

CHATTANOOGA PROCESS™

# synthetic crude oil

*changing the technology*

27th Oil Shale Symposium

Colorado School of Mines, Golden CO

October 15, 2007

## Chattanooga Process Features

- **Fluid Bed Reactor**
- **Hydrogen Environment**
- **No combustion in Reactor (no emissions)**
- **Proven sub-processes**
- **Continuous Operation**
- **Multiple Feed stocks: Shale, Sands, Heavy Oil**



## Fluid Bed Reactor

- **Temperature less than 1000°F / 537°C**
- **600 psig operating pressure**
- **Low velocity through reactor zone**

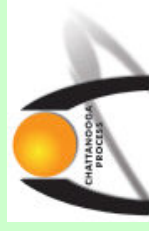
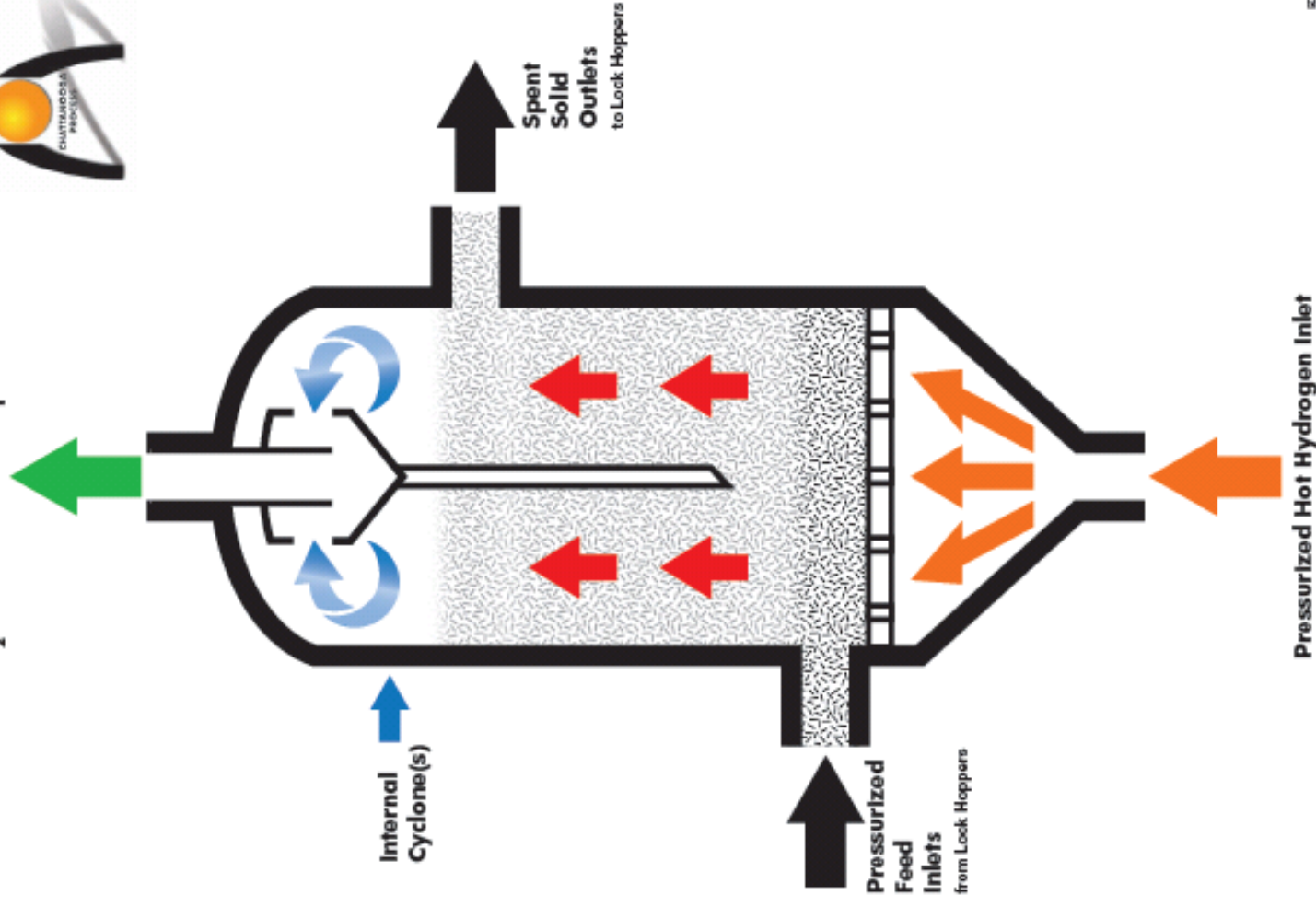


