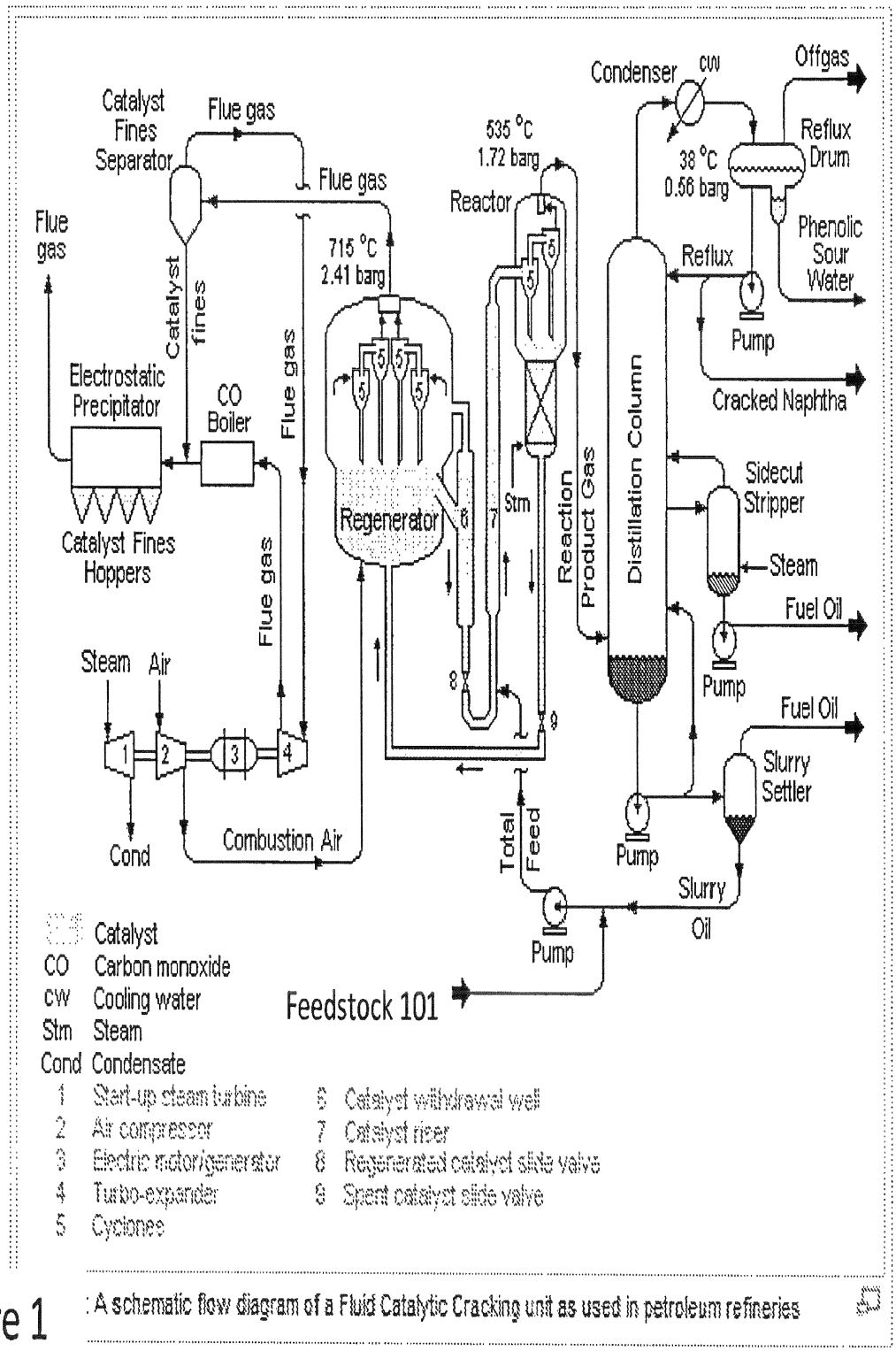


Figure 1 : A schematic flow diagram of a Fluid Catalytic Cracking unit as used in petroleum refineries

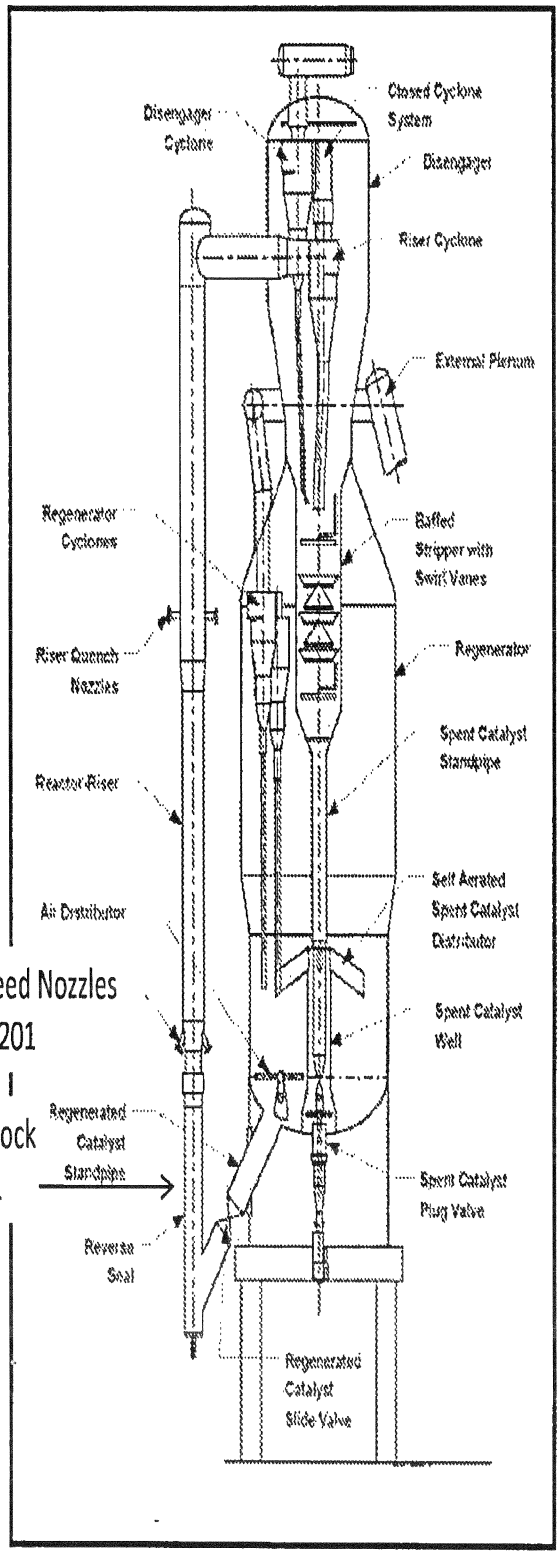

Closed Cyclone System
Disengager Cyclone
Disengager
Riser Cyclone
External Plenum
Regenerator Cyclones
Baffled Stripper with Swirl Vanes
Riser Quench Nozzles
Regenerator
Spent Catalyst Standpipe
Reactor Riser
Self Aerated Spent Catalyst Distributor
Air Distributor
Fresh Feed Nozzles 201
Spent Catalyst Well
Feedstock 101
Regenerated Catalyst Standpipe
Spent Catalyst Plug Valve
Reverse Seal
Regenerated Catalyst Slide Valve

