



G L O B A L F O R U M

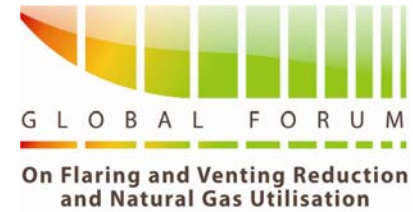
On Flaring and Venting Reduction  
and Natural Gas Utilisation

# Synfuels International, Inc. Upstream GTL Solutions for Flaring



Edward Peterson, PhD, P.E.,  
*Chief Engineer*

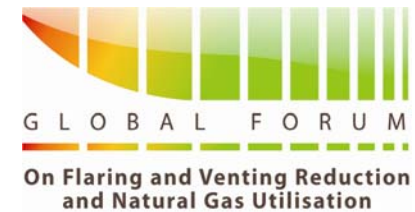
# Why Synfuels pursued an economical GTL & GTE process



- **Government restrictions on flaring**
- **Global Environmental concerns**
- **Increasing demand for 'transportable' liquid fuel in emerging economies**
- **Laws favouring cleaner fuels**
- **Need for greater utilization of resources**
- **Rising energy prices**

# Fischer-Tropsch (F-T)

## *Limitations*



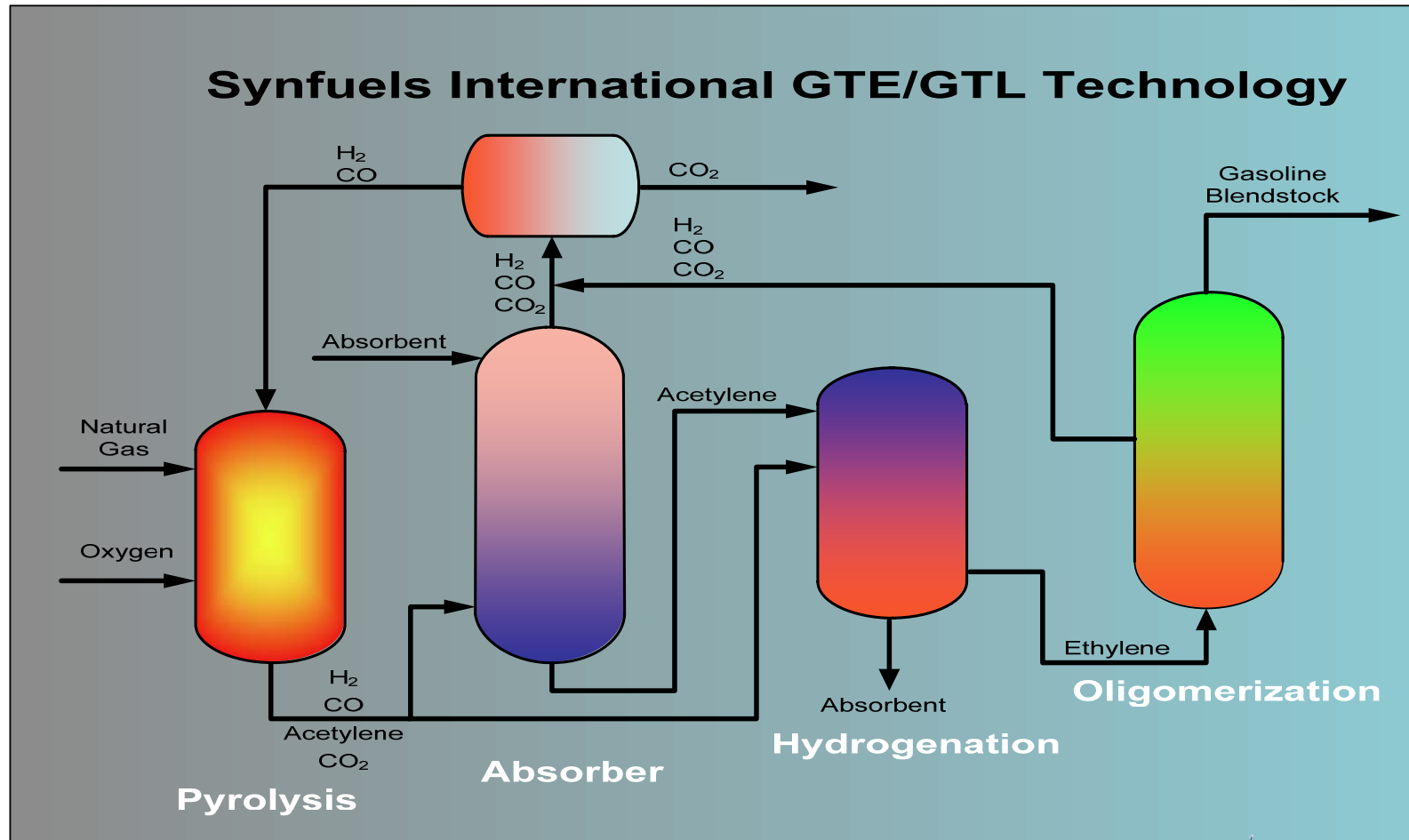
- F-T needs huge plants to create the necessary economies of scale
- F-T's minimum economic size is about 300 MMSCFD
- Primary F-T product has wide molecular weight distribution – lots of waxes and light ends
- Of 15,000+ gas fields outside North America's pipeline network, less than 200 can support mega-scale F-T plants

