QATAR UNIVERSITY

COLLEGE OF ENGINEERING

INTEGRATION OF PRODUCTION PLANNING AND INVENTORY CONTROL OF REFINERY PROCESS

BY

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ABSTRACT

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Title: Integration of Production Planning and Inventory Control of Refinery Process

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The integration between production planning and inventory control in the refinery process is the focus of this thesis. The subject of this study, Doha Refinery, produces Liquefied Petroleum Gas (LPG), 92 RON gasoline, 97 RON gasoline, Jet A1, and Diesel (LGO). The refinery receives 83,660 barrels per day delivered from Dukhan Industrial City in Qatar. Gasoline production is more than the local demand. The increase in the production of gasoline is done for the purpose of building a safe inventory. On the same note, refinery has a production capacity limitation with Jet A1 and Diesel products. Therefore, the production of these products is less than the local demand. Thus, the refinery imports the extra needed quantity to supply the local customers. The production planning team must plan the import dates after monitoring the inventory levels. Therefore, integrating production and inventory is necessary in order to have an overview of the inventory status as well as a strategy for production and the imports' dates and quantities. MS Excel will be the tool that will integrate the production, planning and inventory control. The MS Excel sheets will provide an overview of the daily production, demand, inventory status and export/import days. Moreover, gasoline blending formulation will be included in the sheet. That will allow the planner to issue the blending recipe catered to the operation. In the case of the refinery experiencing a shutdown, the Excel sheet will provide information regarding the inventory quantity, the amount of days it can supply the local customer and the dates for importing the needed quantities.

DEDICATION

To My Parents

ACKNOWLEDGMENTS

I want to thank my supervisor Dr. Tarek El Mekkawy who gave me a great support in both my educational and job career. Dr. El Mekkawy guided me to a new whole level of logic thinking that will benefit me in my career as an Engineer in Qatar Petroleum. I studied Engineering Management to improve my skills in management and administration so I can reach my goal to be very effective and important employee in Qatar petroleum in Qatar. Working under the supervision of Dr. El Mekkawy helped me to know my points of weaknesses and strength. I will work very hard to eliminate my weaknesses and to improve my areas of strength.

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CHAPTER 1: INTRODUCTION

1.1 Background

The “refinery process” is the chemical transforming of crude oil to useful refined products such as Liquefied petroleum gas “LPG”, Gasoline, Jet A1, light gas oil “LGO” / diesel and fuel oil. The studied refinery location is located in the south of Qatar and it is the only refinery in the state of Qatar. The refinery is the only supplier for refined products in Qatar. The refinery started in 1993 with small production to satisfy local demand and export the excess quantities. The refinery works continuously at full capacity in 24/ 7 to meet Qatari demand. In 2003 the Doha refinery management team decided to expand the refinery plant to increase the production to meet the high demand of country. The plant was recommissioned in 2005 with a capacity of over 83,660 barrels per day. In 2020, there was further increased for most of the products. Production planning and inventory control were used to minimize the gap between the demand and supply.

1.2 Problem Description

In 2005, the refinery production was meeting the demand and surplus product was stored as a safe inventory. For each refined product, the average storing capacity was 16 days. By 2020, the demand for some products had become higher. The capacity of the tanks cannot store more five days on average for all refined products. Hence, the storage days is not sufficient and safe enough and the country must have a safe inventory for emergencies due to any issue or shutdown that could happen. The present research will discuss how to integrate inventory control and production planning to solve refinery issues in the short term. The integration of the two divisions will help to

quicken response and enhance the capabilities to deal with demand issues.

The present research provides an outline for the refinery's long-term plans to increase production and have more storage capacity. Production planning plays a critical role in dealing with unplanned shutdowns by preparing a contingency plan to ensure continuous production. The planning team also has to be prepared to deal with minor external issues such as Oxygenate or MTBE not arriving to the refinery from external companies or such product as arrives not meeting the required specification before supplying to customers.

Oxygenates are typically used as gasoline additives to reduce carbon monoxide and have high Research Octane Number" RON" which helps in improving the efficiency of the combustion process inside vehicle's engines. Managing the inventory plays a major role in handling the varying demand. Thus, if the demand is higher than the refinery production some quantities are taken from the inventory. The buildup of inventory levels happens when the production is higher than the demand or products are imported.

Moreover, most of the refinery equipment has been operating since 2003 so some equipment experiences repeated shutdowns. All the existing tanks in the refinery are old, too, and need rehabilitation. Also, integrating production planning with inventory control will help use the storage capacity more efficiently. And integrating two divisions with different tasks will help to reduce the number of employees in the company which will save a good deal of money.

1.3 Research Objectives

The objective of this research is to express the impact of integration of production planning and inventory control in the Doha Refinery. The proposed integration will be

applied to the current and most prominent shortcoming that face the refinery which is the gap between supply and demand. Managing the storing capacity to maintain a safe inventory in case of unplanned shutdown or any other unpredictable event (which has the power to interrupt the production of the refined product) is also considered. Moreover, this study discusses recommended long term plans to enhance the refinery's performance. This can be executed by increasing the production of all goods as well as enhancing the storage capacity of new tanks. The forecasted demand for the year 2019 will be used to show how inventory was controlled in the aforementioned time frame using Materials Requirement Planning (MRP). MRP will be used only for two products, namely, JET A1 and Diesel. The MRP will highlight the quantity of available stock as well as estimate the import shipments time and quantity, since the production is less than the demand. For other products, specifically 92 R and 97 R, there is a higher demand. Thus, the aim is to maintain preservation of production between the minimum storage capacity; 5 days of demand and a maximum storage capacity; 16 days of demand.

1.4 Novelty

The novelty of the proposed method is in providing multi-function MS Excel sheets to manage the production and the inventory in the refinery. The MS Excel sheets provide full year production with the inventory levels. All export and import dates are planned in advance. In most of the refineries, there are many applications used in managing the production and the inventory. Applications such as Aspen that are developed by the Honeywell company in the USA helps the production planning teams to do short term plans. Beside, Pimps which is a software used for long term production plan. The inventory control team uses excel to monitor the tank flow in and out flow. For blending usually refinery uses software that help to generate the blending recipes using ratios.