## Hydrogen because ...

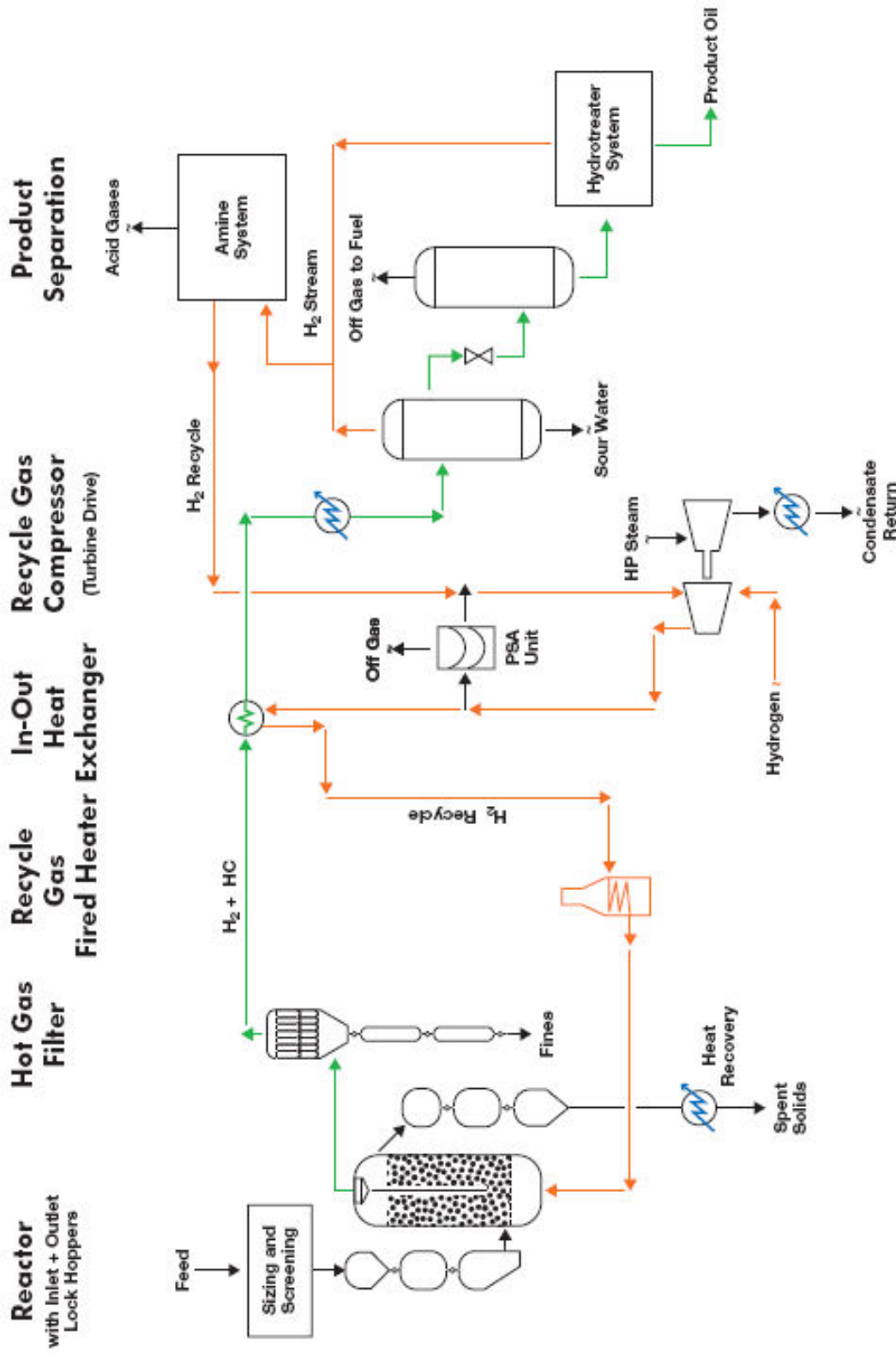
- Fluidizing medium
- Reactant
- Heat transfer
  - High heat capacity
  - High conductivity
  - Low viscosity



