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CCC BLUE HORIZON

CASE REPORT

NEO-SRU DESULFURIZATION UNIT

QATAR



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**INDEX**

1. CASE DESCRIPTION .....	3
1.1 Process Scenario .....	3
2. OPERATION & MAINTENANCE DATA.....	6
3. FINANCIAL ANALYSIS .....	9
4. CONCLUSIONS .....	13



## 1. CASE DESCRIPTION

This is a case description aimed to the installation and operation of a NEO-SRU Catalyst Unit in:

- **Seaport Area, Qatar**

The Catalyst Production Facility is located in:

- **Qatar**

The Project shall be performed in **year 2021**.

In this case scenario, all the equipment required (such as tanks, vessels, pumps, instrumentation) **has been considered as new**.

The installation, commissioning and start-up of the Unit required **less than seventeen months**.

The catalyst process **pressure is low pressure (less than 6 barg)**, and the process **temperature is about 130°C**.

**The required desulfurization capacity is about 2,000 MT/day** and the **Catalyst Consumption is about 34,000 MT/year**.

### 1.1 Process Scenario

The NEO-SRU Fuel production is:

- NEO-SRU Unit Production: **2,000 MT/day**

The Feedstock is:

FEED FUEL	CATALYST
FUEL OIL STREAM ATMOSPHERIC RESIDUE	NEO-SRU-M
<b>100%</b>	<b>&lt; 1%</b>

*Tab. 1.1: Feedstock composition*

The analysis of the Feedstock is here below:

ANALYSIS	UNIT	STANDARD LIMIT 380	TEST METHOD
Density@15°C	kg/m <sup>3</sup>	990 max	ASTM D 1298
Kinematic Viscosity@50°C	C.St	380 max	ASTM D 445
Viscosity Redwood 1@37.8°C	Sec	-	Calculated
Pour Point	°C	32 max	ASTM D 97
Flash Point	°C	65 min	ASTM D 93
Sulphur Total	wt%	3.5 max	ASTM D 1552
Carbon Residue (Conradson)	wt%	15 max	ASTM D 189
Ash	wt%	0.15 max	ASTM D 482
Water and Sediment	vol%	1 max	ASTM D 1796
Calorific Value (Higher)	MJ/kg	41.7 min	Calculated

Tab. 1.2: Fuel Oil Stream Feedstock analysis

The Products is:

- Desulfurized Fuel Oil 0.5% max: **100%**

The analysis of the Product is here below:

ANALYSIS	UNIT	STANDARD LIMIT 380	TEST METHOD
Density@15°C	kg/m <sup>3</sup>	990 max	ASTM D 1298
Kinematic Viscosity@50°C	C.St	380 max	ASTM D 445
Viscosity Redwood 1@37.8°C	Sec	-	Calculated
Pour Point	°C	32 max	ASTM D 97
Flash Point	°C	65 min	ASTM D 93
Sulphur Total	wt%	<b>0.5 max</b>	ASTM D 1552
Carbon Residue (Conradson)	wt%	15 max	ASTM D 189
Ash	wt%	0.15 max	ASTM D 482
Water and Sediment	vol%	1 max	ASTM D 1796
Calorific Value (Higher)	MJ/kg	41.7 min	Calculated

Tab. 1.3: Final Product analysis

Note: the viscosity shall be reduced as well during the process.

Further investigation is necessary in order to calculate the exact Product's final viscosity.



The Unit shall be composed of:

ID	Equipment	Tag N.
1	Drum	105-D-301
2	Electrical Heater	105-HE-301
3	Pump	105-P-301 A
4	Pump	105-P-301 B
5	DSCI Package	105-U-301
6	Static Mixer	105-M-301
7	Hybrid Mixer	105-MH-301
8	Electrical Heater	105-HE-202
9	Mixing Agitator	105-AG-302
10	Pump	105-P-302 A
11	Pump	105-P-302 B
12	Distillation Tower	105-C-301 A
13	Distillation Tower	105-C-301 B
14	Pump	105-P-303 A
15	Pump	105-P-303 B
16	Cooling Fan	105-A-301 A
17	Cooling Fan	105-A-301 B
18	Drum	105-D-303
19	Pump	105-P-304 A
20	Pump	105-P-304 B
21	Drum	105-D-304
22	Electrical Heater	105-HE-304
23	Pump	105-P-305 A
24	Pump	105-P-305 B
25	DSCI Package	105-U-302
26	Static Mixer	105-M-302
27	Hybrid Mixer	105-MH-302
28	Electrical Heater	105-HE-304
29	Mixing Agitator	105-D-305
30	Pump	105-P-306 A
31	Pump	105-P-306 B
32	Drum	105-D-306
33	Pump	105-P-306 A
34	Pump	105-P-306 B
35	Instrumentation	-
36	Electrical	-
37	Piping	-
38	Process Automation	-

