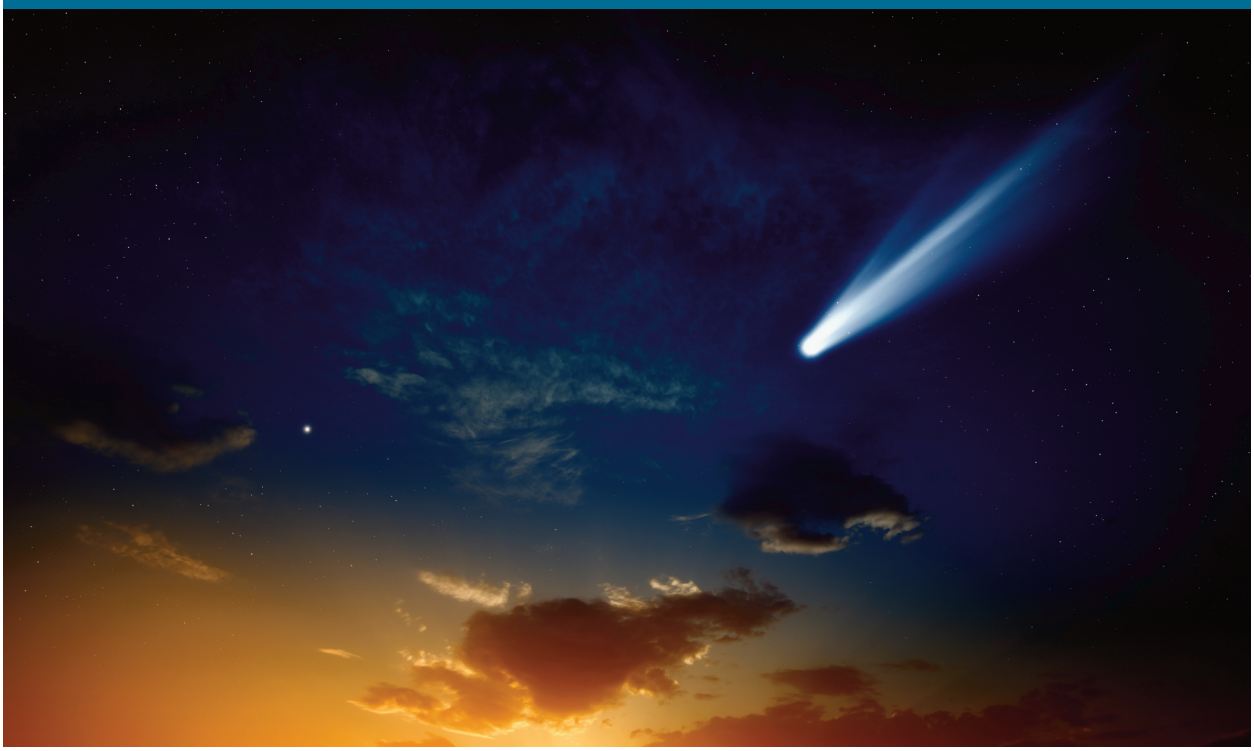

# EPA's COMET Tool Blazes a Path Toward Planning Cleaner Cities

by Nicolle Priester

City-based Optimization Model for Energy Technologies (COMET) is designed to provide planners with the tools they need in order to build sustainable and smarter cities of the future.

**As the threat of climate change grows,** city planners are taking action to implement cost-effective, clean energy solutions, improve building energy efficiency, and change consumption patterns to reduce carbon emissions and other harmful pollution within their cities. One challenge is that major cities may rely on a supply of electricity and fuels outside their jurisdiction. Thus, many city planners may ask, "If my city is receiving electricity from a grid that relies heavily on fossil fuels and I may not have the governing capability to decarbonize and transform the grid, what else can I do to greatly reduce the carbon and other air pollutants that threaten human health and the environment within my jurisdiction?"

Mobility, energy, environment, urban planning, and living standards are all common elements city planners must consider when building sustainable and smarter cities of the future. To equip local officials with the tools they need to find integrated solutions, researchers from the U.S. Environmental Protection Agency (EPA) designed the City-based Optimization Model for Energy Technologies (COMET). COMET allows users to examine the next 40-50 years of energy technology evolution. The model provides practical and applicable energy policy solutions, especially for cities that aim to achieve air pollution emissions reduction targets. The tool can reveal how the energy system can be balanced at the city level under a different set of scenario assumptions, and how system costs and resulting emissions change with respect to those scenarios.