Figure 2A

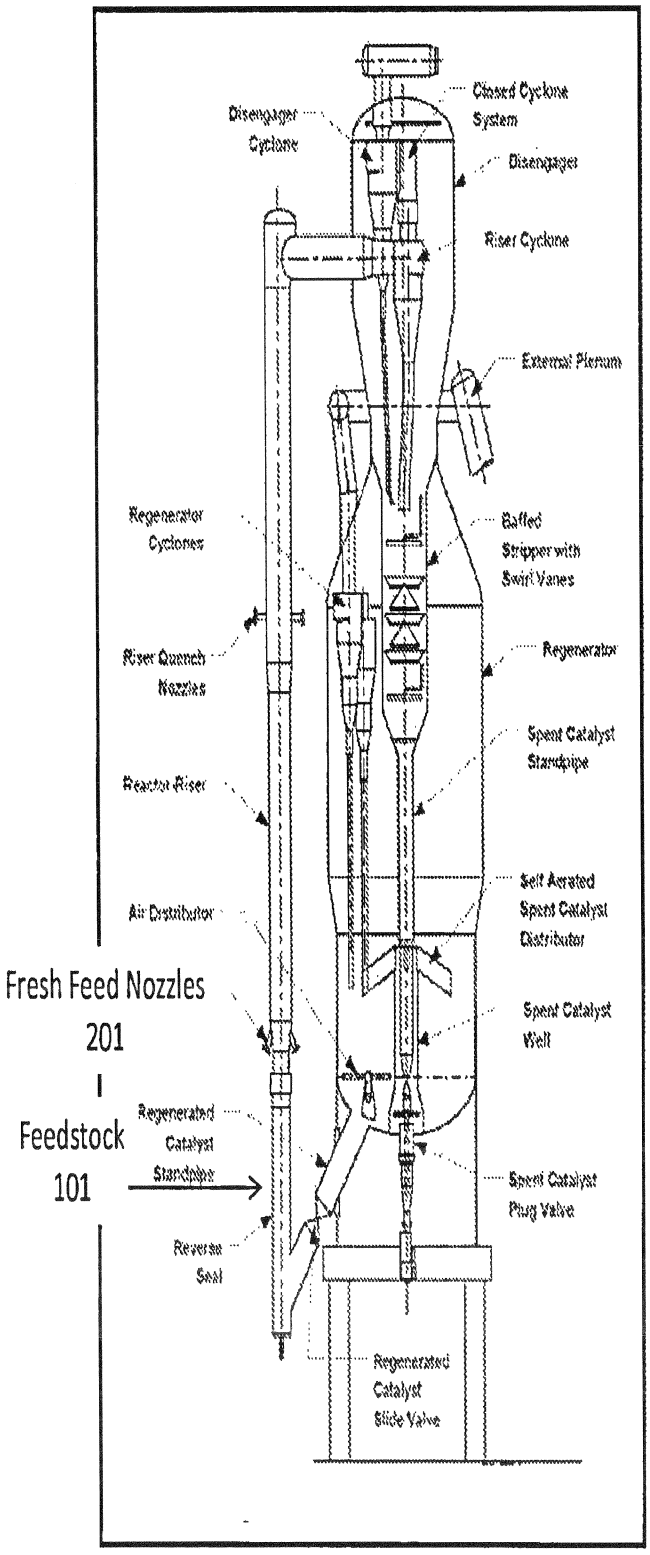
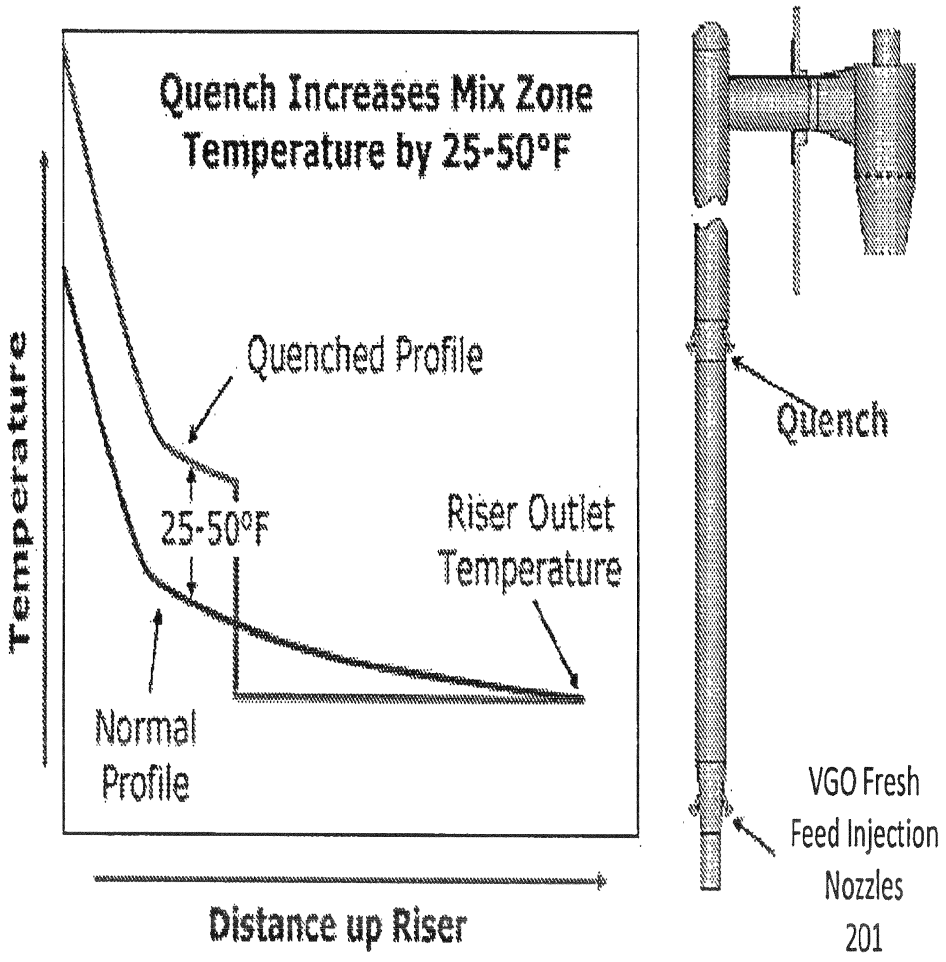

Closed Cyclone System
Disengager Cyclone
Disengager
Riser Cyclone
External Plenum
Regenerator Cyclones
Baffled Stripper with Swirl Vanes
Riser Quench Nozzles
Regenerator
Spent Catalyst Standpipe
Reactor Riser
Self Aerated Spent Catalyst Distributor
Air Distributor
Fresh Feed Nozzles
201
Spent Catalyst Well
Feedstock
101
Regenerated Catalyst Standpipe
Spent Catalyst Plug Valve
Reverse Seal
Regenerated Catalyst Slide Valve

