[redacted]

A PROPOSED

The Modular Expansion of the [redacted] Refinery by 40,000 BPD

Prepared For
[redacted]

Attention
[redacted]

Quote No.
[redacted]

Issue Date
[redacted]

[redacted], Inc.

P.O. Box [redacted]

[redacted], Missouri [redacted]

United States

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Contents

Summary

This proposal is presents a complete solution for the expansion of [redacted] from the current production of 45,000 BPD to a modern modular refinery producing 85,000 BPD with outputs of 95 RON gasoline and Ultra-Low sulfur diesel. We have included as options, methods to process excess bottoms (asphalt) and as well as a use for the sulfur produced.

Current Production

The existing refinery processes 45,000 bpd of crude. The refinery complex consists of three production units:

- Parsons Unit, producing 26,000 bpd,
- Universal Unit, producing 10,000 bpd,
- Cautivo Unit, producing 9,000 bpd,

Finished Products are:

Parsons*: Operational Capacity 26,000 bpd.

Finished Product	Volume, bls per year	Semi-Processed Product	Volume, bls per year
Spray Oil	217,770	Naphtha	1,409,832
Diesel # 2	1,026,996	JP1	1,686,528
Absorber Oil	1,464		
Diesel # 1	111,264		
Fuel Oil	4,570,974		

Universal*: Operational Capacity: 10,000 bpd.

Finished Product	Volume, bls per year	Semi-Processed Product	Volume, bls per year
Diesel # 2	732,732	Naphtha	606,096
Diesel # 1	101,748	JP1	8,784
Fuel Oil	1,948,086		

Cautivo*: Operational Capacity: 9,500 bpd.

Finished Product	Volume, bls per year	Semi-Processed Product	Volume, bls per year
Rubber Solvent	71,004	Naphtha	476,532
Mineral Oil	52,338		
Diesel # 2	766,038		
Fuel Oil	1,909.956		

Stabilizer*: Operational Capacity: 3,216 bpd.

Finished Product	Volume, bls per year	Semi-Processed Product	Volume, bls per year
LPG	13,542	Stabilized Gasoline	957,822

* = Source: PETRINDUSTRIAL Rifineria La Libertad – Situación Actual

Proposed Production

This proposal is for a Modular Refinery expansion to add the capability to process an additional **40,000 bpd** of Oriente crude in the [redacted] Refinery into LPG, 95 RON (Research Octane Number) Gasoline, ULSD (Ultra Low Sulfur Diesel) no. 1 and no. 2 and high quality asphalt

This proposal is based on the following parameters:

a. Throughput requirement is **85,000** bpd,
b. Feed stock is Oriente Crude Oil,
c. Required products are:
    - Liquefied Petroleum Gas (LPG)
    - Motor gasoline 95 RON (Octane)
    - ULSD no. 1
    - ULSD no. 2
    - Asphalt
d. Geographical Location: [redacted] Refinery

A reliable feedstock assay, including a True Boiling Point (TBP) distillation to verify the design and equipment requirements will be necessary prior to signing the Equipment Sales Agreement (ESA).

Based on preliminary information, the following estimated yields could be expected from the existing and new modular equipment outlined in this proposal:

Product, bpd	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Total, bls per year*
LPG	41	59	77	77	1,149	3,377	1,232,605
Rubber solvent	207	207	207	207	207	207	75,555
Turpentine	153	153	153	153	153	153	55,845
Naphtha	7,682	11,188	14,694	14,694	0	0	5,363,310
Gasoline	0	0	0	0	11,067	16,940	6,183,100
HSD no.1	2,336	3,442	4,548	4,548	4,548	0	1,660,020
HSD no.2	7,740	11,180	14,620	14,620	14,620	0	5,336,300
USLD no.1	0	0	0	0	0	12,356	4,509,940
USLD no. 2	0	0	0	0	0	2,237	816,505
Spray oil	657	657	657	657	657	657	239,805
MDO	14,591	14,591	14,591	27,887	21,912	0	7,997,880
Asphalt	11,464	11,464	11,464	21,912	21,912	21,912	7,997,880
#4 Fuel Oil	0	12,927	24,799	0	0	0	9,051,635
Sulfur, MT/day	0	0	0	0	0	115	41,975 MT/year
Lube Oil	0	0	0	0	2,000	2,000	730.000

* = These yields are the best estimate that can be made without the computer process simulation model being developed.