***“Smaller fields need smaller plants that require much less capital than Fischer-Tropsch demands.”***

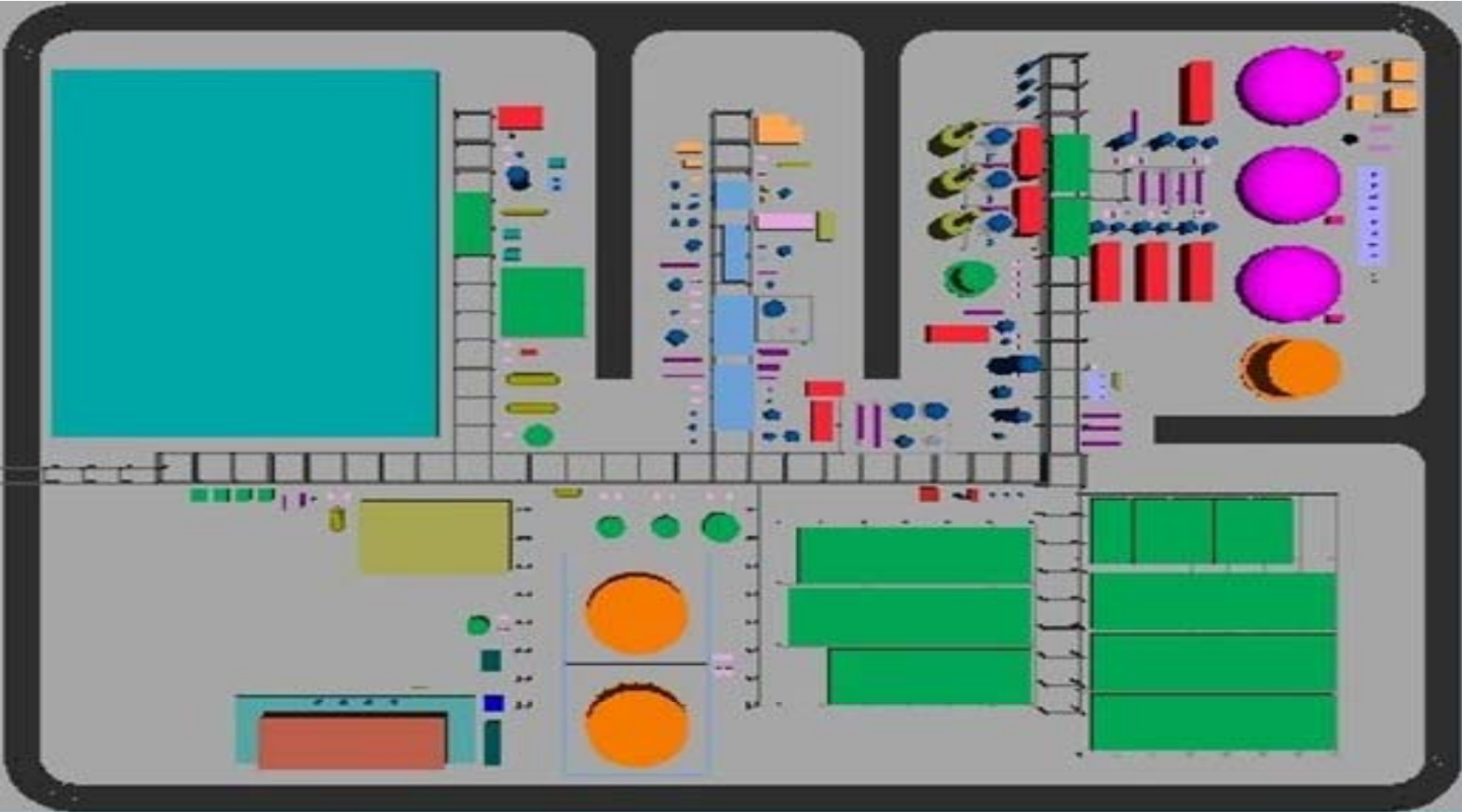
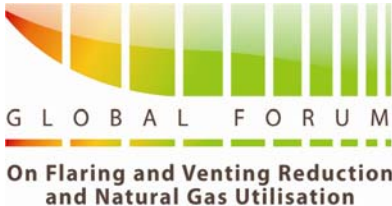
# NEW



