CO_2

Summary of a published paper on the net carbon dioxide balance for the Fischer-Tropsch process compared with conventional processes

1. Gray, David, and Glen Tomlinson, "CO_2 Emissions from Fischer-Tropsch Fuels," Mitretek Systems, Fuels, Lubricants, Engines and Emissions Meeting, Arizona, 1999.

   Carbon emissions, when compared to gasoline from crude, diesel from crude and Fischer-Tropsch from coal/gas are determined to be 45% less than gasoline from crude as the standard. This reduction per mile includes production, combustion and relative efficiency. Overall, the study demonstrates the lower carbon emissions from Fischer-Tropsch technology.

CO_2 Emissions from Fischer-Tropsch Fuels

David Gray and Glen Tomlinson

Mitretek Systems

Paper presented at the Fuels, Lubricants, Engines and Emissions Meeting Sponsored by EFI and DOE

Tucson, Arizona, January 18-20, 1999

Methodology

- Define envelope
- Define feedstock characteristics
  - Crude oil
  - Natural gas
  - Coal
- Define (substantiate) process conversion efficiencies
- Calculate carbon emissions for specified quantity of usable end-use energy supplied

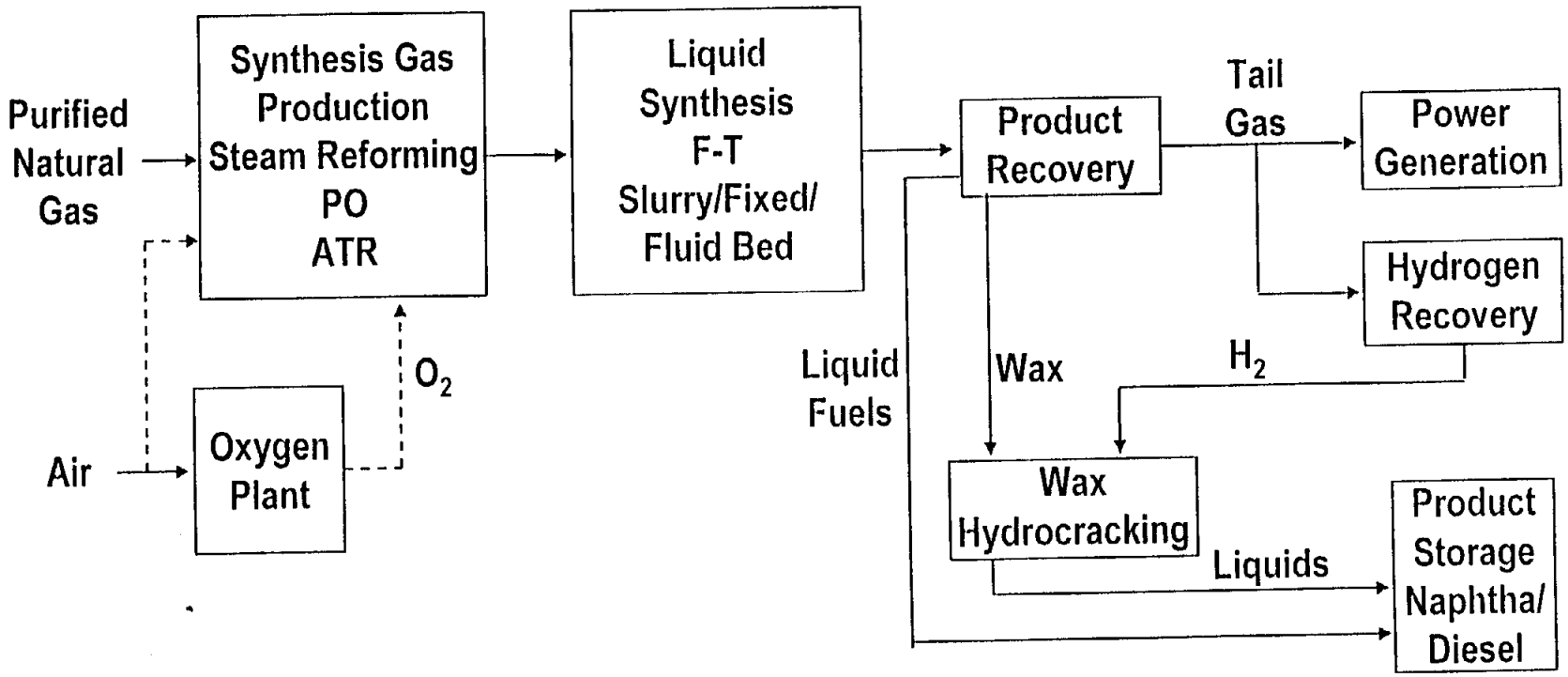
Feedstock Characteristics

Petroleum:	28° API gravity 311 lbs/barrel 5.7 MM Btu/barrel 0.86 Carbon
Natural Gas:	100% CH_4 23,875 Btu/lb (HHV) 0.75 Carbon
Coal:	0.70 Carbon 24 MM Btu/ton

