

PLATFORMING®

Importance of Net Gas Processing

NET GAS PROCESSING AND ITS EFFECT ON YIELDS

The selection of a net gas processing scheme has a major impact on the liquid product recovered and hence the profitability of the UOP® CCR PlatformingSM unit. The product separator gas in today's low-pressure reforming units may contain up to 6 LV-% C₅+ product. In a 20,000 BPSD CCR Platforming unit (Figure 1), with only a single product separator and without an enhanced liquid recovery system, 1,657 BPSD, or \$17 million per year, of the C₅+ product yield is lost with the net gas. Table 1 shows the recovery of reformat and LPG using various recovery systems.

Figure 1
CCR Platforming Unit

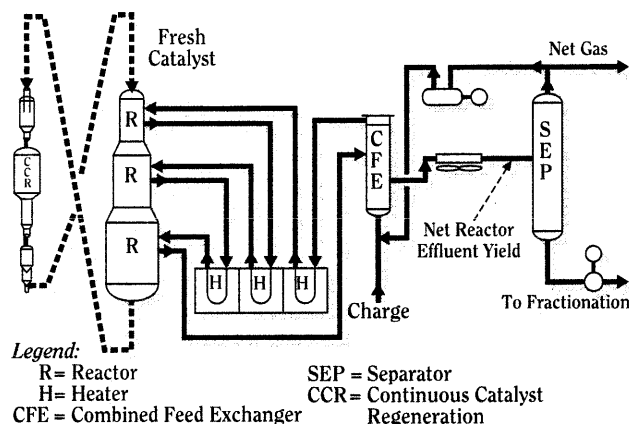


Table 1

Products from Various Net Gas Processing Schemes

Net Gas Processing Scheme	Liquid Products ^a		Increased Product Value, \$MM/yr ^b
	LPG, BPSD	Reformat, BPSD	
No Liquid Recovery Options	41	14,830	—
RECOVERY PLUS TM System on 100% Net Gas to Fuel	345	16,343	15.1
Countercurrent Recontacting on 100% Net Gas to H ₂ Consumers	372	16,235	14.1
Countercurrent Recontacting and RECOVERY PLUS on 100% Gas to H ₂ Consumers	714	16,444	17.0

^a On a basis of total overhead liquid and total bottoms, not C₃-C₄ and C₅+

^b On a basis of an on-stream factor of 365 days/year, a reformat value of \$25.94/bbl, and an LPG value of \$7.00/bbl.

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CHOOSING THE BEST SOLUTION

The goal is to economically maximize the recovery of the liquid C₅+ product. This goal can be attained by applying the correct net gas processing option or options to each given situation. Clear, optimal choices exist for each net gas situation, and the following four-step approach assists in determining the best solution for each refiner's needs.

Step 1: Define the Required Net Gas Destinations

The net gas from the CCR Platforming unit goes to:

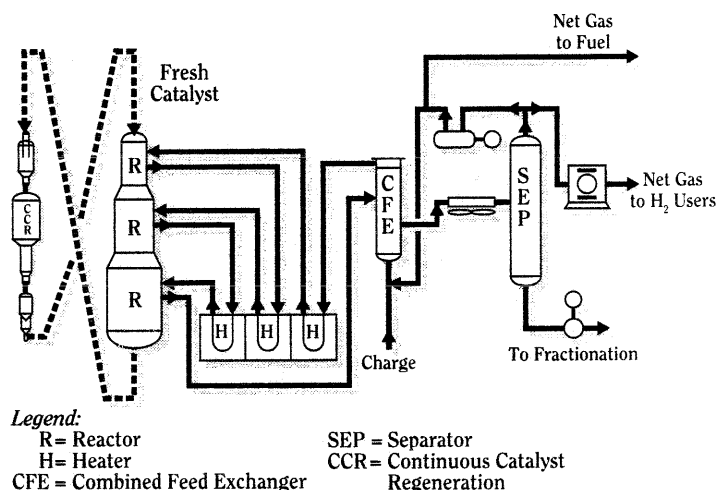
- The fuel gas system
- H₂-consuming process units
- A combination of both

The proper definition of H₂ requirements, pressure and flow, determines the correct recovery systems and avoids unnecessary compression of the net gas.

Step 2: Determine the Optimum Compression Scheme

The required pressures at the user destinations define the required compression scheme (Figure 2). Compressing the net gas stream from a CCR Platforming unit to a pressure that is higher than necessary is usually uneconomical.

Figure 2
Steps 1&2 - Destination & Pressures Define Compression Scheme



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Importance of Net Gas Processing (Cont'd)

Net Gas to Fuel

The net gas going to the fuel gas system from a CCR Platforming unit should be compressed to a pressure just high enough to get into the fuel gas header. This compression can usually be accomplished by sending the net gas to fuel at the recycle compressor discharge.

Net Gas to H₂-Consuming Units

The H₂-consuming units require a higher pressure source of net gas than do fuel gas systems. Three types of compressors, reciprocating, centrifugal, and screw, can be considered depending on the destination pressures and quantities. The destination pressure and the compressor type determine the number of compression stages required.*

Step 3:

Consider the Optimum Liquid Recovery Options

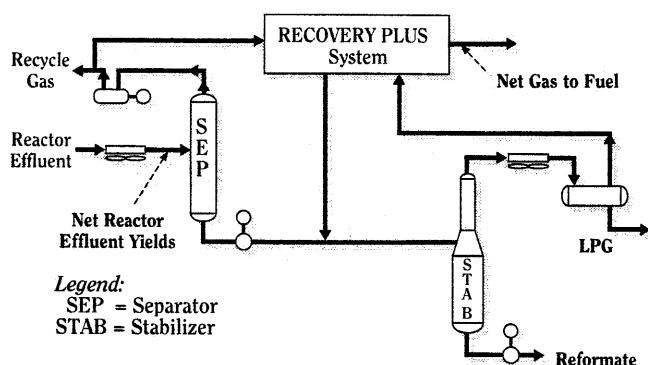
Each possible net gas destination has a clear and distinct best solution for recovering the C₅+ product yield.