Then, the operation team have to convert the ratios two barrels or flowrate. The short term plans in Aspen must be updated with the new gasoline production quantity. The main advantage of the proposed MS Excel sheets is combining most of the application in one MS that can be controlled by one employee. The MS Excel can flexibly changes on long term, short term and blending. Where in the MS excel contain a full year plan that can be that can be revised and change based on. In Addition, the blending formulation is provided for planner to specify the number of barrels for each component that will be mixed to get targeted gasoline which are 92 RON and 97 RON. Moreover, the MS Excel provides graphs that represent the production and tanks stock level quarterly. Also, the Excel sheet is connected to the process historical data "PHD" in the field so the Excel sheet data will be taken from there. PHD will provide data such as the quantities of the products that enters the blending or, the quantities of hydrocarbon stored in the tanks.

1.5 Thesis Outline

This thesis is divided into six chapters. Chapter One introduces the research for the readers including where and why the research is done. Also, it shows how useful it is for people who work in the refinery sector.

Chapter Two provides a detailed explanation for the refinery processes. It includes all the units and the stages in Doha refinery that products go through before supplying it to the local customer. In-addition, the Doha Refinery process flow diagram is provided.

In Chapter Three, a literature review is presented to demonstrate the research novelty. It contains a summary of different articles and books for projects done in the refinery.

In Chapter Four, all methodology used in the integration such as blending, export, import and production. All equations used to develop the MS Excel sheet are shown in Chapter four. The steps for connecting the sheet to the flow meter device in the field are included.

In Chapter Five, the results of integration are shown when providing the graphs showing how the inventory and production are controlled. Also, “What if” analyses is done in to show the effectiveness of the method to overcome different scenarios that might interrupt production.

In Chapter Six, the conclusion and recommendations are presented. The recommendations discuss the long-term plans for the refinery such as increasing the production and the tank capacities.

CHAPTER 2: REFINERY PROCESS OVERVIEW

In this chapter, the Doha refinery process is explained in detail. The first part of the chapter gives an overview for the process. The second part of the chapter discusses how the various units function individually.

2.1 Process Overview

The Unit One distillation column receives the crude transferred from Dukhan. Then crude been separated using boiling points for the products. The column inside is divided using trays and each tray has different temperature. Thus, crude is separated using trays temperature to full range Naphtha, Diesel, Kerosene "Jet A1 "and Residue. The full range naphtha flow from the top of the column to enter unit two the hydrotreater. In the hydrotreater sulfur is reduced and the full range naphtha is separated to three-unit products which are liquefied petroleum gas, "LPG", Light Naphtha and Heavy Naphtha. The LPG flows to unit six. In unit six the gas is treated with amine solution to remove the sulfur and impurities from the gas. Next the treated LPG flows to unit seven to separate butane, "LPG", from the propane and other light hydrocarbons. Then the LPG is stored in sphere number one and two. The stored LPG is ready to transfer to the local customer or it can be used in gasoline blending. The second unit two product is light naphtha that will be pumped to unit 18 then 19 which are Penex and Molex to remove the light hydrocarbon and to increase the RON of the gasoline. Then light naphtha is stored in tanks number one and two. The third unit product is heavy naphtha and is transferred to unit 3 which is reformate unit to increase the RON of the gasoline. The heavy naphtha will be stored in tanks five and six. Both light and heavy naphtha will be used in the blending process along with some of the LPG and other unit

products. In addition, to the pervious products the blending process requires some additives in order to get the target RON for gasoline products. The mix is then augmented with additives such as Oxygenate “MTBE”. The next product is the Jet A1 that will be will transferred to unit four “Jet A1 hydrotreater” to reduce the sulfur content. Then, it is stored in tanks number nine and ten. Next, Diesel or Light gas oil have similar processes to the Jet A1 where the sulfur is reduced in the unit five “LGO hydrotreater”. Then, the Diesel is to be stored in 11 and 12. Both Jet A1 and Diesel have sample hydrotreating process to reduce the sulfur content and then the products are ready to be supplied to the local market. Last product from the distillation is residue which is a heavy product that can be further processed in a unit called the residue catalytic cracker, but this unit is not available in the refinery

