Reversing flow of carbon back to the geosphere. Scaled organic carbon engineering - Feasible or fantasy?

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With the ongoing energy transition, the need for scalable routes to carbon management is now acute, driven by rapid changes in the global environment. Scalability of current CCUS approaches is not matching that need, whether from the carbon capture and storage perspective, in the terms of platform technology developments, or availability of realistic product market sizes for turning excess carbon into high volume, value-added products. Here, currently, only fuel or building materials represent feasible large-scale carbon utilisation reservoirs.

In our group, we are working on a technology development roadmap for carbon management, with scalability at its core, and a focus on organic carbon captured naturally within various high-volume feedstocks- terrestrial and marine biomasses, or organic wastes and residues. Developments are ultimately constrained both by practical and finance realities, thus a key is to couple sequestration applications, such as ocean and land based negative emission technologies, with sustainable, commercially or strategically viable products streams such as low carbon fuel production, renewable energy technology components or coastal hazard mitigation routes. The approach is based on understanding natural processes of organic matter cycling in nature which can be optimised and scaled to achieve net carbon removal from the atmosphere at scale and which may have a financeable solution through auxiliary product streams.

In this presentation, we summarise two examples of evaluation of such potential technologies: large scale marine structures able to accelerate rates of atmospheric carbon burial to marine sediments; and routes for producing benign stable organic carbon species from terrestrial biomass for subsurface or marine storage.