Reaching Net Zero carbon targets through rooftop measures

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Many minds, one mission

About the research

In 2019, the UK pledged to reach "net zero" carbon emissions by the year 2050, with the city of Bristol pledging to reach the same goal by the year 2030. Net zero carbon emissions can be achieved through either a reduction in current emissions or by removing existing emissions from the atmosphere.

Green roofs have been around since the Roman Empire and are defined as roofs with living vegetation on the surface. They have been shown to offer a variety of benefits including absorbing carbon emissions, insulating buildings, and improving local biodiversity. Solar panels are a more recent invention which harness solar energy and convert it into electrical energy, avoiding the carbon dioxide emissions that would have otherwise been released from fossil fuels.

Rooftops account for a quarter of the average city's surface area and 58% of our capacity to avoid greenhouse gas emissions stems from city buildings. Providing financial subsidies to incentivise the retrofitting of these rooftop spaces with solar panels or green roofing therefore offers a clear pathway to help reduce carbon emissions and achieve net zero targets.

This research uses the latest regional data and remote sensing information assessing the suitability of rooftop space across the city of Bristol to directly compare three key outputs for a potential subsidy scheme incentivising the uptake of green roofs or solar panels:

- The city-wide potential carbon reduction by 2050.
- The cost-effectiveness per unit area at reducing carbon emissions.
- The wider economic cost-benefit ratio.

The information provided by this research will aid Bristol City Council in assessing all available uses of state funding to achieve national net zero targets and its own more ambitious net zero target for 2030.

Policy implications

- With the current climate emergency and ambitious net zero targets for Bristol, solar panel systems offer a more efficient use of rooftop space than green roofs to help achieve 2030 and 2050 net zero targets
- Considering the limited capacity of city budgets, green roofing should also be considered as a more financially affordable option that provides a variety of important environmental and social benefits beyond carbon reduction that solar panels cannot deliver. These wider benefits include increases in biodiversity, mental health, and decreases in urban flood risk, who's value is difficult to translate into monetary value
- Any subsidy scheme incentivising rooftop installations should consider important local social and demographic factors, the global benefit of carbon reduction, limits in city financial capacity, and the influence of scheme uptake success on its effectiveness at reducing carbon.
- The potential effectiveness of combined green-solar installations on the same rooftop may provide a way to maximise the benefits of both measures while reducing carbon.

Key findings

- This study finds that a subsidy scheme incentivising rooftop solar panel installations has the potential to reduce over 9.7 million tonnes of carbon by 2050 following a realistic success scenario - over 60 times as many tonnes of carbon than an equivalent scheme subsidising green roofs.
- These results suggest that the replacement of fossil fuel energy consumption with "zero-carbon" solar energy provides a more effective pathway to reducing carbon emissions than the combined carbon absorption and home insulation effects that green roofing can provide.
- In addition, a subsidy scheme incentivising solar panel installations is shown to be over 5.6 times more cost-effective at reducing carbon emissions than green roofing, while green roofs notably offer a more financially affordable option with a superior overall financial cost-benefit ratio at the global scale. Green roofing is shown to provide a variety of important environmental and social benefits that solar panels cannot deliver, including increases in biodiversity, mental health, and decreases in urban flood risk.
- The findings of this study also highlight the strong impact that the uptake success of a subsidy scheme can have on its effectiveness at reducing city-wide carbon emissions.
- Important areas highlighted for future consideration in relation to this research include local sociodemographic factors, the global benefit of carbon reduction, city financial capacity, and the effectiveness of combined green-solar roofs.

Further information

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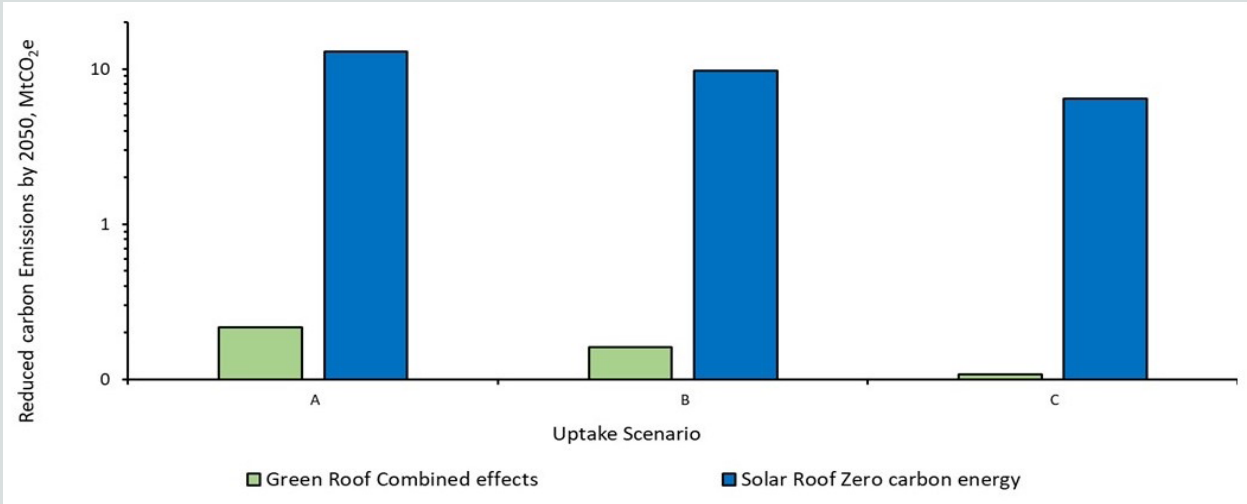

The total potential reduction in emissions by the year 2050 for a green roof and solar panel subsidy scheme in Bristol, in million tonnes (megatonnes) of CO_2 equivalent ($MtCO_2$-e). Uptake scenarios A, B and C represent a theoretical maximum uptake success scenario, realistic high uptake success scenario, and realistic medium uptake success scenario, respectively.