

The thermochemical process development unit at N.R.E.L.

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In 1996, a Thermochemical Process Development Unit (TCPDU) was commissioned as part of the Thermochemical Users Facility (TCUF) at the National Renewable Energy Laboratory. The TCPDU has both pyrolysis and gasification capabilities coupled to state-of-the-art analytical and process control and data acquisition systems. It can also be used for catalytic modification of pyrolysis vapors, raw syngas conditioning, and catalytic synthesis depending on research needs. The individual unit operations were installed to permit multiple equipment configurations. The ability to reconfigure the TCPDU permits operation over a wide range of conditions from pyrolysis through gasification and facilitates the evaluation of various processes and feedstocks for multiple users. A schematic of the typical process flow is shown in Figure 1.

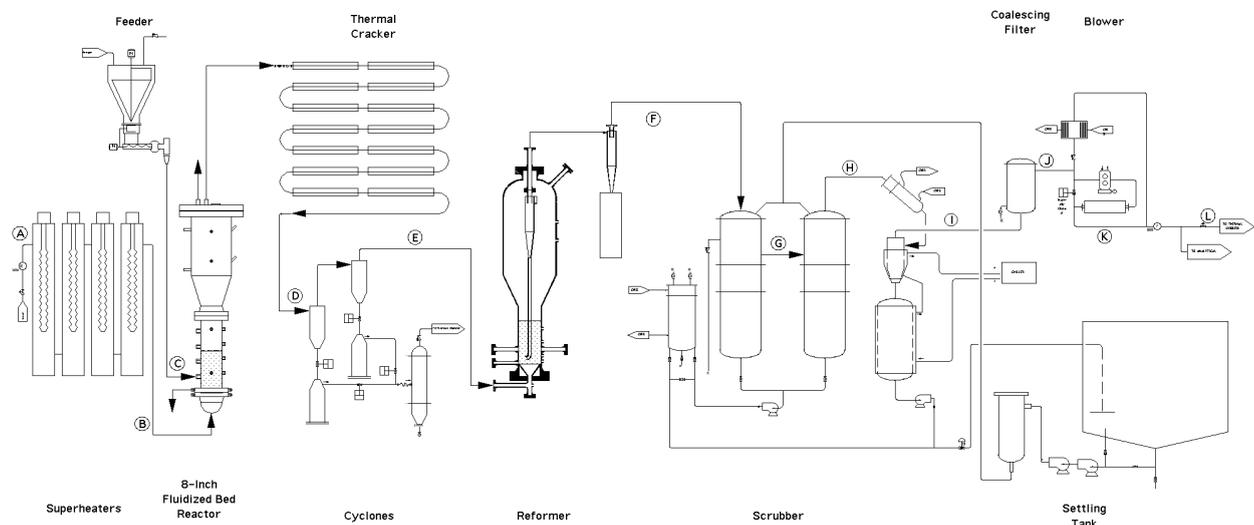


Figure 1. Process flow sheet for a typical TCPDU configuration.

The TCPDU has extensive instrumentation for Supervisory Control And Data Acquisition (SCADA). By continuously monitoring process streams at key locations, operators can assure that mass closure is obtained before and during analytical measurements. A wide range of analytical equipment has been integrated into the TCPDU to determine product composition after each unit operation. The SCADA and analytical equipment are interconnected to provide for data integration into a single database management system. An information flow diagram is shown in Figure 2.

Since its commissioning, the TCPDU has been operated in various configurations. The most common configuration has been as a gasifier emulator. Emulating other gasifiers requires the product gases to have similar compositions. The results from a test to compare TCPDU gas to gas made in the Battelle gasifier is shown in Figure 3. This paper presents the details of the TCPDU design and operation, descriptions of its extensive analytical capabilities, and experimental results.