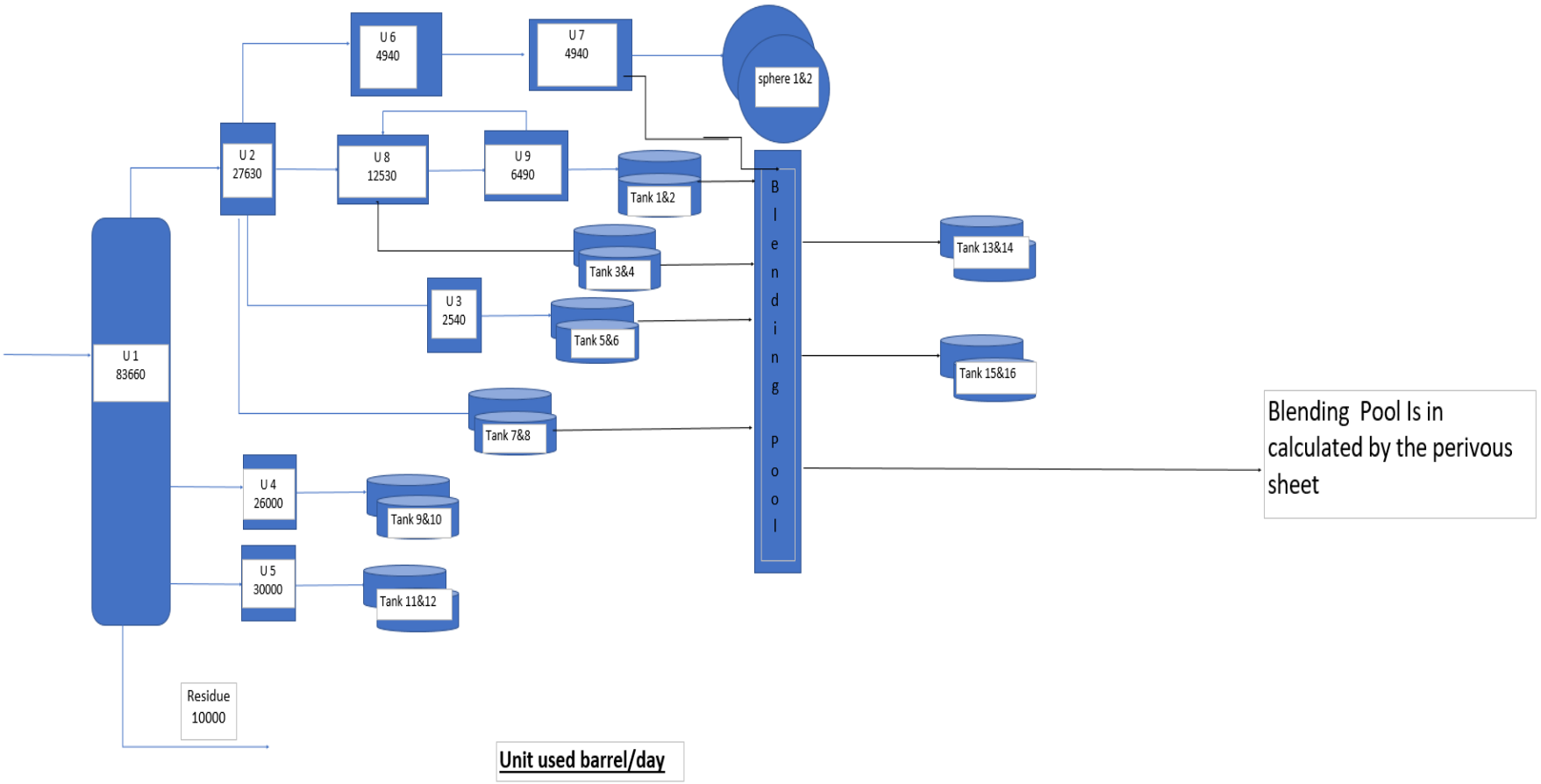

Figure 1: Process Overview.

2.2 Hydro-Treating Process

The hydro-treating process is to remove all unwanted contaminates from the hydrocarbon. Contaminants such as sulfur, nitrogen and heavy metals are removed by bonding them with hydrogen and catalysts inside the reactor. Removing the sulfur and impurities from the products helps to reduce the toxic gases injected into the environment. As illustrated in Figure 1, there are three hydro treating units for gasoline, kerosene and diesel. The gasoline hydro treating process shown in Figure 2 indicates the three unit products which are LPG, Light Naphtha and Heavy Naphtha. As illustrated in Figure 2, the Naphtha is detached by the Separator into three-unit products using a stabilizer. The outcome of unit two is transferred to the next units for further processing. This contrast with kerosene and diesel hydro treating where they are treated then transferred to the tank.

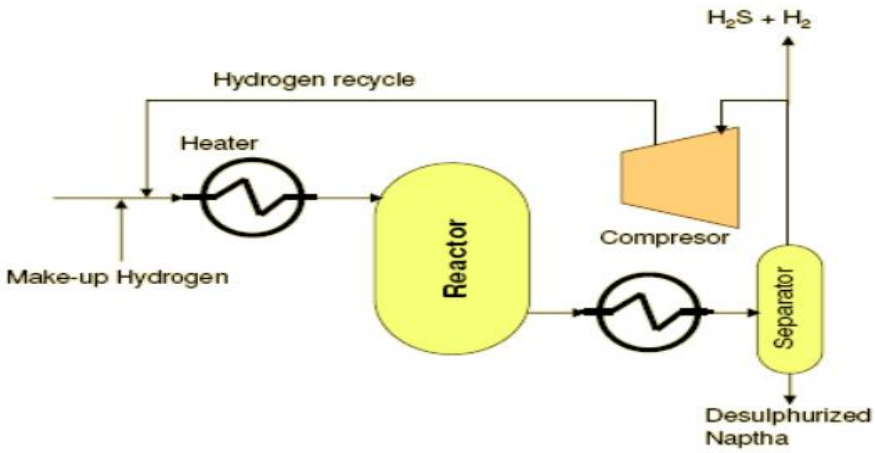

Figure 2: Hydrotreating Process [9].

2.3 Continuous Catalytic Reforming Unit

The CCR unit's purpose is to increase the octane number of heavy naphtha. The process uses a reactor and catalyst to convert straight run naphtha with a boiling range of 80-

150 C to branch chains to improve the octane number. The process requires heating the gasoline to a temperature of 482 C - 520 C after adding hydrogen to the incoming Naphtha and passing it through a series of alternating furnaces. Then, as seen in Figure 3, the Naphtha enters the fixed-bed reactors containing a vaporous platinum-rhenium catalyst. The reaction generates hydrogen that will be reused. The reformate product coming out from the reactor is used in gasoline blending. The octane number is a measure of the resistance of gasoline and other fuels to detonation (engine knocking) in spark-ignition internal combustion engines [29].