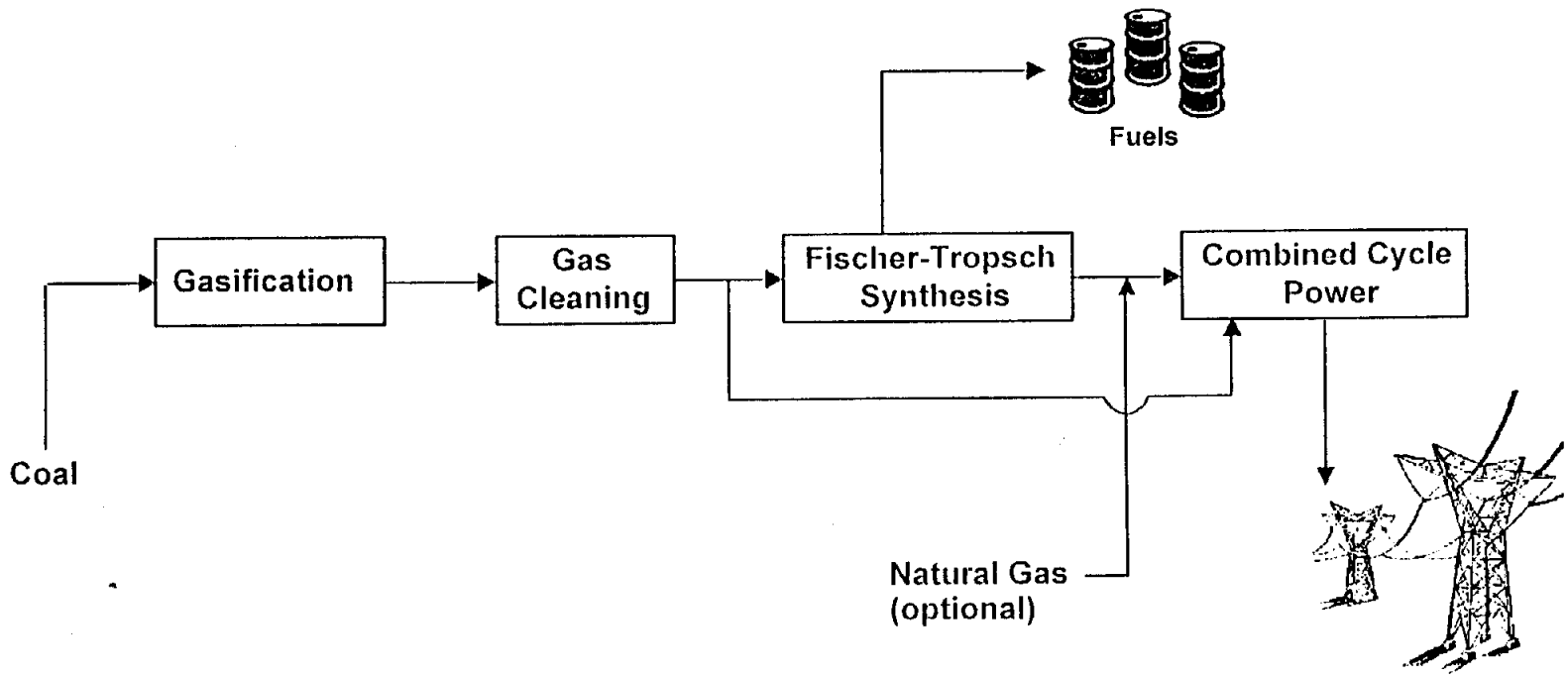
Conversion Processes Considered

- Crude petroleum refining to finished transportation fuels
- Conversion of natural gas to Fischer-Tropsch fuels (GTL)
- Coproduction of F-T fuels and power from coal (and natural gas)

Conversion of Natural Gas to Fischer-Tropsch Fuels (GTL)



Coproduction of F-T Fuels as Power from Coal (and Natural Gas)