Figure 2B

Figure 3 · **Riser Quench Technology**



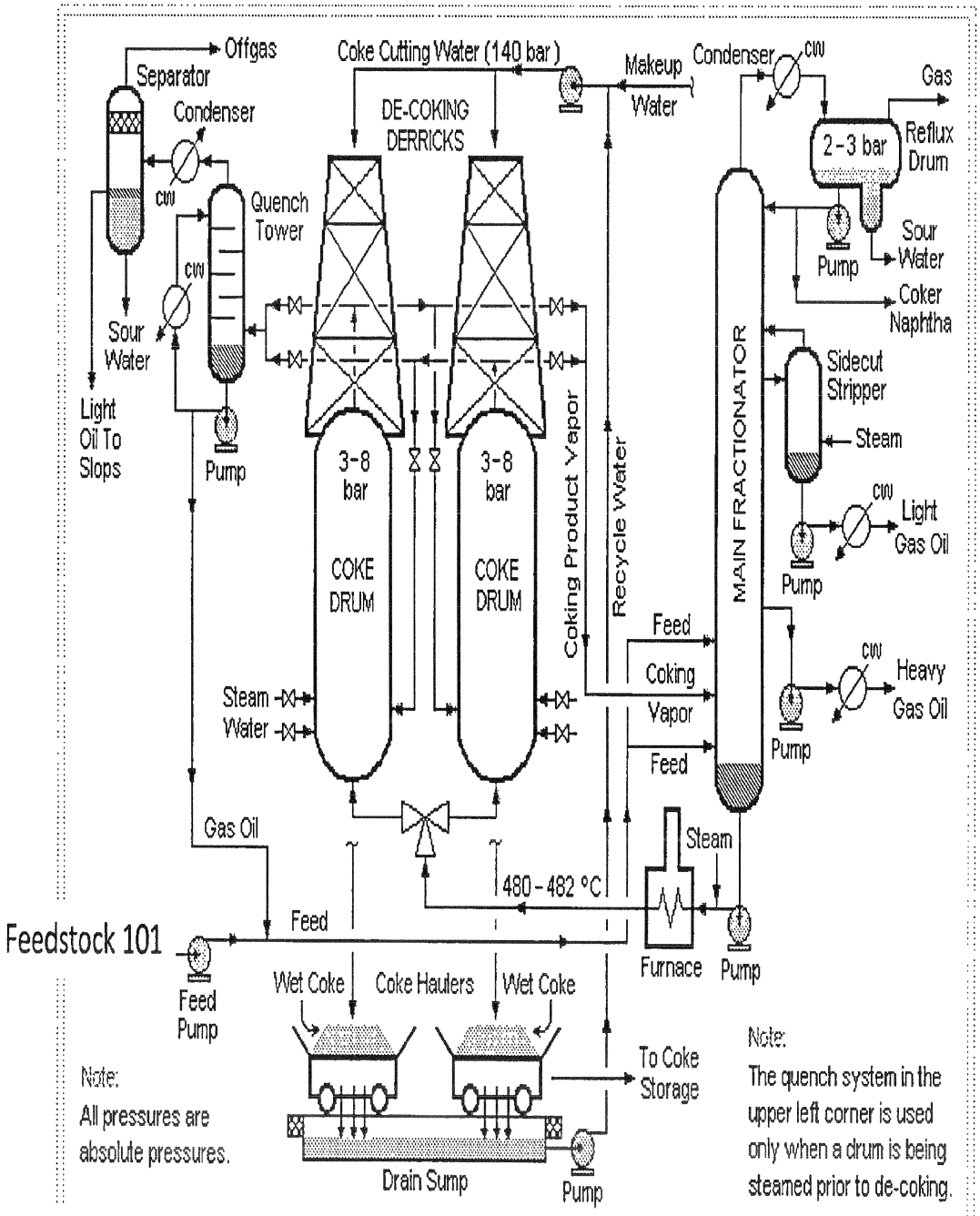


Figure 4 schematic flow diagram of a delayed coking unit

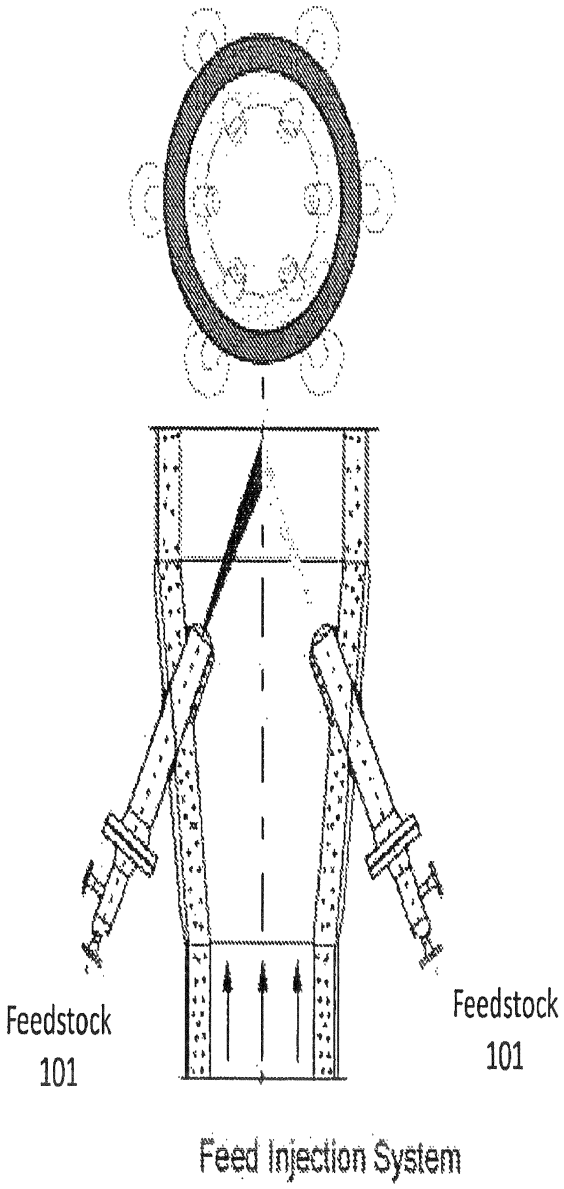


Figure 5

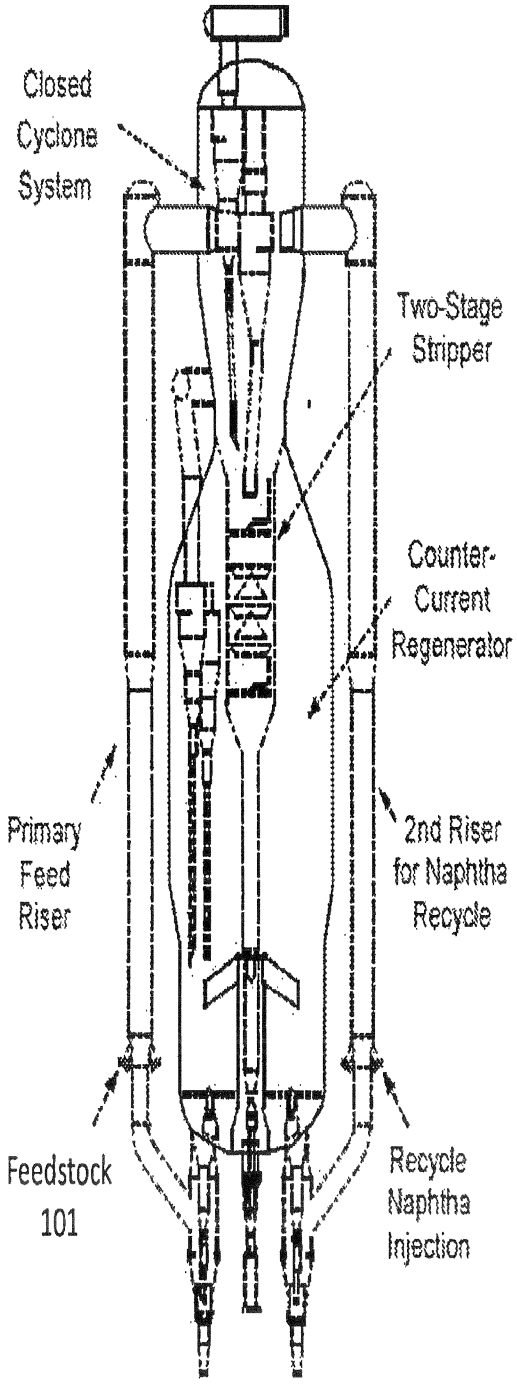

Closed
Cyclone
System
Two-Stage
Stripper
Counter-
Current
Regenerator
Primary
Feed
Riser
2nd Riser
for Naphtha
Recycle
Feedstock
101
Recycle
Naphtha
Injection

