COMPILED AND EDITED BY THE **CONNECT TEAM** BASED ON INPUT FROM THE FEATURED **RESEARCHERS**

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Towards cleaner, cheaper and more efficient power generation

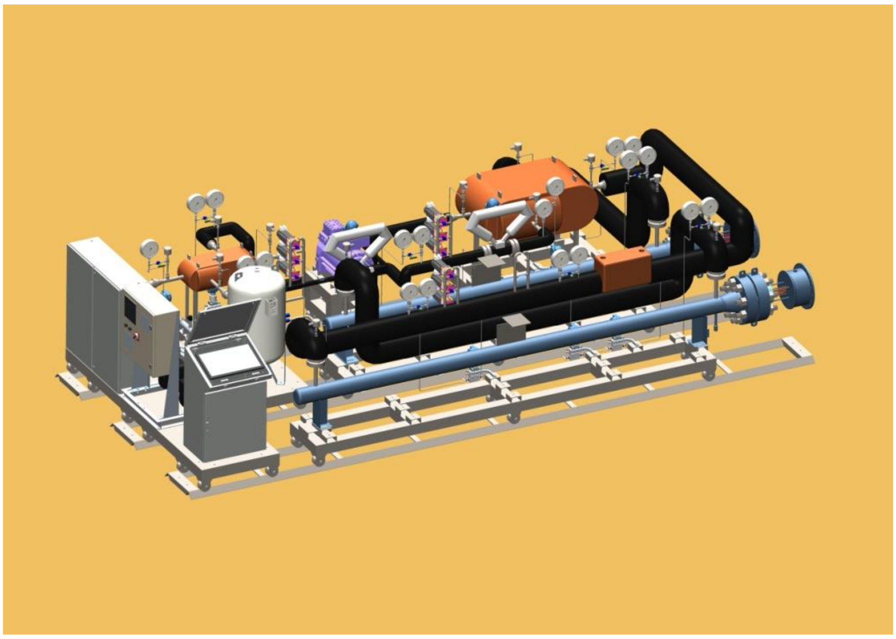
Today's thermal power plants use steam to carry heat away from the source and turn a turbine to generate power. However, one could generate more power if, instead of steam, supercritical carbon dioxide (S-CO_2) is used. The term "supercritical" describes the state of carbon dioxide above its critical temperature of 31°C and critical pressure of 73 atmospheres, making it twice as dense as steam.

The efficiency of energy conversion could also be significantly increased–by as much as 50 percent or more–if S-CO_2 is operated in a *closed loop Brayton cycle*. Besides increasing power generation and making the process more efficient, there are other advantages of using this new technology. Smaller turbines and power blocks can make the power plant cheaper, while higher efficiency would significantly reduce CO_2 emissions for fossil fuel based plants. Moreover, if the power plant used solar or nuclear heat source, it would mean higher capacity at lower operating costs.

In order to help make this technology a reality, a research group led jointly by Pramod Kumar and Pradip Dutta is setting up the world's first S-CO_2 based solar thermal test loop at the laboratory scale at the Interdisciplinary Centre for Energy Research in the Institute. This test loop is designed to generate the necessary data for future development of scaled up S-CO_2 power plants. But this would require overcoming several technological challenges– developing critical components such as the turbine, compressor and heat exchangers that can work at the desired pressure and temperature ranges, and using materials that can withstand these conditions.

In spite of these challenges, the group has made tremendous progress over the past three years. They have developed optimized thermodynamic cycle designs, heat transfer and fluid flow codes for designing the test loop, critical components such as compact heat exchangers and solar receivers, and state-of-the-art instrumentation along with loop control sequence algorithm.

This effort is part of an Indo-US project, which has already been identified as a possible national initiative for the next generation of solar thermal power plants. This gives India an opportunity to become a world leader in this technology and fulfill a major objective of the National Solar Mission which emphasizes indigenous manufacturing.



A Model of the S-CO_2Test Loop Facility at ICER

Dutta and Kumar with their team (MANOJ SUDHAKARAN)