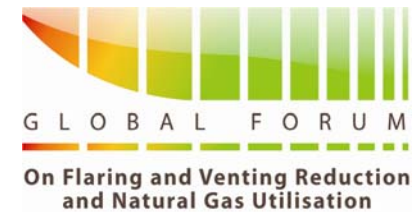
- Innovative new approach – Not a F-T modification
- Lower operating pressure than F-T. Therefore, lower cost and easier fabrication
- Near 0% recycled gas. This reduces operating costs
- Demonstrated effective down to 30 MSCFD
- Most economical between 10 and 250 MMSCFD



# 50 MMSCFD Plant Design



# Clean Gasoline from Methane



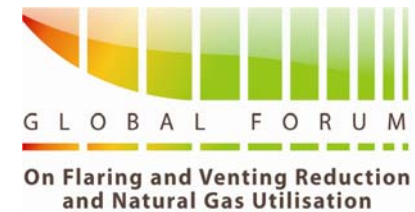
## Synfuels GTL Product Properties

|                            |                         |
|----------------------------|-------------------------|
| <b>Specific Gravity</b>    | <b>0.7599 (Water=1)</b> |
| <b>°API Gravity</b>        | <b>54.71 @ 60°F</b>     |
| <b>Molecular Weight</b>    | <b>100.422</b>          |
| <b>Weight</b>              | <b>6.33 Lbs/Gal</b>     |
| <b>Gross Heating Value</b> | <b>124190 BTU/CF</b>    |

## Synfuels GTL Product Composition

|                      | <b>vol%</b> |
|----------------------|-------------|
| <b>Paraffins</b>     | <b>12</b>   |
| <b>Iso-paraffins</b> | <b>35.9</b> |
| <b>Olefins</b>       | <b>1</b>    |
| <b>Naphthenes</b>    | <b>9.8</b>  |
| <b>Aromatics</b>     | <b>38.5</b> |

