# **Energy System Transformation Playbook EXECUTIVE SUMMARY**

## Project Scope and Introduction

In 2016, three member cities of the Carbon Neutral Cities Alliance (CNCA) joined together to commission the creation of a tool to assist local governments in eliminating greenhouse gas (GHG) emissions from their energy systems. The primary purpose of the project was to develop a guide to help municipal governments to understand and foster energy system transformations in their city or neighborhoods within their city. To this end, the cities of Boulder CO, Minneapolis MN and Seattle WA worked with Integral Group (Vancouver BC) to develop the *Energy System Transformation Playbook*, a clear, step-by-step process for cities and other municipalities to craft their own energy system transformation strategies.

The need for such a process is based on that fact that while some leading cities have begun to trial new policies and planning approaches to achieve deep GHG emission reductions, many have yet to begin the process. This inaction can be attributed to a number of factors, among them the sheer magnitude of GHG emissions reductions that will be needed to avoid the most harmful impacts of climate change. Many jurisdictions are unaware of the kinds of changes that are necessary, or how to begin effecting them given their current economic, social and political climates. A streamlined template that these cities can use to help them identify an effective and comprehensive approach to the elimination of GHG emissions is therefore a particularly valuable tool to help them take up this important challenge. The project expands on the CNCA’s 2015 *Framework for* *Long-Term Deep Carbon Reduction Planning* by packaging a set of tools and carbon reduction strategies into a format that municipal governments can use to understand how an energy transformation can be achieved in their cities.

The project was completed over the months of January to August 2016, during which time the consultant team developed the two major deliverables included in this report:

* An Energy System Transformation Playbook, and
* Three Neighborhood Energy System Transformation Strategies.

The specific objective, methods of data collection and analysis, and final outcomes of each deliverable are outlined below. As the Playbook and associated Energy System Transformation Strategies were developed with American jurisdictions in mind, the contents of this report may be particularly useful for those working in the United States. However, the tools and lessons learned presented in this report are applicable to cities across the world.

## A Playbook for Energy System Transformation

As noted in the Playbook, cities represent a nexus of urban systems that creates both the need and the opportunity to implement the energy system actions necessary to mitigate climate change. However, cities hold several other responsibilities, including the need to provide highly liveable, equitable, and secure environments. Energy system transformation as it is defined and approached in the Playbook therefore focuses on eliciting a transition towards low-carbon, resilient, equitable, and decentralized energy systems that can power cities long into the future. This will require the modernization of the electricity grid to make energy systems resilient to climate change-induced and other impacts, the development of new regulatory and market structures that allow for a more efficient and cost-effective energy provision, and many other changes. It will also require the development and use of planning approaches that support and align with the needs and priorities of stakeholders, including residents and businesses.

The structure of the Playbook allows it to be used by a broad range of municipal governments with differing degrees of control and authority over the urban systems comprising their energy system (i.e. energy supply, buildings, transportation). Each step of the Playbook helps users to identify the key characteristics and actors of their energy system, understand and prioritize each aspect of the energy system according to their relative contribution to GHG emissions, and select relevant strategies and actions to begin transforming the energy system. The Playbook has also been designed for use at either citywide or neighborhood scales, allowing municipal governments the opportunity to test select actions at more localized scales and to align energy system transformation with smaller scales of planning. At each step, guidance for the inclusion of stakeholders is provided to ensure that the actions that are selected take advantage of any additional benefits, and avoid unintended consequences. Altogether, the Playbook contains the following steps, or sections:

**GETTING STARTED** – In this section, municipal governments are oriented to the basic requirements of the process, including suggestions on the formation of a Project Team, the kind of data necessary for the completion of each step, and the importance of identifying and forming partnerships with key actors.

**STEP 1 | Understanding your Energy System** – First, Project Teams are provided a list of key questions to help them obtain a basic understanding of the key players, characteristics, and dynamics of their energy system.