# Chattanooga's Pressurized Fluid Bed Reactor



# The Chattanooga Process



## Patents

- **Five Issued**
  - **Four United States**
  - **One Canadian**
- **Wholly Owned by CC**
- **Additional Patents Pending**



## Why Chattanooga Process for Oil Shale ?

- **“For all oil shales, major yield increases can be obtained only by adding more hydrogen to the organics.**
- **Fluid bed reacting gives oil yields of 125% to 200% higher than standard Fischer-Assay.**
- **Optimal temperature for process: under 1000°F”**

The above are the conclusions of Dr. Burt Davis, Center for Applied Energy Research, U of Kentucky



## **Environmental Benefits over Other Shale Processes**

- **Negligible Water Required**
- **No process Waste Water Discharge**
- **No SO<sub>2</sub>, NO<sub>x</sub> or CO<sub>2</sub> Produced in Reactor**
- **Low Emissions**
- **Immediate Reclamation of Mined Area**



## **Why Chattanooga Process for Oil Sands ?**

- **50% reduction in CO<sub>2</sub> emissions**
- **Elimination of process generated S<sub>02</sub>, NO<sub>x</sub>, NH<sub>3</sub>**
- **Lower capital and operating costs**
- **Complete elimination of tailing ponds and ground water contamination**



## Chattanooga Process Economic Advantages

- **High Product Quality** (Reactor outlet)
  - 28° – 30° API from Oil Sands
  - 20° - 25° API from Oil Shales
  - 50% reduction of sulfur content
- **Lower capital and production costs per bbl**
- **Reduced energy requirements**
- **Smaller capacity facilities are feasible**
- **Self generates fuel and hydrogen plant make up**

