New renewable energy resources

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I recently had a similar discussion with my graduate students in MatSE 597 (Organic/Hybrid Optoelectronic & Photovoltaic Devices), a course that discusses renewable energy, sustainability, and energy transition. We agreed that meeting the energy transition is a complex challenge that requires a multifaceted approach. Though the following factors may not be exhaustive, they are crucial for the transition to renewable energy:

The energy transition is not a simple task. It faces many multifaceted challenges, including technological, environmental, societal, economic, and geopolitical issues. Here, I will comment briefly on the technological and geopolitical aspects to give you a sense of the complexity we are dealing with.

The biggest challenge to solar technology is that it cannot be a standalone solution; it needs complementary storage technologies like batteries to be fully accessible 24/7. Solar installations also require significant land, often in farming communities. Mining for materials to sustain solar and battery technologies opens a new set of challenges. There are many ramifications in terms of challenges that solar power or panels face during their lifespan, including disposal or recycling of this technology.

We have many opportunities and lessons from our past actions and inactions to make the transition more just and sustainable. Deploying some of the renewable technologies can be region-, location-, or geography-dependent. For example, solar energy is highly efficient in hot climates, predominantly found in the global south, while wind energy is more suitable for regions with high natural wind speeds.

Global cooperation and collective action are crucial for investing in renewable energy infrastructures and driving technology innovation and R& D geared toward making the transition just and sustainable. Our past actions have shown that raw materials and minerals mining and processing can negatively impact deprived, rural, local, or Indigenous communities. This past knowledge gives us an opportunity to do better this time. However, this will require the involvement of communities themselves, the right policies, governments, and political will.

These opportunities could open the door for research diversification and inter-/multi-disciplinary team collaboration. Investing money and time into innovation and R& D of new technology for renewable energy harvesting, conversion, and storage is vital. It is also crucial to ensure that communities appreciate the efforts and technologies that could potentially replace or be in the mix with existing fossil fuel-based assets and gadgets.

Therefore, I see a considerable impact not only on how the community of researchers should approach research from an interdisciplinary and community-engagement perspective but also on how renewable technology companies and industries approach their R& D portfolios. Topical research must also involve pre- and post-technology development and deployment assessment. Researchers are becoming increasingly aware

of their research"s carbon footprint, developing new and efficient work methods, and embedding sustainability in their processes.

The danger here is friction between the global south and global north and imminent fracture on the geopolitical front. Global warming and climate change are universal threats and must be confronted together. Working together voluntarily and collectively as equals, knowing our strengths and weaknesses, is the right way forward. Otherwise, countries in the global south may resist the push toward a green energy transition, becoming immediate and/or future polluters of the planet, which contrasts with the desired outcome.

On the technological side, though it may be insignificant, there is a risk that we may fail to fully realize the technological dream and deploy all renewable energy sources in time to mitigate global warming. Finally, in the quest for these technologies, we may end up worsening environmental pollution levels, health hazards, living standards, and well-being of different communities globally.

Almost everything, from solving energy crises in major geographical locations through global cooperation and collective action to protecting our collective environment through equal treatment, climate justice, and mitigating global warming. A collective, well-coordinated effort can help us achieve our renewable energy and climate goals, creating a more sustainable and equitable energy landscape for future generations.

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The pace of deployment of some clean energy technologies - such as solar PV and electric vehicles - shows what can be achieved with sufficient ambition and policy action, but faster change is urgently needed across most components of the energy system to achieve net zero emissions by 2050, according to the IEA"s latest evaluation of global progress.

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