Coal-Based Energy Conversion Systems

Conventional Coal-Fired Power Plant

Coal
4,052 TPD(dry)
2,877 TPD Carbon
99.3 MMM Btu

→ Pulverized Coal Combustion → Steam Turbines → 400 MW, 32.76 MMM Btu (33% HHV)

2,877 TPD Carbon ≡ 400 MW Power

IGCC Power

Coal
3,200 TPD (dry)
2,272 TPD (Carbon)
78.4 MMM Btu

→ Gasification → Combined Cycle Block → 400 MW, 32.8 MMM Btu (42% HHV)

2,272 TPD Carbon ≡ 400 MW Power

Coal to Fuels (F-T)

Coal
2,241 TPD
1,591 (TPDC)
54.9 MMM Btu

→ Gasification → F-T Synthesis → 6,083 BPD, 31.9 MMM Btu (58% HHV)

Net C per Quad = 49.8 MM Tons

All-Coal Coproduction Case

Coal
5,014 TPD (dry)
3,561 TPD Carbon
122.8 MMM Btu

→ Gasification → F-T Synthesis → Combined Cycle Block → 400 MW, 32.8 MMM Btu (52% HHV)

F-T Synthesis → 6,083 BPD, 31.9 MMM Btu

3,561 TPD Carbon ≡ 6,083 BPSD Liquid + 400 MW Power
Net C/Quad = 40.4 MM Tons

Separate Production vs. Coproduction of F-T Liquids and Power

Separate Production of IGCC Power from Coal and F-T Liquids from NG

Natural Gas
836 TPD Carbon
53.2 MMM Btu

→ Autothermal Reforming → F-T Synthesis → 6,083 BPD (Diesel Equivalent)
31.9 MMM Btu (60% HHV)

Coal
3,200 TPD (dry)
2,272 TPD (carbon)
78.4 MMM Btu

→ Gasification → Combined Cycle Block → 400 MW
32.8 MMM Btu (42% HHV)

3,108 TPD Carbon ≡ 6,083 BPSD Liquid + 400 MW Power
Net C/Quad = 26.2 MM Tons

Coproduction of Power and F-T Liquids using Coal and NG Combined (Co Co)

Coal
3,200 TPD (dry)
2,272 TPD (carbon)
78.4 MMM Btu

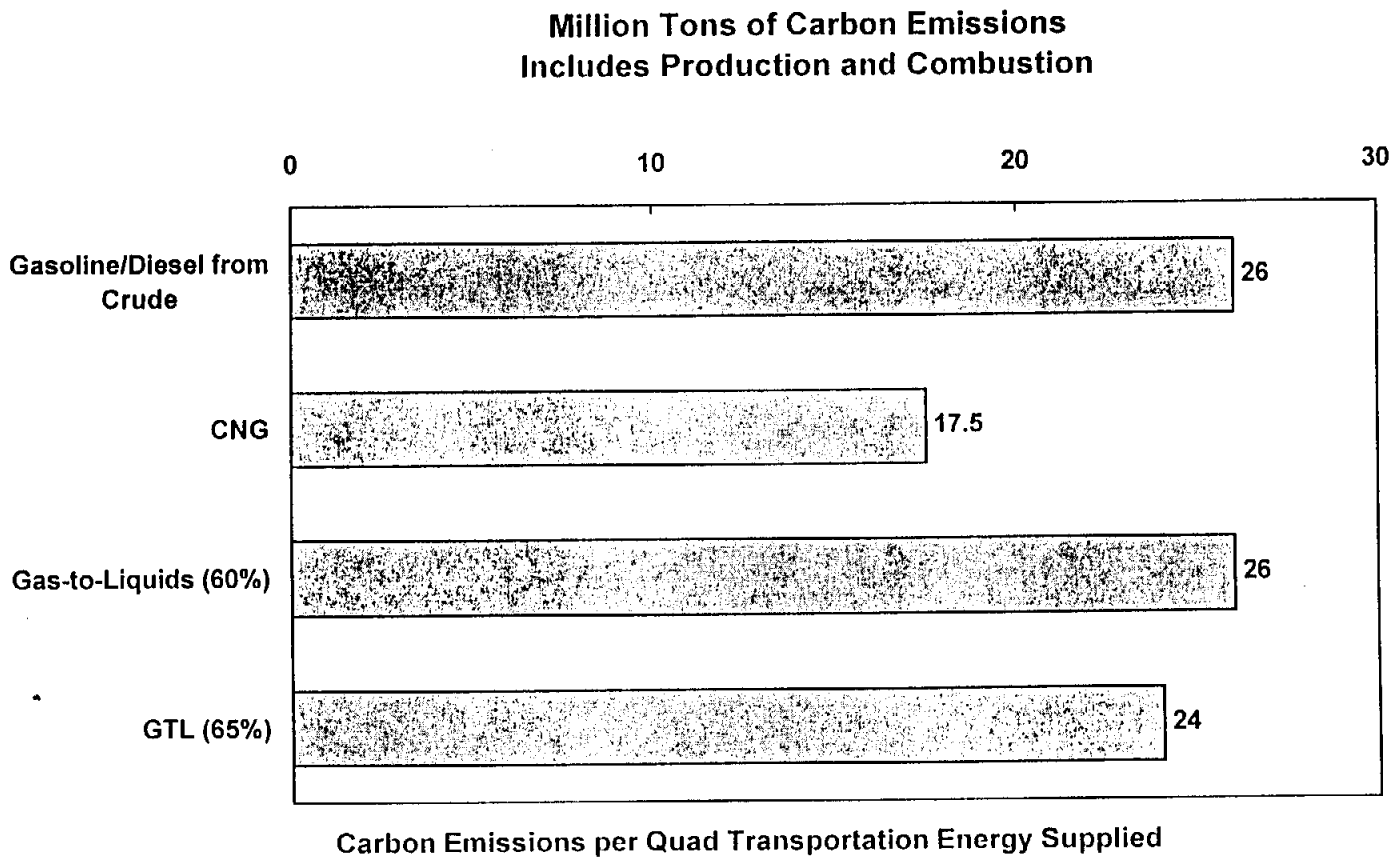
→ Gasification → F-T Synthesis → 6,083 BPD
31.9 MMM Btu