Deliverables

The following are the proposed deliverables:

a. One (1) Engineering and Design Package consisting of:
   - Schedule A-Process Design Package
   - Schedule B- Construction Package
b. Two (2) 20,000 bpd Atmospheric Distillation Unit (ADU) with two side draws made of alloy construction,
c. Two (2) 25,000 bpd Vacuum Distillation Units (VDU) made of alloy construction,
d. One (1) 25,000 bpd Naphtha Splitter,
e. One (1) 18,000 bpd Naphtha Hydrotreater (NHDS),
f. One (1) 18,000 bpd Catalytic Reformer (CRU),
g. One (1) 20,000 bpd Diesel Hydrotreater (DHDS),
h. One (1) 30,000 bpd Hydrocracker (HCU) with a Diesel Hydrotreater (DHDS),
i. One (1) 55 mmscfd Steam Methane Reformer Hydrogen Generator (SMR),
j. One (1) 116 Metric ton Sulfur Recovery Plant (SRU),
k. One (1) 2,000 bpd Lube Oil Hydrotreater with Fractionation,
l. Three (3) 25,000 bpd Flares,
m. One (1) Gas-Fired Thermal Oxidizer to reduce Air Pollution from the Modular Refinery furnaces,
n. One (1) Seawater Reverse Osmosis System to treat oily brine from the Desalter for safe discharge,
o. One (1) Water-Oil Separator and associated Produced Water treatment equipment,
p. One (1) Automatic Oil Purifier to purify and reuse lubrication oils,
q. One (1) Automatic Vacuum Dehydrator for purification and reuse of transformer oil,
r. One (1) Gas-fired Thermal Oxidizer to reduce air pollution from boilers,
s. One (1) Combustion Catalyst Injection System for fuel economy and cleaner burning,
t. One (1) Boiler Feed Water System with all associated additive injection systems,
u. One (1) Firewater system with a diesel and electric motor-driven firewater pump and a Jockey pump,
v. One (1) set of Laboratory Equipment including Oil, Distillate, Water and Asphalt Testing Equipment,
w. Advisory services (only) for installation, commissioning, startup and test run of the equipment. Actual assembly, construction, site work, landscaping and hydrocarbon storage facilities and associated labor are to be done by others.

Engineering and Design Packages

Schedule A - Process Design

The Process design package will be provided after a complete assay as been done on the raw crude to be refined with the new modular refinery equipment. For each component of the over all master plan will be defined and outlined according to the following processes:

- Computer Process Simulation,
- Process flow Diagram (PFD),
- Piping and Instrumentation Diagrams (P & ID),
- Electrical single line diagram,
- Electrical Equipment List,
- Instrumentation Equipment List,
- Heat Exchanger Data Sheets,
- Air Cooler Data Sheets,
- Pump Data Sheets,
- ASME Section VIII pressure Vessel data sheets,
- Process Unit Site Plan.
- Reverse Osmosis System Data Sheet,
- Boiler Feed Water System Data Sheets,
- Oily Water Treatment System Data Sheets,
- Process Water Recycle System Data Sheets,
- Air Pollution Emissions Control Systems Data Sheets, Firewater System Data Sheets

Schedule B - Construction

The Construction design package will include all the drawings and information required to install and setup all of the equipment outlined in the process design package. This package will include the following components:

- Structural Steel Design Drawings for the Skids,
- Equipment General Arrangement Drawings,
- Piping Drawings,
- Electrical Equipment Location Diagrams,
- Instrumentation Location Diagrams,
- Electrical Wiring Diagrams,
- Instrumentation Wiring Diagrams,
- Ancillary Equipment Location Diagrams,
- Ancillary Equipment Details.

Modular Refineries Required

Each of the following Modular Refinery Skids are required to achieve the distillates referenced earlier in this proposal. The list has been compiled to be a complete list of the major skids needed to build and maintain the expansion of the 40,000 bpd. In addition it includes the existing 45,000 bpd of current production to achieve the yields as outlined above. These yields are the best estimate that can be done without the computer process simulation model.

