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Review of climate action plans in 29 major U.S. cities: Comparing current policies to research recommendations

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ABSTRACT

This study reviews the research literature's recommendations on which policies a city can pursue to reduce its greenhouse gas emissions. Using these recommendations, we develop a multi-parameter, analytic scoring rubric for quantifying the comprehensiveness of a city's climate action policy plans. The scoring rubric is used to assess the plans of 29 major U.S. cities revealing trends about urban climate policy in the United States. Most of these plans strongly pursue policies aimed at building quality, mass transit, non-motorized transport, and independence from automobiles. However, the general absence of dense development and parking restriction policies from U.S. cities' climate action plans impedes their ability to leverage those strengths to achieve broad strategies that reduce building energy consumption and shift transportation modes. Moreover, low-density, high-population, high-emitting cities in energy-intensive climates – places that need greenhouse gas reductions the most – are more likely to have deficient climate action plans. These results suggest that many U.S. cities' climate action plans lack the cohesiveness to make them fully successful. Consequently, unless they reevaluate their climate action plans, many U.S. cities might struggle to achieve the broader greenhouse gas reduction strategies needed to significantly contribute to global climate change mitigation.

1. Introduction

Global climate change mitigation requires many different sectors to develop long-term strategic policy plans. While national-scale supply-side sectors, such as the electric power industry, have been implementing greenhouse gas (GHG) mitigation plans for some time, there is a growing focus on reducing the GHG emissions from our largest centers of consumption – cities. Urban areas currently account for 70% of both global energy use (Grubler et al., 2012) and greenhouse gas (GHG) emissions (Cities, 2017). Continued urbanization (Buhaug & Urdal, 2013) threatens to intensify these impacts unless cities can develop and implement successful, urban-scale climate action plans.

Research supports the value of climate change mitigation policy at the urban level (Biello, 2014; Rees & Wackernagel, 1996), suggesting that the shortcomings of international, global-scale, climate-focused treaties can be balanced by self-organized, cooperative agreements between cities (Ostrom, 2010). Urban areas also provide the infrastructure, access to capital, connectivity, and services that facilitate the innovation needed to implement GHG reduction strategies (Glaeser, 2011). Cities mirror this optimism, and U.S. cities have been particularly vocal about their dedication to climate change mitigation in light of U.S. President Trump's intentions to withdraw the United States from the Paris climate agreement (Madhani, 2017). Yet, other writing points out the numerous challenges that cities face – their focus is too local (Hughes, Colijn, & Serpell, 2017), their resources are too limited (Hughes et al., 2017; The Editorial Board, 2018), they report too little data for measuring their progress (Barrett & DeWit, 2017), and they have a poor track record of achieving GHG reduction goals with most of their gains coming from national or state level policies beyond their influence (Brooks, 2017).

Overcoming these challenges requires that cities pursue effective GHG reduction strategies driven by well-developed climate action plans. Researchers have studied a variety of strategies for reducing urban GHG emissions, but few studies have attempted to synthesize them into a holistic definition of what a comprehensive urban climate action plan actually looks like. As a result, we cannot confidently say whether our cities' climate action plans contain the necessary components to make them successful.

This study answers that question by developing a climate action plan scoring rubric. It begins by reviewing the scholarly literature on

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urban GHG reduction policies. We translate that review into a multi-parameter, analytic scoring rubric, which we use to evaluate the climate action plans of 29 cities in major urban areas across the United States. The results provide a broad look at the strengths and shortcomings of U.S. cities' climate action plans and illustrate a new tool for assessing urban climate change mitigation policy.

2. Background

This study reviews the research on urban climate change mitigation policy to develop a scoring rubric that we use to evaluate the climate action plans of 29 major U.S. cities. One other project attempts a similar scope (Heidrich, Dawson, Reckien, & Walsh, 2013; Reckien et al., 2014). This previous project uses published frameworks and processes to develop a scoring rubric for assessing the climate change preparedness of cities in the United Kingdom (Heidrich et al., 2013) and Europe (Reckien et al., 2014). They rank cities' climate change adaptation and mitigation activities by scoring each city's assessment, planning, action, and monitoring. Our study differs from their work in three main ways. First, we develop our scoring rubric from a detailed literature review. Second, our analysis attempts a much broader scope. We divide urban climate mitigation planning into 22 separate policy types. We score each of these policy types individually and also analyze their interrelationships. Third, our case study applies the scoring rubric to cities in the United States.

In the United States, urban areas account for over 70% of greenhouse gas emissions, especially via the power, transportation, industrial, and building energy sectors (Marcotullio, Sarzynski, Albrecht, Schulz, & Garcia, 2013), as shown in Fig. 1. Emissions intensity, however, varies greatly between cities. San Diego, California for example, emits half as much CO_2 per capita as Memphis, Tennessee, and suburban developments tend to emit much more than city centers (Glaeser & Kahn, 2010). Many insights can be drawn from exploring why some cities emit fewer GHGs than others.