F-T Synthesis → Combined Cycle Block → 400 MW
32.76 MMM Btu (55% HHV)

NG
613 TPD Carbon
39.2 MMM Btu

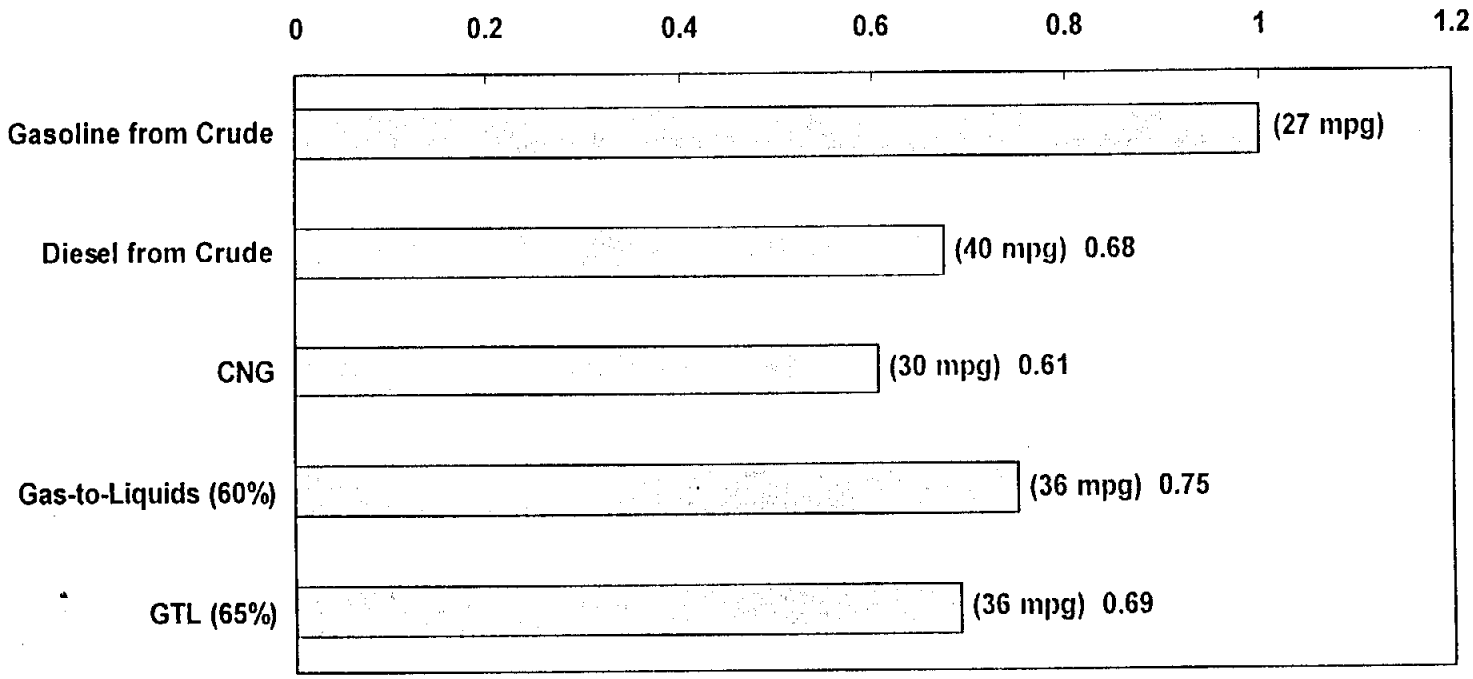
2885 TPD Carbon = 6,083 BPSD Liquid + 400 MW Power
Net C/Quad = 19.2 MM Tons

