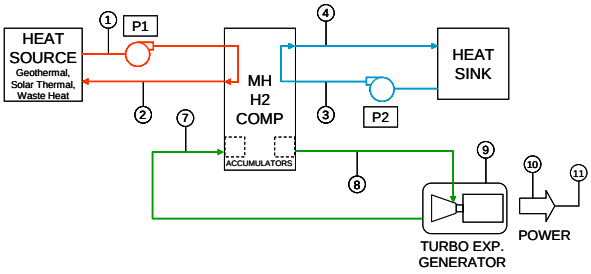
Metal Hydride Cycle — Electricity Generation from Waste Heat



TECHNOLOGY: The Texas Center for Applied Technology (TCAT), a center within the Texas A&M Engineering Experiment Station (TEES), an engineering agency of the state of Texas, has won an award to test and evaluate a new system of improvements to a new Metal Hydride Cycle (MHC) system. The technology was developed by ERRA, Inc., and its subsidiary Ergenics Corporation, a United States MHC system developer and manufacturer. The new MHC system improvements are expected to produce power from tepid heat. The prototype's central feature is a hydride compressor, which alternately absorbs hydrogen when cooled and releases hydrogen when heated. The hydride compressor is expected to create a flow of pressurized gas, which will drive an expander, such as a turbine, thus producing power with a traditional generator.

APPLICATIONS: The MHC prototype will be designed to use low temperature heat recovery from a wide range of abundant and often free sources (e.g., industrial and commercial waste heat, solar-thermal arrays, geo-thermal wells, combustion exhaust gas, and ocean thermal). Heat sinks will be created from existing cooling water or produced using water-to-air heat exchangers.

IMPACT: With its targeted installed cost of $1 to $2/ W_e, the new MHC technology has the potential to be disruptive and transformational to the low temperature heat recovery industry. Nonetheless, other approaches to using such heat do exist. Examples of such systems include Organic Rankine Cycle, Kalina Cycle, Stirling Cycle, and Thermoelectric Elements. However, conversely to the MHC prototype being tested by TCAT's ARPA-E project, all similar existing systems suffer from one or more deficiencies. These deficiencies include the need for a greater temperature difference between the hot and the cold side; the need for a higher temperature heat source; the lack of lower heat-to-power conversion efficiency; the use of a greater number of moving parts; the noise production level; and the high cost versus the projected cost of the new MHC system prototype.

PROJECT SCOPE: Design, construct, field test, and evaluate two new MHC system prototypes over a period of two years. A 5 kW_e prototype will be heated and cooled by a boiler and a chiller at Texas A&M University at San Antonio. An advanced 20 kW_e system will be tied into a waste heat recovery application at a site still to be determined.

PROJECT TEAM: *TCAT* – providing testing and evaluation along with project management. *ERRA, Inc.* and its wholly owned subsidiary *Ergenics Corp.* – providing new system technology to existing MHC systems. *TAMUSA* – providing test site for the 5 kW_e system as part of in-kind contribution.

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TEXAS CENTER FOR APPLIED TECHNOLOGY

There are many problems that require the careful and proper integration of applied technologies to find solutions. The Texas Center for Applied Technology (TCAT) was created to focus on these specific problems and to develop effective and efficient solutions. TCAT's core competency is the innovative application of existing technologies and advanced research to solve complex real-world problems.

TCAT's primary objective is to apply and test technologies to address targeted problems and engage basic research as required. TCAT has employees in a variety of locations with the ability to perform research that cuts across multiple technologies, disciplines, and cultures. The Center's employees are knowledgeable regarding customers' requirements and are ready to respond effectively to provide the best value for the customers' needs including expertise in technology insertion, technology assessments, and test and evaluation.

TCAT is part of the Texas A&M Engineering Experiment Station (TEES), a member of The Texas A&M University System. The A&M System is one of the largest and most comprehensive systems of higher education in the United States. Through a statewide network of eleven university campuses, seven state agencies, and a comprehensive health science center, the A&M System educates more than 120,000 students on its university campuses, conducts more than $780 million in research, and reaches another 22 million people through service each year. TEES is an engineering research agency for the state of Texas and conducts over $147 million in research annually. Because of the Center's position within the Texas A&M Engineering program, TCAT's expertise can easily be extended by rounding out its team with world class faculty researchers, as appropriate. TCAT is in an excellent position for collaboration not only with The Texas A&M University System components and their customers but with other universities, institutions, centers, and industry.

TCAT'S CORE COMPETENCIES

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Manufacturing & **S**ystems **E**ngineering ★ **I**nformation **T**echnology ★ **M**odeling & **S**imulation
Technology **I**nsertion ★ **T**est & **E**valuation

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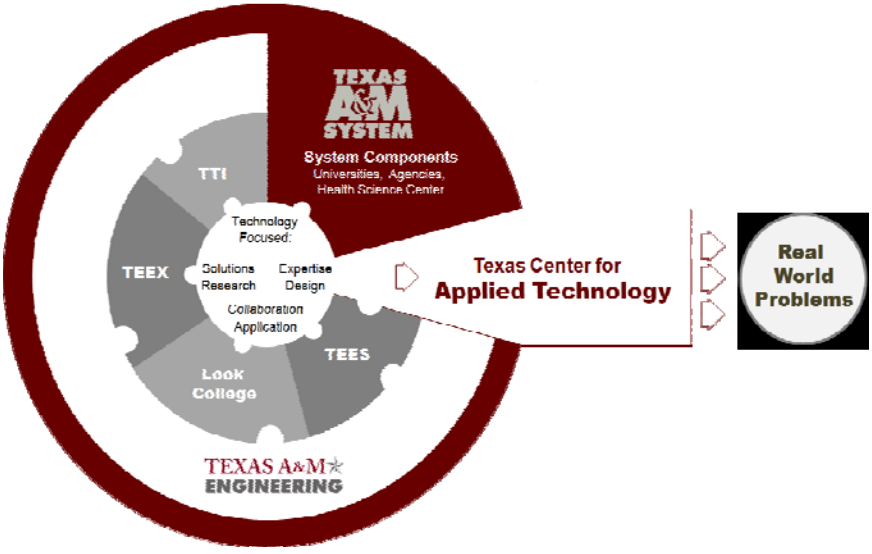
Texas A&M Engineering consists of the Dwight Look College of Engineering, and three engineering agencies, including TEES: Texas A&M Transportation Institute (TTI) conducts research and professional education in all modes of transportation. The Texas A&M Engineering Extension Service (TEEX) works to develop a highly skilled and educated workforce and enhances public safety through training, continuing education, and technical assistance.



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