More evidence needed to establish 5G's green credentials

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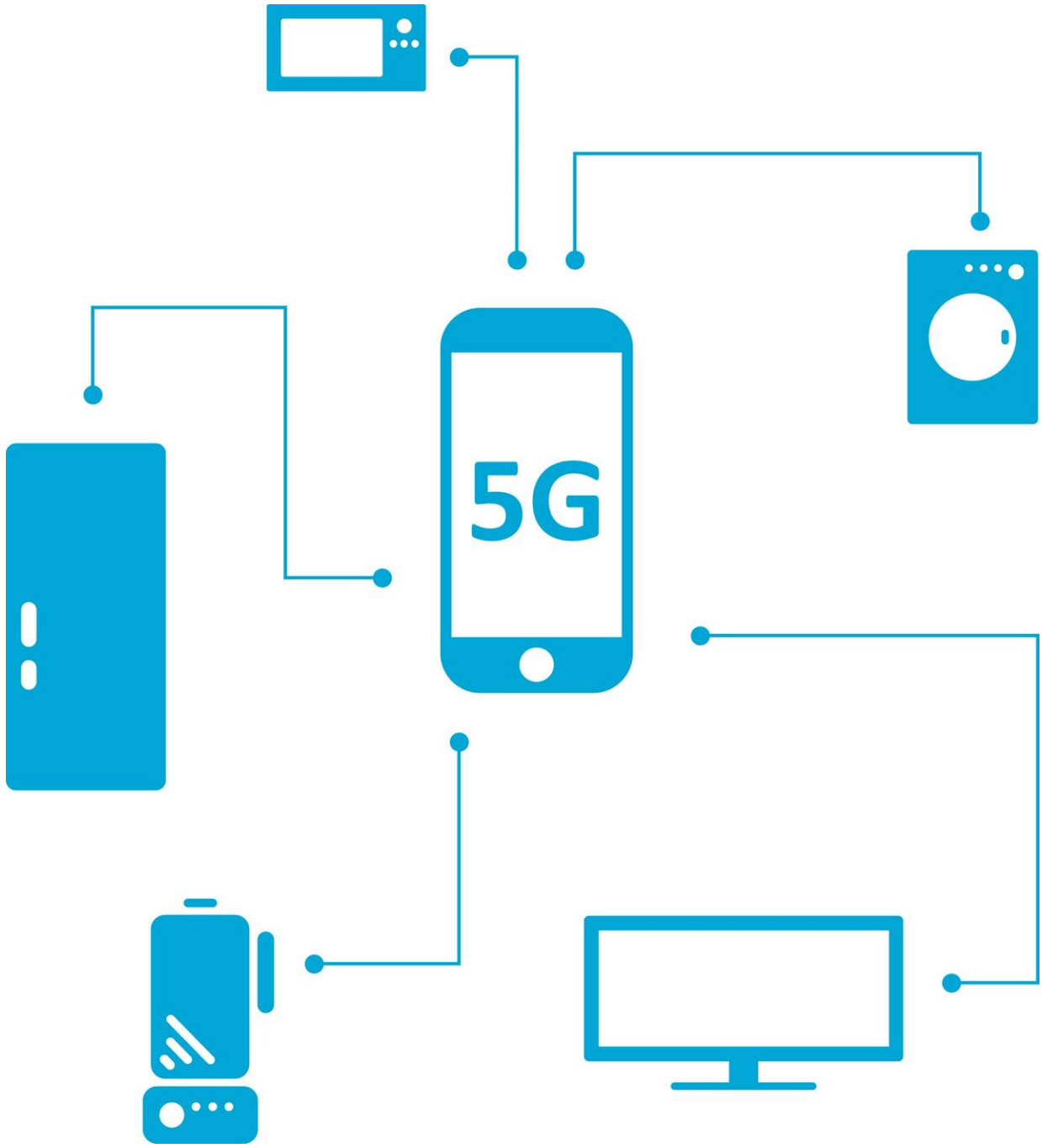

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Widespread expectations that 5G will be a green technology are not

currently backed up by a strong, publicly available, fully transparent evidence base, warns a review of the evidence on 5G energy use impacts by academics at the University of Sussex Business School.

The research warns that existing academic and industry studies into the energy use implications of 5G fail to provide a comprehensive overview of the overall energy use impacts of 5G and overlook three potentially significant issues that broader research on the energy use impacts of other information and communication technologies (ICTs) suggests could be significant.

