Wave Liquefaction™ Product Recovery System

Overview
Wave Liquefaction™ processing is a novel coal to liquids technology, which utilizes electromagnetic waves to break down a coal and natural gas mixture to oil product. H Quest will be building an engineering-scale system that will be capable of 1-2 barrels per day of oil production. This process provides various benefits over traditional coal-to-liquid operations such as greatly reduced reactor pressures and bulk temperatures as well as higher product yields.

Objectives
The team was asked to provide conceptual suggestions for designs of a product recovery system that would address challenges such as aerosol formation (1), oil trapped and/or condensed on char (2), high molecular weight and aromatic species in tar/liquid product and asphaltene (3), and pre-asphaltene content (4) has to be addressed in designing a proper product recovery system.

Approach
- Contact with sponsor representatives regarding system design deliverables and specifications.
- Substantial research of processes and potential system design.
- Preliminary concept generation for system components.
- Revision of patented components and processes.
- Down-selection of system components to satisfy consumer needs.
- Process Flow Diagrams were generated and updated throughout the project design.
- Theoretical yields of product separators were produced using Aspen HYSYS.
- Material stream balances for the system were generated and analysed.
- An overall system efficiency was determined.
- Results and outcomes of the system design were discussed in detail with sponsor representatives.

Outcomes
- The designed system utilizes the following processes:
  - Hot initial solid-vapor separation.
  - Secondary condensation of hydrocarbon vapors to clean the outgoing gas stream.
  - Mixture of the solids and liquids before entering a residue recovery unit.
  - Elimination of solids, asphaltenes, and pre-asphaltenes from the oil products.
  - Fractionation of oil into multiple product streams.
- The result of our design is a two-stage separation system tailed off with a supercritical solvent extraction process.
- Both separators operate at a high efficiency when removing liquids and solids from a gas stream.
- The gases exiting the system need to be scrubbed to meet EPA standards and require a system to be completed by another design project.