The role of ‘living laboratories’ in unlocking the potential of renewable energy and smart distributed energy systems to address the UN SDGs

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The UN Sustainable Development Goals provide a framework towards a more sustainable future. Although each goal can be targeted separately, the greatest benefit is to be had in ensuring that projects exploit synergies between different goals, are developed with an interdisciplinary perspective, and integrate different stakeholders across academia, business, government, NGOs, and communities.

In combination, Renewable Energy Systems (RES) and distributed ‘smart’ energy networks (SEN) provide opportunities to drive down CO₂ emissions, clearly addressing SDG13, ‘climate action’. However, significant potential exists to positively contribute to a wider suite of goals as well as the potential to negatively impact other aspects. Addressing these tensions and opportunities requires development of a detailed understanding of the full societal, economic and environmental impacts of such developments.

Such integrated renewable energy systems and smart energy networks are in the early stages of development. Taking a ‘living laboratory approach’ enables the development and live-testing of new energy systems, including the opportunity to consider full life cycle assessment impacts and benefits, as well as investigate and co-develop interactions with end-users. Here we outline the potential of one of Europe’s largest ‘at scale’ multi-vector smart energy systems, developed as a ‘living laboratory’ at Keele University in the UK, to demonstrate an integrated approach to addressing the UN’s SDGs through integrated RES-SEN systems. The scale and scope of the project provides the opportunity for the detailed analysis required to provide a model of a scalable, integrated RES-SEN approach as part of an evolving energy landscape, where multi-vector renewables, and distributed energy and storage provide new models for decarbonisation, whilst also contributing more widely to the UN’s SDGs.

This project represents an ambitious and innovative demonstrator programme that brings together multiple stakeholders to explore the potential for addressing the core SDGs of ‘climate action’, ‘affordable and clean energy’, ‘sustainable cities and communities’, ‘decent work and
economic growth', and ‘industry, innovation and infrastructure’, while exploring the additional potential impacts and benefits to ‘quality education’, ‘life on land’ and ‘partnerships for the goal’. The programme of work focuses on technical developments, societal adoption and full economic life-cycle assessment, which combined are developing a blueprint for the integration of RES-SEN technologies across the evolving energy landscape by working in partnership with key industrial and commercial partners to contribute to a wide array of the UN’s SDGs.