Much of the disparity between cities' GHG emissions can be explained by examining their energy use. Urban GHGs originate mainly from energy consumption – either directly (e.g. transportation fuel) or indirectly (e.g. power sector emissions via electricity consumption) (Grubler et al., 2012). A city's per capita energy use is influenced primarily by climate, global economy, consumption patterns, building quality, urban form, and transportation (Grubler et al., 2012). Similarly, the most important factors influencing urban greenhouse gas emissions are economic activity, population density, gasoline prices (Creutzig, Baiocchi, Bierkandt, Pichler, & Seto, 2015), climate, and power sector fuel mix (Glaeser & Kahn, 2010).

Cities might reasonably expect to impact GHG emissions by influencing these underlying causes, yet only some of these factors can be effectively addressed by urban policy mechanisms. Urban policy tends to have limited influence on the most significant causes of emissions,

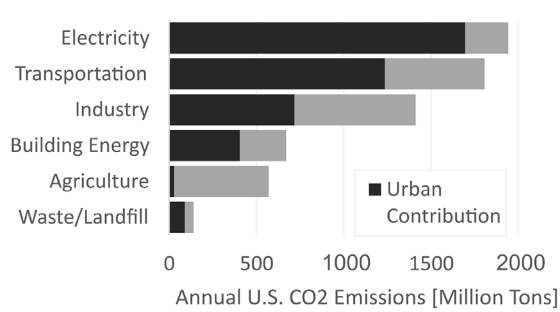

Fig. 1. Based on data from Marcotullio et al. (2013) and U.S. Environmental Protection Agency. (2018), urban areas account for 70% of U.S. greenhouse gas emissions. Note that the "electricity" category includes energy consumed by buildings and the "building energy" category focuses mainly on point-source emissions from fuel combustion for heating, cooking, and water heating.

such as climate, trade, industry, and income. Alternatively, cities have significant influence over the factors that influence GHG emissions the least, such as fuel substitution, district energy systems, distributed renewable generation, and urban afforestation (Seto et al., 2014). However, a few strategies, such as building energy efficiency, technology adoption, infrastructure, and urban form are both amenable to urban policy and influential on urban emissions (Seto et al., 2014).

While infrastructure policy is most significant in rapidly growing cities undergoing regular construction projects, urban form policy is important for influencing transport and energy use patterns in mature cities where infrastructure construction is already locked in Seto et al. (2016), Unruh (2002), as in the United States. Urban form – the configuration of roads, buildings, public structures, green spaces, the distribution and mix of land uses, and the relative location of activities and places of origin and destination – falls well within the influence of urban policy (Seto et al., 2014) and indirectly impacts emissions via its influence on the transportation and building sectors (Creutzig et al., 2016; Silva, Oliveira, & Leal, 2017). Smaller spatial separation between daily destinations, especially home and work, decreases average travel distances leading to lower energy consumption and emissions in the transportation sector and to reduced infrastructure construction requirements (Vojnovic, 2014). Increased urban density also leads to smaller housing units, more shared walls, and other architectural form features that reduce building energy consumption (Madlener & Sunak, 2011).

The synergies between urban form and other strategies illustrate a major theme – urban climate action policies influence each other in complex ways, so effective climate action plans cannot rely on piecemeal solutions (Lohrey & Creutzig, 2016; Vojnovic, 2014). For example, policies that support mass transit, disincentive private vehicles, develop pedestrian infrastructure, encourage mixed-use development, and promote higher density will support each other's effectiveness (Gately, Hutyra, & Wing, 2015; Newman & Kenworthy, 2013). Beyond synergies, policies also exhibit trade-offs and dependencies. Trade-offs exist between disincentivizing automobile use and encouraging vehicle electrification, for example, and successful district energy systems depend strongly on high urban density (Grubler et al., 2012).

Density deserves more discussion because it is uniquely impactful and U.S. cities struggle to achieve it. Population density in the U.S. tends to be lower than European and Asian cities (Steemers, 2003). One explanation for this low density is that the federally-funded highway system runs through the centers of most major cities providing massive urban road construction subsidies that have incentivized driving over other transportation modes. Consequently, U.S. urban planning is extremely automobile-friendly (Troy, 2012). This development pattern exhibits a path dependence on private vehicles (Arthur, Ermoliev, & Kaniovski, 1987) as well as infrastructure lock-in (Seto et al., 2016) with effects that may last for centuries. Other work suggests that urban sprawl and low density might indicate a society that prefers greater energy consumption and rural power sector emissions over automobile congestion and urban air pollution (Lohrey & Creutzig, 2016) – a reasonable hypothesis given the energy and land wealth of the United States.

This last observation about the interrelationship between sprawl, rural emissions, congestion, and urban air pollution illustrates a final important point about this study – climate action policies, while focused on reducing GHG emissions, can also impact economics, health, recreation and other components of urban residents' quality of life (Grubler et al., 2012). These interactions manifest as both trade-offs and co-benefits. Very high density leads to smaller, lower-utility living spaces (Lohrey & Creutzig, 2016), for example, while vehicle electrification can reduce urban noise and air pollution (Grubler et al., 2012). While these interactions are not unimportant, this study focuses on climate change mitigation only discussing quality of life impacts to add context. As a result, this study might under-value broadly beneficial strategies, such as increased green space, due to their limited influence