Net Gas to Fuel

For the net gas going to fuel from the discharge of the recycle gas compressor, the UOP RECOVERY PLUS™ system is the most efficient option available for achieving the optimum recovery of C₅+ product and LPG liquids. The RECOVERY PLUS system offers the highest liquid recoveries at the lowest capital and utility costs (Figure 3).

Figure 3

Steps 3 & 4 – Optimum Liquid Recovery Options 100% of Net Gas to Fuel



* Examples with the net gas going to H₂ consumers are shown with two compression stages to 450 psig.

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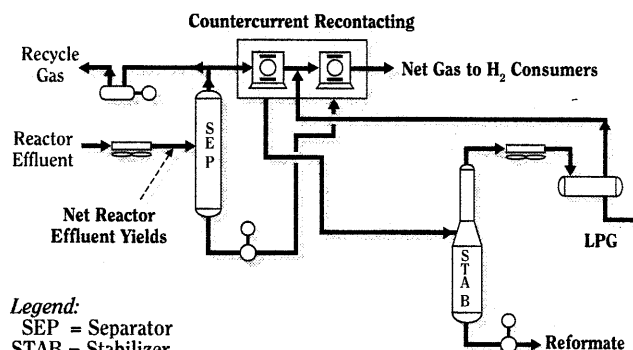
Net Gas to H₂ Consumers

The most efficient option for the net gas that is being compressed to the H₂-consuming units is UOP's patented countercurrent recontacting scheme (Figure 4). Countercurrent recontacting enhances the required stages of compression and efficiently takes advantage of the higher pressure to recover C₅+ liquids without significantly increasing the capital or utility costs associated with the required compression train.

As shown in Figure 4, the overhead vapor from the stabilizer column is recycled back to the countercurrent recontacting section. To maximize LPG liquid recovery in situations where 100% of the net gas is going to the fuel gas system, the overhead vapor goes to the RECOVERY PLUS system.

Figure 4

Steps 3&4 - Optimum Liquid Recovery Options 100% of Net Gas to H₂ Consumers



Legend:
SEP = Separator
STAB = Stabilizer

Additional recoveries are achievable by applying a RECOVERY PLUS system to the net gas going to H₂-consuming units after countercurrent recontacting. The favorable economics of this application of the RECOVERY PLUS system are dependent on a few key factors described in Step 4.

Importance of Net Gas Processing (Cont'd)

Step 4:

Determine the Need for Additional Liquid Recovery for Net Gas to H₂-Consuming Units

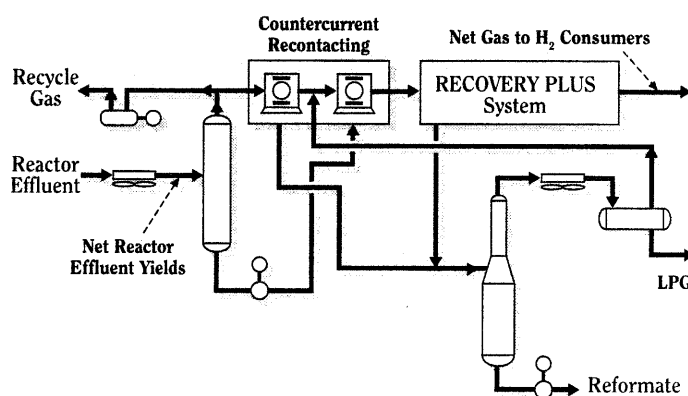
Four clear situations warrant the addition of a RECOVERY PLUS system on the net gas going to H₂-consuming units after countercurrent recontacting (Figure 5):

- When maximum C₅+ product yield is required. Table 1 illustrates how the addition of a RECOVERY PLUS system after countercurrent recontacting increases reformat production by 209 BPSD in a 20,000 BPSD CCR Platforming unit.
- When a PSA unit is installed to produce high-purity H₂ for the H₂-consuming units. Without the RECOVERY PLUS system, the LPG and reformat liquids still in the net gas are lost to the tail gas from the PSA unit. UOP supplies state-of-the-art PolyBed® PSA units to refiners worldwide.
- When the CCR Platforming unit feeds an aromatics complex. Without the RECOVERY PLUS system, aromatics and aromatic precursors exit with the net gas, and the overall yields of the aromatics complex are reduced.
- When a market for LPG exists. The RECOVERY PLUS system efficiently recovers the LPG liquid components still in the net gas directly as LPG from the stabilizer overhead net liquid. Table 1 illustrates how the addition of a RECOVERY PLUS system after countercurrent recontacting increases LPG production by 342 BPSD in a 20,000 BPSD CCR Platforming unit.

The combination of countercurrent recontacting and the RECOVERY PLUS system results in the recovery of \$17 million per year of LPG and reformat product yields that would otherwise have been lost with no liquid recovery options.

Figure 5

Steps 3&4 - Optimum Liquid Recovery Options 100% of Net Gas to H₂ Consumers



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RECOVERING REFINERY LIQUIDS BY USING THE RECOVERY PLUS™ SYSTEM

Stephen J. Dittmeier
UOP
Des Plaines, Illinois, U.S.A.

INTRODUCTION

The selection of a net gas processing scheme has a major impact on liquid yields and hence the profitability of the Platforming* unit. UOP has continually invested in developing and improving net gas processing solutions.

This paper discusses one such solution, the RECOVERY PLUS* system, and its use in improving the economics of the Platforming unit. The RECOVERY PLUS system employs a patented, nonlicensed technology that works with any separator or recontacting system to recover additional liquid products from the net offgas. A discussion on how the RECOVERY PLUS system can affect economics is followed by a review of actual operating data from three delivered systems. The results obtained from using the RECOVERY PLUS system are looked at from several different perspectives.

NET GAS PROCESSING

Net gas processing is an often-overlooked method of improving refinery economics. The product separator gas in today's low-pressure reforming may contain up to 6 LV-% of the C₅+ product. Although product losses are more dramatic in a Platforming unit operating at low pressure, losses will occur in all cases. To date, the RECOVERY PLUS system has been applied in almost every conceivable net gas situation. Systems are in operation on net gas from product separator's in the Platforming unit that are operating at a variety of pressures

as well as downstream of both cocurrent and countercurrent recontacting facilities. RECOVERY PLUS system's are in operation on both new and existing units.