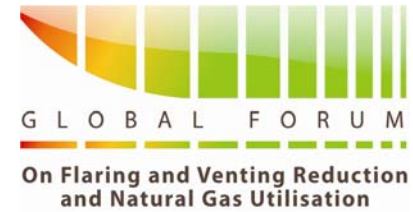
# Gas-Phase Hydrogenation Problems



- Must limit acetylene concentration for reaction and temperature control
- High temperature can lead to a “run-away” reaction
- Requires processing large volumes of diluents rich gas
- Tends toward over-conversion to ethane



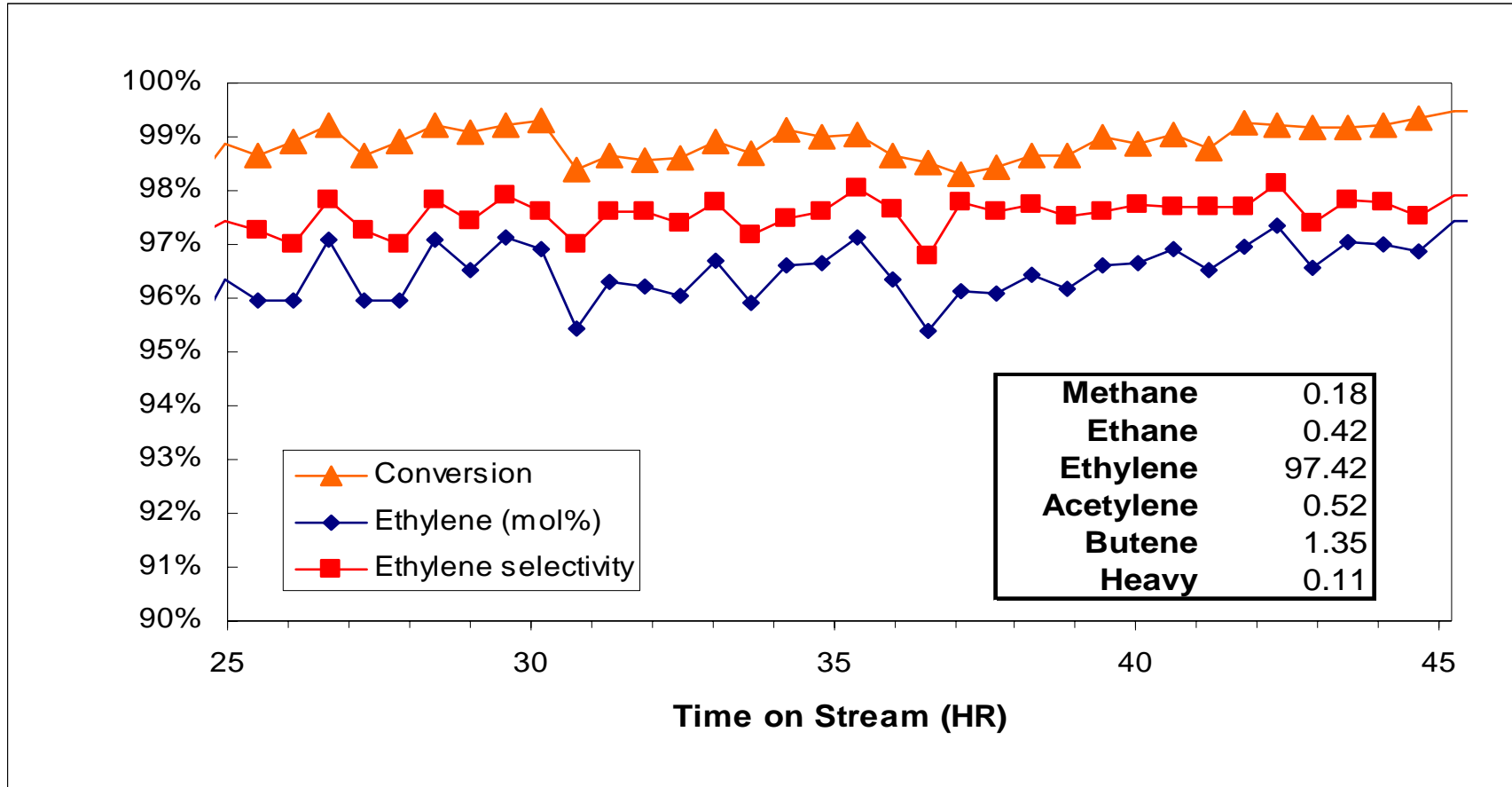
# Synfuels Uses Liquid-Phase Hydrogenation of Acetylene