**STEP 2 | Characterizing your Sphere of Influence** – Next, Project Teams are provided with a means of characterizing their relative degree of interest, influence, and control over each of the three urban systems comprising a city’s energy system: energy supply, buildings, and transportation. The exercise allows Project Teams to identify the broad transformation pathway they can take in each system.

**STEP 3 | Quantifying your Energy and Emissions Baseline** – In this step, Project Teams use data on energy use in each of the three urban systems to determine their relative contributions to the overall GHG emissions of the municipality or neighborhood under exploration. Teams can then use this information to develop future projections and prioritize their decarbonization efforts.

**STEP 4 | Identifying Barriers and Opportunities** – Project Teams are then guided through a series of key questions to derive further insight into any potential barriers or opportunities they may face in implementing action in any of the three urban systems.

**STEP 5 | Selecting Strategies and Actions** – At this stage, Project Teams will use the information gathered above to identify the specific strategies and actions they can take to initiate an energy system transformation. Based on their sphere of interest (and where applicable, the development profile of the neighborhood under exploration), Project Teams will select the strategies and actions most relevant to their context and interests.

**STEP 6 | Identifying Co-Benefits** – With their strategies and actions identified, Project Teams can then identify any potential synergies or conflicts between each action and any existing municipal policies or priorities. Important co-benefits can be identified to ensure the wise use of resources and harmony between existing municipal government action.

**STEP 7 | Crafting an Engagement Strategy** – In this final section, Project Teams are given an exercise to help build on pre-identified partnerships and identify the appropriate means of engaging important stakeholders.

Actions and strategies proposed in the Playbook itself were adapted from the CNCA Framework, as well as through a review of existing best practices in energy system decarbonization. Specific tools to assist cities in engaging in energy system transformation were proposed, applied to three neighborhoods (see below), and refined to improve their clarity and utility for other municipal governments. Feedback from representatives of the three CNCA cities was used to improve the final draft of the Playbook.

## Testing the Playbook

To pilot the Playbook and ensure its utility, Integral Group applied it to three different neighborhoods in each of the three participating cities. This process was done collaboratively in such a way as to provide further insight into the Playbook’s usability, comprehensiveness, and ability to prioritize key elements of an energy system transformation. Each neighborhood was selected and categorized using the Urban-to-Rural Transect Model**,** a framework that helps characterize a city’s different zoning categories based on varying physical and social dimensions. This framing was used to help assess whether and how different neighborhood characteristics, such as block size, dominant building typology, or connectivity might affect the selection or applicability of different energy system transformation priorities.

The creation of individual Neighborhood Energy System Transformation Strategies was also intended to assist each of the three cities to better understand and assess their own transformation priorities. Strategies were developed by Integral Group and are not intended to represent any city’s assumptions about the future of the neighborhood (e.g. land development patterns), nor do the recommended actions represent the perspectives or priorities of the cities or other energy system stakeholders. More accurate and fully developed Energy System Transformation Strategies would have required additional time and stakeholder consultation to complete, and were out of the scope of this project. Rather, the Strategies should be viewed as example analyses of what it will take for a city or neighborhood to eliminate GHG emissions from its energy system, both in terms of the types of actions and the scale of effort required. However, the Strategies may be used to inform discussions among City staff and other stakeholders regarding what the City must achieve to transform its energy system.

The three neighborhoods selected for assessment were:

* East Arapahoe (Boulder CO): A low-density, primarily commercial and industrial neighborhood with high energy demands and low transit, cycling, and walking connectivity. It is assumed that the area will become a mixed use neighborhood with new residential development alongside commercial and industrial growth. The total floor space of buildings in the neighborhood is assumed to grow from 2.2 million to 4.4 million square feet by 2050.
* Lower North Loop (Minneapolis MN): A medium-density, primarily industrial neighborhood with some commercial, government, and residential buildings, limited but improving transit, cycling, and walking connectivity, and buildings that are reliant on large quantities of natural gas for heating. It is assumed to become a highly diverse neighborhood characterized by mid- and high-rise residential and commercial buildings, while maintaining light industrial activity, improving its transportation connections, and fostering a greater sense of community around the existing farmer’s market. The total floor space of buildings in the neighborhood is assumed to grow from 4.9 million to 8.0 million square feet by 2050.
* A Seattle Urban Center (Seattle WA): A stylized representation of one of the city’s Urban Centers, the Urban centre is the densest of the city’s neighborhoods, characterized by a mixture of residential and commercial uses, building heights, and densities. The neighborhood is assumed experience low but steady growth, with a slight change in composition towards more residential buildings. The total floor space of buildings in the neighborhood is assumed to grow from 15.5 million to 20.0 million square feet by 2050.

