A path for considering equity in early-stage research

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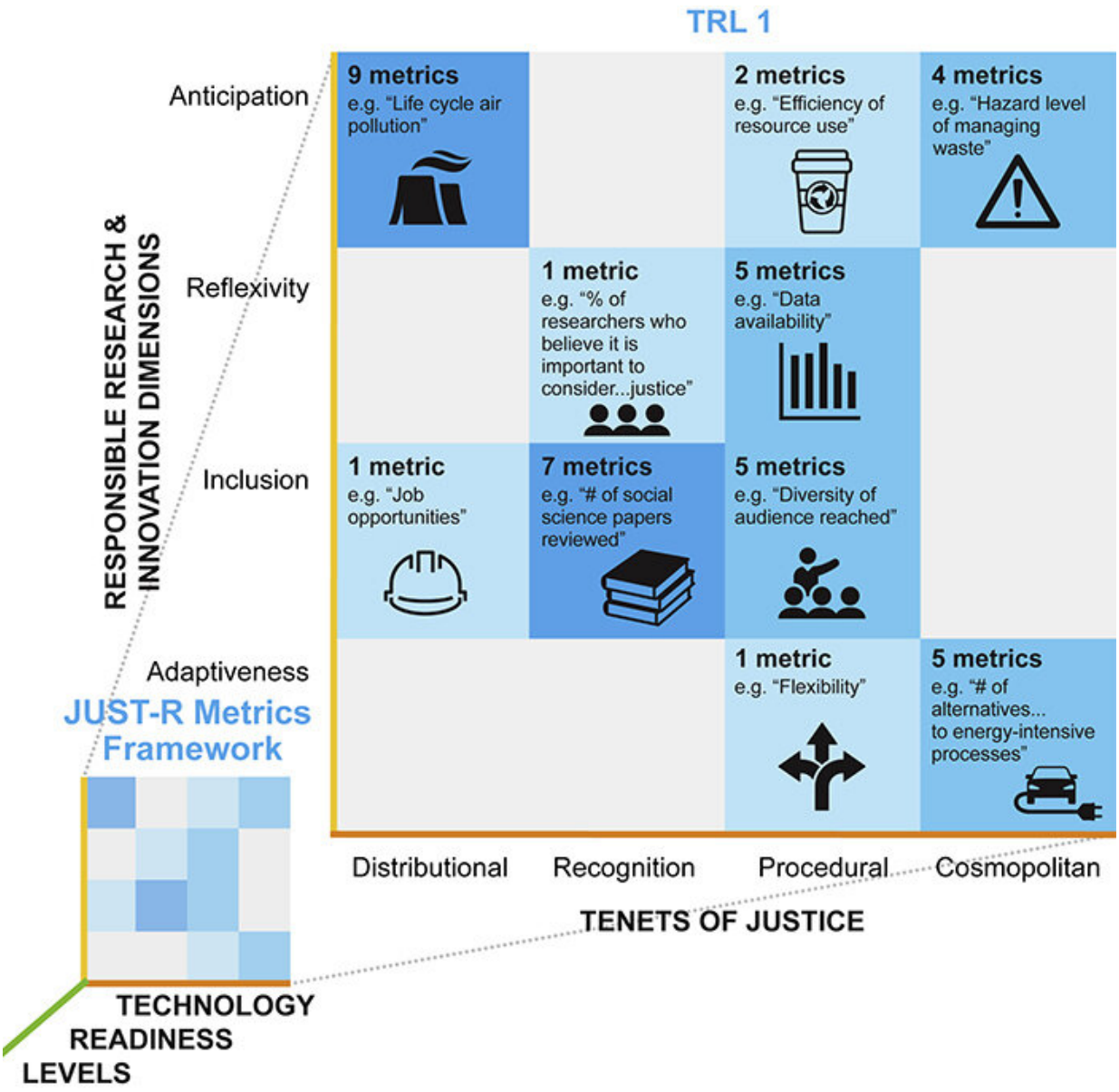

Metrics in the JUST-R framework are organized across responsible research and innovation dimensions, tenets of energy justice, and technology readiness levels. This graphic shows all the metrics available for the earliest stage of research and development. Credit: NREL

Clean energy for all will not happen on its own. It will happen, in no small part, due to the efforts of researchers who think critically about the social impacts of their work from the very beginning.

That type of critical thinking is what helped National Renewable Energy Laboratory (NREL) researchers Nikita Dutta, Elizabeth Gill, Bettina K. Arkhurst, Mary Hallisey, and Kate Anderson develop a new tool for incorporating equity into renewable energy research. This tool, the Justice Underpinning Science and Technology Research (JUST-R) metrics framework, aims to help researchers think more about the social impacts of technologies from the earliest stages of research and development.

"If you only focus on the technical components, you can really miss important social dimensions that have huge impacts," said Dutta, a materials science researcher at NREL. "We need to make sure that the technologies that we put out into the world are doing something positive for people, not contributing to existing inequities."

Dutta is the lead author of a newly published article in *Joule*, "JUST-R Metrics for Considering Energy Justice in Early-Stage Energy Research," that outlines this framework.

NREL thinks about energy equity in terms of the equitable distribution of energy systems' social, economic, and health benefits and burdens across all segments of society. Energy justice focuses on achieving

equity in the energy system while also acknowledging and remediating past harms. The "justness" of a technology can be difficult to evaluate, especially in the early stages of research and development, where researchers are farthest removed from the end product of their work.

However, waiting to determine the social impacts until later stages may not only waste money, time, and resources but can also cause real-world harm to communities.

"NREL's vision is a clean energy future for the world, and designing solutions that enable everyone to be part of the clean energy transition is critical to achieving that," said Kate Anderson, the energy justice lead at NREL. "Often, we don't think about equity impacts until deployment—but by then, inequities are already baked in and can be expensive or difficult to change. The JUST-R framework tackles this challenge by helping researchers to integrate equity from the beginning."

During the literature review process, the research team found that many of the existing metrics for social considerations were only applicable to deployment. The JUST-R framework includes 50 metrics total, with 30 selected from literature and 20 newly proposed to address this gap.

The new metrics are measurable at the earliest stage of technology development and prepare researchers to meet later metrics moving forward. For example, the "number of social science papers reviewed" metric could give early insight into the needs of communities that might benefit from the technology.

The tool is designed to work for researchers across a variety of fields. The authors, who all hail from different disciplines, tested this by applying the metrics to their own work.

"Certain metrics carry different weight in different fields and lead to

different thought processes," Dutta said.

Their article showcases Dutta's case study, which evaluated her previous materials science work. From that assessment, Dutta came up with 27 new ideas for how the project could have been handled differently.

The case study also revealed some of the hurdles that could prevent researchers from applying the ideas that they generate. Time was one of the biggest challenges identified. A researcher may not feel they have the time to learn more about energy justice and make these considerations.

But that time could be worth it in the long run.

"If you're incorporating energy justice into your research questions and designs at early stages, you will be better positioned to deal with the different impacts that come up," Dutta said. "Overall, it is a more efficient path in terms of research time and dollars."

The authors hope the JUST-R metrics will encourage researchers to think more about equity in their work in every step of the process. The framework is not set in stone—it is meant to evolve and adapt. It provides a foundation for researchers to build off to best fit their respective disciplines.

"What I want people to take away from this is that it's not about checking boxes," Dutta said. "It's about thinking critically about your research and making meaningful choices."

More information: Nikita S. Dutta et al, JUST-R metrics for considering energy justice in early-stage energy research, *Joule* (2023). DOI: 10.1016/j.joule.2023.01.007

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