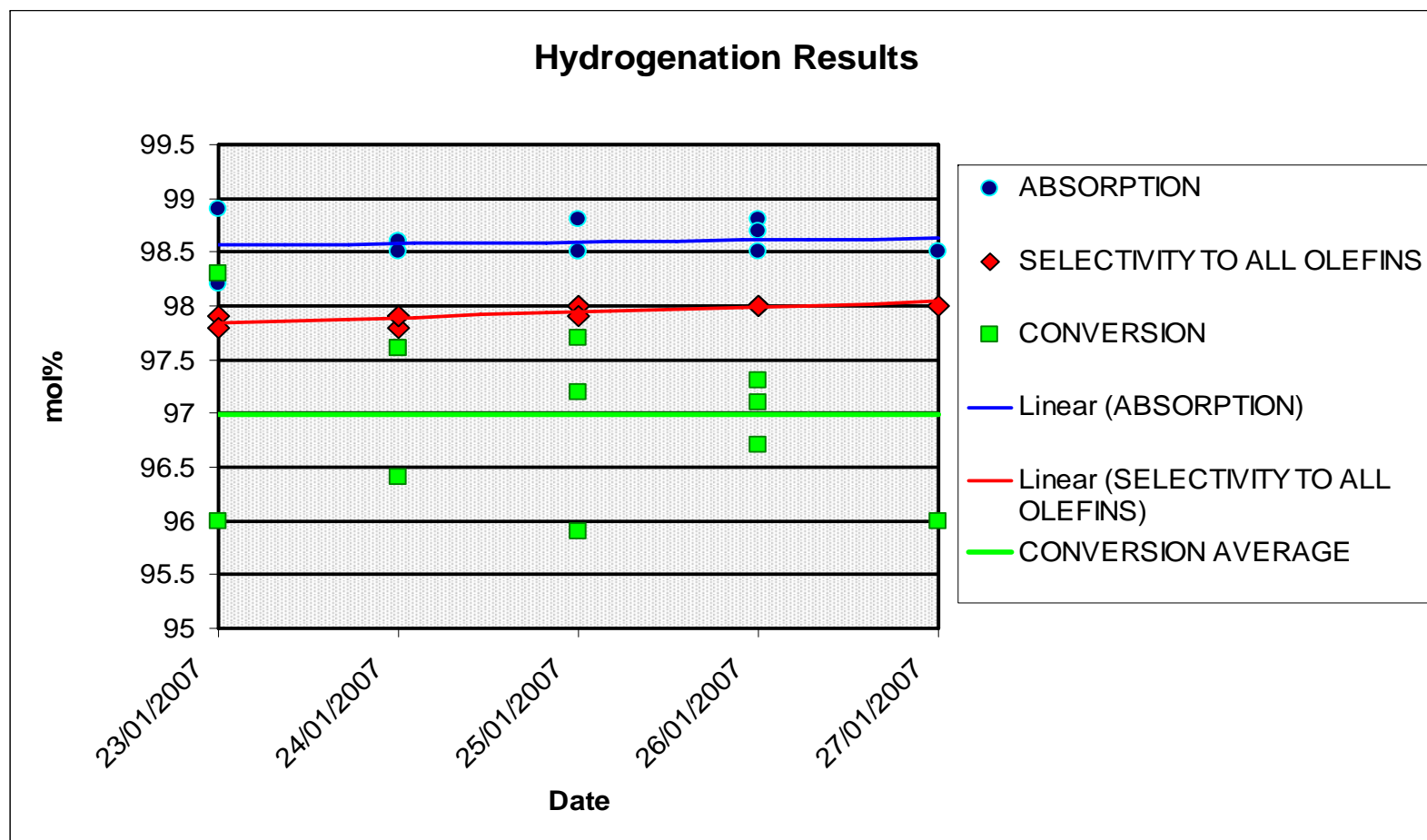
- Selectively absorbs acetylene
- Rejects unwanted gases
- Greatly reduces volume of processed gas
- Operates at moderate conditions
- No thermal “run-away” reaction
- Much higher acetylene concentrations can be used

