50-MW$_e$ Pre-Commercial Testing Completed at Tampa Electric Company for Coal-to-Chemicals Ready Syngas

RTI International has completed the large-scale pre-commercial testing of its warm gas desulfurization process (WDP) technology at Tampa Electric Company’s Polk 1 IGCC Power Station in Polk County, Florida. The technology performed as expected after >3,500 hours of total syngas operation, reducing total sulfur to sub-ppmv levels (as low as 100 ppbv) following WDP plus activated amine carbon capture.

RTI’s warm syngas cleanup technology platform removes contaminants such as sulfur and heavy metals at warm process temperatures (250-650 °C), eliminating the need for substantial gas cooling and expensive heat recovery systems. Technoeconomic analyses indicate that CAPEX and OPEX can be reduced by up to 50% versus conventional technologies and at higher overall efficiency.
The Technology

RTI’s syngas cleanup technology platform removes contaminants such as sulfur and heavy metals at warm process temperatures (i.e., 250-650 °C for WDP and > 250 °C for other trace contaminants), eliminating the need for substantial gas cooling and expensive heat recovery systems. This can increase the thermal efficiency and significantly reduce the capital and operating costs of syngas cleanup systems (by up to 50%) when compared to conventional process technologies.

In addition to demonstrating warm syngas desulfurization, the RTI pre-commercial facility also included a water-gas-shift (WGS) reactor to enrich the hydrogen content of the cleaned syngas and an advanced activated amine process for capture of > 90% of the carbon dioxide from the syngas stream. In combination, these process blocks produced a cleaned and conditioned syngas suitable for many coal-to-chemicals applications, such as fuels, hydrogen, ammonia, methanol, or substitute natural gas.

RTI’s WDP alone is capable of removing up to 99.9% of the total sulfur contaminants (both H₂S and COS) from raw syngas at typical gasifier pressures and warm process temperatures. When coupled with the downstream activated amine system used for carbon capture in the pre-commercial facility, total sulfur was reduced by as much as 99.999% to achieve sub-ppmv levels needed for conversion of syngas to chemicals and fuels.

The 50-MWₑ pre-commercial process performed as expected, duplicating performance at lab and pilot scales, and the project generated the data needed to mitigate final design and scale-up risks for a full commercial plant.

The performance and cost of RTI’s advanced syngas cleanup technology make it highly attractive in the global marketplace versus competing technologies. RTI is now in the process of contracting with preferred industrial partners to develop a full commercial offering of this technology by late 2016.

The Demonstration Project

RTI’s pre-commercial test facility used about 20 percent of the raw synthesis gas (syngas) from Tampa Electric’s existing 250 megawatt Polk 1 coal- and petcoke-fueled integrated gasification combined cycle (IGCC) plant as its input feed stream.

Following cleanup by the RTI WDP unit, sweet WGS, and > 90% carbon capture, the syngas was re-introduced downstream of the existing syngas cleanup block and combusted in the existing syngas turbine. The sulfur dioxide product from RTI’s WDP regeneration loop was fed to the existing Polk 1 sulfuric acid plant.

Mechanical construction of the precommercial testing facility was completed ahead of schedule and below the targeted budget. The unit performed as expected through >3,500 hrs of testing. The technology is now ready for demonstration and deployment at full commercial scale.

The overall project was managed by RTI. In addition to Tampa Electric, RTI’s technology partners in the project included BASF Corporation, Clariant Corporation, and Eastman Chemical Company. Primary funding for the project was provided by the U.S. Department of Energy. The engineering, procurement, and construction of the facility were contracted to Amec Foster Wheeler. CH2M Hill served as the owner’s engineer for RTI.