The first application of COMET was recently piloted in New York City (COMET-NYC), which has a goal to reach 80% greenhouse gas reduction relative to 2005 levels by 2050. In pursuit of this goal, NYC implemented benchmarking laws that require large commercial buildings to report their energy consumption. Along with one of the largest subway systems in the world, NYC has an extensive fleet of cars, trucks, busses, and other forms of public transportation, so the city can directly track fuel consumption and resulting emissions from its own public fleets. The city also analyzes

data to account for the emissions from private transportation and other sources, such as buildings and waste, that it does not track directly.

An energy systems model like COMET needs generous amounts of data to provide an accurate analysis of future scenarios, so data-driven NYC was the perfect case study for the COMET developers to pioneer the first test of the tool. After populating the model with the energy consumption and emissions data provided from the NYC Department of Health and Mental Hygiene and NYC's Office of Long-Term Planning and Sustainability, along with technology portfolios for buildings and transportation technologies, EPA researchers conducted a scenario analysis to explore different pathways to reduce carbon emissions. The analysis highlighted the importance of fuel efficiency, early fleet turnover to high-efficiency vehicles, and increasing the use of clean fuel and electric powered vehicles, which resulted in significant reduction of carbon and other air pollution.

Recognizing uncertainty about the future, the researchers examined another scenario where the regional grid did not meet New York State's clean energy standard of obtaining 50% renewable generation by 2050. They found that even in this scenario that relies on a more carbon-intensive grid, NYC's emission reduction goal could still be met cost-effectively if the city's transportation sector is electrified earlier. The researchers also found that this scenario provided additional reductions of the air pollutants nitrogen oxide and particulate matter, which are emitted by motor vehicles and industrial sources.

"Many countries, cities, and regions have committed to net-zero emissions targets by 2050 or 2060," says EPA researcher Dr. Ozge Kaplan, an energy systems modeler who is leading COMET's development. "Electric vehicle sales have grown world-wide and charging stations have become increasingly commonplace on streets and roads. Additionally, renewable energy production costs have dropped much faster than many expected, she adds.

"Energy systems tools such as COMET can help decision makers identify near- and long-term cost-effective strategies to meet their clean energy targets while quantifying multi-pollutant trade-offs that can improve or worsen public health impacts from air pollution. The tool can focus in on which sectors should be prioritized in order to get the most bang for their buck," Kaplin explains. The research was published in the January 2021 fifth anniversary issue of *Nature Energy*, which was dedicated to addressing transportation and decarbonization questions.[1]

COMET characterizes and assists with planning the energy system at the city level and is one part of EPA's broader energy research portfolio that examines the environmental aspects of energy system evolutions at different spatial and temporal scales. To help guide the sustainable energy decision-making process at other state, regional and local levels, EPAUS9rT is a regional database developed by EPA researchers that provides information that represents energy supply, technology, and demand throughout the major sectors of the U.S. energy system. The unique contribution

of this database lies in its thorough representation of greenhouse gas and air pollutant emissions. GLIMPSE is another decision support modeling tool being developed by EPA that will assist states with energy and environmental planning through the year 2050. Users of GLIMPSE will be able to explore the impacts of energy technologies and policies on the environment. It is anticipated that GLIMPSE will be publicly released in 2022.

The recent COMET-NYC pilot study highlights the importance of energy system level planning at the city level and proactive efforts by cities to reduce harmful pollution levels and to mitigate the causes of climate change. EPA's energy research continues to improve the ability of the nation to evaluate the potential costs, benefits, and risks associated with production and use of existing and emerging energy resources. The tools and information are empowering regional, state, and local governments as they adopt policies and incentivize technologies to address the challenge of climate change and meet environmental and sustainable energy goals to protect public health and our life-giving Earth. **em**

## Useful Links

- City-based Optimization Model for Energy Technologies (COMET): **https://www.epa.gov/air-research/city-based-optimization-model-energy-technologies-comet**
- EPAUS9rT – An Energy Systems Database for use with the TIMES Model: **https://www.epa.gov/air-research/epaus9rt-energy-systems-database-use-times-model**
- GLIMPSE – A computational framework for supporting state-level environmental and energy planning: **https://www.epa.gov/air-research/glimpse-computational-framework-supporting-state-level-environmental-and-energy**

## More Information

For more information about the **EPA Research Highlights** column, contact Ann Cornelius Brown, U.S. Environmental Protection Agency (EPA), Office of Research and Development, Research Triangle Park, NC; e-mail: **brown.ann@epa.gov**.

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### Reference

1. Isik, M.; Dodder, R.; Kaplan, P.O. Transportation emissions scenarios for New York City under different carbon intensities of electricity and electric vehicle adoption rates; *Nature Energy* 2021, *6* (1), 92-104; **https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=350611&Lab=CEMM**.