Figure 6

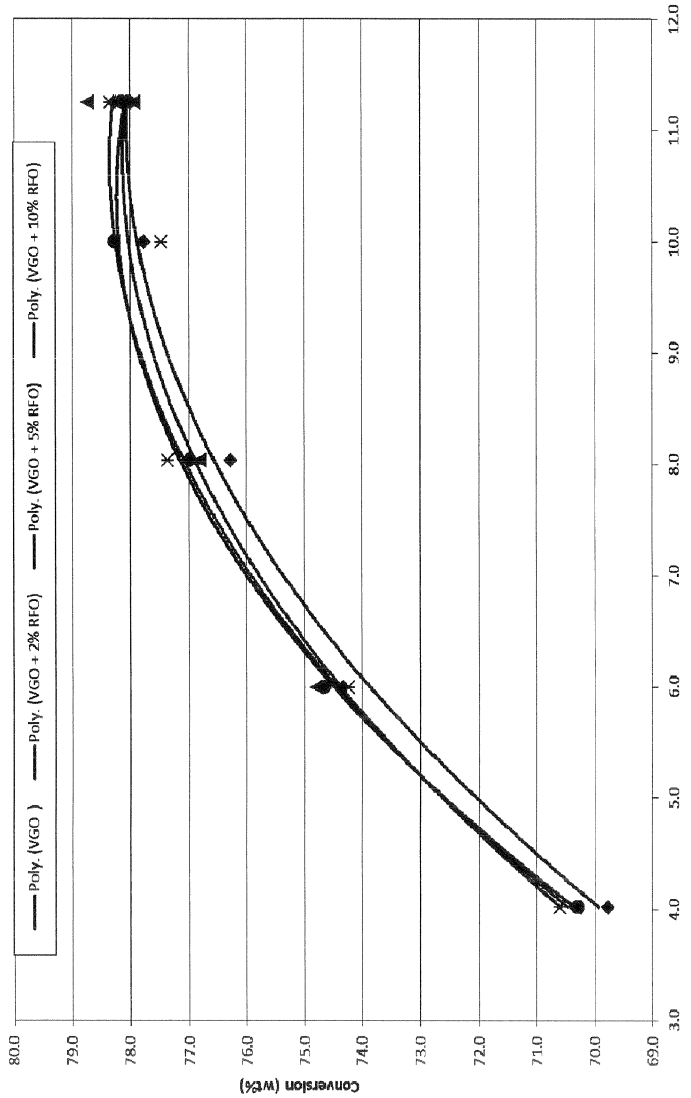

Poly. (VGO)
Poly. (VGO + 2% RFO)
Poly. (VGO + 5% RFO)
Poly. (VGO + 10% RFO)
Conversion (wt%)
Cat:Oil Ratio
80.0
79.0
78.0
77.0
76.0
75.0
74.0
73.0
72.0
71.0
70.0
69.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0

FIGURE 7

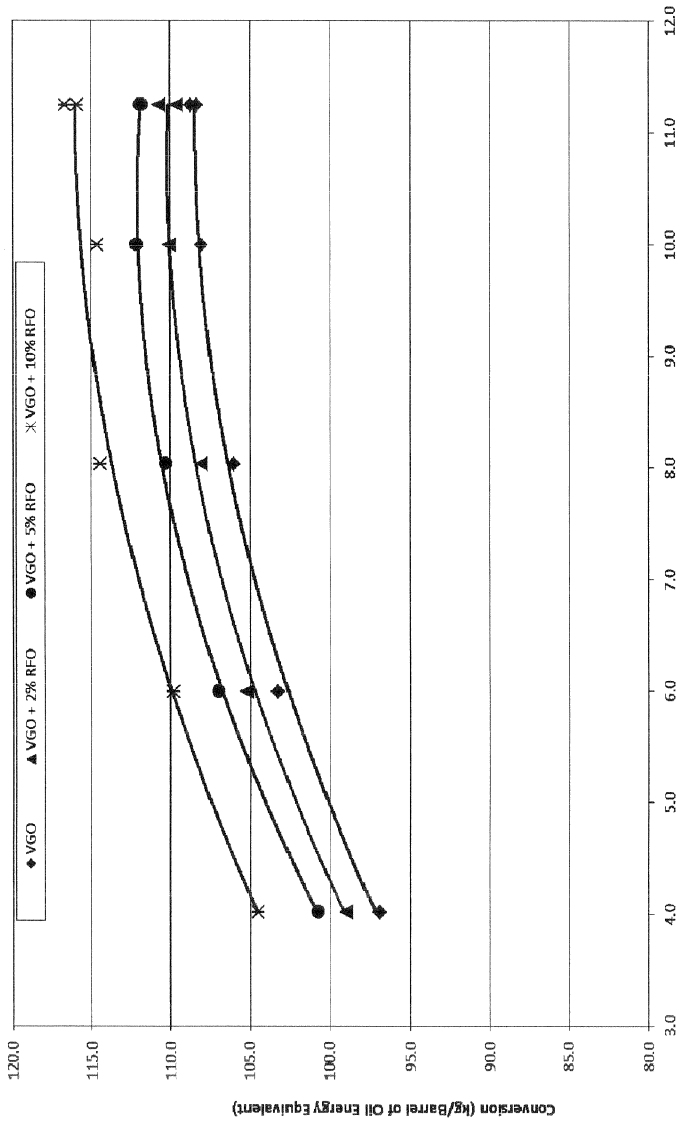

VGO
VGO + 2% RFO
VGO + 5% RFO
VGO + 10% RFO
Conversion (kg/Barrel of Oil Energy Equivalent)
Cat:Oil Ratio
120.0
115.0
110.0
105.0
100.0
95.0
90.0
85.0
80.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0

