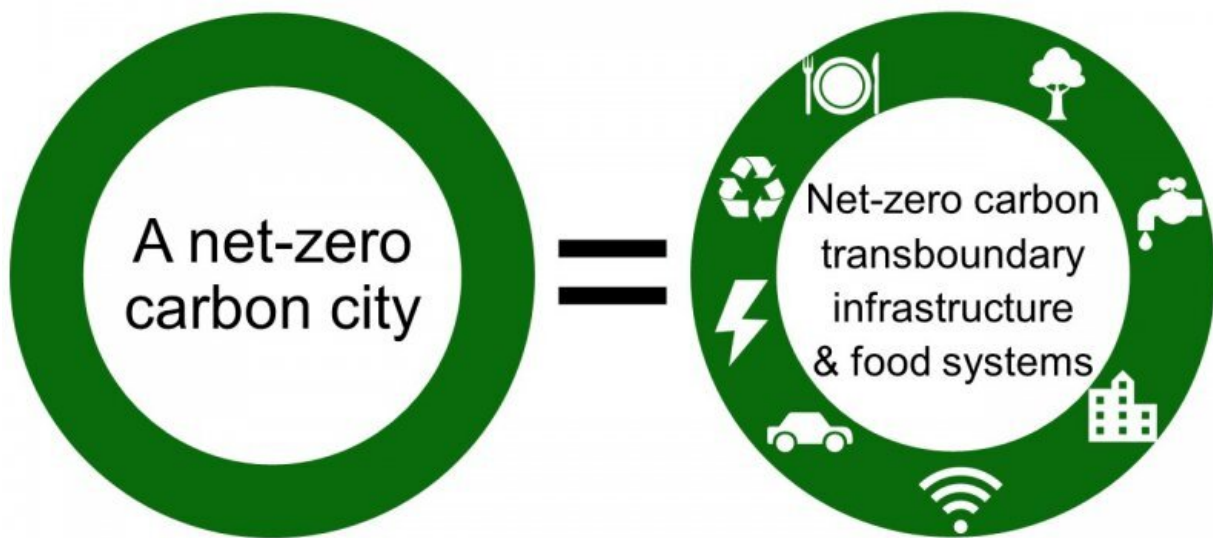


Research meets the challenge of measuring urban carbon emissions

May 17 2021, by Morgan Kelly



Source: Ramaswami, 2021

A group of scientists and urban-policy specialists have laid out seven key service sectors that city leaders can evaluate to gauge — and reduce — their carbon emissions. They emphasize focusing on the sectors of energy, transportation-communications, food, construction materials, water, green infrastructure, and waste-management systems as part of a “transboundary” approach that involves tracking carbon emissions along the supply chains that connect community-wide demand for these services to their sources. They report that transitioning these sectors to net-zero carbon can be coupled with improvements that would enhance equal access to food, sanitation, clean air and water, transportation and essential city services. Credit: Anu Ramaswami, Princeton University

As more people call for action against climate change, more than 500 cities worldwide have established low-carbon and net-zero carbon goals intended to substantially reduce greenhouse gas emissions in the coming decades.

But a major challenge to these decarbonization plans is the lack of a consensus on how to measure urban [carbon](#) emissions in the first place.

Now, a group of scientists and urban-policy specialists attempt to cut through the confusion about urban carbon accounting approaches by laying out seven key service sectors that [city leaders](#) can evaluate to gauge—and reduce—their carbon emissions.

The authors report in a peer-reviewed commentary in the journal *Nature Sustainability* that transitioning these sectors to net-zero carbon can be coupled with improvements that would enhance equal access to food, sanitation, clean air and water, transportation and essential city services.

The authors emphasize focusing on the seven sectors of energy, transportation-communications, food, [construction materials](#), water, green infrastructure, and waste-management systems as part of a "transboundary" approach. The transboundary approach involves tracking carbon emissions along the supply chains that connect community-wide demand for these services to the power plants, factories and farms that produce electricity, fuels, construction materials, water, and food essential for cities to function.

"We make the case for researchers and practitioners to consider defining a net-zero carbon city as one that has net-zero carbon infrastructure and food provisioning systems," said lead author Anu Ramaswami, Princeton's Sanjay Swani Professor of India Studies and professor of civil and environmental engineering and the High Meadows Environmental Institute.

Cities present a unique challenge for carbon accounting, said Ramaswami, who wrote a [blog post for *Nature*](#) on the background of the paper. Cities are small-scale open systems embedded within large-scale infrastructure and trade networks, and rely heavily on imports and exports. This means that a lot of materials, energy, water and other goods and services move in and out of cities, which makes accounting for carbon emissions especially difficult, she said.

"Getting clarity on what sectors to focus on to measure transboundary carbon emissions in a way that supports a net-zero transition is a big deal for cities," said Daniel Hoornweg, professor at Ontario Tech University and the former lead urban specialist at the World Bank who was not involved with the current paper.

Cities have been grappling with many alternate greenhouse gas accounting approaches, the authors write. Their paper argues that in a future reliant on net-zero electricity, food and mobility systems, one needs to worry less about the carbon embodied in all trade, which will automatically become near zero. Rather, leading cities can help in the net-zero transition by strategically focusing their carbon accounting on these critical sectors that are pillars of a net-zero carbon future.

A focus on these seven key provisioning systems allows city-level efforts on buildings, energy, mobility, food and waste systems to connect consistently and systematically with larger-scale efforts around net-zero power grids, circular economy and sustainable agriculture. Most importantly, focusing on these seven sectors also enables linking carbon mitigation with other sustainability priorities, particularly inequality in infrastructure access and consumption, health co-benefits, and resource sustainability addressing carbon linkages with water, land and bioresources.

"Many cities and counties are leading the way in their commitments to

reduce emissions," said Angie Fyfe, executive director of ICLEI—Local Governments for Sustainability U.S. (ICLEI U.S.), the largest global network of local governments working toward sustainability. Eli Yewdall, senior program officer at ICLEI U.S., is a co-author of the paper.

"As cities invest in a net-zero emissions transition, they need clarity on which emissions measurements will best inform their analyses and planning," Fyfe said. "This paper affirms that a focus on net-zero electricity and mobility systems are essential, and provides a framework to discuss which additional sectors, such as food, green infrastructure, and waste systems, can be valuable as both a carbon-mitigation strategy and a means to improve community health and vibrancy."

Organizations such as ICLEI U.S., the World Resources Institute and C40 have been collaborating to develop protocols to support carbon measurements associated with cities worldwide. Indeed, the advanced option in the Global Protocol for Cities already covers a majority of these sectors, with more data needed to address food and construction materials supply chains in cities. The paper notes that new data science and carbon analytics will be critical to provide data on the demand and supply of all seven sectors.

"We want [carbon emissions](#) footprinting across all seven sectors to be broadly available to all urban areas across the world, which will require robust partnerships between researchers and city-networks. said co-author Josep "Pep" Canadell, executive director of the Global Carbon Project.

The framework presented in the *Nature Sustainability* commentary stems from a workshop jointly hosted by the Global Carbon Project and the NSF Sustainable Healthy Cities Network led by Ramaswami. It represents a dialog between researchers and practitioners across the

world on defining what a net-zero carbon city is and how to advance carbon analytics toward a sustainable future.

The commentary, "Carbon analytics for net-zero emissions sustainable cities," was published May 13 by *Nature Sustainability*.

More information: Anu Ramaswami et al. Carbon analytics for net-zero emissions sustainable cities, *Nature Sustainability* (2021). [DOI: 10.1038/s41893-021-00715-5](https://doi.org/10.1038/s41893-021-00715-5)

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