The liquid-recovery options available vary from doing nothing at all to recontacting 100% of the net gas followed by the RECOVERY PLUS system. In some situations, not all the net gas from the Platforming unit is compressed for use by consumers, some is sent directly to the fuel gas system. The RECOVERY PLUS system has been placed on that portion of the net gas stream that is sent to fuel.

The goal of net gas processing is to economically maximize the recovery of the liquid C₅+ product. Liquefied petroleum gas (LPG) is also recovered, and this recovery further improves the hydrogen purity of the net gas and minimizes fuel gas production.

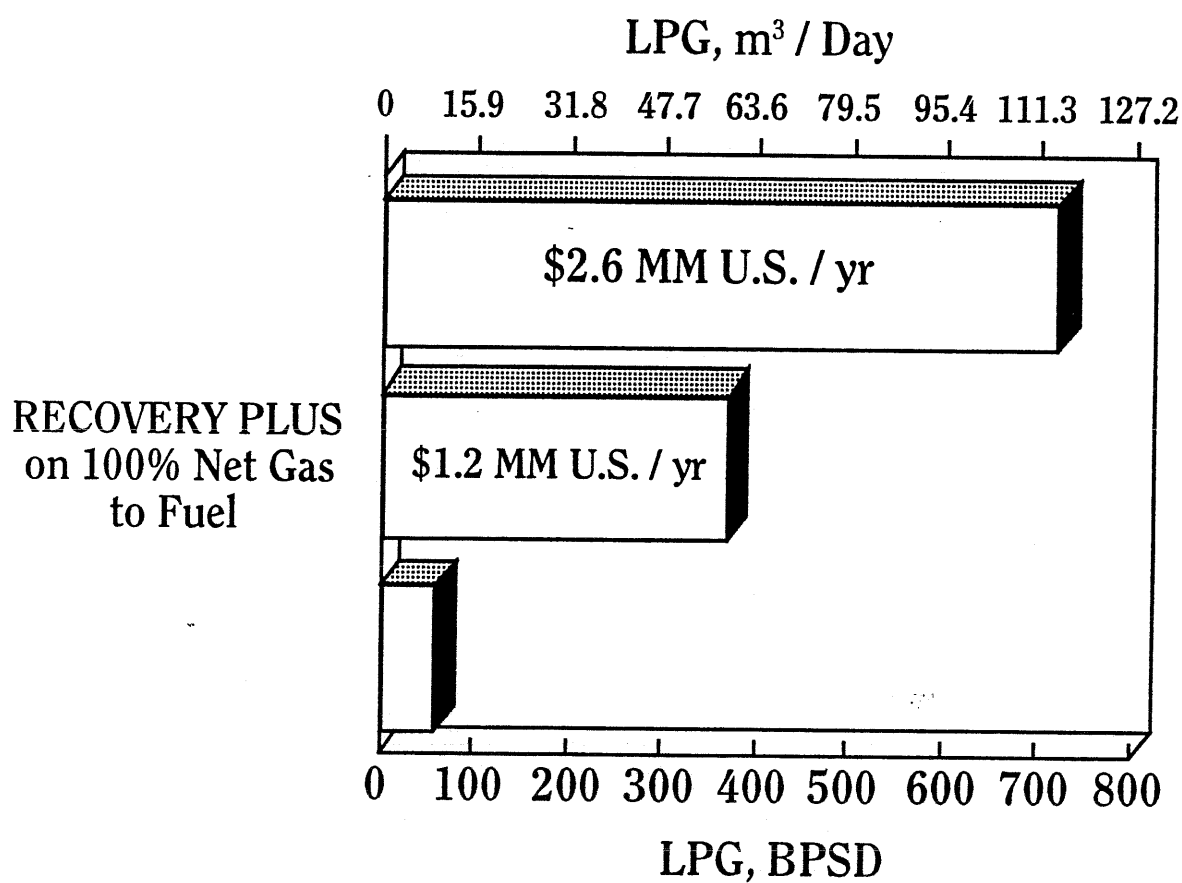
ECONOMIC VALUE OF NET GAS PROCESSING

The impact on refinery economics of the various net gas processing schemes can be seen in Figures 1 and 2. The data presented is based on a CCR* Platforming unit with a fresh feed rate of 3,179.8 m³/day (20,000 BPSD) and an operating pressure at the product separator of 2.5 kg/cm²g (35 psig). Net product values used in the evaluation are \$69.0/m³ (\$11.00/barrel) for LPG and \$97.5/m³ (\$15.50/barrel) for reformate. The data presented are barrels per stream day of liquid sent to the stabilizer column.

Figure 1 shows the LPG recovered by employing the various net gas processing schemes, which include the RECOVERY PLUS system. The LPG in the stabilizer feed was increased from 6.5 m³/day (41 BPSD) to as much as 113.5 m³/day (714 BPSD) to yield \$2.6 million U.S. per year of additional product revenue. The RECOVERY PLUS system can also be designed to recover an additional 20% LPG when economically justified.

Figure 1

Potential LPG Yields



UOP 2110G-4M

Figure 2 shows reformat recovery obtained using these same schemes. Reformat in the stabilizer feed was increased from 2,357.8 m³/day (14,830 BPSD) to 2,614.4 m³/day (16,444 BPSD), or 10.9%. The economic impact of applying net gas processing can be as much as \$8.9 million U.S. per year.

In this example, the refiner can realize as much as \$11.5 million U.S. per year in additional LPG plus reformat product revenues that would otherwise have been lost to fuel.