FIGURE 8

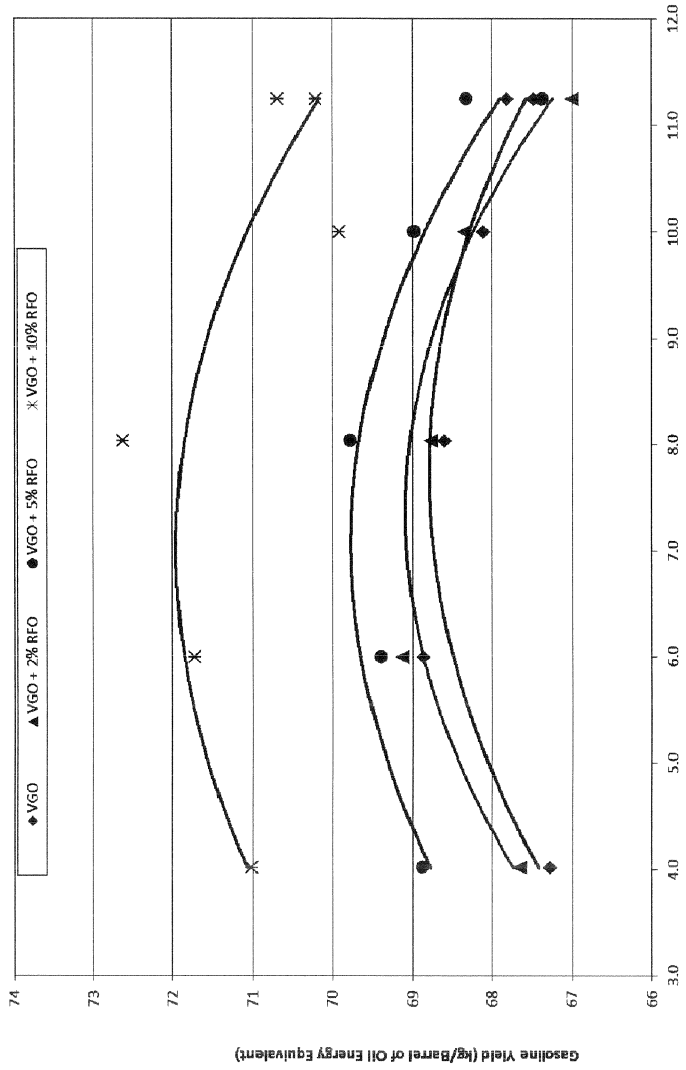

VGO
VGO + 2% RFO
VGO + 5% RFO
VGO + 10% RFO
Gasoline Yield (kg/Barrel of Oil Energy Equivalent)
Cat:Oil Ratio
74
73
72
71
70
69
68
67
66
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0

FIGURE 9

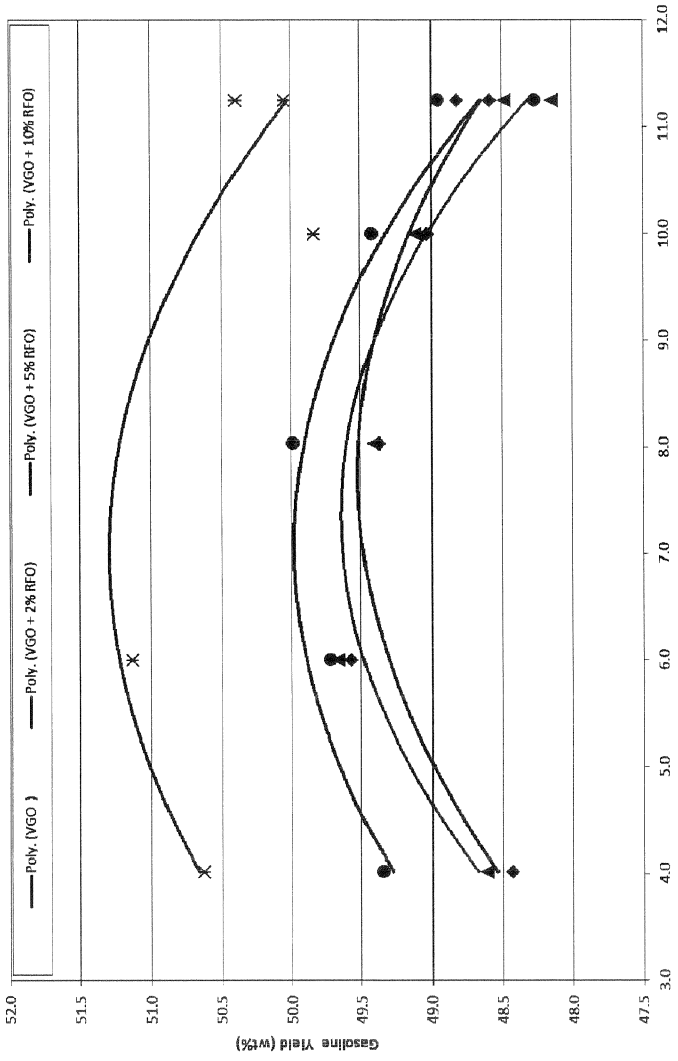

Poly. (VGO)
Poly. (VGO + 2% RFO)
Poly. (VGO + 5% RFO)
Poly. (VGO + 10% RFO)
Gasoline Yield (wt%)
Cat:Oil Ratio
52.0
51.5
51.0
50.5
50.0
49.5
49.0
48.5
48.0
47.5
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0

FIGURE 10

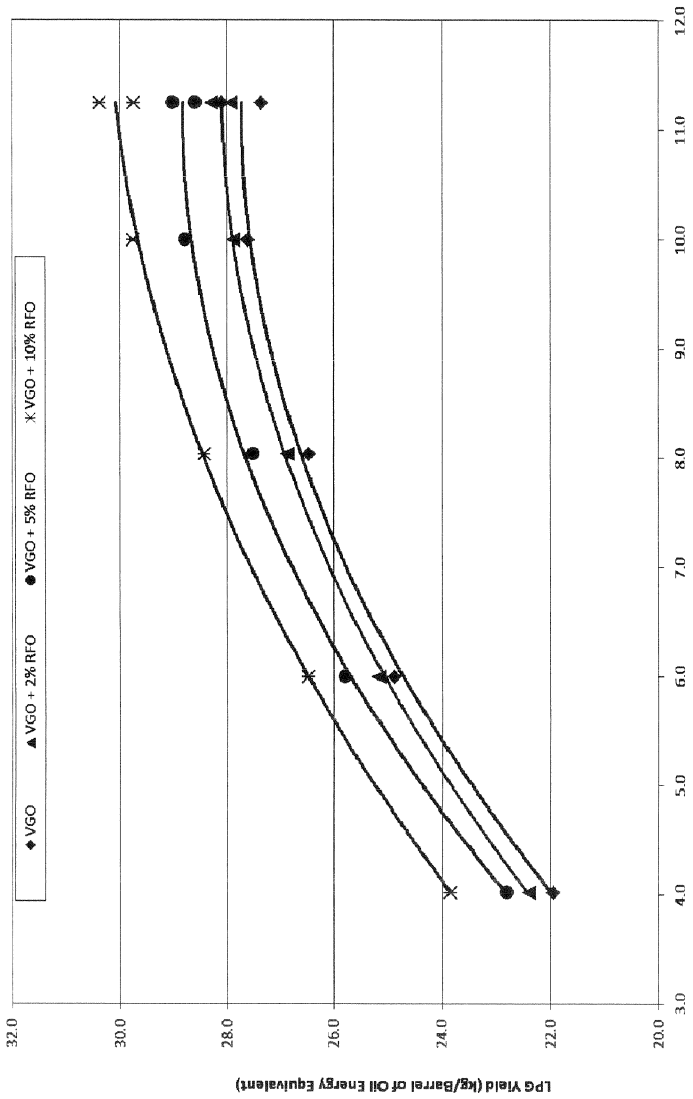

VGO
VGO + 2% RFO
VGO + 5% RFO
VGO + 10% RFO
LPG Yield (kg/Barrel of Oil Energy Equivalent)
Cat:Oil Ratio
32.0
30.0
28.0
26.0
24.0
22.0
20.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0

