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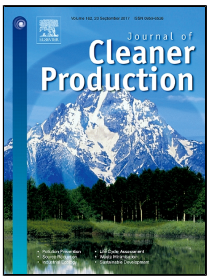

Title: Battery storage for post-incentive PV uptake? A financial and life cycle carbon assessment of a non-domestic building

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Title: Battery storage for post-incentive PV uptake? A financial and life cycle carbon assessment of a non-domestic building

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ABSTRACT:

The rapid growth of photovoltaic (PV) installations in recent years has largely been driven by government incentive schemes that make PV an attractive option for building owners seeking to reduce their greenhouse gas emissions and energy costs. As government incentives are reduced or withdrawn the incorporation of battery storage, to lower building electricity grid imports through increased on-site PV self-consumption, is an option to sustain rooftop PV uptake. This study combines a life cycle assessment approach and discounted cash flow analysis to assess the CO_2 and financial impact of adding battery storage to a PV assemblage in the context of future incentive withdrawal, electricity system decarbonisation and changing technology costs. An example non-domestic building in the UK with a 20kW mono-crystalline silicon PV and lithium-ion battery storage is modelled. With electricity grid decarbonisation in line with the Paris Climate Change Agreement, the PV and battery system here reduces the building's CO_2 emissions by 17% (19tCO_2) compared with the grid-only reference over a 30year lifetime. The analysis also highlights that adding battery storage does not necessarily increase CO_2 savings achieved by PV alone for the building, if grid decarbonisation is considered. PV systems without batteries in the UK are however found to be viable in 2020 without government incentives. For system considered here the battery costs of <£334/kWh available capacity are needed in 2020 for batteries to positively affect the financial performance of PV. The study therefore concludes that UK battery costs have to continue to reduce rapidly, or additional revenue from providing electricity system services is needed to make batteries financially attractive in lower insolation areas like the UK. Policy to reduce electricity system CO_2 through building integrated battery uptake requires better understanding of the net system CO_2 impact in line with other changes in electricity generation and demand.

Keywords: Life cycle assessment; financial analysis; PV; battery storage; organizational barriers

1. Introduction:

The world faces an ongoing 'trilemma' of reducing greenhouse gas (GHG) emissions that contribute to climate change, while providing affordable and reliable electricity supply. Within this context the installed capacity of solar photovoltaics (PV) has increased sharply, with a confluence of falling module costs and government incentives driving rapid uptake, even in lower insolation regions such as the UK (Fraunhofer ISE 2016). For building owners, rooftop PV can reduce the cost and carbon dioxide (CO_2) emission of their electricity supply by avoiding imports from the