Atmospheric Distillation Unit (ADU)

The ADU (Atmospheric Distillation Unit) separates most of the lighter end products such as gas, gasoline, naphtha, kerosene, and gas oil from the crude oil. The crude oil is preheated by the bottoms feed exchanger, further preheated and partially vaporized in the feed furnace and passed into the atmospheric tower where it is separated into off gas, gasoline, naphtha, kerosene, gas oil, and bottoms. This tower contains fractionation trays, is equipped with top pump and two side draws (for naphtha, kerosene, and gas oil products).

Vacuum Distillation Units (VDU)

The VDU (Vacuum Distillation Unit) takes the residuum from the ADU (Atmospheric Distillation Unit) and separates the heavier end products such as vacuum gas oil, vacuum distillate, slop wax, and residue. Heavy crude oil is preheated by the bottoms feed exchanger, further preheated and partially vaporized in the feed furnace, and passed into the vacuum tower where it is separated into slop oil, vacuum gas oil, vacuum distillate, slop wax, and bottoms residue.

Naphtha Splitter

The Naphtha Splitter tower is a tray fractionation column, which separates the Full Range Naphthas (FRN) into a Light Naphtha (LSR) and a Heavy Naphtha product. Light naphtha from the splitter tower overheads is first cooled against the incoming FRN and then condensed in an air fin fan cooler into the overhead reflux drum. From this overhead drum LSR is provided as reflux to the splitter tower or routed to the light naphtha stabilizer tower located in the Gas plant for stabilization and recovery of light ends LPG. Un-condensed vapors are re-circulated to the Crude unit overheads section for recovery. The splitter tower bottoms are Heavy Naphtha and forms the feed to the Naphtha Hydrotreater section and subsequently the Catalytic Reformer feedstock. This stream is routed as a hot feed to the Naphtha Hydrotreater. Naphtha splitter bottoms are pumped via a heat exchanger to recover heat from Naphtha Hydrotreater hot reactor effluent into a fired furnace to provide the desired re-boil duty to effect the separation of the light and heavy naphthas.

Naphtha Hydrotreater (NHDS)

Naphtha Hydrotreater (NHDS) is a catalytic chemical process used to remove sulfur (S) from refined petroleum products such as gasoline or petrol. Another important reason for removing sulfur from the naphtha streams is that sulfur, even in extremely low concentrations, poisons the noble metal catalysts (platinum and rhenium) in the catalytic reforming units that are subsequently used to upgrade the octane rating of the naphtha streams. The Naphtha Hydrotreater processes include facilities for the capture and removal of the resulting hydrogen sulfide (H_2S) gas. The hydrogen sulfide gas is then subsequently converted into elemental sulfur.

Catalytic Reformer (CRU)

Catalytic reformer (CRU) is used as a chemical process to convert naphthas, typically having low octane ratings, into high-octane liquid products. This process re-arranges or re-structures the hydrocarbon molecules in the naphtha feedstocks as well as breaking some of the molecules into smaller molecules. The overall effect is that the product reformate contains hydrocarbons with more complex molecular shapes having higher-octane values than the hydrocarbons in the naphtha feedstock. In so doing, the process separates hydrogen atoms from the hydrocarbon molecules and produces very significant amounts of byproduct hydrogen gas for use in the

Diesel Hydrotreater (DHDS)

Diesel Hydrotreater (DHDS) is also catalytic chemical process used to remove sulfur (S) from refined petroleum products such as diesel fuel. The Diesel Hydrotreater processes include facilities for the capture and removal of the resulting hydrogen sulfide (H_2S) gas. The hydrogen sulfide gas is then subsequently converted into elemental sulfur.

HydroCracker (HCU) with a Diesel Hydrotreater (DHDS)

The HydroCracker Unit is a device that converts light and heavy gas oils to more valuable lower boiling point products. It is essentially catalytic cracking in the presence of hydrogen at elevated pressure (70 - 210 (Bar)) and moderate temperature (280 - 450 (C))

Steam Methane Reformer Hydrogen Generator (SMR)

Steam reforming converts methane (and other hydrocarbons in natural gas) into hydrogen and carbon monoxide by reaction with steam over a nickel catalyst.