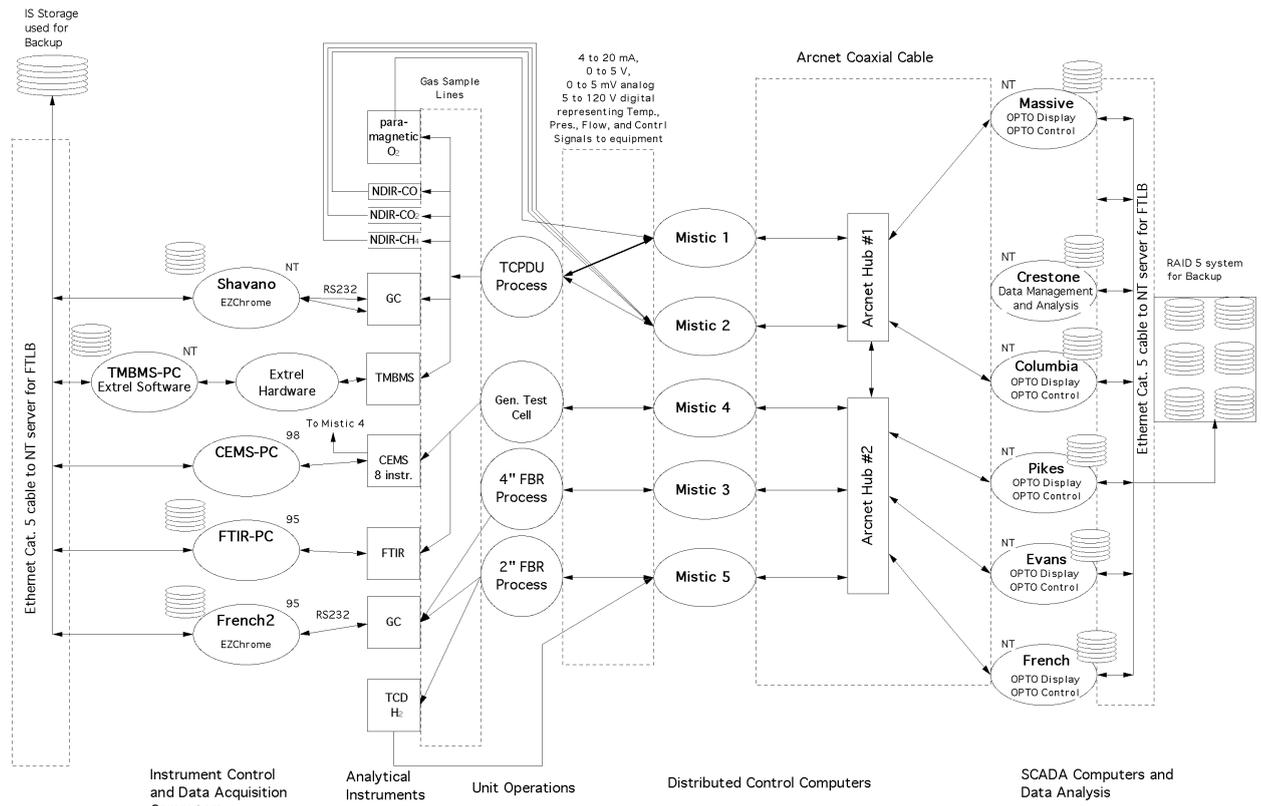


Figure 2. A schematic representation of information flow in the Thermochemical Users Facility.

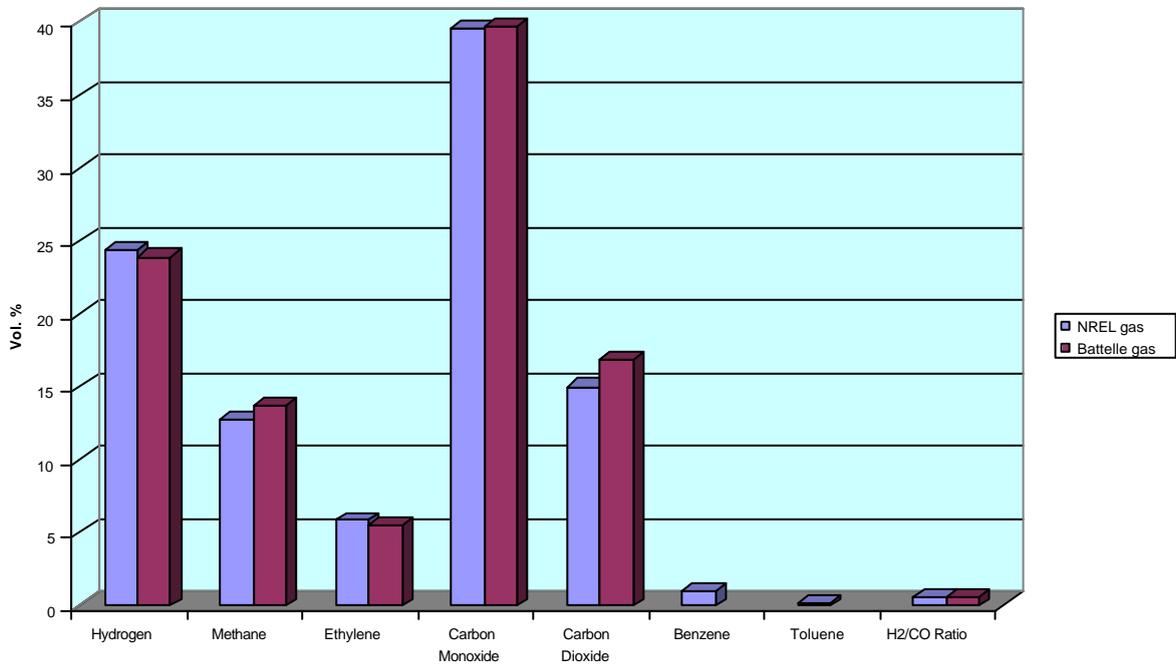


Figure 3. A comparison of TCPDU and Battelle gasifier pyrolysis gas with switchgrass feedstock.