# Pulverised coal injection at 500 psi - GTI Dry Solids Pump development and testing for gasification applications

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The gasification and clean coal industry has been seeking a solution for feeding carbonaceous materials into high gas pressure environments for many years. Existing feeding technology handicaps implementation of advanced combustion systems due to pressure levels below that desired by gasifier manufacturers, unreliable and inaccurate feed control, and the need for very large footprints and structure heights for stacked lock hoppers, the only feed solution. These attributes contribute to high capital cost, high operating cost and a proven low level of feed reliability. Additionally, existing feed systems are unable to handle a wide range of coal types, particularly low rank coals such as sub-bituminous and lignite. For gasification systems to achieve their potential, highly controlled and accurate feeding along with feedstock flexibility is critical to reduce cost of operation and make them competitive with traditional power plants.

This requirement for a high-pressure feed solution has in major goal of the US Department of Energy National Energy Technology Laboratory (NETL). The project, initiated by Pratt and Whitney Rocketdyne (PWR), has been acquired by the Gas Technology Institute (GTI), who is finishing the development program. A full-scale Dry Solids Pump (DSP) was designed by PWR. This direct-to-commercial scale approach was intended to reduce development time to market for the DSP system. The full-scale DSP was manufactured and installed in a test stand at the Energy & Environmental Research Center (EERC) in Grand Forks, North Dakota.

Following DSP commissioning, a test program was undertaken to verify the pump's ability to inject pulverized coal into high gas pressure. A challenge to this development approach arise from the time to dismantle, cost to modify, and time and cost to reassemble the commercial-scale pump to support iterative changes required for development. To address this challenge, a program was instituted whereby a subscale version of the DSP was built to allow rapid and lower cost optimization of the internal mechanisms of the machine. As part of this subscale program, the DSP was tested using a range of coals from anthracite through bituminous to sub-bituminous, lignite and coal-biomass blends. Testing of the subscale DSP confirmed its ability to handle these coals and coal-biomass blends and allow injection into a high-pressure environment (150 psi for the

subscale DSP). The design data generated by the subscale test program was then incorporated into a modification of the original full-scale DSP which was commissioned early in 2018. Following commissioning the DSP has been tested at a range of pressures up to 500 psi, the hardware's design pressure limit.

This paper will present the results of the successful full-scale pump development and test program along with future steps and the anticipated commercial DSP configuration design.