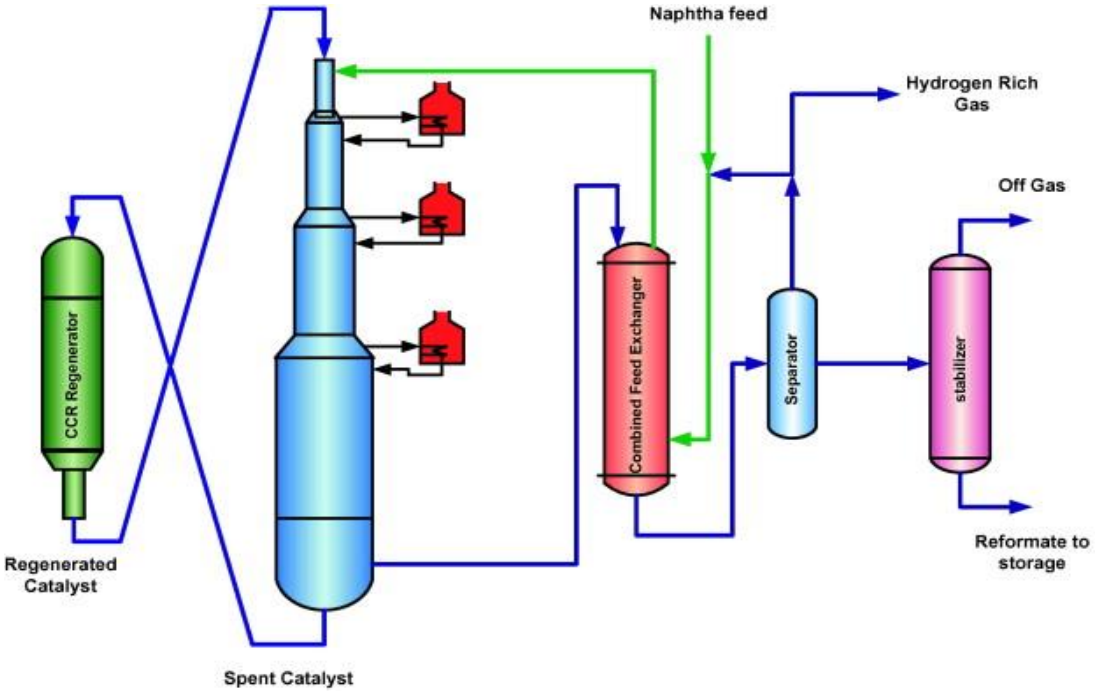

Figure 3: Continous catalytic reforming units [33].

2.4 Penex and Molex

The Penex and Molex help to increase the RON of the light naptha coming from the hydrotreater. The light naptha goes to dryer to remove any mositure which would otherwise damage the chloride injection. The chloride injection to the hydrocarbon helps to enhance catalyst performance in the reactor. to remove the light hydrocarbon in the light naphtha. Then the product is pumped to Molex to remove the remaining the

light hydrocarbon and separate the isobutane in the light naphtha which is pentane "C5". The removel of the light hydrocarbon increases the RON of naphtha which jumps from 65 to 90 RON. The Penex and Molex units are illustrated in the figures (Figure 4 and Figure 5) presented below.

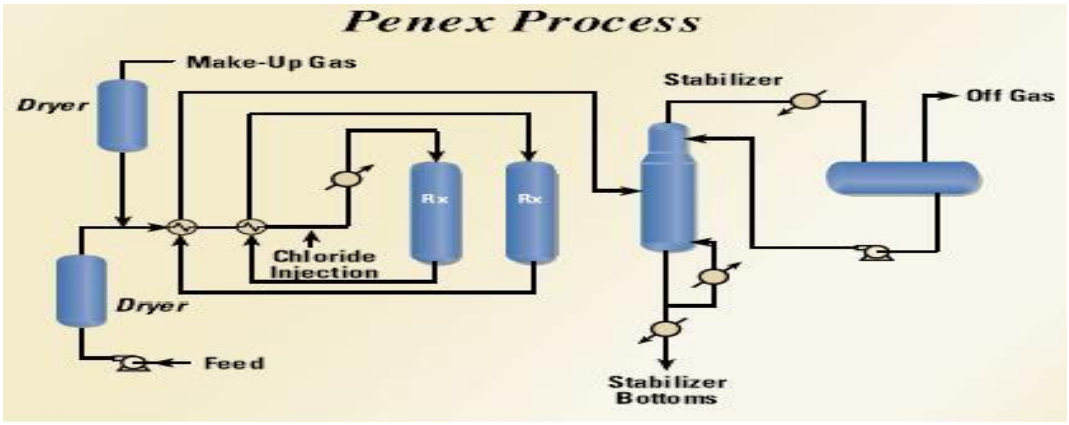

Figure 4: Penex Process [14].

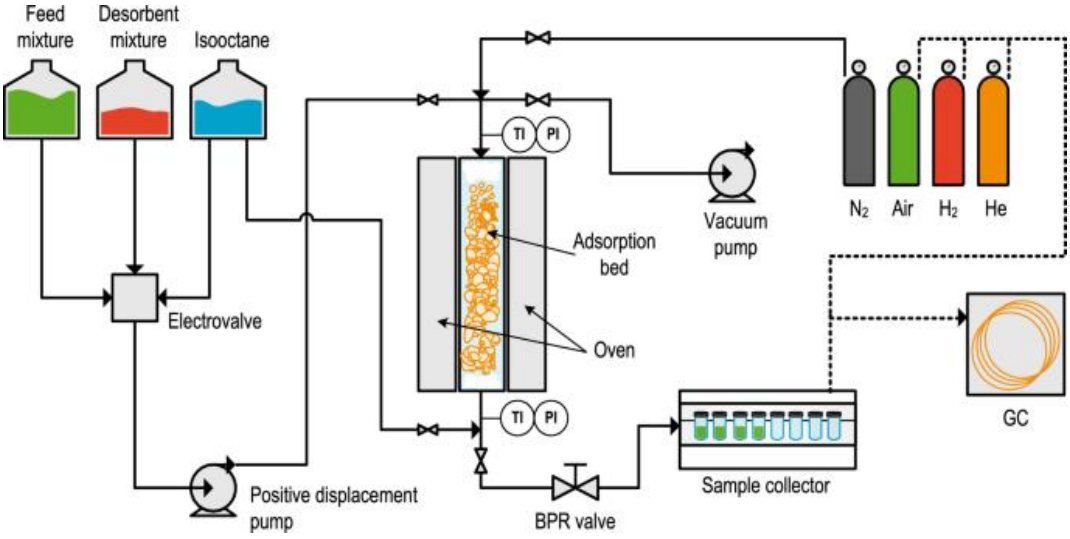

Figure 5: Molex Process [28].

