Imperial College London

Natural Environment Research Council

2024_9_ChemEng_AH: Development of a land use layer for more effective integrated assessment modelling of climate change mitigation

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Climate change mitigation pathways are typically heavily dependent on use of land for bioenergy production, carbon dioxide removal, energy production and storage, alongside the core land use demands for food and other goods, ecosystem services, water, ecosystem services, built environment and much more. However, most integrated assessment modelling (IAM) – which is a central tool for creation of climate change mitigation pathways (such as for the IPCC) – does not have a strong link between land use considerations and energy transition pathways modelling. This slows countries/organisations down in terms of planning policies/activities that are consistent with achieving Paris Agreement targets.

Easy access to high quality land use tools is a key barrier to rapid and effective integrated assessment modelling. This project will address this gap by building an open-source, spatially and temporally-resolved land use layer for use in climate change modelling. The core aim of the tool will be to produce the input parameters need by IAMs, and provide a land use assessment of pathways emanating from IAMs.

Drawing initially on FAO datasets to map current land uses, and existing efforts such as MAgPIE, we will develop estimates of bioenergy potential for any area selected, consistent with meeting other land use demands and cognisant of possible climate scenarios. Project scope will then be expanded to consider Carbon Dioxide Removal via land use change, and water use, including its use in green hydrogen production. All this will be developed within a framework that takes account of key land use issues such as food production, non-food agriculture, forestry, recreation, biodiversity, non-energy water uses, etc.

The project has great potential for impact in relation to more effective climate change mitigation modelling, identification of bioenergy and hydrogen potentials in a region, alongside assessment of biodiversity impacts, and trade-offs between land use choices. The student will engage with our Climate Compatible Growth project, giving opportunities to create impact with governments globally on this issue.