Tab. 1.4: Unit Components



## 2. OPERATION & MAINTENANCE DATA

This chapter includes all the data used in the next Chapter for the Financial Analysis.

### License and Land

No cost for land, license and certifications, have been considered.

The required land extension for the Unit is:

- Land Extension: **2,000 m<sup>2</sup>**

### Production Rate

The standard production rate of this Unit is:

- Unit Production Rate: **2,000 MT/day**

### Unit Construction Investment

The total investment of the Unit includes:

- **Engineering**
- **Process Unit Equipment**
- **Shipment**
- **Installation, Commissioning & Start-Up Activities**

Note that, it **has not been included** in this Report:

- Any Equipment not explicitly mentioned in this Report
- Logistics Unit
- Utility Unit
- Auxiliary Facilities
- Any heating system (the HSFO shall be supplied at a temperature of 130°C)
- Off-Site Facilities
- Storage Tanks
- Firefighting Equipment
- Communication Equipment
- Roads & Civil Structures, Terrain preparation

### Construction Activity Plan

The Engineering, Procurement, Construction Plan is:

ACTIVITY	MONTHS											
	1	2	3	4	5	6	7	8	9	10	11	12
Engineering	■	■	■	■								
Procurement			■	■	■	■						
Shipment					■	■	■	■				
Construction & Installation							■	■	■			
Commissioning								■	■			
Start-Up									■	■		
Production										■	■	■

Tab.2.1: Activity Plan

### Feedstocks, Products & Utilities

The quantities of Feedstocks, Products, Utilities are:

#### PROCESS

Process Stream	Unit	Q.ty
HSFO (Feed)	[MT/h]	83.33
Catalyst (Feed)	[MT/h]	4.17
LSFO (Product)	[MT/h]	79.17

#### UTILITIES

Utility Stream	Unit	Q.ty
Utility Water	[MT/year]	612
Fuel Gas – Methane	[MT/year]	387
Electric Power	[MWh/year]	3,433
Steam	[MT/year]	262,838 *

Tab.2.2: Streams

\* : Steam to be recirculated

The price of Feedstocks, Products, Utilities have been considered in the Financial Analysis as follows:

#### PROCESS

Process Stream	Unit	Market Price
HSFO (Feed)	[USD/MT]	250
Catalyst (Feed)	[USD/MT]	1,100
LSFO (Product)	[USD/MT]	340

#### UTILITIES

Utility Stream	Unit	Market Price
Water	[USD/m3]	3.00
Fuel Gas – Methane	[USD/MMBTU]	1.80
Electric Power	[USD/kW]	0.08

Tab.2.3: Costs

Note that for Operation & Maintenance purposes, **all the utilities and the heating system necessary for the specific desulfurization process have been considered and fully calculated in this Report.**

#### Personnel

The personnel employed in the Operation & Maintenance the NEO-SRU Unit has been considered **N.9 people**, in 3 total day & night shifts:

Personnel	Q.ty
CONTROL ROOM PERSONNEL	3
FIELD PERSONNEL	6

*Tab.2.4: Personnel*

#### Data

The following data have been considered for the analysis:

Data	Unit	Evaluation
Work days/year	<i>[days]</i>	340
Material Losses	%	5%
Maintenance	%	10%
Life Span	<i>[years]</i>	15
Taxes	%	15%
Discount Rate (annual)	%	10%
Interest Rate (annual)	%	10%

*Tab.2.5: Data*





### 3. FINANCIAL ANALYSIS

This chapter analyses the costs and benefits of this Case.

