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Greenhouse Gas Mitigation: Land Use and Transportation Strategies

Overview of Issue

In the past two years research has pointed towards the possibility of using urban planning as a tool to reduce greenhouse gas emissions in urban areas. For many focused on the issue of climate change, there is a consensus that atmospheric carbon dioxide should be contained at no more than twice the maximum level of atmospheric carbon dioxide that existed during the pre-industrial era. Studies show that global pre-industrial atmospheric carbon dioxide concentrations reached a level of about 280 parts per million (ppm). Consequently, carbon dioxide should be maintained below 560 ppm to ensure minimal global effects. Based on this, many active in the field have set a goal of limiting carbon dioxide levels to 500 ppm +/- 50 ppm. The current concentration of atmospheric carbon dioxide is about 375 ppm.

In analyzing ways to limit the growth of carbon dioxide concentrations, the construct of business-as-usual (BAU) is often utilized. BAU assumes that people will continue behaving just as they have been. In other words, their transportation behaviors, consumption patterns, etc. will continue along the current trajectory. Under BAU conditions, studies show that we are likely to roughly double our carbon dioxide emissions over the next 50 years. In order to meet the 500 ppm goal, however, greenhouse gas emission rates must remain approximately the same as they are today.

An often-cited article published in 2004 by Pacala and Socolow argue that we have the ability with current technology to stay under the 500 ppm concentration goal over the next 50 years. We currently produce 7 Gigatons of carbon (GtC) emissions annually, but we are on track to over double that value to more than 14 GtC/y by 2050. To meet the 500 ppm level, we need to keep emissions constant at about 7 GtC annually. Pacala and Socolow use the idea of *the climate stabilization triangle* divided into seven *wedges* that each represent a strategy to reduce future carbon emissions by 1 GtC/y in 2050. Each of these wedges represents a change to BAU that will help us to limit carbon dioxide concentrations at 500 ppm. Pacala and Socolow suggest 15 different options that each could represent a wedge if adopted (as their article has been analyzed and discussed, other wedges have since been suggested). Examples of mitigation strategies that focus on transportation include doubling average fuel efficiency, reducing private automobile dependency, utilizing bio-fuels, and utilizing hydrogen-powered vehicles.

Importance to Land Use and Transportation

The readings for our case study evaluate the impacts of future urban form changes on greenhouse gas emissions. Both articles essentially make the case for creating denser urban areas in the US in order to decrease carbon dioxide emissions. They argue that denser urban areas will be more energy efficient than BAU urban forms to accommodate population growth. In summary, both make the case that people will use automobiles less if they live in a dense urban area.

This argument is backed by some research, and they argue that it will take place based on a variety of factors. First, denser urban areas will make private automobile usage less attractive because of congested city streets. Second, denser urban areas will have more destinations within walk-able and bike-able distances, and this reinforces traveling by alternative modes. Third, public transportation infrastructure and operating expenses are more economically feasible in denser areas. Transit systems in denser area pay for themselves more than transit systems in less dense areas. In a related vein, because transit is more economically feasible in a dense area, it will be more likely to be built and will make transit more convenient for people. In summary, both articles argue that we should take advantage of the links between land use and transportation in ways that will decrease carbon dioxide emissions. If we build denser urban areas, this can be taken advantage of in ways that decrease driving and vehicle emissions. Marshall claims that reducing urban sprawl in the US could account for one half or more of a wedge in carbon dioxide concentrations.

Stone et al. argue that by 2025 50 percent of the built environment will be new since 2000. Thus they argue for a re-concentration of people and specifically advocate smart growth policies as a key strategy in reducing carbon dioxide emissions. They point out that vehicle miles traveled (VMT) is impacted by density, land use mix, street design, network design, regional accessibility, and proximity to transit. Thus, denser, transit-friendly urban areas can reduce VMT. Their specific study looks at 6 Midwestern states and uses models to predict carbon emission in 2050 using different scenarios. For land use, they have a BAU scenario as well as two different smart growth scenarios. The authors combine these scenarios with a situation where fuel economy improves moderately and a situation where the entire vehicle fleet turns over to hybrid electric vehicles. While both smart growth and fleet change strategies are shown to have the potential to reduce carbon dioxide emissions, the authors argue that the two strategies should be combined to maximize carbon dioxide emission reductions.

The Evidence

The authors readily admit that the relationship between urban form and potential carbon dioxide emission reductions is not heavily studied and needs more work. Travel behavior is not only dictated by urban scaling metrics such as population density but by a host of other urban characteristics (e.g., land-use mix, accessibility, building codes) as well. While population density may implicitly account for some of these other characteristics more study is necessary to determine which urban policies would be most effective in curbing greenhouse gas emissions. Nonetheless, preliminary analysis indicates that urban planning could be a valuable tool in the climate change arena while simultaneously producing other non-pecuniary benefits (i.e., public health, enhanced public service efficiencies).

Works Cited

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