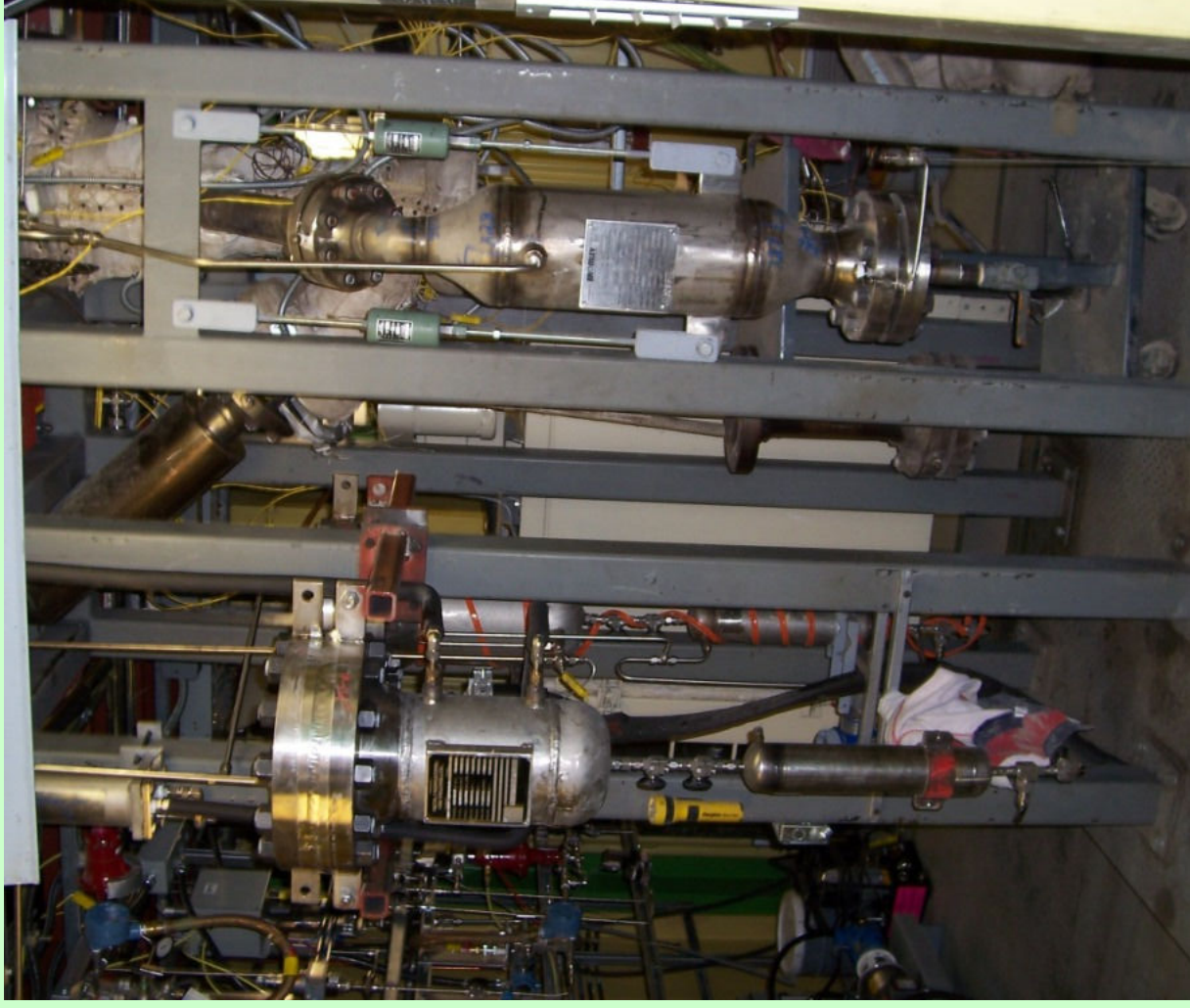
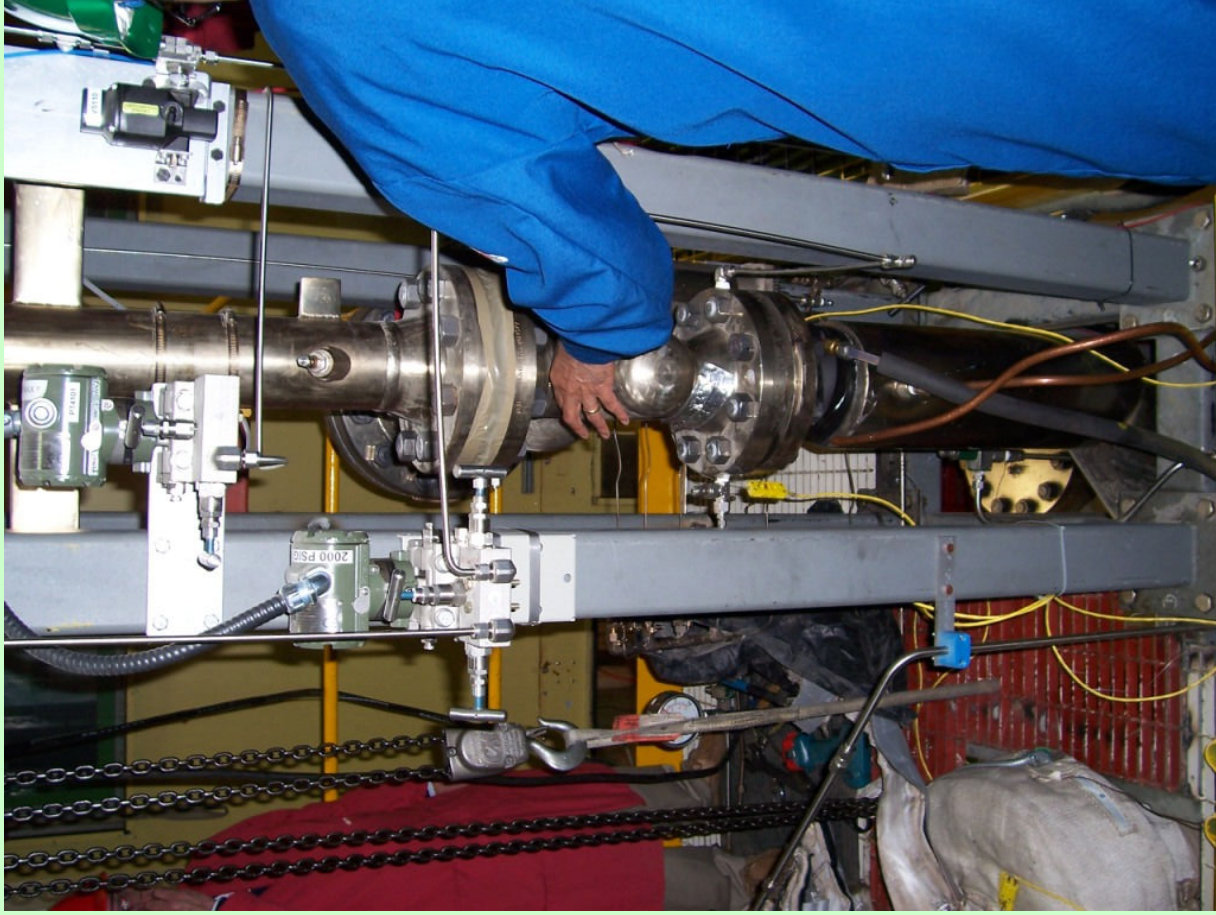