2.5 Amine Treatment and Gas Recovery

Amine treatment is to remove the H2S, CO2 and unwanted gases from the LPG or butane chain using a chemical substance called Methyl Di Ethanol Amine "MDEA". After amine absorb all the impurities from the LPG chain it is transferred to the gas recovery unit. In the gas recovery unit LPG is enters a splitter to separate lighter hydrocarbons from LPG "C4". The gas recovery unit enhances the RVP (Reid Vapor Pressure) to 85 psi max. RVP is a measure of volatility and is defined as the pressure at which a hydrocarbon liquid will begin to flash to vapor under specific conditions. The figure below (Figure 6) illustrates the Amine process, representing the absorber and the Amine Regenerator.

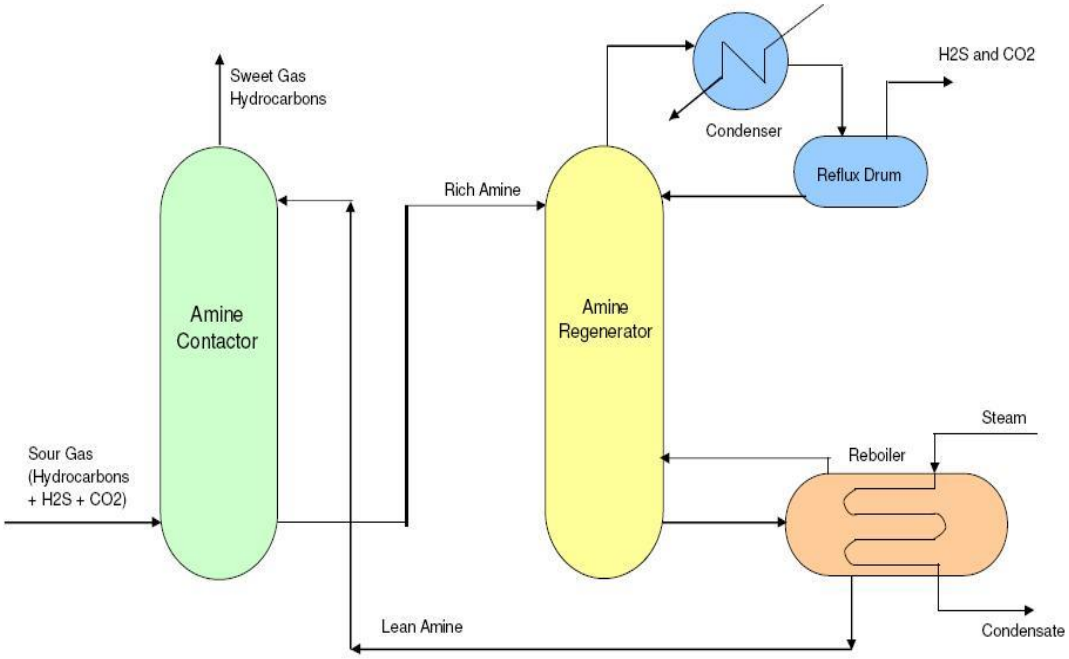

Figure 6: Amine Treating Process [10].

2.6 Blending Process

Blending the gasoline is one of the major processes in the refinery. The main purpose

of blending is to allocate the available blending components in such a way as to ensure all products demanded and all specifications are met at the least cost and to produce a product which will maximize overall profit. The gasoline blending pool contain different components with different grades of octane. Typical grades include 83 octanes (blended later with an oxygenated fuel such as ethanol), regular 87 octane and premium 92 octane. The Reid Vapor Pressure (RVP) is set depending on the average temperature of the location where the gasoline will be used. It is important to mention that cold temperatures require higher RVP than warmer environments. The figure below (Figure 7) represents the blending tanks and pipe.