FIGURE 11

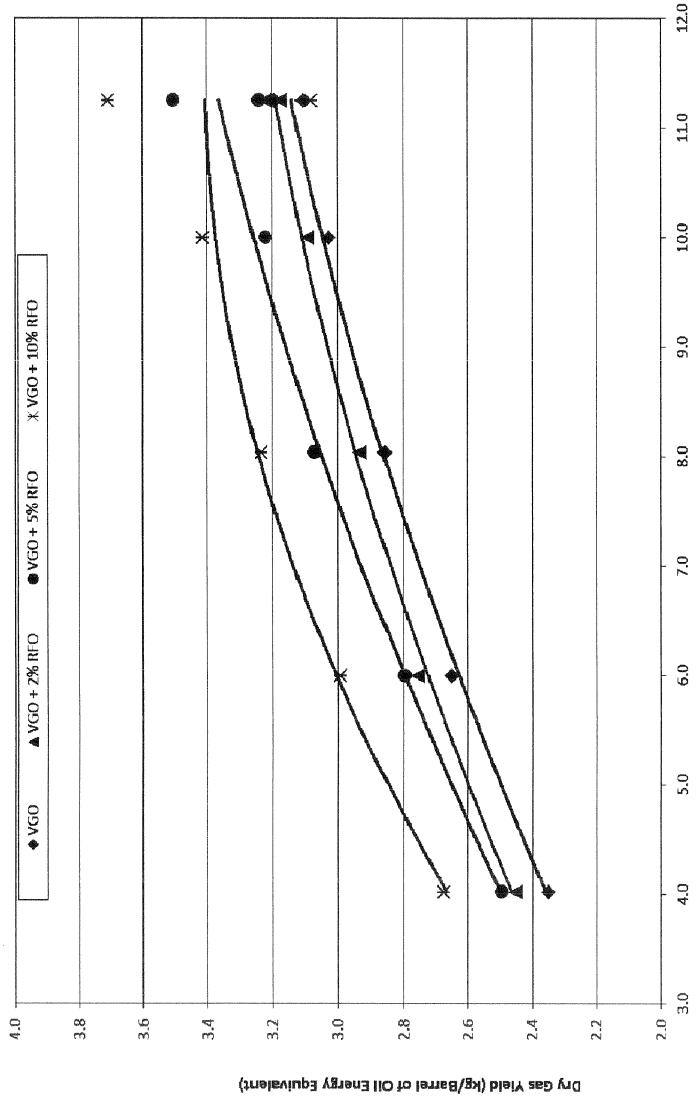

VGO
VGO + 2% RFO
VGO + 5% RFO
VGO + 10% RFO
Dry Gas Yield (kg/Barrel of Oil Energy Equivalent)
Cat/Oil Ratio
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0

FIGURE 12

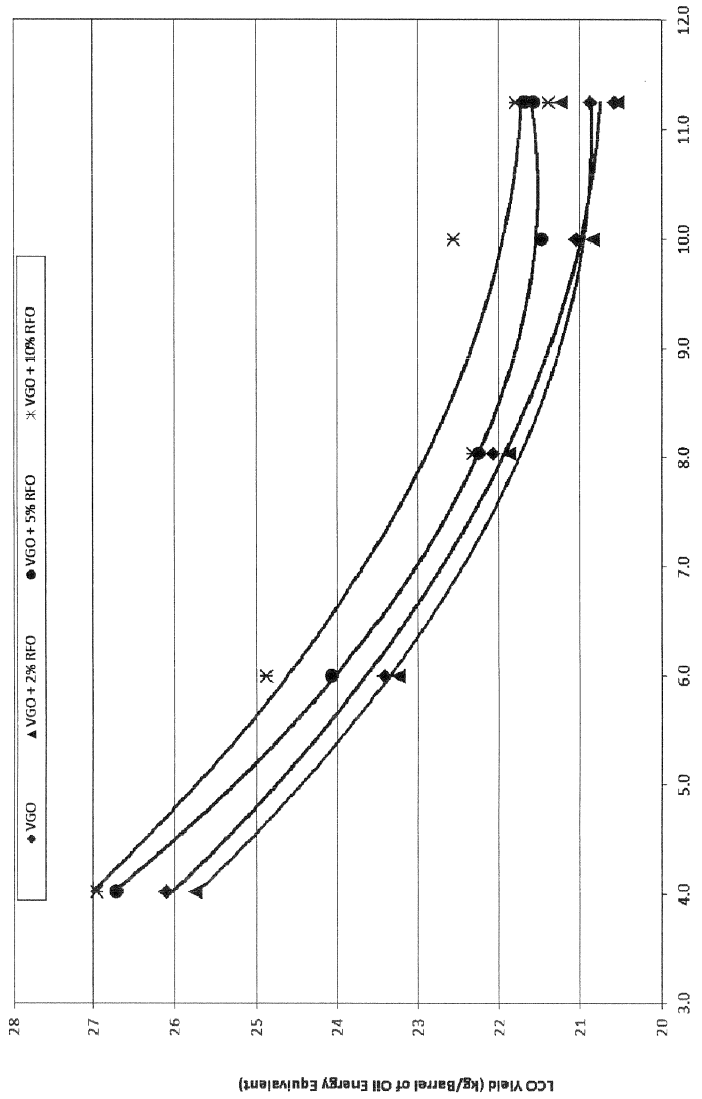

VGO
VGO + 2% RFO
VGO + 5% RFO
VGO + 10% RFO
LCO Yield (kg/Barrel of Oil Energy Equivalent)
Cat:Oil Ratio
28
27
26
25
24
23
22
21
20
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0

FIGURE 13

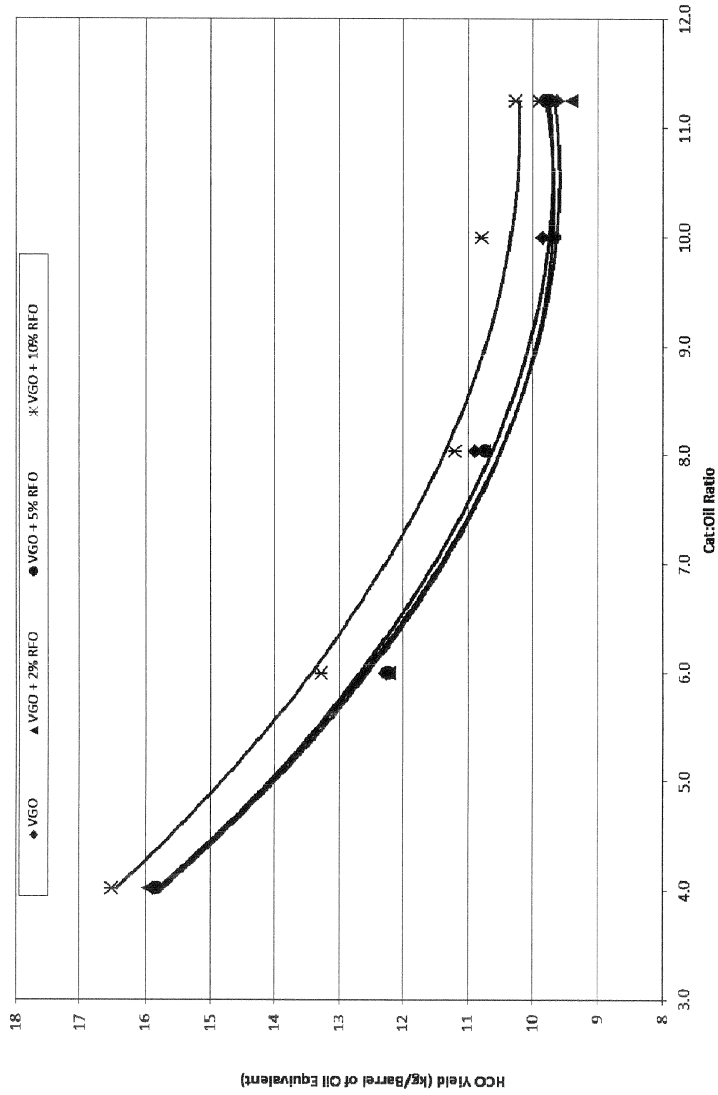

HCO Yield (kg/Barrel of Oil Equivalent)
Cat:Oil Ratio
VGO
VGO + 2% RFO
VGO + 5% RFO
VGO + 10% RFO

