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Assessment of Multi-Domain Energy Systems Modelling Methods

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Abstract : Emissions are a consequence of electricity generation. A major option for low carbon generation, local energy systems featuring Combined Heat and Power with solar PV (CHPV) has significant potential to increase energy performance, increase resilience, and offer greater control of local energy prices while complementing the UK’s emissions standards and targets. Recent advances in dynamic modelling and simulation of buildings and clusters of buildings using the IDEAS framework have successfully validated a novel multi-vector (simultaneous control of both heat and electricity) approach to integrating the wide range of primary and secondary plant typical of local energy systems designs including CHP, solar PV, gas boilers, absorption chillers and thermal energy storage, and associated electrical and hot water networks, all operating under a single unified control strategy. Results from this work indicate through simulation that integrated control of thermal storage can have a pivotal role in optimizing system performance well beyond the present expectations. Environmental impact analysis and reporting of all energy systems including CHPV LES presently employ a static annual average carbon emissions intensity for grid supplied electricity. This paper focuses on establishing and validating CHPV environmental performance against conventional emissions values and assessment benchmarks to analyze emissions performance without and with an active thermal store in a notional group of non-domestic buildings. Results of this analysis are presented and discussed in context of performance validation and quantifying the reduced environmental impact of CHPV systems with active energy storage in comparison with conventional LES designs.

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