To create each Strategy, background research on the three neighborhoods was conducted to obtain an overarching picture of their principal characteristics, including the most applicable transect category, key development patterns, important actors, energy system attributes, and other relevant information. Wherever possible, data on energy use and emissions, potential land development patterns, and other important information was obtained directly from City representatives. This data was then used to create a Transformation Scenario for each neighborhood by modeling the potential energy and emissions scenarios with and without a set of proposed decarbonization strategies. The model represented energy supply, buildings, and transportation for Boulder and Minneapolis, and focused only on energy supply and buildings for Seattle. Current and projected energy use were based on available data and future assumptions related to energy GHG factors, growth in renewable electricity sources, building types, building square footages, building energy demand profiles (energy use intensities and fuel mixes), travel demand (vehicle miles traveled), and mode share. In general, each Transformation Scenario focused on decarbonizing electricity, eliminating fossil fuel dependency in buildings, increasing transit, cycling, and walking, and transitioning remaining passenger vehicles to electric vehicles. Once complete, each Transformation Strategy was reviewed and refined in conversation with individual City representatives.

It should also be noted that in collaboratively reviewing the experience of developing the Energy System Transformation Strategies, the focus of the project shifted from the neighborhood to the city more broadly. This occurred as it became apparent that while the Rural-to-Urban Transect lens provided a means of categorizing different neighborhoods, many of the strongest strategies and actions necessary to decarbonize and transform a neighborhood’s energy system would be applied citywide (e.g. zero emission building codes) and require the engagement of several key actors at and beyond the municipal scale. For example, eliminating GHG emissions from new construction in a lower growth scenario (e.g. Urban Center in Seattle) versus a higher growth scenario (e.g. East Arapahoe in Boulder) requires new buildings to be designed and constructed to operate without any dependence on fossil fuels (e.g. natural gas for heating). While a city may be able to accomplish this in a given neighborhood, ultimately eliminating fossil fuel dependence in buildings will require changes to the city’s entire building code. Similarly, eliminating GHG emissions from all existing buildings will require fuel switching building retrofits that eliminate fossil fuel dependency in favor of electricity and zero emission district energy, whether the city already has a zero emission electricity grid (e.g. Seattle) or not (e.g. Boulder and Minneapolis). Similar points can be made regarding the strategies and actions needed to decarbonize electricity and the transportation system.

Overall, the larger scale changes and partnerships with key actors that are required for energy system transformation make the transformation of a single neighborhood a considerable challenge, in most cases. However, as some cities may wish to focus investigations on a smaller unit of analysis (e.g. to ensure a rapidly developing neighborhood is designed with the future energy system in mind), the final Playbook allows its application at both city and neighborhood levels.

In addition to the three neighborhoods above, a draft version of the Playbook was applied to Chautauqua in Boulder by representatives of Chautauqua with support from the City of Boulder. The results of that pilot application are also included in this report.

## Report Outline

In the remainder of this report contains the deliverables discussed above, in the following order:

* CNCA Energy System Transformation Playbook;
* East Arapahoe (Boulder) Energy System Transformation Strategy;
* Lower North Loop (Minneapolis) Energy System Transformation Strategy;
* Seattle Urban Center (Seattle) Energy System Transformation Strategy; and,
* Chautauqua Energy System Transformation Strategy.