Carbon Emissions
(Natural Gas Based Systems)



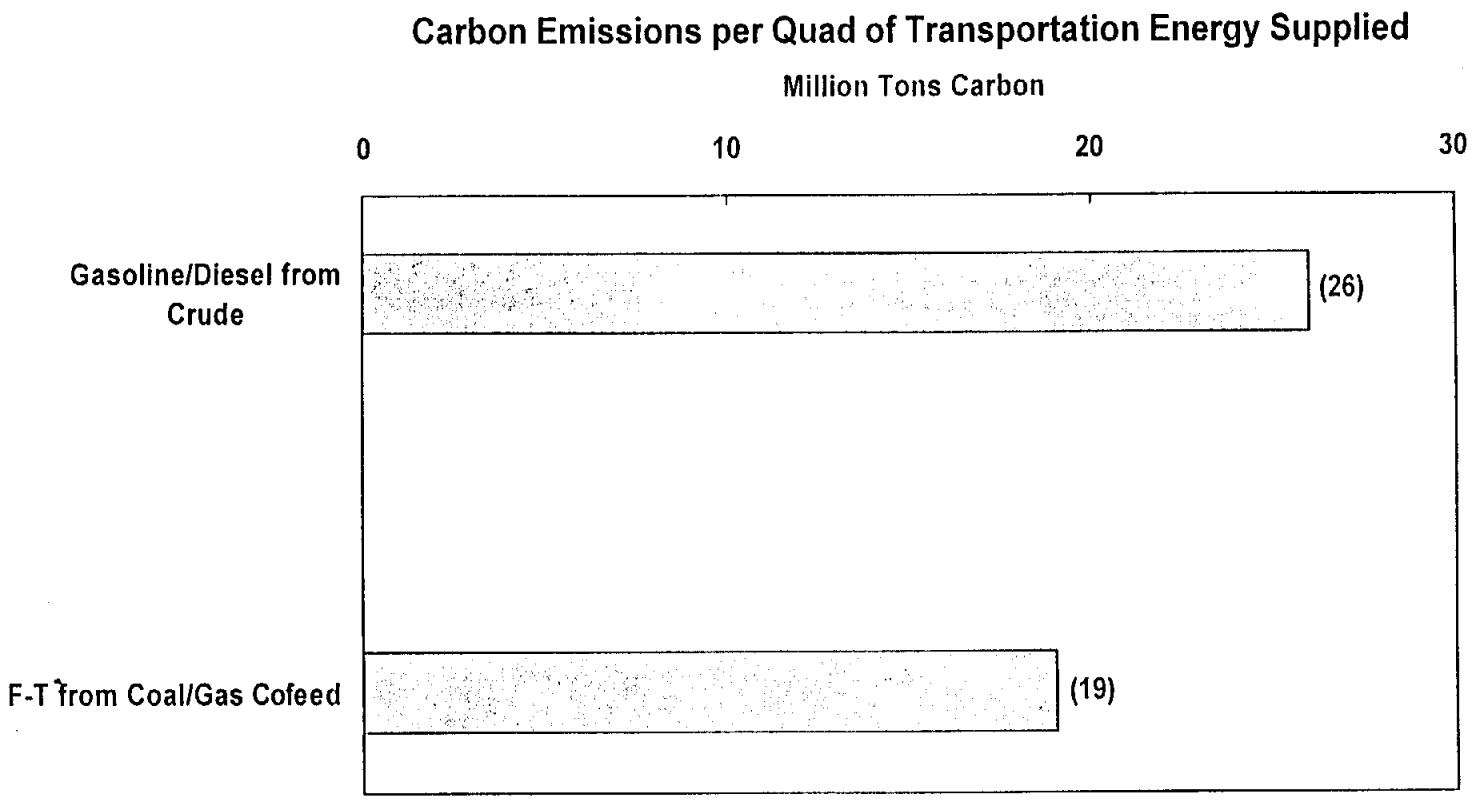
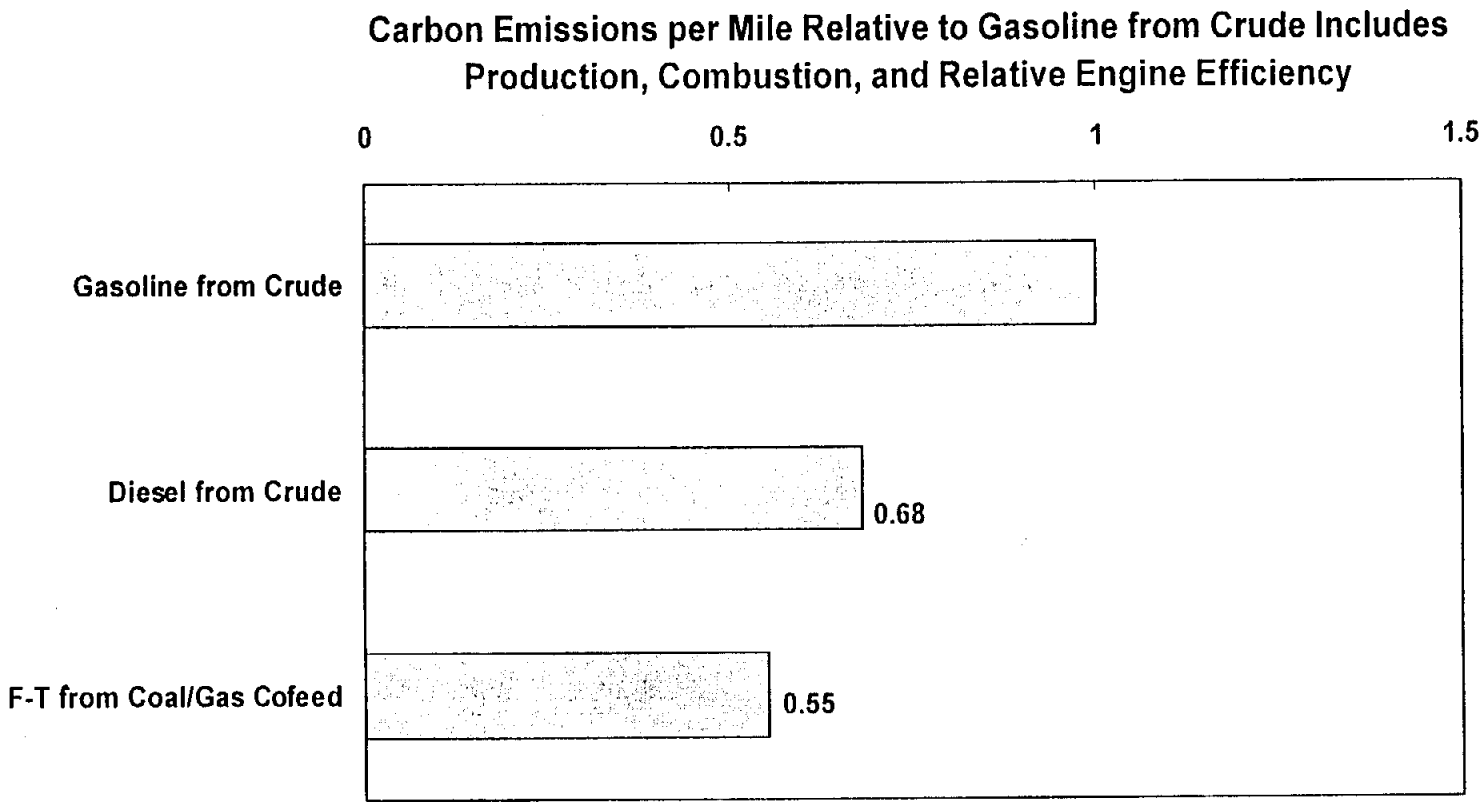
Carbon Emissions
(Natural Gas Based Systems)

Carbon Emissions per Mile Relative to Gasoline from Crude Includes Production, Combustion, and Relative Engine Efficiency



F-T Liquids from GTL amount to 2/3 Diesel, 1/3 Gasoline

Carbon Emissions
(Coal and Natural Gas Based Systems)



Carbon Emissions
(Coal and Natural Gas Based Systems)