THE RECOVERY PLUS SYSTEM

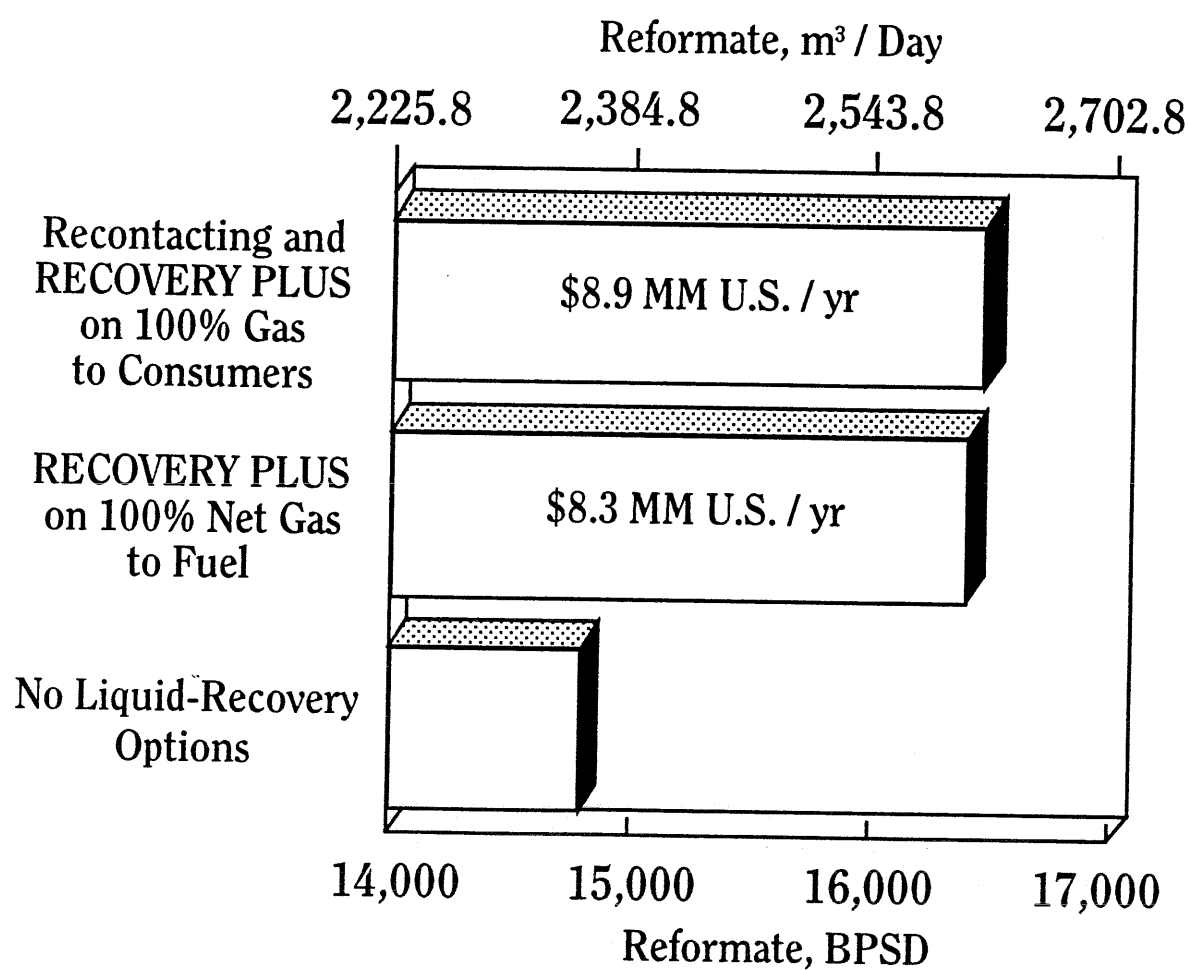
Refiners have chosen to install the RECOVERY PLUS system for the following reasons:

- To maximize reformat yield
- To recover additional LPG for sale as a liquid product
- To maximize aromatics recovery in aromatics applications

Two variations of the RECOVERY PLUS system are available: C₅+ optimized and LPG optimized. Both will recover 85 to 95% of the C₅+ material in the net gas stream. The LPG optimized variation achieves propane recoveries of up to 75% versus the 30 to 40% obtained by the C₅+ optimized system.

The LPG optimized system is used primarily by refiners who have a market for liquid propane and can therefore realize high product values. In special situations, the improvement in hydrogen purity realized by using the LPG optimized system may justify its use.

Figure 2
Potential Reformate Yields



UOP 2110G-5M

Operating Experience and Demonstrated Performance

This section looks at the actual performance of three RECOVERY PLUS systems currently in operation. Product values used in the economic evaluations are shown in Table 1.

Table 1
NET PRODUCT VALUES

<u>Components</u>	<u>Net Value</u>	
	<u>\$/m³</u>	<u>(\$/bbl)</u>
C ₃	69.0	(11.00)
iC ₄	85.0	(13.50)
nC ₄	77.0	(12.20)
iC ₅	98.0	(15.60)
nC ₅	93.0	(14.80)
C ₆ +	100.0	(15.90)

Net values = LIQUID PRODUCT VALUE – FUEL VALUE

In Aromatics production cases the net product value used for Benzene and Toluene will be substantially higher than the C₆+ value shown.

In all of the cases discussed, the RECOVERY PLUS system exceeded guaranteed recoveries. The refiner in all cases was able to realize a simple payout of less than a year. This payout is typical of the results that can be realized in most cases. The majority of RECOVERY PLUS system proposals are showing payouts between 8 and 18 months.

In addition to the performance obtained, the operating history of each system has been good. Maintenance requirements have been low, and ease of operation is reported to be high.

The first case presented, Case A, is a 7,154.6 m³/day (45,000 BPSD) CCR Platforming unit with a product separator pressure of 3.5 kg/cm²g (50 psig). The C₅+ optimized RECOVERY PLUS system was incorporated during the Schedule ASM stage of the project. The system processes 60% of the net gas from the product separator. The remaining 40% of the net gas is sent to recontacting.

The results obtained during the RECOVERY PLUS system demonstration run are shown in Figure 3. Liquid recovery, measured by a mass flow meter, represents a total of 10.13 LV-% of the Platforming unit feed. The figure further breaks down the recovered hydrocarbon by component. The breakdown shows that 6.4 LV-% of the total 10.13 LV-% came from recovered C₆+ material.

