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# Assessing the Impact of Low Carbon Technology Integration on Electricity Distribution Networks: Advancing towards Local Area Energy Planning

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**Abstract :** In the pursuit of achieving net-zero carbon emissions, the integration of low carbon technologies into electricity distribution networks is paramount. This paper delves into the critical assessment of how the integration of low carbon technologies, such as heat pumps, electric vehicle chargers, and photovoltaic systems, impacts the infrastructure and operation of electricity distribution networks. The study employs rigorous methodologies, including power flow analysis and headroom analysis, to evaluate the feasibility and implications of integrating these technologies into existing distribution systems. Furthermore, the research utilizes Local Area Energy Planning (LAEP) methodologies to guide local authorities and distribution network operators in formulating effective plans to meet regional and national decarbonization objectives. Geospatial analysis techniques, coupled with building physics and electric energy systems modeling, are employed to develop geographic datasets aimed at informing the deployment of low carbon technologies at the local level. Drawing upon insights from the Local Energy Net Zero Accelerator (LENZA) project, a comprehensive case study illustrates the practical application of these methodologies in assessing the rollout potential of LCTs. The findings not only shed light on the technical feasibility of integrating low carbon technologies but also provide valuable insights into the broader transition towards a sustainable and electrified energy future. This paper contributes to the advancement of knowledge in power electrical engineering by providing empirical evidence and methodologies to support the integration of low carbon technologies into electricity distribution networks. The insights gained are instrumental for policymakers, utility companies, and stakeholders involved in navigating the complex challenges of energy transition and achieving long-term sustainability goals.

**Keywords :** energy planning, energy systems, digital twins, power flow analysis, headroom analysis
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