#### INVESTMENTS & COSTS

UNIT CONSTRUCTION INVESTMENT		
LAND		0 USD
	EXTENSION :	1,000 m <sup>2</sup>
LEGAL PERMITS		0 USD
ENGINEERING LICENSE		370,817 USD
ENGINEERING		764,770 USD
PROCESS UNITS		3,258,500 USD
LOGISTICS SYSTEMS		0 USD
UTILITY UNITS		0 USD
AUXILIARY FACILITIES		0 USD
OFF-SITE FACILITIES		0 USD
PILOT UNIT		0 USD
EQPMT SHIPMENT		472,483 USD
INST, COMM, STARTUP		488,775 USD
<b>UNIT INVESTMENT</b>		<b>5,355,345 USD</b>

Tab.3.1: Unit Construction Investment



<b>OPERATION COSTS</b>			
<b>FEEDSTOCK</b>		<b>170,000,000</b>	<b>USD/year</b>
	QUANTITY :	680,000	MT/year
	AVERAGE PRICE :	250	USD/MT
<b>CATALYST</b>		<b>40,800,000</b>	<b>USD/year</b>
	QUANTITY :	278,290,000	MT/year
	AVERAGE PRICE :	0.15	USD/MT
<b>ELECTRICITY</b>		<b>274,640</b>	<b>USD/year</b>
	AVERAGE CONS. :	5.3	kWh/MT
	PRICE :	0.08	USD/kWh
<b>FUEL GAS</b>		<b>36,583</b>	<b>USD/year</b>
	QUANTITY :	387	MT/year
	PRICE :	0.006	USD/kWh
<b>STEAM</b>		<b>78,851</b>	<b>USD/year</b>
<b>PERSONNEL</b>		<b>108,000</b>	<b>USD/year</b>
<b>MAINT &amp; SERVICES</b>		<b>325,850</b>	<b>USD/year</b>
<b>OPERATION COSTS</b>		<b>211,623,925</b>	<b>USD/year</b>

Tab.3.2: Operation & Maintenance Costs



## REVENUES & PROFITS

### SALES REVENUES

<b>PRODUCT</b>		<b>219,640,000</b>	<b>USD/year</b>
	QUANTITY :	646,000	MT/year
	AVERAGE PRICE :	340	USD/MT
<b>TOTAL SALES REVENUES</b>		<b>219,640,000</b>	<b>USD/year</b>

