Thesis Project Portfolio

Quantifying the Socio-Economic Impacts of Decarbonization Policy using Integrated Assessment Modeling

(Technical Report)

Addressing Criticisms Towards Integrated Assessment Models: What scholars are missing using the Global Change Analysis Model as a case study.

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

As the issue of climate change grows more pressing, integrated modeling techniques are being increasingly relied on as a tool to understand the impacts of proposed decarbonization policies. My technical work and STS research are connected by this topic: both are centered on the idea of how integrated models are used to assess the effectiveness of decarbonization pathways as well as the implications of these plans on global society. My technical work focuses on linking two of these models to analyze the effects of the implementation of a carbon tax on the United States. My STS work focuses on the nature of criticisms surrounding integrated assessment models and how these criticisms may be addressed through improved understanding of data. While these two projects approach integrated modeling from opposite sides, the core issue for both areas of research is how integrated modeling can be used as a tool to chart a path towards global net-zero emissions.

My technical work used integrated modeling techniques to understand how potential policies, specifically various levels of a carbon tax, would impact the energy system of the United States. My team developed a computable general equilibrium (CGE) model to observe the economic response to a carbon tax within the energy sector, and linked our results to the Global Change Analysis Model (GCAM) to understand where emerging sustainable technologies, like carbon capture and storage, fit into the picture. The goal of our research was to improve existing capabilities in the integrated modeling field by providing a framework for a coupled approach between CGE and GCAM modeling to leverage the strengths and weaknesses of each.

My STS research also focused on integrated models, but from the opposite side: I explored existing criticisms within the current academic literature and how these issues may be addressed. I employed Leonelli's relational view of data to argue that understanding data within

GCAM, and therefore any integrated assessment model, can contribute to addressing three common criticisms cited with the models: lack of transparency, hypersensitivity, and inappropriate assumptions. From my research, I found that current scholars and critics of IAMs are missing key pieces of evidence by not researching model input data, which leads to an incomplete level of evaluation. The goal of this research is to encourage scholars to deepen their understanding of integrated models, so that we may use them properly to thoughtfully move forward on a path that is best for global society

Working on both of these projects in tandem greatly informed and influenced my research in each. Exploring the models from opposite perspectives helped me have a more holistic view of their strengths and weaknesses, which would have been more difficult to create had I done them separately. My technical work aided me in exploration of GCAM's data system to conduct my analysis in my STS research, since I was familiar with working with the model in my technical project. My STS research equipped me with understanding potential weaknesses in the models I was working with for my technical project, which allowed me to better understand their advantages and what questions could (or could not) be answered by the model. Overall, working on my STS and technical research together greatly improved the quality of both projects due to the nature of approaching the topic of integrated modeling in the context of climate change from opposite directions.