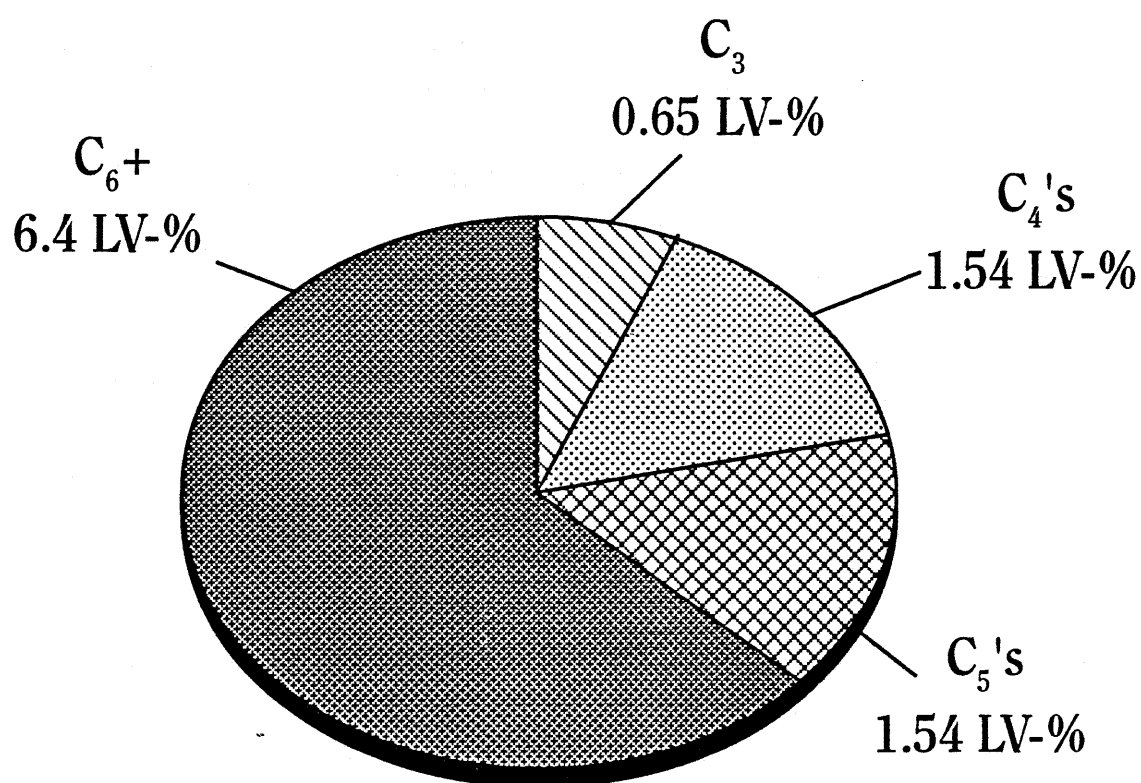
The feed rate used in calculating the 10.13 LV-% recovered was 4,292.7 m³/day (27,000 BPSD). To be consistent with sending 60% of the total net gas to the RECOVERY PLUS system, the 7,154.6 m³/day (45,000 BPSD) feed rate was prorated. The predicted performance of the system in this application was 8.17 LV-% of the Platforming unit feed, based on the 4,292.7 m³/day (27,000 BPSD) feed rate. The liquid product recovered by the RECOVERY PLUS system resulted in \$14.6 million U.S. per year in additional product revenues.

Many times refiners are unaware that valuable liquid products are being lost to the fuel gas system. The C₅+ hydrocarbons are frequently below their equilibrium levels or do not appear at all in the GC analysis of the net gas stream. This may be due to condensation of C₅+ hydrocarbons in the sample cylinder as it cools; in which case, reheating the sample cylinder prior to analysis will give more accurate results. Some refinery laboratories cut off the chromatograph prior to the C₅+ peak; in which case, a more complete analysis may reveal heavier hydrocarbons. In some cases the analytical method used may not be appropriate for detecting C₅+ hydrocarbons.

Figure 4 shows a comparison of the Case A actual performance (as measured by mass flow meter) versus the calculated performance from the available GC analysis. The degree of error in the GC data increases as the component molecular weight increases. Actual liquid recovered by the RECOVERY PLUS

