

# **ENABLING LOW-CARBON CITIES:**

# **THE ROLE OF ENERGY & EMISSIONS MODELLING**

REPORT ON SUSTAINABILITY SOLUTIONS GROUP'S THOUGHT LEADERSHIP SYMPOSIUM

FEBRUARY 2019

**SSG**

# SSG THOUGHT LEADERSHIP FORUM

As an affiliate event to the Global Climate Action Summit held in September 2018 in San Francisco, Sustainability Solutions Group hosted a one-day symposium on modelling energy use and greenhouse gas emissions mitigation in cities. The event was a presentation and discussion forum for cities' climate action success and challenges to date, and a discussion platform to determine future requirements and opportunities in modelling low carbon pathways for cities. The symposium convened top modelers, policy makers, academics, consultants, non- profits, and other key thinkers on city climate action. This brief draws on the presentations made and the discussions held during the day- long workshop.

# MUCH HAS BEEN ACCOMPLISHED, MUCH HAS BEEN LEARNED

Urban climate change mitigation has come a long way since its inception in the late 1980's when a handful of North American and European cities first formed the Urban CO<sub>2</sub> Reduction Project. Now there are thousands of local governments around the world with stated commitments to targeted reductions in greenhouse gas emissions.

Energy and emissions mitigation modelling has been instrumental for cities in understanding emissions production, translating city systems and infrastructure, human behavior, and policy effects into quantifiable energy and emissions information and trends, and enabling energy and emissions modelling projections for future years.

Modelling is bridging the divide between problem identification and solution creation. Energy and emissions models have identified the emissions reduction potential of municipal land use, transportation and energy policies and actions, as well as their estimated costs and paybacks, steering municipalities to effective climate action.

With the help of emission inventory methods and model simulations of emission reduction opportunities, we now have a good understanding of both the sources of emissions in cities and what physical changes are needed to reduce them.

The short list of generic requirements for low carbon communities includes:

- » Net zero emissions from new buildings;
- » Deep retrofits of all existing buildings;
- » Electrification of personal transportation;
- » Decarbonization of the electricity supply;
- » Land use and zoning that reduces the travel needed for everyday needs;
- » Zoning and urban spatial structures that support of district energy and microgrids;
- » Zero emission management of all organic waste; and
- » Maximizing waste reduction and recycling.

## THORNY ISSUES

Energy and emissions modelling of urban systems is becoming increasingly sophisticated, revealing a number of “thorny” issues facing urban climate mitigation efforts in many cities:

- » The spatial resolution of urban energy modelling now supports the analysis of the impact of land use changes on building and transportation energy use, but the results indicate only modest impacts compared to what had been expected.
- » The emission reduction potential of active transportation, while not insignificant, is limited by the share of person-miles of travel that are walkable or cyclable in today’s cities with today’s cycling technology.
- » There is enormous inertia in the urban built environment. The building stock and infrastructure turns over very slowly, “locking in” the energy and emissions patterns of investments for decades into the future, and constraining the possibilities for mitigation.
- » Both the data and the models for simulating commercial transportation are lagging behind our understanding of other sectors. This includes both freight movement and the burgeoning amount of light vehicle commercial traffic associated with the economic activity in modern, post-industrial cities.
- » The granularity of the modelling required in both time and space to properly identify and analyze opportunities for microgrids and district energy systems poses a challenge for the existing generation of urban climate mitigation models. Further development is needed on the capacity of the models to incorporate energy storage and local intermittency of supply.

## THE REMEDIAL, INCREMENTAL APPROACH IS INSUFFICIENT

At the same time, urban mitigation efforts have not been able to realize the emission reduction potential that has been identified. Urban human activity remains a major driving force of global greenhouse gas emissions and, with few exceptions, climate action plans are not disruptive enough. The roles of inventories and climate action plans as tools for energy and climate literacy are important, especially in building public energy literacy and support, and encouraging support from city councils. However, there is concern that many climate action plans are falling short on impact.

Historically, urban climate plans and the models that support them have taken the same incremental approach that has characterized most climate change mitigation efforts. It

is fundamentally remedial in its framing of the challenge (“react and cure” in Brundtland parlance). Typically, a “business as usual” projection of energy using and emitting activities will be adopted, and then energy efficiency, renewable energy and other technical fixes are applied to bend the emissions curve down in an effort to reach an identified targeted level of emissions by a specified future date.

While some local governments, particularly in smaller communities, point to the lack of resources and capacity to develop and implement emission reduction strategies for their communities, slow progress in urban climate mitigation is widespread and not restricted to small municipalities.

What progress is being made is often the result of policies and investments that are not undertaken as climate mitigation initiatives, but that have the coincidental effect of reducing emissions. Some research indicates that while cities with climate action plans have lower emissions than cities that do not, it is not because they have climate action plans but because of the land use, housing, infrastructure and transportation strategies they are implementing for other reasons. What are categorized in climate change mitigation plans as “collateral benefits” are valued more highly by communities than GHG emission reductions, and it is pursuit of these “co-benefits” that has been driving the moderation of energy use and emissions in cities.

