Congressional Testimony of

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Chairman Jamaal Bowman, distinguished members of the committee, I am honored to have the opportunity to offer my views on the energy science research needs to improve our energy systems and combat the threat of climate change. I bring two decades of experience in the energy sector, including a decade of interdisciplinary academic experience in understanding the role of energy in society and development. I have examined the energy needs of people, communities and nations, and the threats posed by climate change and its mitigation to human wellbeing. Drawing on this experience, I have focused my comments on the importance of integrating socio-economic factors into energy and climate models ("E-C models") to better project how different communities may be impacted by and respond to climate policies. The models that I address are those that project greenhouse gas (GHG) emissions from human activities and simulate policies and actions to reduce these emissions. This includes the global Integrated Assessment Models (IAMs) as well as national energy-economy models. In my view, E-C models can support the implementation of climate policies by better representing society and the social processes that influence household behavior. I describe why it is important to build stronger bridges between social science research and E-C models and then provide suggestions for future research in this direction.

We are at a critical juncture in human history. National governments are preparing to ramp up their pledges to the Paris Agreement to accelerate decarbonization and achieve net-zero emissions by 2050. The changes implied by these targets are potentially far-reaching, involving not only how we produce and deliver energy, but also how we use energy, both directly, such as to heat our homes, and indirectly, through the manufacturing of products that we purchase and use. These changes may affect our homes, how we get around, how and where we work, what we eat, how we engage with each other and with technology, how we organize our lives, and how we shape our future physical environment.

Translating aspirations into policies that can achieve this scale of transformation in society requires turning knowledge in many disciplines, including the social sciences, into action. Scientists have identified many avenues for social science to support global environmental change research[1]. Indeed, there has long been a trend in research to integrate social and biophysical sciences. The number of social science publications in global environmental research grew from just a handful of studies in 1990 to over 3,500 articles per year[2] by 2011. Just in the context of climate mitigation, social science can help understand the social processes that drive our energy and emissions growth, the behavior of institutions that make and implement policy, and the processes by which transformative change can take place. My focus in these comments is specifically on households — how E-C models represent households' consumption behavior and their response to policies. The motivation for this focus is twofold: first, there is increasing recognition in the U.S. by policymakers and scientists of the need to view climate change as a matter of social justice and equity[3]; second, there is growing recognition among climate researchers that E-C models under-represent the opportunities for behavioral change that can enhance the quality of our lives in a low-carbon society[4].

E-C Models have been instrumental in getting us to this point. E-C models have helped us understand how human systems drive greenhouse gases (GHG) and climate change, how climate change would in turn impact us, and what changes in our energy system would be required to mitigate climate change. We have learned about the pace of decarbonization required to avoid the worst effects of climate change, the portfolios of technologies that could get us there, and potential impacts of decarbonization on the economy and the environment. E-C models also shed insights on the potential trade-offs and synergies between different choices for reducing emissions. The IAM scenarios of climate stabilization feature in the Intergovernmental Panel on Climate Change's (IPCC) periodic reports on the state of science. These scenarios are used widely by different communities, including policymakers, finance, development agencies, and researchers who want to understand what to expect from future climate policies. As we move towards designing and implementing effective policies, we need to better understand how individuals and societies across the United States will respond to energy/climate policies. The E-C models can play an important supporting role to anticipate these responses, assess the impacts of policies on different social objectives, and track their collective progress in reducing emissions.

I now lay out some of the research challenges for enhancing E-C models to (1) address equity and social justice; and (2) expand opportunities for identifying wellbeing-enhancing and GHG-reducing consumption.

Addressing Equity and Social Justice

The IPCC has repeatedly emphasized that low-income communities globally are likely to face a disproportionate burden of climate change and of efforts to mitigate its effects. Events such as Hurricane Katrina have shown us that this applies to disadvantaged communities in the U.S., particularly people of color. The social sciences offer a rich understanding of the structural and environmental conditions that perpetuate poverty and inequality. Racial inequalities in energy burdens in the U.S. are stark. Low-income Black communities spend more than double the share of income on transport as the average American, while a third of them have no vehicle and poor transit options. Mortality during heat waves is higher in low-income Black communities, very likely due to lower use of air conditioning.

Studies that examine the limitations of E-C models in representing poverty and inequality show that there are many aspects to improving E-C models[5]. One prerequisite step in this direction is for E-C models to incorporate more detailed representation of households. This includes: disaggregating households based on structural differences; incorporating social and contextual factors into how people make decisions; broadening model outcomes to include non-economic dimensions such as health.

