Objectives

• Conduct a long (2500 hour) run on live coal derived syngas from Eastman Chemical Company’s commercial gasification facility in Kingsport, TN
• Measure levels and type of contaminants
• Measure steady state deactivation rate of Syntroleum cobalt FT catalyst
• Regenerate FT catalyst and measure initial rate
Coal to Liquids Process Scheme

Gasification Process

- **Gasifier**
- **Quench**
- **Shift Conversion**
- **Clean Up**
- **Guard Beds**

Fischer-Tropsch Process

- **Synthesis Gas (SynGas)**
- **PSA**
- **Refining**

**Inputs:**
- **COAL**
- **H₂O**
- **O₂**

**Outputs/Products:**
- **Tail Gas**
- **Diesel**
- **Naphtha**
- **LPG**

**Important Ratios:**
- **2.1:1 H₂/CO Ratio**
Syntroleum Experience

- Syntroleum has experience operating lab, pilot and demonstration scale FT reactors
- Syntroleum has demonstrated commercially scalable slurry cobalt FT catalyst
- Syntroleum has cobalt FT catalyst activity maintenance experience
- Syntroleum has a novel patented slurry FT Catalyst Regeneration Process
Catalyst Testing Unit
Reactors, Guard Beds and Controls
Laboratory Trace Contaminant Study

Results from Laboratory Gas Contaminant Study

- Operation with no contaminant in feed gas
- Operation with 10X contaminant concentration in feed gas
- Operation with X contaminant concentration in feed gas
- Operation with 100X contaminant concentration in feed gas
Bench Scale CSTR Data

Reactor/Catalyst Performance During Eastman Study

Green curve shows reactor/catalyst performance using reference syngas.

Red curve shows reactor/catalyst performance using live syngas.
CSTR Data and Syntroleum Pilot Plant Data

Comparison of Syntroleum Pilot Plant Reactor/Catalyst Performance to Eastman Study Data

Blue curve shows reactor/catalyst performance from Syntroleum Pilot Plant
Syntroleum FT Catalyst before and after Regeneration

Comparison of Initial Activity of Fresh and Regenerated Catalyst from Eastman Study

Orange and blue curves show lab regeneration of catalysts from Eastman syngas and Eastman reference gas runs respectively.

Red and green curves show initial runs on Eastman syngas and reference syngas respectively.
Summary

• Syntroleum and Eastman combined their experience and facilities to demonstrate a cobalt FT catalyst operation on coal derived syngas

• A 2500 hour run demonstrated excellent catalyst stability with no sign of attrition

• After 2500 hours of operation the catalyst was regenerated with Syntroleum’s patented process and demonstrated complete recovery