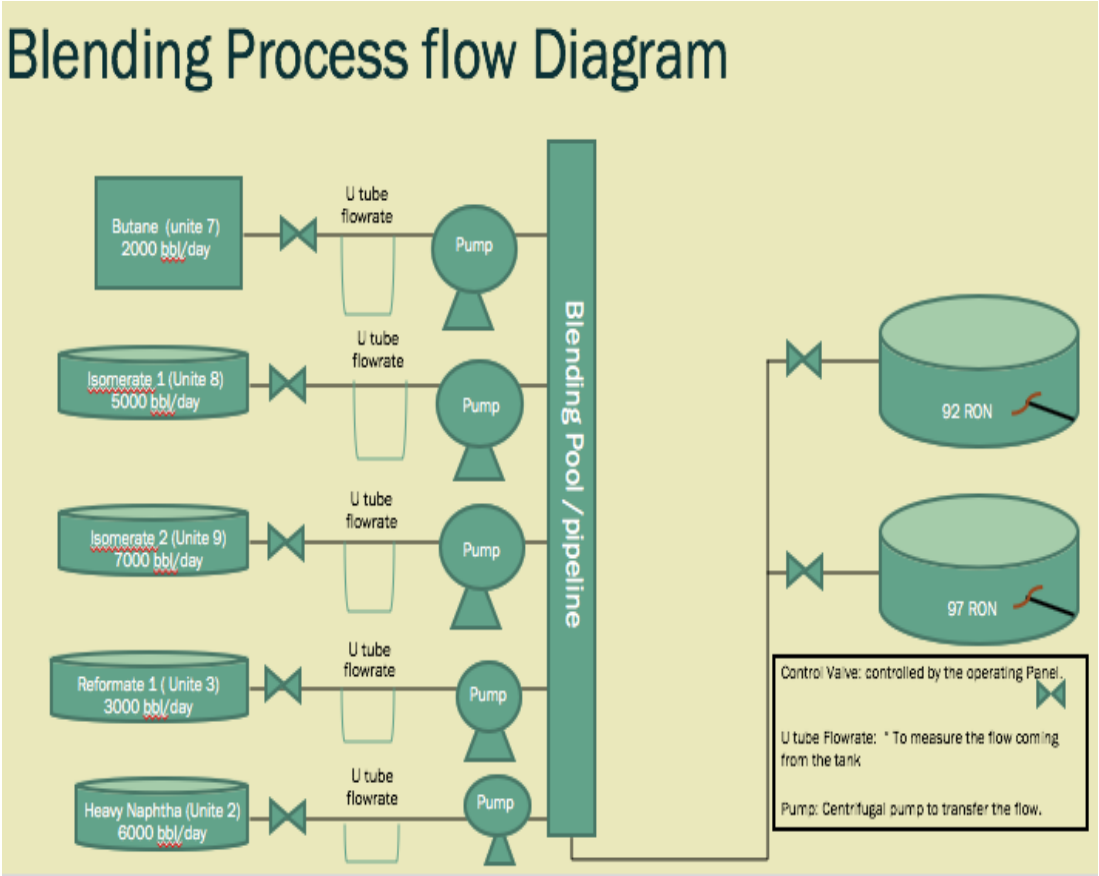

Figure 7: Blending Process.

CHAPTER 3: LITERATURE REVIEW

In 2018 a study was integrating the production planning and procurement planning for the refinery. Crude oil procurement is a very critical process to supply the refinery with the needed quantity of crude to produce refined products. Thus, the integration between the production planning and procurement helps to ease the operation of supplying crude to the refinery. The processes is currently done by computer programs due to the large volume of the production as the problem of optimization for crude procurement is otherwise too large to monitor and direct. The studies discus's an alternative method that determines the desired quantity for crude is solving the refinery optimization issue to minimize the diversion of crude. (Choi et al., 2018)

Another study was highlighted to maximize the refinery short term production using an algorithm. The study aimed to maximize the refinery profits and to reduce the operating costs in the short-term planning strategy. The refinery planning team had solved their problem over a previous evaluated prediction horizon and this prediction horizon is moved by a one-time interval at each following step where the optimization is recurring. The article was based on two literature review papers so as to strengthen the initial assumption where the articles suggested that the refinery process comprises of the oil fields, crude oil vessels, the storage, charge and production tanks, as well as the crude distillation units (CDU). (YüUzgeç et al., 2016)

Chinese university student Mr., Zhen GAO did a study on optimizing the refinery model of production. The author used integer linear programming in the planning. The method was applied in all refinery processing units. The main purpose of the study was to prove that the planning can decide which run-mode to use with each processing unit in each

period of a given horizon so as to satisfy the demand, in support of limiting the total cost of production and minimizing inventories. The outcome was that the model can be regarded as a generalized vehicle for a lot of sizing problems in operating carry out, to production and consumed a lot more than one unit. The author developed a formula for the logarithm called branch-and-price (BP) for solving the interested optimization problem. The model and implementation of the algorithm are described in detail in that article. The computational results verified the effectiveness of the proposed model and the solution method. (GAO et al., 2007)

Another study established a nonlinear planning model to manage the total production in the refinery. The representation of the refinery is the main purpose; therefore, all the processes of the refinery that are modelized involve a nonlinear and blending relation, too. (Yang and Barton, 2016)

Cubatao refinery located in Spain developed a planning tool. This tool specialized in developing the diesel production in the refinery. Thus, has been provided a better optimized result that model affords to users. The optimized method used no computerized algorithm. The model was based only on experience and hand calculation. During the calculation the refinery takes all factors that affect the production seriously. Factors such as market limitation for all diesel products that are provided by the Spanish refinery were taken into account. Also, the differences are noted between the suggested model and logarithm method where the logarithm allows the refinery to define new points of operation. Also, it shows the maximum of valuable products to attain the highest profit for the refinery. (Moro et al., 2000)

The study done by Edith Ejikeme-Ugwu and Meihong Wang highlights the importance of “blending” in the crude oil industry. Crude oil prices are being maintained at a high

level by the oil producers around the world. Therefore, refineries use blending to mix lower value product with high value product to maximize their profits. Products such as slope is produced by the crude refineries have low value when mixed with crude oil with higher value the refinery will get more profit.. There are other products produced that require blending such as gasoline. The refineries used computational models such as Aspen and Hysys to blend their product. The two models are mathematical and are developed for crude units in games through collected information. The models combine all the units in the crude refinery through empirical methods to cover all the production units. The models are used mainly by the production planning team. (Ejikeme-Ugwu and Wang, 2012)

The integration of production planning and scheduling was projected in the refineries. The integration was based on two principles. One of the principles is called the “rolling horizon strategy” and the second principle is called “two level decomposition strategy”. The study was based on the C.P. Lue and G, Rong book where the short term of production scheduling is considered. The book recommended a strategy of the upper level multiperiod mixed integer linear programming (MILP) model. Also, the book recommended another method for a lower level simulation system in order to find the optimal optimization model for the integration. The risks and uncertainties were also mentioned in the study. Perfect integration was required to be taken into account in the undefined parameters with both non-stop and separate probability supply. (LUO and RONG, 2008)

Production Planning is one of the most important departments of the refinery. The calculation of the production and demand of the local market is done by the production planning team. Also, production planning deals with the marketing team constantly to

know the needed quantity of export or to import from the international market. However, there are some challenges that face the production planning team. One of these challenges is discussed in the research done by Chinese students in China University on the challenges of uncertainty events. The authors classified the issue as a critical problem that effects plantwide optimization and the authors suggested some models to deal with the issue. The model involves hybrid programming model which incorporates the linear programming model with the stochastic programming. The authors suggested two articles to deal with uncertainty demand. The hybrid programming model came from linear programming. The model was used as an approximation functions to solve uncertainties of distribution assumptions.

