Smaller scale solutions needed for rapid progress towards emissions targets

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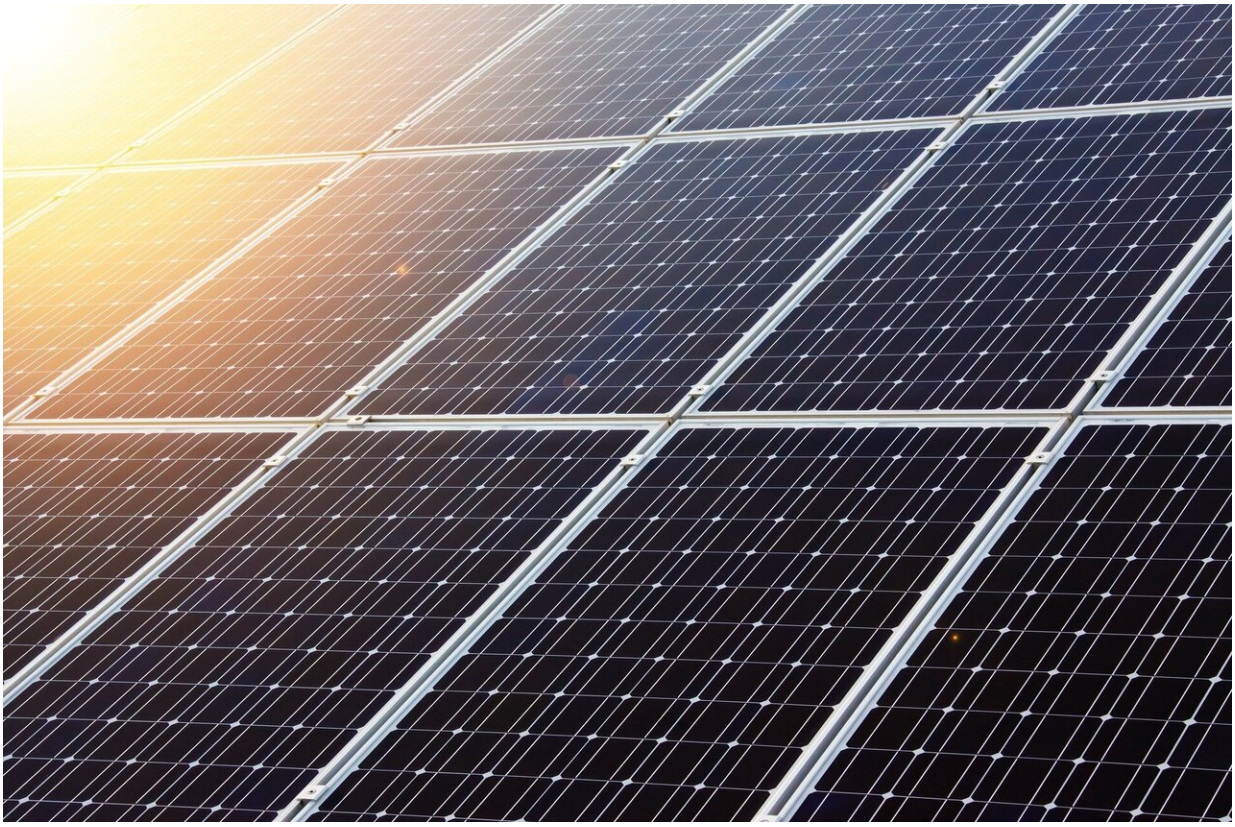

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Low-carbon technologies that are smaller scale, more affordable, and can be mass deployed are more likely to enable a faster transition to net-zero emissions, according to a new study by an international team of

researchers.

Innovations ranging from solar panels to electric bikes also have lower investment risks, greater potential for improvement in both cost and performance, and more scope for reducing energy demand—key attributes that will help accelerate progress on decarbonisation.

In order to meet international climate targets, emissions of greenhouse gases need to halve within the next decade and reach net-zero around mid-century. To do this will require an unprecedented and rapid transformation in the way energy is supplied, distributed and used.

Researchers from the Tyndall Centre for Climate Change Research at the University of East Anglia (UEA), the International Institute for Applied Systems Analysis (IIASA) in Austria, and the University Institute of Lisbon, collected data on a wide variety of energy technologies at different scales and then tested how well they performed against nine characteristics of accelerated low-carbon transformation, such as cost, innovation and accessibility.

They then asked: is it better to prioritise large-scale, costly, non-divisible or "lumpy" technologies, such as nuclear power, carbon capture and storage, high-speed transit systems, and whole-building retrofits?

Or is it better to focus on more "granular" options, which are smaller in size, lower in cost, and more modular so they scale not by becoming bigger but by replicating? Examples of these more granular technologies include solar panels, electricity storage batteries, heat pumps, smart thermostats, electric bikes, and shared taxis or 'taxi-buses'.

Publishing their findings in the journal *Science*, the team finds that subject to certain conditions, more granular alternatives out-perform larger scale technologies in a number of important ways.

Lead researcher Dr. Charlie Wilson, at UEA, said: "A rapid proliferation of low-carbon innovations distributed throughout our energy system, cities, and homes can help drive faster and fairer progress towards climate targets.

"We find that big new infrastructure costing billions is not the best way to accelerate decarbonisation. Governments, firms, investors, and citizens should instead prioritise smaller-scale solutions which deploy faster. This means directing funding, policies, incentives, and opportunities for experimentation away from the few big and towards the many small."

As well as being quick to deploy, smaller scale technologies have shorter lifespans and are less complex so innovations and improvements can be brought to market more rapidly. They are also more widely accessible and help create more jobs, giving governments a sound basis for strengthening climate policies.

Co-author Prof Arnulf Grubler, at IIASA, said: "Large 'silver bullet' technologies like nuclear power or carbon and capture storage are politically seductive. But larger scale technologies and infrastructures absorb large shares of available public resources without delivering the rapid decarbonisation we need."

The researchers emphasise that smaller scale technologies are not a universal solution. In some situations, there are no like-for-like alternatives to large-scale technologies and infrastructure such as aircraft flying long-haul or industrial plants producing iron, steel, and cement.

In other situations, large numbers of smaller scale technologies need to integrate within existing infrastructure: widespread deployment of heat pumps and solar panels needs electricity networks, electric vehicles need charging stations, and insulation products need buildings.

"Smaller scale innovations are not a panacea," added co-author Dr. Nuno Bento, of the University Institute of Lisbon, "but in many different contexts they outperform larger-scale alternatives as a means of accelerating low-carbon transformation to meet global climate targets."

'Granular technologies to accelerate decarbonization', C Wilson, A Grubler, N Bento, S Healey, S De Stercke, and C Zimm, is published in *Science* on Friday April 3, 2020.

More information: C. Wilson el al., "Granular technologies to accelerate decarbonization," *Science* (2020). science.sciencemag.org/cgi/doi … 1126/science.aaz8060

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