Figure 3

Liquid Recovery

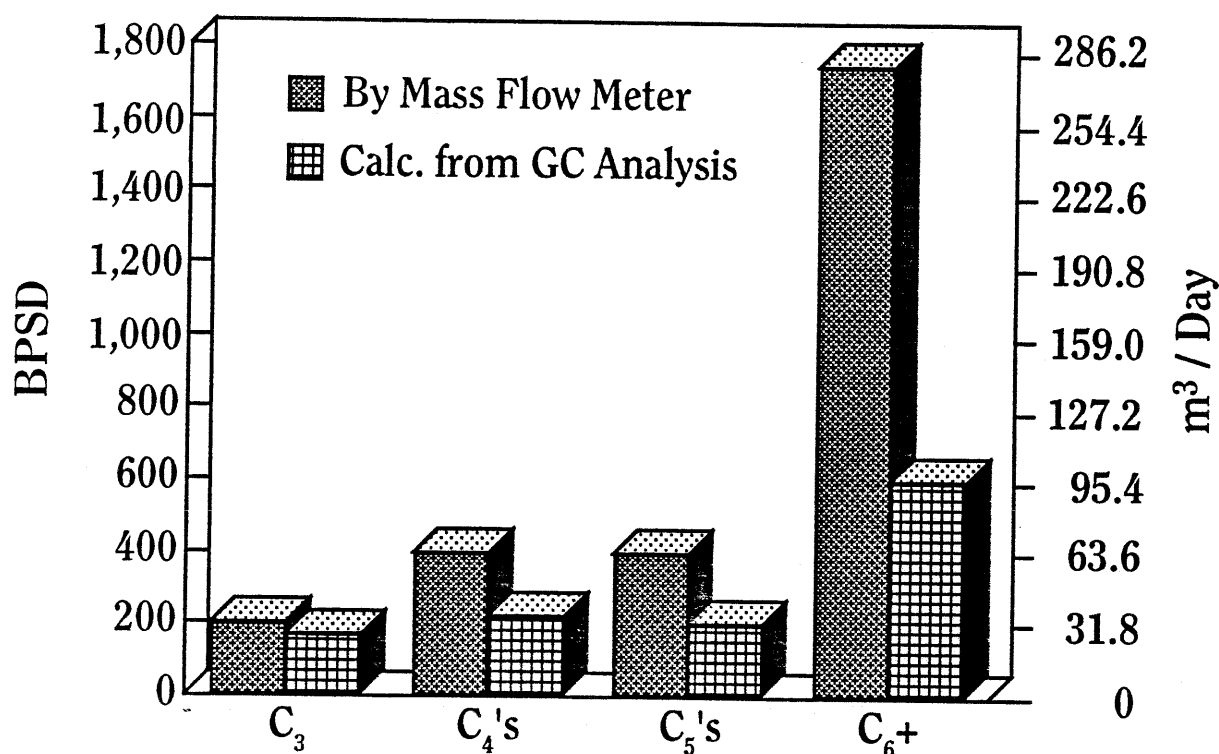


Total 10.13%

UOP 2110G-9

Figure 4

GC Analysis May Not Tell the Real Story



UOP 2110G-10BM

system was 436.3 m³/day (2,744 BPSD) but GC analysis predicted only 169.2 m³/day (1,064 BPSD) of recoverable liquid. This result points out the importance of proper GC analysis of net gas from the Platforming unit. Without proper attention, opportunities for improved profitability can be missed.

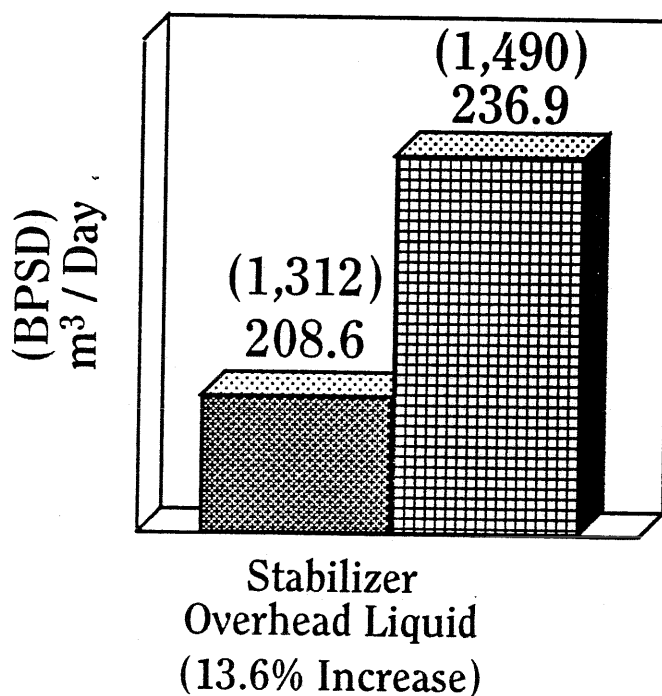
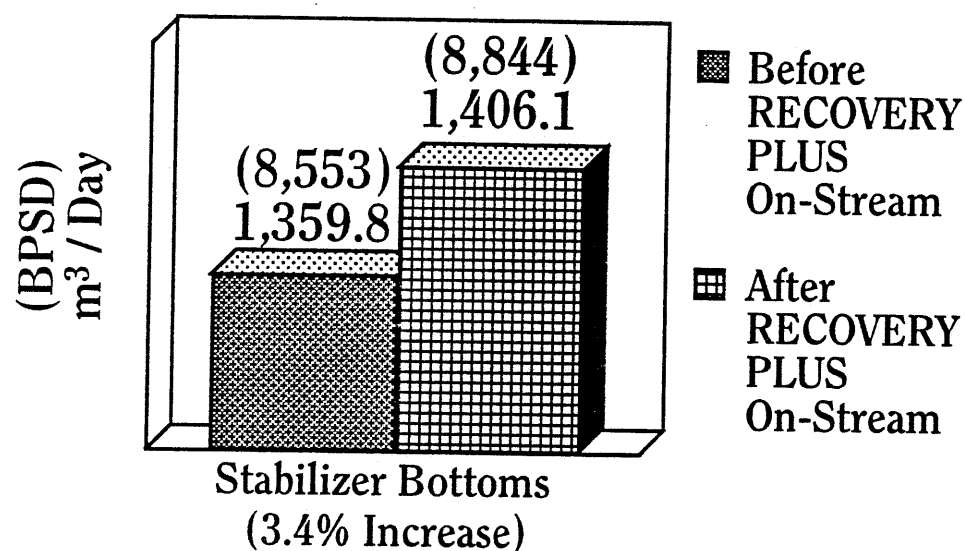
Case B, is a 2,543.8 m³/day (16,000 BPSD) semiregenerative Platforming unit with a product separator pressure of 16.5 kg/cm²g (235 psig). The RECOVERY PLUS system is C₅+ optimized. The system is placed on 100% of the net gas directly off the product separator.

In this case, performance was demonstrated by calculating the difference in liquid product flow rates from the stabilizer column before and after the RECOVERY PLUS system was placed in operation. The results of the performance test are shown in Figure 5. The stabilizer bottoms product was increased 46.3 m³/day (291 BPSD), or 3.4%. The stabilizer overhead product was increased 28.3 m³/day (178 BPSD), or 13.6%. The total increase in recovered liquids was 74.6 m³/day (469 BPSD). The recovered liquid products resulted in \$2.4 million U.S. of additional revenue per year. During the test, the Platforming unit was operated at only 72% of design, or 1,828.4 m³/day (11,500 BPSD). With the Platforming unit operating at design feed rate, the RECOVERY PLUS system recoups 103.5 m³/day (651 BPSD) of additional liquids with a annual value of \$3.33 million U.S. The predicted performance of this System at design feed rate was 96.7 m³/day (608 BPSD).

In Case B, calculated performance from available GC analysis predicted only 59.0 m³/day (371 BPSD) of recoverable liquid product compared to the 74.6 m³/day (469 BPSD) actually recovered.

Case C, is an 1,748.9 m³/day (11,000 BPSD) semiregenerative reformer with a product separator pressure of approximately 13.0 kg/cm²g (185 psig). The RECOVERY PLUS system is LPG optimized. This is the first LPG optimized RECOVERY PLUS system in commercial operation. It was placed on-stream in May 1992. The system processes 100% of the net gas directly off the product separator.