The academics from the Sussex Energy Group also warn that the widespread adoption of unlimited data subscriptions for 5G users and the facilitation of advanced and data-intensive mobile services such as VR and more sophisticated mobile gaming could encourage energy-intensive user practices, contribute to ever-growing levels of data traffic, and counteract the energy-saving potential of 5G efficiency improvements.

The need for large-scale infrastructure updates every decade to accommodate new generation mobile networks and the even shorter lifespan of smartphones leave a significant environmental impact which must be combatted through the modular design of network infrastructure, right to repair legislation and bans on planned obsolescence from manufacturers, details the newly-published study in Renewable and Sustainable Energy Reviews.

The study, funded by the Centre for Research on Energy Demand Solutions, also recommends network operators and service providers raise awareness among users and make information more transparent about the energy use implications of different practices such as streaming video over Wi-Fi rather than mobile data or sending a message by SMS rather than instant messaging.

App developers should also factor sustainability and energy efficiency considerations into the earliest design stages, the study recommends.

Benjamin Sovacool, Professor of Energy Policy in the Science Policy Research Unit at the University of Sussex Business School, said: "There has been insufficient 'user-centric' work focusing on the relationship between 5G energy use and user behavior leaving unanswered questions about how and under what conditions 5G might become more or less energy intensive.

"We also need greater resource and focus given over to the kinds of strategies that might be pursued by app designers, mobile operators, technology firms and governments aimed at reducing energy intensive behaviors particularly around flat pricing structures, declining per-bit data prices and the proliferation of unlimited data subscriptions which encourage wasteful practices and generate direct rebound effects."

Tim Foxon, Professor of Sustainability Transitions in the Science Policy Research Unit at the University of Sussex Business School, said: "Our review suggests that work on the energy use implications of 5G has overwhelmingly focused on the energy required to power mobile phone networks. However, the energy required to manufacture and install network equipment and manufacture mobile phones is a potentially important part of the puzzle that seems to be routinely overlooked in assessments of 5G's energy use.

"There are encouraging signs that the industry is starting to take this issue of embodied energy more seriously, and we would hope to see this continue as the industry starts to look toward standardization processes for 6G. Addressing embodied energy involves prolonging the lifespans of infrastructure and devices, designing equipment to be easily upgraded and repaired, and improving the reusability and recyclability of equipment."

Academics from the Science Policy Research Unit (SPRU) at the University of Sussex Business School carried out a literature review to examine whole network level assessments of the operational energy use implications of 5G, the embodied energy use associated with 5G, and indirect energy use effects associated with 5G-driven changes in user behavior and patterns of consumption and production in other sectors of the economy.

The review found a surprising lack of assessments of the energy use implications of 5G at the whole network level. Those that do exist tend to produce relatively encouraging findings—suggesting that the improved energy efficiency of 5G can ensure that overall network energy consumption remains flat or falls in spite of high rates of data traffic growth. But the research authors caution that a number of these studies fail to fully disclose key data and assumptions on which these findings are based.

Furthermore, the research paper warns that current studies into 5G energy use fail to properly account for:

- the impact of the embodied energy associated with network infrastructure and user devices
- direct rebound effects associated with 5G-driven changes in mobile device user behavior
- wider indirect energy use effects, including the scope for 5G to enable energy savings in other areas of economic and social life (so-called 'enablement effects')

The review found that industry scenarios tend to emphasize the energy or emissions saving potential of increasing adoption of ICTs, due to the optimisation of processes and systems and structural changes as virtual processes replace physical processes.

But the Sussex Energy Group researchers warn that whilst some estimates suggest that mobile communications enables emissions savings ten times greater than the footprint of the industry itself, the scope for 5G specifically to produce such enablement effects has not yet been comprehensively assessed, nor has whether such effects would exceed the operational and embodied energy use of 5G as well as any rebound effects it may produce.

Dr. Laurence Williams, Research Fellow in Environmental Politics in the Science Policy Research Unit at the University of Sussex Business School, said: "We have identified a number of potentially significant shortcomings of the evidence base on the energy use implications of 5G. The surprising lack of peer-reviewed, publicly available whole network level assessments on the energy use implications of 5G, and patchy disclosure of the key data and assumptions of those studies that do exist, currently make it impossible to conclude with any confidence that 5G will reduce the energy consumption of mobile networks.

"In the context of challenging net zero targets that demand emissions reductions across all sectors of the economy, this is a knowledge gap that needs to be addressed. In order to be comprehensive, future studies should consider embodied energy alongside operational energy, and include indirect energy use effects such as rebound effects and enablement effects. Furthermore, whilst energy efficiency improvements are of course crucially important, more consideration should be given to how user behavior and mobile services can be shaped to be less energy-intensive."

Provided by University of Sussex