## FROM INCREMENTAL TO TRANSFORMATIVE STRATEGIES

Some cities are diverging from incremental step approaches to climate action to focus on transformative actions for making the transition to a low carbon future. Examples like Oslo, Norway—which has made the City Centre a car free zone and plans for fossil fuel free public transit—are important sources of inspiration for policy design. Increasingly ambitious goals and programs are being created, often in large cities.

This approach starts with the so-called “co-benefits” and seeks to align low carbon outcomes with the designs, investments, regulations and behaviors that govern urban systems for the provision of housing, employment, education, public health, access and personal mobility, waste reduction and management, supply chains and commercial traffic, and the associated hard and soft infrastructure requirements. In Brundtland parlance, this is the “anticipate and prevent” approach to achieving sustainability.

The broader scope of the transformative approach requires accessing and integrating the knowledge and insights of a wide range of expertise and interests that have not necessarily been engaged in climate mitigation planning under the incremental, remedial approach, and there will be implications to energy and emissions modelling that are not yet fully appreciated. There will still be a need for the detailed simulation of the energy system itself that has characterized climate mitigation modelling to date, but there will also need to be a richer

understanding and characterization of the systems that give rise to the demand for energy services in the first place. This could be achieved by coupling the existing energy and emissions models to the specialized models that already exist for characterizing urban systems such as personal mobility, land use, housing, and waste management.

## “THIS IS NOT AN ENVIRONMENTAL CHALLENGE, THIS IS A PEOPLE ISSUE”

On the ground, progress on climate mitigation in cities will continue to be the result of a mix of strategies that address different emission sources, different stakeholder groups within the community, and different degrees of readiness to face the challenge. Effective local climate mitigation employs a mix of standards and regulations to ensure minimum requirements are met, mass marketing tools to accelerate implementation of established solutions, and creative support for early adopters of advanced approaches.

Across the spectrum of actions, however, the critical path to accelerated progress in cities has to do with human, institutional and financial capacity and innovation to implement what the models have clearly established as the necessary changes that must take place. As one workshop presenter said, “this is not an environmental challenge, this is a people issue”.

Especially with the transformative approach, it is essential to have early engagement, widespread climate “literacy”, and methods for “convening the marketplace” of government, business and civil society stakeholders. With the scope of the challenge widened beyond the technologies and techniques for reducing emissions from an established “business-as-usual” baseline to including consideration of how the carbon intensity of the baseline itself might be lowered, the importance of the human dimension takes on even greater significance.

## THE PATH FORWARD

In light of the symposium discussions, several recommendations have been made for municipal, state, and federal governments to observe as to what is next for climate action in cities.

**RECOMMENDATION 1:** Increase support to small and medium sized cities in taking climate action. In cities with fewer resources to complete deep energy and emissions modelling, the role of ‘sufficient’ modelling is key. The ability to quickly replicate vital information between cities with similar geographies and patterns of use could be of vital importance. Regional planning approaches could play a key role for small and medium sized cities. Within this framework, higher levels of government would be required to take regional action while supporting localized action.

**RECOMMENDATION 2:** Energy and emissions modelling needs to focus on climate action implementation. Cities should use quantitative modelling support in policy and action design, progress reporting, and policy revision when required. Cities need dependable energy and emissions data to determine the outcomes of specific actions. Quantitative information helps define viable programs, bridging emissions inventories and action implementation.

**RECOMMENDATION 3:** Climate action should be integrated into everyday municipal operations and decision making, including capital and operating budget planning. Municipal sustainability departments and staff may be a starting place for climate policy and action, but these elements need to be integrated into job descriptions, staff roles and responsibilities, work plans and mandates, and reporting structures to be effective in addressing climate change.

**RECOMMENDATION 4:** Climate planning in cities needs to reflect the relationship between climate, social equity, health and community empowerment. In particular, energy and emissions in cities are closely tied to building and housing policy. Energy and emissions modelling processes and planning must address these elements alongside climate impacts to ensure municipal policy is holistically achieving decarbonized, equitable cities.

## CONCLUSIONS

Energy and emissions modelling is empowering cities to create informed climate policy. In leading cities, modelling is evolving to include broad land use, financial, and societal considerations, which is enabling urban policy that is balanced and effective in addressing climate and societal issues simultaneously. There are critical challenges in extending these approaches to all cities and in distributing climate action throughout city management and operations. With leadership from local, regional and senior governments, cities can secure resources, adopt leading approaches, and use appropriate modelling processes to create effective policy and achieve substantial progress in mitigating GHG emissions.

# PARTICIPANTS LIST

Thank you to all participants in the Enabling Low Carbon Cities with Energy and Emissions Modelling Symposium. These insights are a direct product of the work and knowledge of the participants. Thank you to the Women's Building in San Francisco for hosting the event.

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