FIGURE 14

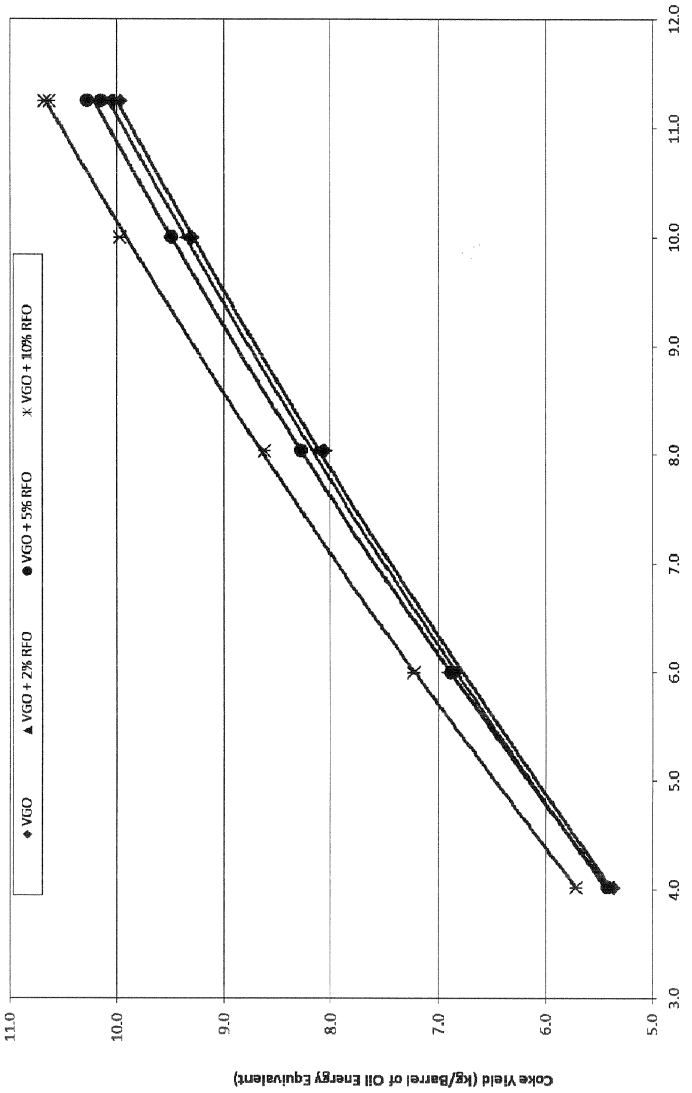

VGO
VGO + 2% RFO
VGO + 5% RFO
VGO + 10% RFO
Coke Yield (kg/Barrel of Oil Energy Equivalent)
Cat:Oil Ratio
11.0
10.0
9.0
8.0
7.0
6.0
5.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0

FIGURE 15

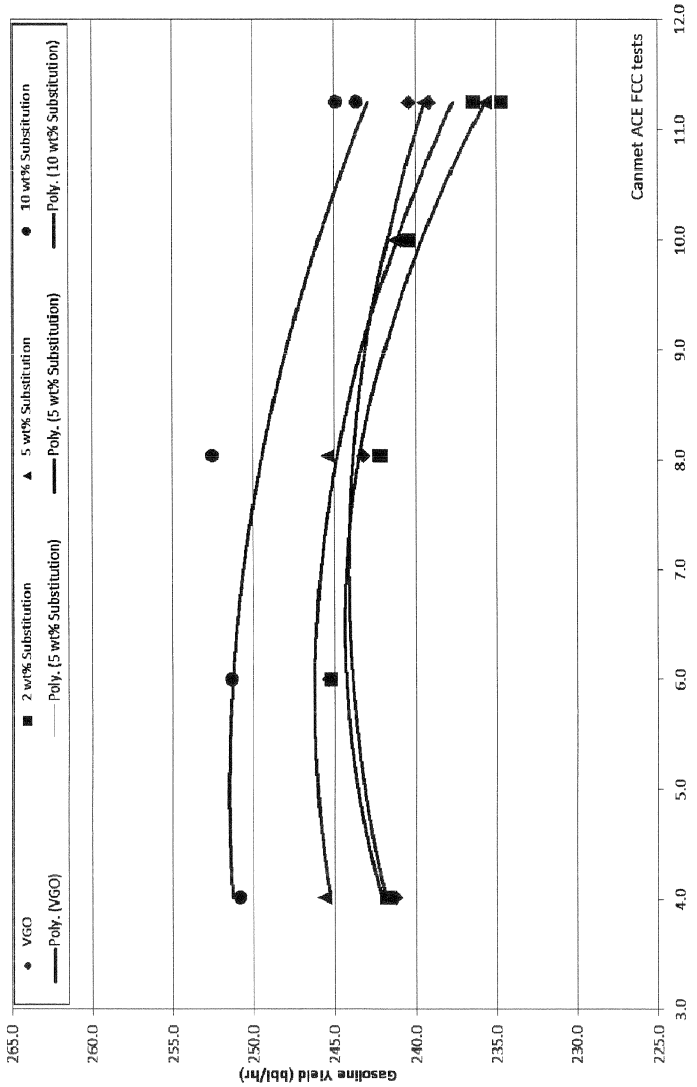

VGO
2 wt% Substitution
5 wt% Substitution
10 wt% Substitution
Poly. (VGO)
Poly. (5 wt% Substitution)
Poly. (5 wt% Substitution)
Poly. (10 wt% Substitution)
Gasoline Yield (bbl/hr)
265.0
260.0
255.0
250.0
245.0
240.0
235.0
230.0
225.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
Cat:Oil Ratio
Canmet ACE FCC tests