Sulfur Recovery Plant (SRU)

The hot combustion products from the furnace enter the waste heat boiler and are partially cooled by generating steam. Any steam level from 3 to 45 bar g can be generated. The combustion products are further cooled in the first sulfur condenser, usually by generating LP steam at 3 – 5 bar g. This cools the gas enough to condense the sulfur formed in the furnace, which is then separated from the gas and drained to a collection pit. In order to avoid sulfur condensing in the downstream catalyst bed, the gas leaving the sulfur condenser must be heated before entering the reactor. The heated stream enters the first reactor, containing a bed of sulfur conversion catalyst. About 70% of the remaining H_2S and SO_2 in the gas will react to form sulfur, which leaves the reactor with the gas as sulfur vapor. The hot gas leaving the first reactor is cooled in the second sulfur condenser, where LP steam is again produced and the sulfur formed in the reactor is condensed. A further one or two more heating, reaction, and condensing stages follow to react most of the remaining H_2S and SO_2.

Lube Oil Hydrotreater with Fractionation

Hydro-finishing of the lube oil distillate removes chlorinated contaminants, nitrogen compounds, sulfur compounds, oxygenated compounds and the small quantity of non lube components recovered from the used oils with the lube oil fraction. The hydro-finishing is performed over a suitable catalyst and allowed to purify and upgrade the oil fraction in color, oxidation stability, acidity, emulsification characteristics and other quality requirement. Chlorinated contaminants and nitrogen compounds are converted into ammonium chloride. By this process, a finished lube oil product is obtained which has excellent lube properties, stability and additive response, whereas viscosity and gravity essentially do not change. The system consists of three sections, the hydrogen production, the reaction and the separation section.

Gas-Fired Thermal Oxidizer

Thermal oxidizers are used to reduce air pollution emissions from a variety of industrial processes by treating the polluted exhaust gas prior to discharging the exhaust gas to atmosphere. To destroy the contaminants in a polluted exhaust gas, a thermal oxidizer uses the principle of "thermal oxidation". Thermal oxidation is a combustion process in which the contaminants within the polluted exhaust gas react with oxygen in a temperature-controlled environment to create an oxidation reaction. This chemical reaction is what reduces the pollutants in the exhaust gas to an innocuous emission (CO_2, water vapor, and heat) to atmosphere.

Seawater Reverse Osmosis System

Unlike osmosis, which is the natural tendency of pure water to flow through a membrane into impure water, reverse osmosis is achieved by applying very high pressure to seawater to counteract the osmotic flow. Thus, seawater is forced through a semi-permeable membrane, which removes all the dissolved solids and produces fresh, potable water on the other side. This method rejects at least 98% of salts, contaminates, and pollutants from seawater.

Oil-water Separator and associated Produced Water treatment equipment

Oil-water separators are "in-line" devices used to remove oils and greases (and sometimes solids) from industrial waste streams and storm water discharges. Oil-water separators operate by employing various physical or chemical separation methods, including gravity separation, filters, coagulation/flocculation, and flotation. The objective is to produce an effluent that is safe to discharge to open waters.

Automatic Oil Purifier

The self-contained Allen Hydroscav Oil Purifier system uses filtration and thermal dehydration to remove solids and moisture from almost all types of oil. Hydroscav Oil Purifiers are cost-efficient and designed for continuous, unattended operation (except for startup and shutdown). With a compact design, Hydroscav Oil Purifiers allow for easy installation and accessibility of components for servicing.

Automatic Vacuum Dehydrator

Industrial oil deteriorates over time due to absorption of moisture from the atmosphere, contamination of hydrocarbon gases, and acid generation as a result of hydrolysis. The Conditioner is designed to purify a variety of industrial oils and prolong its useful life almost indefinitely.

Boiler Feed Water System

Proper treatment of boiler feed water is an important part of operating and maintaining a boiler system. As steam is produced, dissolved solids become concentrated and form deposits inside the boiler. This leads to poor heat transfer and reduces the efficiency of the boiler. Dissolved gasses such as oxygen and carbon dioxide will react with the metals in the boiler system and lead to boiler corrosion. In order to protect the boiler from these contaminants, they should be controlled or removed, trough external or internal treatment. The treatment and conditioning of boiler feed water must satisfy three main objectives, continuous heat exchange, corrosion protection, and production of high quality steam.

