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Independent Study & Mentorship

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**Assessment:**

Prior to my first interview assessment, Professor Bruce McCarl sent me several of his research papers on various topics, including greenhouse gas (GHG) emissions and bioenergy. In his paper "Bioenergy in a Greenhouse Mitigating World," McCarl examined the role of agriculture in reducing GHG emissions through bioenergy production to shed light upon policymaking in agriculture. Professor McCarl examined bioenergy as a GHG mitigating tool, where biofeedstocks from crops, residues, or wastes can substitute fossil fuels to reduce excess GHG emissions. Yet, the potential emission reductions depend on the type of feedstock and energy. Mr. McCarl also mentioned that the net benefits of bioenergy depend on fossil fuels during the production, transportation, and processing processes. For example, corn-based ethanol offsets only 17% of GHG emissions compared to gasoline while bioelectricity has higher offsets. However, Mr. McCarl notes a limitation with bioenergy, arguing that an increase in demand for bioenergy causes leakages, where GHG reductions are often negated by increased emissions

elsewhere. Therefore, policies may result in none or even negative net GHG benefits, like grain-based ethanol policies. As GHG prices rise, residue-based bioenergy and cellulosic ethanol would be more effective to yield positive GHG benefits.

The research article not only provides a detailed analysis of greenhouse gas offsets from different forms of bioenergy, like ethanol, biodiesel, and bioelectricity, but also examines how there are economic incentives in climate policy. Since more cities are using more bioenergy strategies nowadays to shift away from the large GHG emissions that fossil fuels produce, McCarl argues that common reliance on grain-based ethanol can be replaced by alternatives like cellulosic ethanol or residue-based bioenergy. I believe that the shift in thinking that there are better alternatives than the current will help mitigate climate change effects, prompting more considerate and helpful policy changes. After considering potential policy changes, I decided to research what specific policies might address bioenergy and its role in GHG reduction, land use, and climate change mitigation. I found two interesting policies: Renewable Fuel Standard (RFS), a United States policy that mandates increasing volumes of renewable fossil fuels like ethanol and biodesiel into transportation, and Carbon pricing Mechanisms (Cap and Trade or Carbon Taxes), policies that prices carbon emissions to incentivize low-emission technologies. GHG permit prices can make bioelectricity and cellulosic ethanol cheaper than grain-based ethanol, causing more public and private businesses to adopt bioenergy sources with higher GHG offsets.

Overall, Professor Bruce McCarl's research has allowed me to understand the effectiveness of bioenergy, land use, and possible economic incentives that can drive different forms of policymaking. One common unsurprising statement made in research papers is the inevitability of climate change. In order to reduce carbon emissions, better, more environmentally-friendly actions need to take place. However, the public sector is often

overwhelmed by other issues in the world, so it is up to private companies to act sustainably. Yet, for action to occur, oftentimes deterents like taxes or incentives must be used, such as providing grants, tax credits, or subsidies in order to encourage changes. Mr. McCarl's research has not only showed me what motivates individuals to act sustainably, but also has provided examples on the future direction of bioenergy and subsequent policies.