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A LIFE CYCLE ASSESSMENT BASED COMPUTATIONAL FRAMEWORK FOR INLAND CO₂ TRANSPORTATION BY TRUCKS

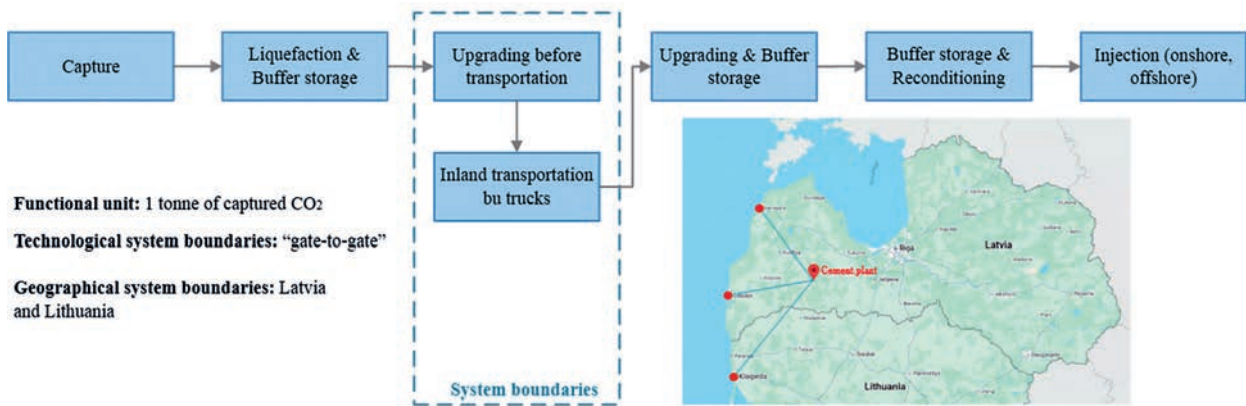
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Abstract – Achieving net-zero emissions targets for industries (especially hard-to-abate) has positioned carbon capture, utilization and storage (CCUS) as emerging CO₂ reduction technology in Europe with rapid growth of research and pilot projects in recent years. The scope of ongoing CCUS projects is expanding to include both CO₂ utilization as a feedstock for industrial applications (including chemicals, steel, construction, textiles, energy storage and renewable energy sectors) and CO₂ geological storage. In the context of geological storage in the Nordic–Baltic region, a significant initiative in this context is the actively developing “Northern Lights” project. Despite the promising potential of CCUS for mitigating CO₂ emissions, the CO₂ reduction potential across the entire supply chain must be clearly defined to ensure a cumulative net reduction. Specifically, the balance of stored or utilized CO₂ should be genuinely negative after accounting for the CO₂ emissions generated within the CCUS supply chain itself. One of the methodological tools employed to address this issue is life cycle assessment (LCA). Within the scope of the present research, an LCA-based computational framework for the transportation of CO₂ captured from industrial sources is developed. A case study is conducted for Latvia, where the source of captured CO₂ is a local cement producer. The captured CO₂ is transported under three alternative scenarios to the ports of Liepāja and Ventspils in Latvia, and to the port of Klaipėda in Lithuania, for subsequent marine transportation to offshore geological storage. In addition, the study is supplemented by a sensitivity analysis addressing transport-related parameters, including fuel types, vehicle technologies and CO₂ flow specifics.

Keywords – Carbon capture and storage; CO₂ inland transport; sustainability assessment



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