Some additional studies show the efficiency of linear programming in development of the hybrid programming model with an error percentage less than 20% and higher than 0.5%. The model shows tests results of the hybrid programming model have affected the operation positively with weight factor (0.1-0.2) which have a great positive impact on the operational strategies for the refinery. The test was done on uncertainty demand and the result showed a great outcome in profits, higher than normal linear programming and stochastic programming one with about 1.5% and 0.4% enhancement, respectively. (LI et al., 2007)

Another study showed how to integrate the short-term crude oil scheduling and mid-term refinery planning using the Lagrangian Decomposition logarithm. LD is categorized as a mixed integer nonlinear program. The main concept is of integration ns both short term and midterm are in crude units having their economic net value and purpose. A multi-scale approach is proposed in the framework to aggregate continuous and discrete-time formulations in crude scheduling and refinery planning respectively.

The automated result of calculating each term individually shows a great enhancement on the economic objective values. Furthermore, the proposed method needed less CPU time converging to a small (1-5) percent as a perfect result unlike the monolithic method that uses the MINLP solver. (Yang et al., 2019)

The management of the inventory is highlighted by the study done by Tsinghua University. Due to the high cost of the inventory the studies show that the inventory cost is up to 30% of the total of the supply chain. The important role of inventory control is taken into account to optimize the inventory cost. Inventory control plays an important role to support the refineries in case of fluctuating local demand and good optimization helps the refinery to ensure the availability of the products in storage in case of excessive demand. All the while storing the excess quantity of the refined product when the demand is less than the product output in the refinery. The paper suggests a multi- period programming method that helps to optimize the inventory. The new method showed good output that was used in industrial data. (Chen et al., 2007)

There are more terminologies used mainly in production planning and these terminologies involve push and pull systems. The article done by Gang Xiong and Timo R. Nyberg (DATE) discuss the use of the two production modes on the Crude Information Management System “CIMS” with all application used to run the refinery. The authors discuss at the beginning the introduction of the production system impact of the two modes individually used in CIMS. The authors then explained the impact of the two-modes combined in CIMS. Then the authors compared the modes with Material Requirement Production “MRPII” and Just in Time “JIT”. Also, the authors discuss the strategies in push and pull systems such as the production plan and scheduling strategy. The mode of production discussed are straight forward with all basic outlines given in

the context of the overall manner. Additionally, in the integrated production plan administration the basic production characters and production problem solving are discussed in their details by the authors. (Xiong and Nyberg, 2000)

Unfeasible linear programming “LP” is discussed to know how it can be used effectively in refinery production planning. The article by Tsinghua University proposes a three stage strategy that will allow LP to be used effectively. The first stage is checking the data entered so if there are any errors, they can be identified and repaired. The second stage is reviewing the data to check if the material balance is given because it must be done before the solving of the LP model. Thus, checking the existence of the material balance will help to identify the second error and to correct it. The third stage is to identify and find the complex and unpredictable information in the LP system. All the above stages are done by computer technology, so it can be applied on LP and other applications used in the refinery. (LI et al., 2006)

An article was published by the University of Surrey which investigated the integration between the oil refinery and the ethylene production plant. According to the authors the two plants are connected by the use of some similar materials. These materials will be removed totally or partially to rely on external sources “outside contractor”. There are many advantages of the integration such as the production of the two plants increasing which also means the profits will increase drastically. To optimize the system the authors suggested integrating three systems that are already in use in both plants. Also, there are the integrated system models called MINLP which can be used in all systems in the plants. Furthermore, the authors used some examples and some case studies to strength their suggestions of integration. The examples given by the authors showed outstanding results in profit and operation. (Ketabchi et al, 2019)

Mixed integer linear programming “MILP” is discussed in that research paper. The focus of the main discussion was on the frame that the MILP takes to control the inventory of the refinery. The inventory area that was discussed is the maritime inventory routing problem “MIRP”. The involvement of MIRP in the refinery serves products that were shipped from other ports to supply local demand. The shipment unloads the products in dedicated compartments assigned from the refinery management. Vendor managed inventory “VMI” is the base for the workers inventory to know the time of arrival, the shipment quantity, and the port number. Also, VMI provides the shipment tracking service for the workers in addition to other activities of loading along with loading, level of inventory and jetty activities. The model showed effective results according to the authors in scheduling the shipment, inventory and shipment cost. (Golpîra, 2019)

Another article published by a Texas A&M University student discussed the use of different non-linear applications in complex refinery work. The model that aimed to be used is an integrated data driven model with global optimization. The proposed application helps the refinery business by improving and controlling inventory. The application provides an outline with three features the model can provide to users. The first feature is automatic linear programming generation and sparse data- driven process models. The first feature is based on the models of properties and compositions. The second feature gives an estimation of model parameters and as an example the student used Dasan refinery data in South Korea to test this theory. The third feature involves using global optimization of non-linear and multi-period large scale production. Accordingly, it will help to serve refinery commercial targets. Conferring to the authors after the model was applied in different places, the outcome resulted in optimal multi period plans that held an average of 57% to 94 % in each case the model was applied

to. (Demirhan et al., 2020)

CHAPTER 4: PROPOSED INTEGRATION METHODOLOGY

In this Chapter, the integration methodology will be explained. In addition, all the mathematical equations that have been used in blending process and production plan will be explained in this chapter. Moreover, the required products specification will be looked at.

4.1 Integrating the Production Planning and Inventory Control

The main aim of this thesis is to integrate the production planning and inventory control. The refinery plant in Doha, Qatar has been taken as an example to apply the proposed integration methodology. The refinery plant produces some different products that need storing and disturbing to the local customers. Also, the refinery is assumed to be the only refinery in country, so the production planning team responsible to plan the production, import and export. While, the inventory management team responsible to do the transferring the products, maintain safe inventory and operating the inventory. Figure 8 shows the steps of the proposed integration methodology. These steps will be explained in the sequel.

