PROJECT SUMMARY/ABSTRACT

Name of Applicant: RTI International

Project Director/Principal Investigator(s): Brian Turk

Project Title: AOI 3 – Benefits of Integrating PWR and RTI Advanced Gasification Technologies for Hydrogen-Rich Syngas Production

The fundamental challenge for gasification for power and coal-to-liquid production is to achieve production costs for syngas that ensure the overall conversion process is cost-competitive with other conversion technologies and alternative feedstocks such as natural gas. Previous studies by DOE and others have indicated that this challenge cannot be addressed by improving only one step in the overall gasification process. The overall objective of this proposed project is to assess the potential to achieve a substantial reduction in the production cost of H_2-rich syngas via gasification with near-zero emissions due to the cumulative and synergistic improvements realized when multiple advanced technologies are incorporated into the overall conversion process. The advanced technologies to be assessed include several of the most advanced and potentially cost-disruptive technologies under current development: the compact gasification system (CGE) and dry solids pump (DSP) being developed by Pratt & Whitney Rocketdyne (PWR), warm syngas cleanup technologies and a novel reactor design for H_2 enrichment being developed by RTI International, and a commercially available activated amine process offering substantial benefits for carbon dioxide capture but never before applied to syngas applications due to constraints that are eliminated when integrated with RTI's technology.

Through previous individual techno-economic studies, PWR's advanced gasification technology with dry feed and RTI's warm syngas cleanup technologies have shown the potential to enable substantial reductions in cost and significant improvements in efficiency to the overall gasification process for power generation. These benefits have now been substantiated through extensive pilot plant or near-commercial demonstration testing. The estimated cumulative effects of simply combining these technologies' individual benefits indicate that production costs may be reduced 20-25%, capital costs may be reduced 33-38%, and efficiencies may be increased by as much as 7-8%. Although full techno-economic analyses are not currently available for both technologies for coal-to-liquid production systems, similar cumulative benefits are expected. Beyond these cumulative additive benefits, additional synergistic benefits are likely to be realized from combining the proposed technologies. Such synergistic benefits would most likely result from reductions in raw material usage (i.e., reduced production costs) and equipment size (i.e., reduced capital costs) due to reduced throughputs achieved from overall efficiency improvements associated with integration of the technologies.

The proposed project would engage key technical experts from PWR and RTI, utilize the best available data on costs and performance from recent pilot plant and near-commercial demonstrations of each technology, and engage Nexant to complete preliminary conceptual designs and techno-economic analyses to assess the overall cumulative and synergistic cost, efficiency, and environmental performance benefits achievable from integration of these advanced technologies for ultra-clean power generation and coal-to-liquids production with carbon capture. In addition, the proposed project would include experimental work to evaluate the technical feasibility of an advanced hydrogen enrichment process that could provide additional efficiency and cost benefits. The integration of these advanced technologies has the potential to represent a disruptive technology change that could fundamentally redefine the market and be cost-competitive with natural gas while reducing emissions to near-zero. If this goal is reached, the future for coal could be as promising as the future for shale gas for both power and chemical/fuel applications and our domestic energy security would be greatly enhanced.