New techno-economic model optimizes waste-heat conversion technologies

December 18 2021, by Kiran Julin

Credit: CC0 Public Domain

Every year, 50% of the energy produced worldwide from coal, oil, natural gas, nuclear, and renewable energy sources is lost as heat. This untapped resource could be a promising additional source of useful energy, and for decades, scientists have worked to develop efficient

systems to convert waste heat to electric power.

In a recent study published in *Joule*, Berkeley Lab researchers developed a techno-economic model to predict the economic viability of different waste-heat conversion technologies. Their model will help guide future research by steering scientists toward novel designs and technologies that are more likely to enable cost-effective and efficient waste-heat conversion.

Up until now, most of the research centered around waste-heat conversion technologies has been focused on the physics behind waste-heat conversion engines, such as thermoelectric generators that recover exhaust heat in internal combustion engines. Berkeley Lab's techno-economic model enables researchers to have a more system-wide approach, which focuses on technological requirements for commercial viability, such as the temperature of the waste heat source, the cost of heat exchangers, or the minimum capacity factor—the fraction of the time the waste heat source is available.

"Although more than 60% of the waste heat is available below 100 degrees Celsius, our analysis shows the waste heat conversion is only economical above 150 degrees Celsius," said Ravi Prasher, associate lab director at Berkeley Lab. "This finding is very important in prioritizing research and development for waste heat conversion heat engines."

The techno-economic model from this study enables researchers to better predict which sectors and circumstances will be more ideally suited to waste-heat conversion technologies.

More information: Charles Geffroy et al, Techno-economic analysis of waste-heat conversion, *Joule* (2021). DOI: 10.1016/j.joule.2021.10.014