Figure 5
Liquid Recovered



UOP 2110G-13CM

System performance as shown in Figure 6 was calculated from GC analysis. This LPG optimized system recovered 67 mol-% of the propane in the net gas stream. Total C₃+ liquid recovery was 77.4 m³/day (487 BPSD), or 73 mol-% of the C₃+ hydrocarbons in the net gas stream. This system was guaranteed to recover 66 mol-% of the C₃+ hydrocarbons in the net gas. Recovered product value is \$2.4 million U.S. per year.

During the demonstration test, the reformer was being run at 70% of design feed rate, or 1,224.2 m³/day (7,700 BPSD). At design feed rates, the RECOVERY PLUS system achieves 110.7 m³/day (696 BPSD) of liquid recovery and results in \$3.43 U.S. per year of additional revenue. The recovered liquid product represents 6.2 LV-% of the 1,224.2 m³/day (7,700 BPSD) reformer feed rate.

WORLDWIDE SUPPLY

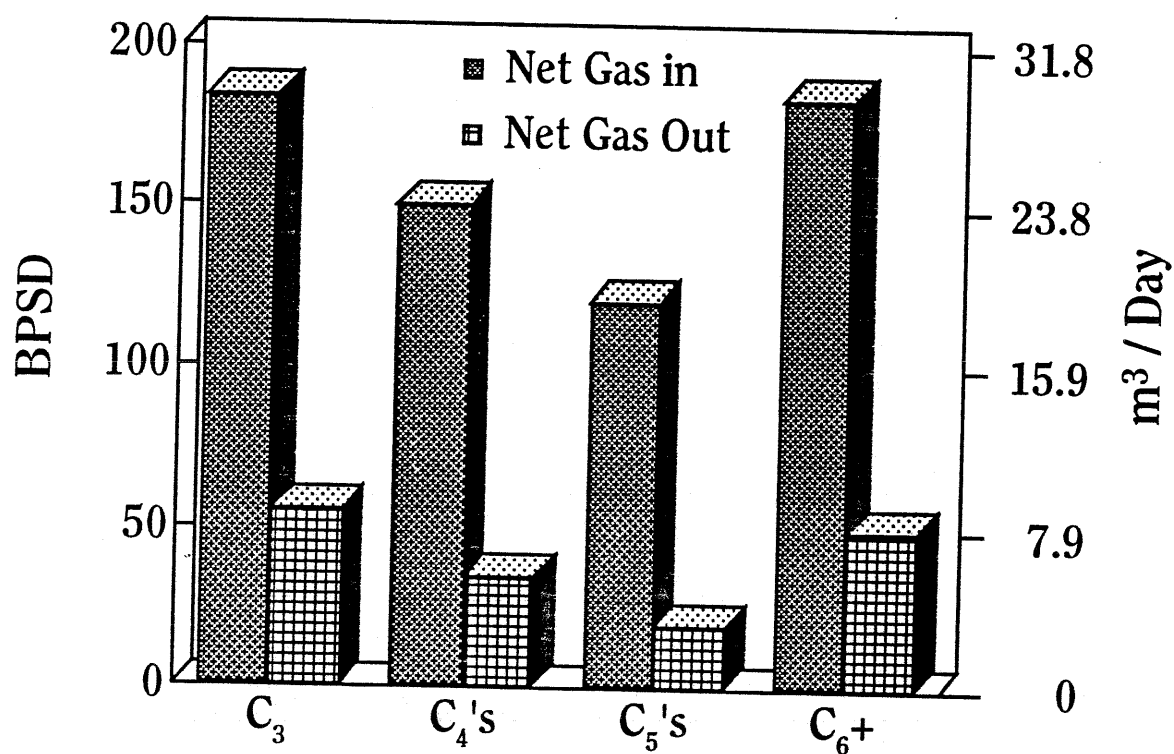
To date, RECOVERY PLUS systems have been delivered to every continent but Africa and Antarctica. Nine systems are in operation, and four more are in design and fabrication. An additional 15 systems have been incorporated in issued CCR Platforming unit Schedule ASM designs.

The RECOVERY PLUS system is designed, built, and guaranteed by UOP. The system is preengineered and fabricated using modular construction techniques. UOP has carefully combined the advantages of shop fabrication with the refiner's need for maintenance access and operability. The system can be installed in add-on situations during normal refinery turnarounds.

Preengineering consists of standardizing the general arrangement of equipment, piping layout, and structural design and establishing other details that are followed in the absence of refiner preference. The preengineered system has built-in flexibility to utilize specific refiner installation details.

The ability to make this engineering information available to a refiner for review prior to submitting a fixed price allows for a mutually agreed scope of work and supply to be established. The goal is to efficiently deliver a product with a high level of quality that meets refining industry codes and standards.

Figure 6
*Net Gas Components
of RECOVERY PLUS*



UOP 2110G-14M

The RECOVERY PLUS system has gone through HAZOP review by both UOP and most of UOP's customers, and the design is being continuously improved to incorporate the result of these reviews. In addition UOP has improved on the design on the basis of the results of inspections of the product by the UOP Technical Services Department.

SUMMARY

To date 28 refiners have found the RECOVERY PLUS system to be a profitable solution to their net gas processing needs. The system always offers incremental improvement in liquid recovery over any existing net gas flow scheme. Combining the RECOVERY PLUS system with an existing net gas processing scheme or including it in a new unit design will maximize liquid product recovery at a simple payout of between 8 and 18 months.

Still many refiners are unaware of the opportunity that exists in the area of net gas processing. This situation may be due to misleading GC analysis or more simply that time is not available to consider the possibilities.

The RECOVERY PLUS system has demonstrated performance and the results are well documented. The ability to predict performance allows UOP to demonstrate the profitability of the system in all net gas processing schemes. UOP would be happy to discuss your particular situation in more detail. If you would like further discussion on this subject, please call Stephen J. Dittmeier at 708-391-2437. If you would like UOP to look at the profitability of the RECOVERY PLUS system to your particular situation, you can fill out the questionnaire at the end of this section.

* RECOVERY PLUS, Platforming, CCR, and Schedule A are trademarks and/or service marks of UOP.

THE RECOVERY PLUS™ SYSTEM

If you would like to receive a budget price proposal for your specific application, please fill out the following questionnaire and return to the attention of Stephen J. Dittmeier at telefax 708-391-2469. If you have questions phone number is 708-391-2437.