E-C models mostly rely on single 'representative' households in regions, with the assumption that, in aggregate, differences within regions balance out. However, policymakers may want to target subgroups for social protection or support for green investments. Without proper social protection, green investments can worsen poverty by increasing energy prices, or be out of reach for low-income households. For example, low-income households or those with senior citizens in hot climates may need financial support to run air conditioning if energy prices increase. Contextual conditions such as whether they live in cities, or socio-demographic characteristics, can also influence the scope for new technology adoption. For instance, electric scooters and car-sharing options may have greater potential in cities where more people can access them. Policies for energy efficiency retrofits may have to be designed differently for homeowners in the suburbs and rental units in multi-rise buildings. Few E-C models have started segmenting households based on income. Models could incorporate other structural factors to reflect different needs and likely responses to climate policies.

Household decisions in E-C models typically represent individual preferences and responses to price changes. The social sciences offer insights on how social norms, neighbors' actions and various constraints can shape individual decisions. For instance, homes located near those that have rooftop solar panels are more likely to invest in it themselves. On the other hand, the 'digital divide' may be a barrier to widespread adoption of new electric mobility options and 'smart' devices in homes that require the use of smart phones and the Internet. Making these effects more explicit in models can enable more realistic assessments of technology adoption. Further research is required to examine specifically the adoption of new green technologies, which may present opportunities and risks to new users.

The energy services we enjoy have far-reaching impacts on our health and wellbeing and on that of others. Economic indicators, such as households' energy expenditures, typically measure the financial burden households bear for these services. However, expenditure shares may mask different levels of service if people forego services that they cannot afford. For instance, heating and cooling our homes provides comfort and protection from extreme climates only if we turn devices on. Energy services may be instrumental to meet other needs. How much time and money people spend on transport influences their job opportunities, access to nutritious food, and the scope for other activities. Making these connections requires developing new indicators of energy services besides economic costs. We would also learn of the inter-dependence of people's wellbeing through the byproducts of their energy use. Automobiles cause air pollution that affect public health. On the other hand, new electric mobility options reduce local air pollution but may increase pollution from power plants, which disproportionately harm communities located near them.

Opportunities for Wellbeing-enhancing Mitigation

Household consumption choices may affect wellbeing and cause GHG emissions in less direct ways. Research in the social sciences shows that beyond a point increasing material consumption adds less and less to our wellbeing. Climate researchers have identified many wellbeing-enhancing changes in consumption patterns that would reduce GHG emissions, such as reducing beef consumption[4]. Even more profound changes in our lifestyles, such as reducing waste, shifting to shared mobility options, using products longer through better care and maintenance, can reduce material use and free up societal resources to improve our lives in different ways. The resulting reduction in material and energy demand from these lifestyle shifts can ease the burden on the pace of future decarbonization of energy supply. However, we need more research in the social sciences to examine the feasibility of these changes and realize these potential benefits.

New research in wellbeing assessment over the last couple of decades offers new data and insights on different dimensions of wellbeing in communities across the United States. However, we lack a systematic understanding of how different lifestyles and consumption patterns contribute to wellbeing in different communities and contexts. Bringing together research in wellbeing and consumption in the social sciences with climate research may reveal new opportunities to pursue consumption choices that reduce GHG emissions and improve wellbeing.

Way Forward

The above comments aim to identify the potential for E-C models to support the pursuit of equitable and wellbeing-enhancing climate mitigation policies by deepening how they model households' characteristics, decisions, and wellbeing. There is considerable knowledge from past research in the social sciences that can be harnessed, but new research and data will also be required.

One could identify at least two approaches to moving forward — one that involves continuing to improve the models themselves; another is for social scientists to critically interpret decarbonization pathways generated by E-C models to assess their feasibility and consonance with knowledge in their disciplines. Both approaches will likely require significant commitment to interdisciplinary research, and collaborations across diverse disciplines within the social sciences and modeling communities. Based on my knowledge of ongoing research in the climate modeling community in Europe, including my own research, there has been significant funding and research into building more realism in E-C models through collaborations with social scientists.

As mentioned, one important step in this direction is to develop a finer-scale disaggregation of households in E-C models to better characterize their energy service conditions. The E-C models are already setting up for this. With the promulgation of the Sustainable Development Goals (SDGs), and the increase in the number of climate pledges at various levels of government, there has been growing interest to apply E-C models to include more fine-grained analysis at smaller spatial scales and shorter time horizons, while also addressing broader social objectives[6]. However, there are still large knowledge gaps and methodological challenges in this research direction. Moving from global and regional to local within models may be burdensome and present computational challenges. Alternative approaches need to be assessed, such as coupling local and regional models.

There exists already a wealth of data in the U.S. from national household surveys by various government agencies that periodically collect information on different aspects of household characteristics (e.g., the American Communities Survey, American Housing Survey, Residential Energy Consumption Survey, Survey of Consumer Finances, and numerous others). These data would be a valuable starting point. It is also likely that new data would need to be collected through new surveys and community engagement to identify disadvantaged communities that are under-sampled in these surveys.

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