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RTI International completes key operational milestone for DOE-funded warm syngas cleanup and carbon capture technology at Tampa Electric Company

TAMPA—Last Friday, the U.S. Department of Energy joined RTI International and Tampa Electric Company to recognize a key operational milestone for a large demonstration-scale application of RTI's warm synthesis gas (syngas) desulfurization process technology at Tampa Electric Company's coal gasification plant site in Polk County, Florida.

RTI's technology is a critical enabling technology in DOE's advanced gasification technology roadmap to produce cleaner energy from coal.



RTI's warm syngas cleanup demonstration plant site in Polk County, FL

The warm syngas desulfurization process demonstration unit has accumulated more than 1,000 total hours of operation on actual coal and petcoke-based syngas feed, achieving greater than 99.7-99.9 percent total sulfur removal (for both H₂S and COS) at temperatures as high as 600°C. When integrated with a downstream activated amine system for high-level carbon capture, total sulfur in the cleaned syngas has been reduced to sub-ppm levels, starting from levels exceeding 10,000 ppm, resulting in greater than 99.99 percent total sulfur removal.

RTI's platform of syngas cleanup technologies removes contaminants such as sulfur and heavy metals at warm process temperatures, reducing or eliminating the need for substantial syngas cooling and expensive heat recovery systems. This increases the thermal efficiency and reduces the capital and operating costs of new gasification-based systems when compared to conventional syngas cleanup technologies.

"Achieving this 1000-hour operations milestone is a critical step in demonstrating the successful scale-up of this first-of-a-kind technology," said Wayne Holden, Ph.D., president and CEO of RTI. "Our demonstration plant process performance has now replicated previous performance at lab, bench, and pilot scales, in line with our target expectations."

Key to the technology is a proprietary regenerable solid sorbent that can be used in a small-footprint dual transport reactor system with very low attrition loss.

In 2010, RTI was selected by the DOE to receive funding to scale-up its novel syngas cleanup technology coupled with more than 90 percent carbon capture at the Tampa Electric Company.

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The DOE has a long history of collaboration with RTI and also with Tampa Electric Company at the Polk Power Station.

Techno-economic studies indicate that the warm desulfurization process can integrate synergistically with many conventional and novel CO₂ removal technologies (e.g., chemical absorbents such as amines, physical absorbents such as chilled methanol or dimethyl ethers of polyethylene glycol, solid sorbents, and membranes).

The warm syngas desulfurization process, when integrated with this broad spectrum of CO₂ removal technologies, enables them to meet syngas purity requirements for ultra-clean power and chemicals/fuels applications, while reducing capital costs for syngas cleanup by as much as 40 percent compared to conventional standalone technologies, reducing overall syngas cleanup operating costs, and providing higher overall process efficiencies.

The demonstration facility uses about 20 percent of the total raw syngas from Tampa Electric Company's existing 250 megawatt Polk 1 coal/petcoke-fueled integrated gasification combined-cycle (IGCC) plant as its input feed stream. In addition to demonstrating the warm syngas desulfurization process, the demonstration facility also includes an RTI advanced design water-gas-shift reactor to enrich the hydrogen content of the cleaned syngas at lower cost and higher efficiency and a commercially-available activated amine process for capture of more than 90 percent of the carbon dioxide from the syngas stream. Following clean-up, the hydrogen-enriched syngas is re-introduced to the IGCC plant and combusted in its existing syngas turbine.

Mechanical construction of the demonstration facility was completed early last year ahead of target schedule and under target budget.

In addition to the successful 1,000+ hour operational milestone, the following additional accomplishments have been achieved at the demonstration facility:

- Sorbent capacity has been steady and the sorbent regenerates readily.
- Cleaned syngas and regenerator off-gas streams have been successfully integrated into and utilized in the existing TEC plant.
- The warm syngas desulfurization process system can operate at stable steady-state with minimal operator intervention.
- The warm syngas desulfurization process system has been successfully run at rates substantially below and above design.
- Total sulfur in syngas downstream of the integrated warm syngas desulfurization process and activated amine system has achieved sub-ppm levels, suitable for many chemicals, fertilizers and fuels applications.
- Slip-stream micro-reactors have been installed and will be utilized to test the cleaned syngas for suitability for the direct production of chemicals and fuels (e.g., methanol and Fischer-Tropsch).
- The project has accumulated approximately a half-million hours of total construction and operations labor without an OSHA-recordable or lost-time injury.

The current DOE-funded demonstration program is scheduled to be completed by late summer 2015. RTI is now seeking a suitable partner(s) to help drive global commercial deployment of the technology.



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