Firewater System

Fire pump piping system includes test loop, bypass, pressure relief line, jockey pump interface, and all valves for a complete fire fighting system. All systems use UL/FM approved diesel engine drivers and control panels, plus jockey pumps and accessories.

The Skid Components

Include with each mini refinery or skid supplied the following components are standard where they apply:

- Pressure Vessels,
- Main Pumps and Spare Pumps,
- Air Coolers
- Heat Exchangers
- Process Heaters with Emission Controls,
- On-Skid Piping, Control Valves, manual gate, ball and check valves,
- Insulation and Aluminum Jacketing for piping, vessels and exchangers as needed,
- Skid-mounted Equipment on heavy-duty steel frames with grating in high traffic areas,
- Carbon steel equipment and piping will be sand-blasted to SP-6 and painted,
- Instrumentation (including instrument air system) installed and wired to a skid-mounted junction box,
- Electrical equipment installed and wired to a skid-mounted Motor Control Center (MCC),
- Boiler Feed Water Generation System,
- Reverse Osmosis System installed,
- Process Water Recycling System installed,
- Oily Waste Water Treatment System installed,
- Air Emission Control Equipment installed,
- Additive Dosing Systems piped and wired,
- Firewater System
- One-year's supply of spare parts for the MREP

Documentation Package

A documentation package supplied with the equipment includes:

- Three (3) sets of job books containing vendor drawings, data, spare parts lists and equipment operating manuals,
- Three (3) sets of the Engineering and Design Data Package,
- Three (3) sets of Plant Operating Manuals consisting of the recommended start-up, operating and shut-down procedures,
- Three (3) sets of Operating and Maintenance Manuals of Ancillary Equipment.

Advisory-only on-site services

On-site advisory services (only) are provided at the refinery site only for advising the Installation Contractor (by others) on the installation, commissioning, start-up and test run of the equipment. Eight thousand twenty-five (8,025) man-days have been allocated for advisory-only services.

These include:

- A Project Manager,
- A Construction Manager,
- A process Engineer,
- An Electrical Engineer,
- A Rotating Equipment Mechanic,
- An Instrumentation and Electrical Technician,
- A Plant Operator.

Utility Requirements

Estimated Utility Requirements of the Modular Refineries are as follows:

Item	ADU	VDU	CRU	HCU	HDS	SMR
Steam (300 psig), lbs per day	0	0	0	0	0	2,389,063
Operating Power, kWh per day	36,000	15,000	54,000	390,000	240,000	42,970
Cooling Water, gallons per day	0	0	0	0	0	0
Fuel, mmbtu per day	2,000	1,500	5,400	6,000	8,000	12,890
Process Water, gpm	0	0	0	0	0	0

Warranty

[redacted] warrants that the equipment shall be free from defects in design and workmanship and free from defects arising from failure to conform to the engineering specifications for a period of thirty-six (36) months following shipment. The tie-in between the [redacted] and the Modular Refinery is performed by others. Problems associated with the tie-in of the MREP with the main refinery are not the responsibility of [redacted]. In no case will liquidated damages be accepted.

Assumptions and Limiting Conditions

The following items are excluded from this proposal:

- Freight charges beyond the Port of Houston, Texas, USA,
- Catalyst and other process consumables,
- Providing any equipment or process units not mentioned in this proposal,
- All permits and associated costs, i.e. building, environmental permits, etc.,
- Any and all sales taxes, use taxes, import duties, customs fees, storage fees and other fees associated with importing the equipment,
- Land acquisition and site construction, i.e. site grading tank berms, landscaping, facility and access roads, paving, security fencing, concrete foundations etc.,
- Utilities, natural gas supplies, sewer, telephone etc.
- Outside process battery limits (OSBL) equipment, feedstock supply and product storage tanks, piping and associated pipe supports, loading and unloading facilities, pipeline connections, buildings etc.
- Actual installation, commissioning, startup and test run of the equipment will be advisory only. The installation contract will be executed by others as appointed by the end user.
- Any unforeseen conditions or items not specifically noted in this proposal.

