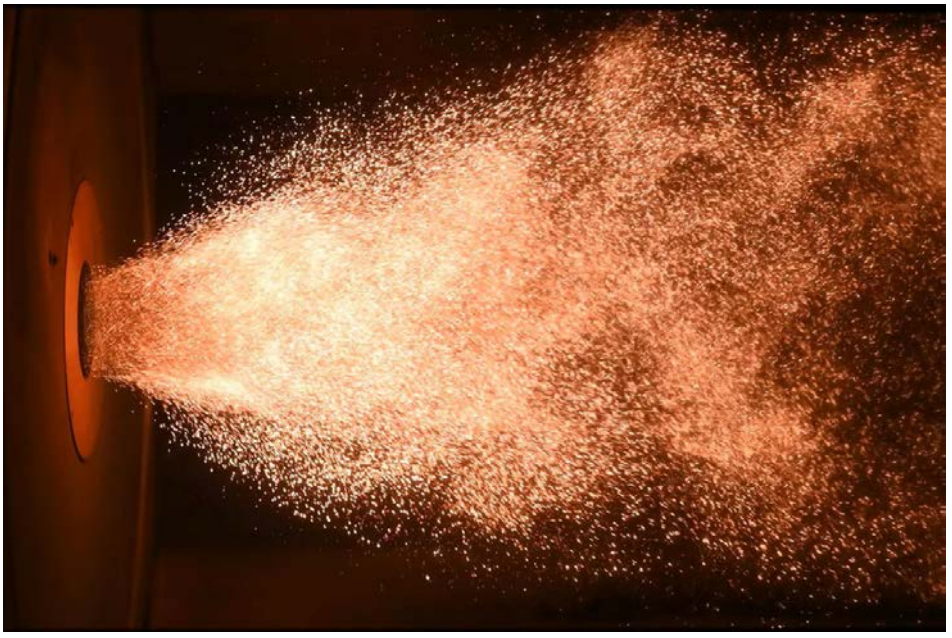
The Dawn of a New Iron Age: Turning Rust into Renewable Power



What if one of humanity's oldest materials could help solve one of its newest challenges? Researchers at the **Karlsruhe Institute of Technology (KIT)** are exploring a remarkable possibility: using iron powder as a chemical energy carrier to complement hydrogen in a climate-neutral energy system.

The concept is elegantly circular. Renewable electricity produces hydrogen, which removes oxygen from iron oxide and restores it to iron powder. The iron can then be transported, stored and burned to release energy, producing iron oxide once again. In this closed cycle, **carbon dioxide emissions can be avoided.**

Iron powder could behave much like coal during combustion, raising an exciting possibility: existing coal-fired power plants could potentially be converted to use iron. While modifications would be needed to the heat-generation system, turbines, generators, steam cycles and grid connections could potentially continue operating.

KIT researchers incorporated the iron cycle into an energy-system model looking toward 2050. Their findings suggest that iron will not replace hydrogen, batteries or other storage technologies—but could become a powerful partner, particularly for **long-duration energy storage and energy transport.**

Unlike hydrogen, iron powder is relatively easy to store and transport. It could carry renewable energy from regions rich in wind and sunshine to places where electricity production is constrained. Germany, with its extensive coal-power infrastructure and limited opportunities for hydropower and underground hydrogen storage, could have especially strong potential.

The economic question remains: how affordable will power-plant conversions be, and how efficiently can iron oxide be transformed back into iron?

Yet the vision is compelling. **Tomorrow's energy revolution may not discard the industrial infrastructure of yesterday—it may reinvent it.** Rust could become more than a symbol of decay; it could become a stepping stone toward a resilient, circular and carbon-neutral energy future.