Tab.3.3: Sales Revenues

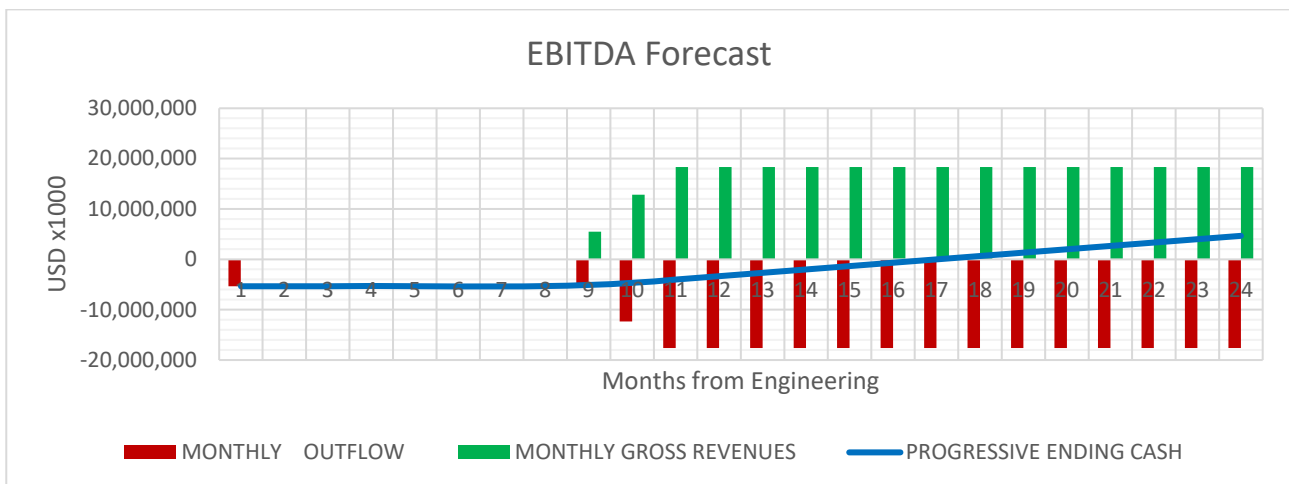
### PROFITS

<b>1. EBITDA</b>		<b>8,016,075</b>	<b>USD/year</b>
<b>2. DEPRECIATION</b>		<b>192,900</b>	<b>USD/year</b>
<b>3. EBIT</b>		<b>7,823,175</b>	<b>USD/year</b>
<b>4. PROFIT B4 INC TAX</b>		<b>7,287,641</b>	<b>USD/year</b>
<b>5. INCOME TAXES</b>		<b>1,093,146</b>	<b>USD/year</b>
<b>6. NET PROFIT</b>		<b>6,194,495</b>	<b>USD/year</b>
<b>7. PAYBACK B4 INC TAX</b>		<b>0.68</b>	<b>years</b>

Tab.3.4: Profits

CASH FLOW									
YEAR	MONTH	MONTHLY OUTFLOW	PROGRESSIVE OUTFLOW	MONTHLY GROSS REVENUES	PROGRESSIVE GROSS REVENUES	MONTHLY ENDING CASH	PROGRESSIVE ENDING CASH	MONTH	YEAR
1	1	-5,355,345	-5,355,345	0	0	-5,355,345	-5,355,345	1	1
	2	0	-5,355,345	0	0	0	-5,355,345	2	
	3	0	-5,355,345	0	0	0	-5,355,345	3	
	4	0	-5,355,345	0	0	0	-5,355,345	4	
	5	0	-5,355,345	0	0	0	-5,355,345	5	
	6	0	-5,355,345	0	0	0	-5,355,345	6	
	7	0	-5,355,345	0	0	0	-5,355,345	7	
	8	0	-5,355,345	0	0	0	-5,355,345	8	
	9	-5,290,598	-10,645,943	5,491,000	5,491,000	200,402	-5,154,943	9	
	10	-12,344,729	-22,990,672	12,812,333	18,303,333	467,604	-4,687,338	10	
	11	-17,635,327	-40,625,999	18,303,333	36,606,667	668,006	-4,019,332	11	
	12	-17,635,327	-58,261,326	18,303,333	54,910,000	668,006	-3,351,326	12	
2	1	-17,635,327	-75,896,653	18,303,333	73,213,333	668,006	-2,683,320	1	2
	2	-17,635,327	-93,531,980	18,303,333	91,516,667	668,006	-2,015,313	2	
	3	-17,635,327	-111,167,307	18,303,333	109,820,000	668,006	-1,347,307	3	
	4	-17,635,327	-128,802,634	18,303,333	128,123,333	668,006	-679,301	4	
	5	-17,635,327	-146,437,961	18,303,333	146,426,667	668,006	-11,295	5	
	6	-17,635,327	-164,073,288	18,303,333	164,730,000	668,006	656,712	6	
	7	-17,635,327	-181,708,615	18,303,333	183,033,333	668,006	1,324,718	7	
	8	-17,635,327	-199,343,942	18,303,333	201,336,667	668,006	1,992,724	8	
	9	-17,635,327	-216,979,269	18,303,333	219,640,000	668,006	2,660,731	9	
	10	-17,635,327	-234,614,596	18,303,333	237,943,333	668,006	3,328,737	10	
	11	-17,635,327	-252,249,923	18,303,333	256,246,667	668,006	3,996,743	11	
	12	-17,635,327	-269,885,251	18,303,333	274,550,000	668,006	4,664,749	12	

Tab.3.5: Cash Flow



Graph.3.1: Cash Flow



#### 4. CONCLUSIONS

The NEO-SRU Unit to be installed in Qatar resulted to be highly efficient and profitable and can be paid back in about 13 months (including the time necessary for Production Plant Installation).

Key parameters are:

- Capital Needs **Euro 5,355,345** (*Construction, Installation, Start-Up*)
- Operation & Maintenance **61.20 USD/MT**
- Pay Back Period **< 17 months**
- Circulating Capital **Euro 17,635,327** (*one month of operation*)

Break Even data are:

- Gross Revenues **Euro 219,640,000**
- Total Variable Expenses **Euro 211,623,925**
- Gross Income **Euro 8,016,075**
- Gross Income Margin **3.65%**