Applicable Design Standards

- ASME Code Section VIII, Division 1, Pressure Vessels and Heat Exchangers
- ANSI B31.3 Petroleum Refinery Piping
- FM Requirements for Burner Control
- API-RP520, Parts I and II, Design and Installation of Pressure Relieving Systems in Refineries
- API-500A Classification of Areas for Electrical Equipment in Petroleum Refineries (Class 1, Group D, Division 2) on the process end of the skid. A firewall separates the process end of the skid from the control room and heater end of the skid. A seal is placed in all conduits that pass through the firewall. The heater end of the skid is unclassified.

Schedule and Shipment

All equipment is provided FAS Port of Houston, Texas, USA. The target schedule is as follows, after the signing of the Contract and receipt of progress payments for each individual stage:

Stage 1. Twelve (12) months:	one (1) 25,000 bpd VDU,
Stage 2. Sixteen (16) months:	one (1)20,000 bpd ADU,
Stage 3. Twenty (20) months:	one (1) 20,000 bpd ADU,
Stage 4. Twenty-four months:	one (1) 25,000 bpd VDU,
Stage 5. Twenty-eight months:	one (1) 25,000 bpd Naphtha Splitter,
	one (1) 18,000 bpd NHDS,
	one (1) 18,000 bpd CDU,
	one (1) 2,000 bpd Lube Oil Hydrotreater,
Stage 6. Thirty-two months:	one (1) 55 mmscfd SMR,
	one (1) 30,000 bpd Combination Hydrocracker & Diesel HDS
	one (1) 116 metric ton per day SRU

Price Summary

Stage One*†	USD	442,650,000.0
Stage Two*†	USD	29,300,000.00
Stage Three*†	USD	253,910,000.00
Stage Four*‡	USD	7,100,000.00
Stage Five*†	USD	19,790,000.00
Stage Six*†	USD	85,240,000.00
Total Cost*†	**USD**	**837,990,000.00**

* Prices quoted will be contingent on those effective at the time the purchase order is received and material is purchased. The price listed is contingent upon obtaining a reliable assay of the feedstock for design and equipment verifications.

† Ex works Huston, Texas, USA

‡ Net price each, additional

Payment Schedule

Down Payment Due At Signing	USD	442,650,000.00
Due at 12 months after contract signing	USD	29,300,000.00
Due at 16 months after contract signing	USD	253,910,000.00
Dues at 20 months after contract signing	USD	26,890,000.00
Due at 28 months after contract signing	USD	61,750,000.00
Due after successful startup	USD	23,490,000.00

Quote Validity

This quote is valid for thirty (30) days from the date on the front cover, unless extended in writing by [redacted], Inc.

This document is only a non-binding proposal and does not constitute a contract or agreement with respect to the subject matter herein mentioned. No contract shall be deemed to exist between [redacted], Inc. and Petro Ecuador, unless and until a mutually acceptable written [redacted], Inc, Equipment Sale Agreement (ESA) has been executed.

Terms

The payment schedule is designed to fund the necessary working capital for the project. All equipment is specifically designed for each application and involves significant financial risks to [redacted]. Standard international banking and financial practices do not apply to the equipment, because the equipment is unique and does not have an alternative market. Therefore, the project costs for the buyer will increase if payment terms deviate from those listed above. These added costs include Letters of Credit and all associated fees and project working capital costs.

A Final Note:

[redacted], Inc. takes great pride in our long heritage as the industry leader in environmental technology and process equipment. We appreciate the opportunity to present you with this comprehensive proposal. Our primary focus has been to provide a state-of-the-art, environmentally responsible refining process. Our goal is to provide you with the technology to differentiate Ecuador, in the world of refining, by providing the best solution with the most affordable price.

In addition, we appreciate your interest in increasing your distillate production with the incorporation of environmental technology. We believe that your effort to go "green" with your refineries provides great rewards for the people of Ecuador now and in the future.

Again, I would like to thank you for the opportunity to quote this project and look forward to working with you to see this project to completion.

[redacted]
President
[redacted]