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Net Zero Carbon: Conceptual Framework and Assessment Approaches

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Abstract

The concept of Net Zero Carbon and carbon neutrality has emerged as a central pillar in global climate mitigation strategies, aiming to balance anthropogenic Greenhouse Gas (GHG) emissions with removals within defined system boundaries. Despite widespread adoption of net zero targets across sectors, inconsistencies in definitions, accounting boundaries, and assessment methodologies continue to pose significant challenges for transparent and comparable evaluations. This presentation provides a concise overview of the conceptual foundations of carbon neutrality and net zero carbon, highlighting their evolution from early standards.

The study reviews key international standards and frameworks governing net zero and carbon neutrality assessments, including PAS2060, ISO 14064-1,2,3, ISO 14067, ISO 14068, the GHG Protocol, and emerging voluntary carbon market guidelines. Particular emphasis is placed on the progression of these standards toward prioritizing emission reductions, robust baseline definition, transparent reporting and credible carbon credits.

To demonstrate the practical application of these frameworks, a case study of a tea estate is presented. The assessment integrates activity-based emission accounting across Scopes 1, 2, and relevant Scope 3 categories, alongside quantification of biogenic carbon sequestration from plantation biomass and associated land-use systems. The net carbon balance is evaluated to determine whether the estate meets net zero or carbon neutrality criteria and to assess its eligibility for carbon credit generation under prevailing verification requirements. The case study illustrates key methodological considerations, data uncertainties, and decision thresholds that influence net zero claims. Overall, the presentation aims to bridge conceptual frameworks and applied assessment approaches, offering insights relevant to academia, policymakers, and industry stakeholders engaged in credible net zero transitions.