Customer: _____

Location: _____

BASIS OF DESIGN

REFORMING UNIT DATA

- | | | |
|----|-------------------------------|-------|
| 1. | Fresh Feed Rate, BPSD | _____ |
| | Water in Fresh Feed, wt-ppm | _____ |
| 2. | H ₂ /HC, mol ratio | _____ |
| 3. | Feed Description: | _____ |
| | a. Gravity, API | _____ |
| | b. Distillation, °F, ASTM | _____ |
| | IBP | _____ |
| | 10% | _____ |
| | 30% | _____ |
| | 50% | _____ |
| | 70% | _____ |
| | 90% | _____ |
| | EP | _____ |
| | c. Composition, LV-%: | _____ |
| | Paraffins | _____ |
| | Naphthenes | _____ |
| | Aromatics | _____ |
| 4. | Catalyst Type | _____ |
| | CCR Design Rate, pph (if any) | _____ |
| 5. | Avg. Reactor Pressure, psig | _____ |

-
- | | | |
|------|---|-------|
| 6. | Stabilizer Bottoms C ₅ +, RONC | _____ |
| 7. | LHSV, hr ⁻¹ | _____ |
| 8. | Separator Temperature, °F | _____ |
| 9. | Separator Pressure, psig | _____ |
| 10. | Recontactor Temperature, °F (If any) | _____ |
| 11. | Recontactor Pressure, psig (If any) | _____ |
| 12. | Recycle Gas to Recontactor (Yes or No) | _____ |
| 13. | Net Gas from 1st Stage, MM SCFD | _____ |
| 14. | Net Gas from 2nd Stage, MM SCFD | _____ |
| 15. | Stabilizer Receiver Temperature, °F | _____ |
| 16. | Stabilizer Receiver Pressure, psig | _____ |
|
 | | |
| 17. | Current <u>Net</u> Offgas Composition from Reformer, mol-%: | |
| | H ₂ | _____ |
| | C ₁ | _____ |
| | C ₂ | _____ |
| | C ₃ | _____ |
| | iC ₄ | _____ |
| | nC ₄ | _____ |
| | iC ₅ | _____ |
| | nC ₅ | _____ |
| | C ₆ + | _____ |
-

18. Current Net Offgas Rate from Reformer, MM SCFD and psig:

	<u>MM SCFD</u>	<u>psig</u>
To Fuel Gas	_____	_____
To Hydrotreater	_____	_____
To Other Units	_____	_____
Other _____	_____	_____
Total	_____	

19. Value of Recovered Liquids from Net Offgas, USD/bbl: *

C ₃	_____
iC ₄	_____
nC ₄	_____
iC ₅	_____
nC ₅	_____
C ₆₊	_____

* These values should represent the value you place on these products if they can be recovered in the stabilizer liquid instead of losing them in the net offgas. In the absence of supplied values, UOP will use standard industry values.

20. Please include a sketch of your reformer's recontacting or net offgas system.

NOTE: The foregoing information is required to facilitate the generation of a preliminary UOP Platforming yield estimate. This estimate is then used as the basis for determining the estimated performance of the RECOVERY PLUS™ system.

THE RECOVERY PLUS™ SYSTEM

If you would like to receive a budget price proposal for your specific application, please fill out the following questionnaire and return to the attention of Phil Fleming at telefax 32 (3) 541 7806. If you have questions phone number is 32 (3) 540 9956.

Customer: _____

Location: _____

BASIS OF DESIGN**REFORMING UNIT DATA**

- | | | |
|----|---|-------|
| 1. | Fresh Feed Rate, m ³ /day | _____ |
| | Water in Fresh Feed, wt-ppm | _____ |
| 2. | H ₂ /HC, mol ratio | _____ |
| 3. | Feed Description: | |
| | a. Gravity, API | _____ |
| | b. Distillation, °C, ASTM | |
| | IBP | _____ |
| | 10% | _____ |
| | 30% | _____ |
| | 50% | _____ |
| | 70% | _____ |
| | 90% | _____ |
| | EP | _____ |
| | c. Composition, LV-%: | |
| | Paraffins | _____ |
| | Naphthenes | _____ |
| | Aromatics | _____ |
| 4. | Catalyst Type | _____ |
| | CCR Design Rate, pph (if any) | _____ |
| 5. | Avg. Reactor Pressure, kg/cm ² g | _____ |

6. Stabilizer Bottoms C₅+, RONC _____
7. LHSV, hr⁻¹ _____
8. Separator Temperature, °C _____
9. Separator Pressure, kg/cm² g _____
10. Recontactor Temperature, °C (If any) _____
11. Recontactor Pressure, kg/cm² g (If any) _____
12. Recycle Gas to Recontactor (Yes or No) _____
13. Net Gas from 1st Stage, nm³/hr _____
14. Net Gas from 2nd Stage, nm³/hr _____
15. Stabilizer Receiver Temperature, °C _____
16. Stabilizer Receiver Pressure, kg/cm² g _____

17. Current Net Offgas Composition from Reformer, mol-%:

H ₂	_____
C ₁	_____
C ₂	_____
C ₃	_____
iC ₄	_____
nC ₄	_____
iC ₅	_____
nC ₅	_____
C ₆ +	_____

18. Current Net Offgas Rate from Reformer, nm³/hr and kg/cm² g:

	<u>nm³/hr</u>	<u>kg/cm² g</u>
To Fuel Gas	_____	_____
To Hydrotreater	_____	_____
To Other Units	_____	_____
Other _____	_____	_____
Total	_____	

19. Value of Recovered Liquids from Net Offgas, USD/m³: *

C ₃	_____
iC ₄	_____
nC ₄	_____
iC ₅	_____
nC ₅	_____
C ₆ +	_____

- * These values should represent the value you place on these products if they can be recovered in the stabilizer liquid instead of losing them in the net offgas. In the absence of supplied values, UOP will use standard industry values.

20. **Please include a sketch of your reformer's recontacting or net offgas system.**

NOTE: The foregoing information is required to facilitate the generation of a preliminary UOP Platforming yield estimate. This estimate is then used as the basis for determining the estimated performance of the RECOVERY PLUS™ system.