FIGURE 16

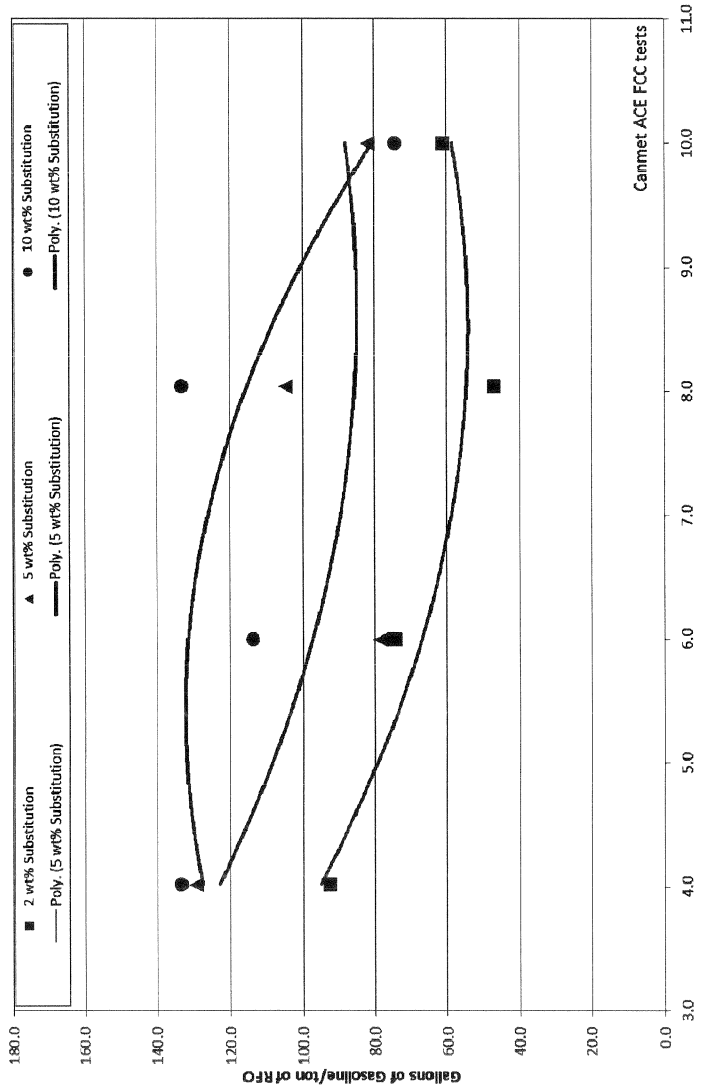

2 wt% Substitution
5 wt% Substitution
10 wt% Substitution
Poly. (5 wt% Substitution)
Poly. (5 wt% Substitution)
Poly. (10 wt% Substitution)
Gallons of Gasoline/ton of RFO
Cat:Oil Ratio
Canmet ACE FCC tests
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0

FIGURE 17

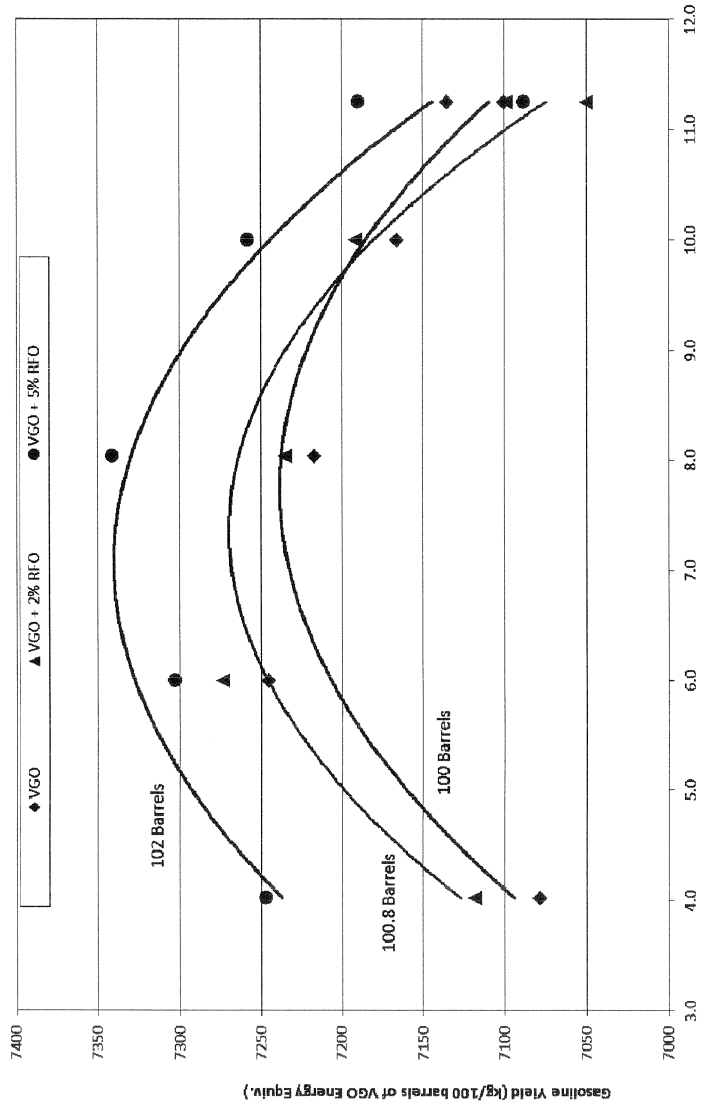

VGO
VGO + 2% RFO
VGO + 5% RFO
102 Barrels
100.8 Barrels
100 Barrels
Gasoline Yield (kg/100 barrels of VGO Energy Equiv.)
Cat:Oil Ratio
7400
7350
7300
7250
7200
7150
7100
7050
7000
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0

FIGURE 18

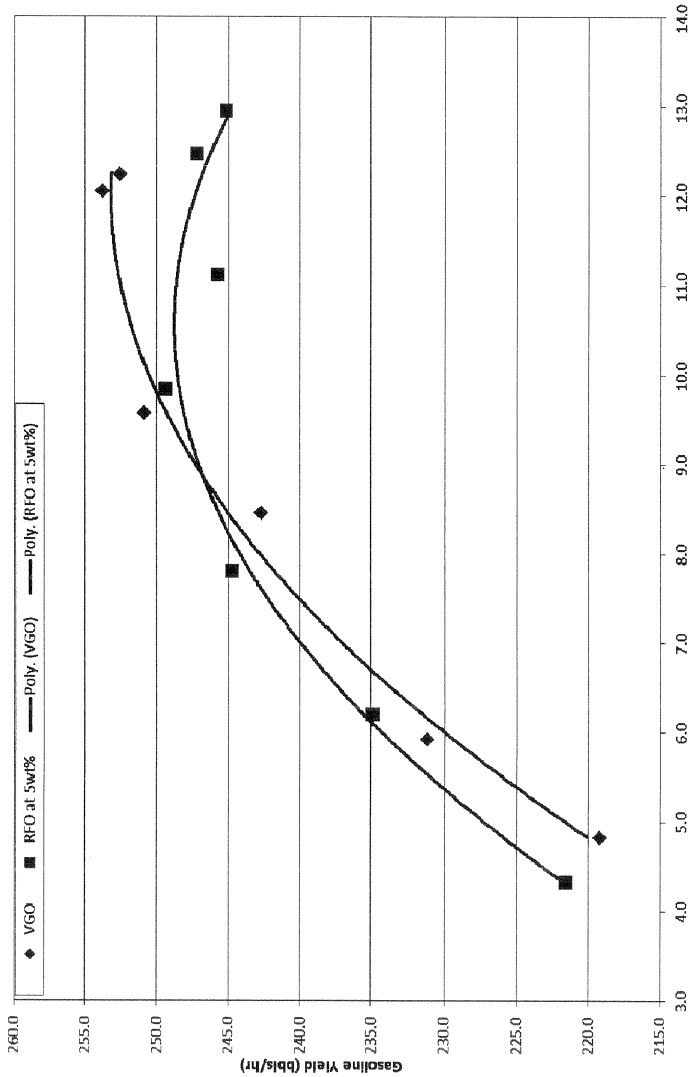

VGO
RFO at 5wt%
Poly. (VGO)
Poly. (RFO at 5wt%)
Gasoline Yield (bbls/hr)
Cat:Oil Ratio
260.0
255.0
250.0
245.0
240.0
235.0
230.0
225.0
220.0
215.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0

FIGURE 19