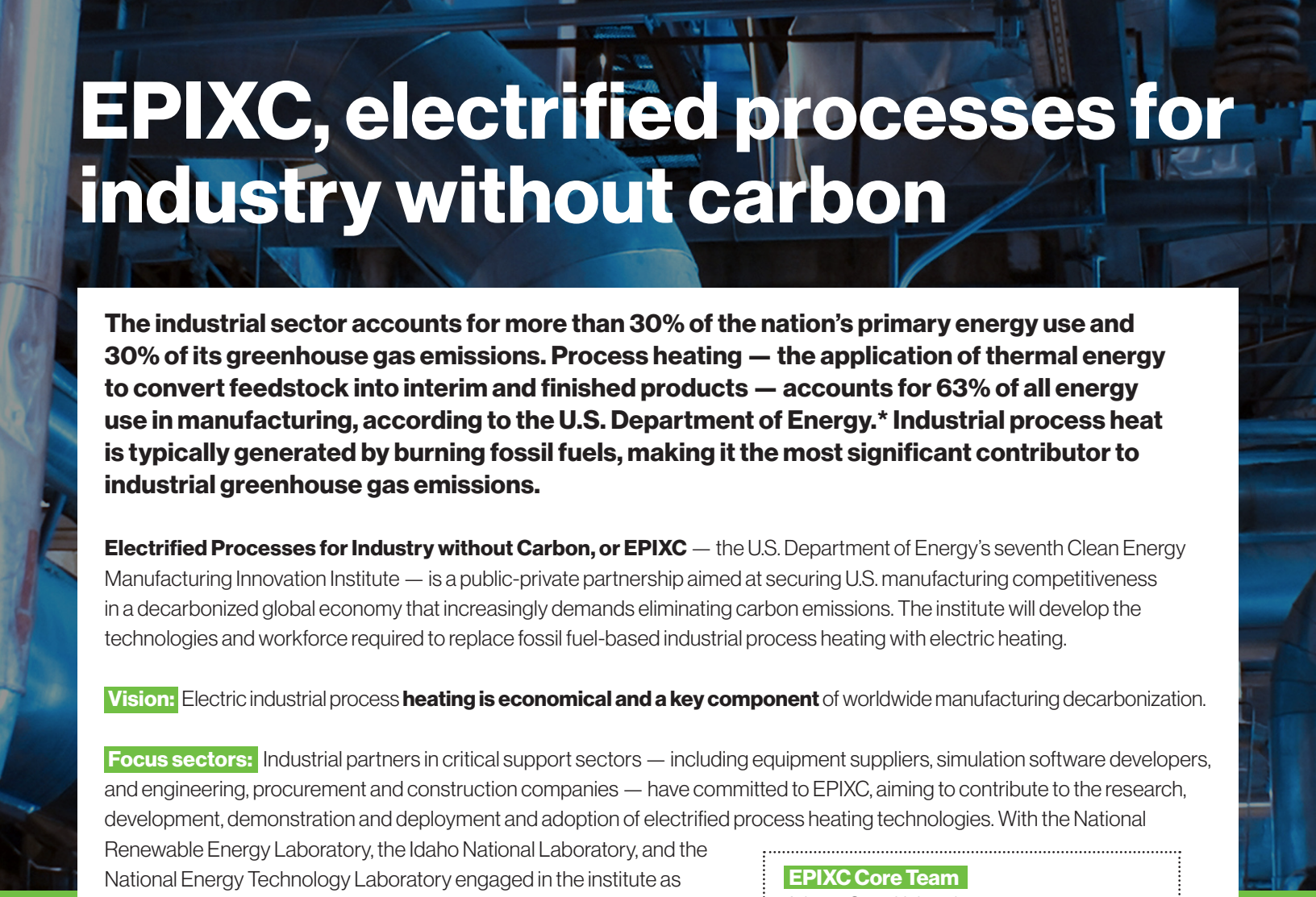

EPIXC, electrified processes for industry without carbon

The industrial sector accounts for more than 30% of the nation's primary energy use and 30% of its greenhouse gas emissions. Process heating — the application of thermal energy to convert feedstock into interim and finished products — accounts for 63% of all energy use in manufacturing, according to the U.S. Department of Energy.* Industrial process heat is typically generated by burning fossil fuels, making it the most significant contributor to industrial greenhouse gas emissions.

Electrified Processes for Industry without Carbon, or EPIXC — the U.S. Department of Energy's seventh Clean Energy Manufacturing Innovation Institute — is a public-private partnership aimed at securing U.S. manufacturing competitiveness in a decarbonized global economy that increasingly demands eliminating carbon emissions. The institute will develop the technologies and workforce required to replace fossil fuel-based industrial process heating with electric heating.