# Extended Duration Conversion and Selectivity

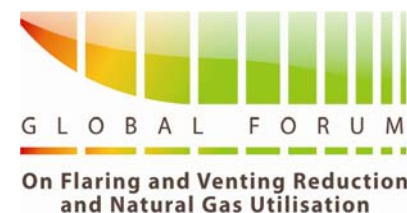
Lab Data



# Plant Results



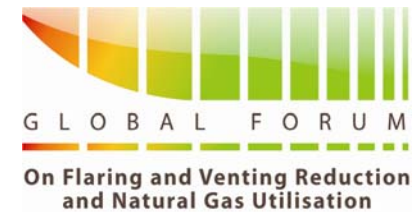
# Intellectual Property



Synfuels Technology is covered by 10 US Patents and dozens of patents pending:

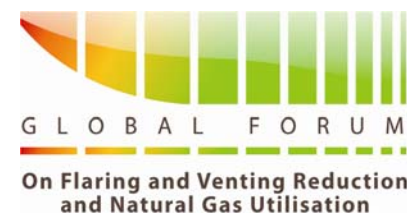
|   |                         |
|---|-------------------------|
| <u>Method for Converting Natural Gas to Liquid Hydrocarbons</u>                                     | Patent Number:6,130,260 |
| <u>Method for Converting Natural Gas to Liquid Hydrocarbons</u>                                     | Patent Number:6,323,247 |
| <u>Method for Converting Methane-Containing Gaseous Hydrocarbon Mixtures to Liquid Hydrocarbons</u> | Patent Number:6,433,235 |
| <u>Method for Converting Natural Gas to Liquid Hydrocarbons</u>                                     | Patent Number:6,602,920 |
| <u>Process for Liquid Phase Hydrogenation</u>   | Patent Number:7,045,670 |
| <u>Method for Converting Natural Gas to Olefins</u>   | Patent Number:7,119,240 |
| <u>Process for Conversion of Natural Gas to Hydrocarbon Liquids</u>                                 | Patent Number:7,183,451 |
| <u>Process for Conversion of Natural Gas to Ethylene</u>  | Patent Number:7,208,647 |
| <u>High Temperature Hydrocarbon Cracking</u>  | Patent Number:7,250,449 |
| <u>Process for Liquid Phase Hydrogenation</u>   | Patent Number:7,408,091 |

# Summary



- A unique, patented natural gas to gasoline or ethylene process
- Established, fully scalable, industrially proven design
- Synfuels liquid-phase hydrogenation is the technology's cornerstone
- Breakthrough technology reduces recycle, compression and system volumes resulting in low capital and operating cost and High IRR
- **Flaring problems eliminated with Synfuels Gas-to-Gasoline plants erected up-stream, on-site**

# Synfuels Top Team



## **Synfuels International, Inc.**

Mr. Ben Weber, CEO

Mr. Thomas Rolfe, President

Mr. Charles Matar, Managing Director, MENA

Dr. Ed Peterson, Chief Engineer

## **Bryan Research and Engineering**

Prof. Jerry Bullin, President

Dr. Joel Cantrell, Development Engineer

## **Texas A&M University**

Prof. Kenneth Hall, former Head of Chemical Engineering