## **Chattanooga Process Pilot Plants**

- **National Center for Upgrading Technology**
- **Located in Alberta**
- **Pilot Plant I commissioned in 2000**
- **Pilot Plant II commissioned in 2004**



# Chattanooga Process Pilot Plant II



## Results of Tests Conducted at NCUT

### **PILOT PLANT I:**

- **Proved reaction kinetics for bitumen**
- **Produced 32<sup>o</sup> – 36<sup>o</sup> API oil**

### **PILOT PLANT II:**

- **Achieved fluidization**
- **Extracted ~100% of kerogen contained in oil shale**



## Results of Tests Conducted at NCUT

### PILOT PLANT II:

<u>Resource</u>	<u>Yield</u>
Colorado Oil Shale	51.5 gal./US ton *
Kentucky Oil Shale #1	15.4 gal./US ton **
Kentucky Oil Shale #2	12.6 gal./US ton ***

\* Fischer Assay - 28.4 g/t

\*\* Fischer Assay - 7.7 g/t

\*\*\* Fischer Assay - 6.3 g/t



# The company: **Chattanooga Corp**

## *The direct Team:*

M.J. Karpenski, President/CEO,

**31 yrs Div. P/CEO Foster-Wheeler**

J.A. Doyle, Chairman,

**37 yrs EVP, WR Grace Corp**

C.G. Kirkbride, Director

**son of original Patent author**

L.J. McEvoy, Director, VP

**34 yrs EVP F-W Corp**

F. Hildebrandt, Director, SVP

**35 yrs Federated Chem., Ltd.**

A.M. Howarth, Director, VP

**20 yrs operations & Bell Labs**

W.E. Poist, Director, VP

**32 yrs CPA & Mgmt Cons.**

G.J. Porges, Counsel

**32 yrs Mng Partner, PHKP**

## *Extended Team:*

P.J. Davies, retired, Chief Mining Eng.,

**Bechtel Corp.**

Dr. T. Knowlton, Technical Dir.,

**Particulate Solids Research Inc.**

Dr. R. Thais, Chrmn, Christian Bro. U.

**Chem. E Dept Head**

Dr. B Davis, Professor, U. Kentucky

**Center for Applied Energy Research**

*The Portfolio:* **4 US and 1 CA Patents, 3 US and 3 CA Applications**

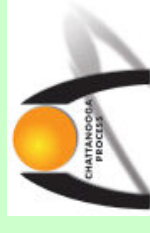
*Patent Counsel:* **Morgan & Finnegan**

*Key Partners:* **Alberta Research Council / National Center for Upgrading Technologies (NCUT) , PSRI, CAER / UK, DOE**



## Chattanooga Process Summary

- **Proven Technology**
- **Ready to move to Demonstration Plant**
- **Multiple Feed stocks**
- **Patent Protection**
- **Sound Economics**
- **Higher Yield = Higher Profitability**
- **Superior Product Quality**
- **Upfront Hydrogen Use = Greater Cycle Efficiency**
- **Minimal Reclamation Cost**
- **Environmentally Beneficial**
- **Minimal Emissions**
- **Minimal Water Requirements and Impacts**
- **Shorter Permitting Cycle**



## **Chattanooga Corp**

**Martin J. Karpenski, CEO/President**

**Thank you.**

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