Vision: Electric industrial process **heating is economical and a key component** of worldwide manufacturing decarbonization.

Focus sectors: Industrial partners in critical support sectors — including equipment suppliers, simulation software developers, and engineering, procurement and construction companies — have committed to EPIXC, aiming to contribute to the research, development, demonstration and deployment and adoption of electrified process heating technologies. With the National Renewable Energy Laboratory, the Idaho National Laboratory, and the National Energy Technology Laboratory engaged in the institute as lab partners, we have **secured the participation of key industry-university consortia,** including the Process Science and Technology Center at the University of Texas at Austin; the Kent D. Peaslee Steel Manufacturing Research Center at the Missouri University of Science and Technology; the Power Systems Engineering Research Center and a new cement test bed being built at Arizona State University; and the Robertson Pulp and Paper Laboratory Complex at North Carolina State University, which includes the Baby Wolfpack pilot paper plant. Each consortium has broad participation from industrial stakeholders and runs established, industry-relevant test beds.

EPIXC Core Team

Arizona State University
Idaho National Laboratory
Missouri University of Science and Technology
National Energy Technology Laboratory
National Renewable Energy Laboratory
Navajo Technical University
North Carolina State University
Stanford University
Texas A&M University
Tuskegee University
University of Texas at Austin

The EPIXC mission:

To develop and scale innovative electric industrial process heating concepts for advanced manufacturing to reduce emissions, improve production flexibility and enhance energy efficiency. Through research, development and demonstration efforts, education and workforce development programs, and the creation of jobs for underrepresented communities, EPIXC will provide cost-effective manufacturing decarbonization solutions. These solutions will accelerate the U.S. transition to a future with net-zero carbon emissions and contribute to the DOE's Industrial Heat Shot™ initiative goals.

**Thermal Process Intensification: Transforming the Way Industry Uses Thermal Process Energy, US DOE, EERE, Advanced Manufacturing Office, Workshop Report, May 2022*

Key technology challenges will span multiple time and space scales. At the systems level, renewable power generation using wind and solar technology is the primary source of clean electricity. However, **generation rates for this weather-dependent technology fluctuate** during the day and seasonally. This presents a challenge as the current industrial base requires that energy be available at the needed level at any given time. Accordingly, large-scale energy storage may be required to supply the necessary operational energy to industrial customers. In the long term, electrified heating may require novel, highly flexible process designs that can respond reliably to such fluctuations by altering their operating levels and production rates. At the process unit level, nascent electric pathways for heat delivery, such as radiation, induction, plasma, resistance and microwave, require careful validation and scaling up. **Electric heating must ultimately be as productive as combustion heating** for applications such as drying, melting, chemical reactions and more to ensure that products exhibit similar or improved quality and performance compared to those made by conventional fossil fuel-based processes. In many cases, electric heating pathways could revolutionize product quality and production economics.

Workforce and education: Overcoming these technical challenges and implementing the relevant solutions underscores a critical need to train and recruit the future manufacturing and installation workforce. These workers will install, operate and maintain the next generation of electric heating technologies. They will also need to understand the power grid integration issues posed by significant increases in power demand and high levels of variable renewable generation. **The new workforce will therefore require interdisciplinary training,** wherein expertise in electrified heating technologies is supported by knowledge of power systems and manufacturing processes in industries of high economic and environmental impact. EPIXC is a unique ecosystem for transforming industrial heating through innovative research, complemented by transformative education and workforce development, or WFD. EPICX will be comprehensive, aiming to integrate research for doctoral and master's degree students and experiential learning opportunities for undergraduate and associate degree-seeking students and continuing education learners. The EPIXC approach will also engage underrepresented groups, including women and veterans, and provide a voice to disadvantaged communities seeking environmental justice.

Partnership: The EPIXC innovation ecosystem is inclusive and offers industry and other key stakeholder constituency members affordable opportunities to participate actively and derive commensurate benefits. **EPIXC offers industry partners a clear path to derisking electrified heating technology while reducing emissions.** The institute also offers industry members flexibility in energy usage, potential new product lines and a platform for training current and new employees. EPIXC provides unique test beds in chemical processing, iron and steel, paper and pulp, and cement to evaluate electric heating technologies at scale.

EPIXC membership is tiered at three levels: **Bronze at $15,000 per year, Silver at $50,000 per year and Gold at $200,000 per year.** All members can respond to request for proposal, or RFP, and workforce development opportunities issued by EPIXC. Silver and Gold tiers offer increased access to intellectual property and institute governance. Gold-level members have priority access to the institute's unique test beds for electrification technologies.

EPIX
ELECTRIFIED PROCESSES FOR INDUSTRY WITHOUT CARBON

ASU
Arizona State University