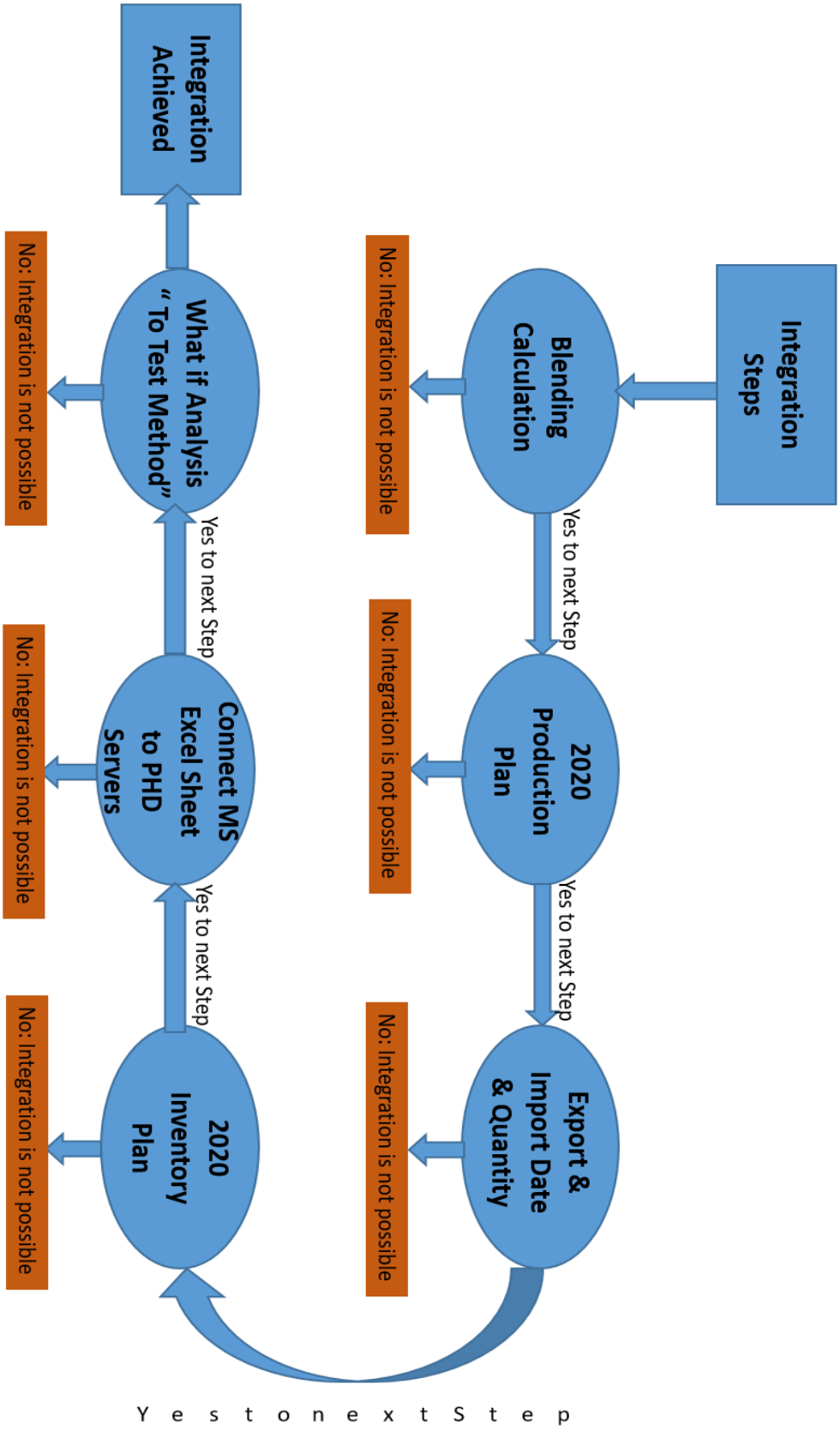

Figure 8: Flowchart of the Proposed Integration Methodology

4.2 Blending Calculation

The blending calculation that was done on the Excel sheet it helps to specify the quantity of 92 research octane number and 97 research octane number "RON". The quantity must be produced must be based on the demand quantity. However, the refinery produces more than local demand to build up the inventory and to keep a safe inventory. The blending process have some major parameters to take care of such as Research octane number, Reid vapor pressure, and light components in gasoline, Reid vapor indicator and benzene. The main equation used to calculate the total RON is:

$$RON = \frac{Vi\ \%\ x\ Vi\ RON}{\sum V_i} \qquad (1)$$

In the table (1) blending products and their quantities are shown. In table (2) all products specification is shown:

Table 1: Blending Components.

Component	UNIT	Production Barrels	BAL Barrels
Butane	7	1940	1940
Isomerate 1	8	6190	6190
Isomerate 2	9	6340	6340
Reformate-1	3	2540	2540
Light Naphtha	8	4100	4100
Tr Hvy Nap	2	3520	3520
MTBE	Import	16370	16370

Table 2: Blending Specification.

Components	Ron	LCS	RVP (psi)	RVI	Benz (ppm)
Butane	100	1	85	258.1	0
Isomerate 1	81.2	1	13.5	25.9	0.1
Isomerate 2	87.5	1	13	24.7	0.1
Reformate-1	97.8	0	8.5	14.5	3
Light Naphtha	70	0	6.3	10	3.5
Tr Hvy Nap	51.3	0	4	5.7	0.3
MTBE	117	1	9	15.6	0

The blended gasoline products must have 92 RON and 97 RON that was specified by the refinery management. Tables (3) and (4) were mathematically designed to control the gasoline blending process in the Excel sheet. Sample of the calculation will be given below the tables.

Table 3: 92 Ron Blending Recipe.

92 Ron		Percentage %	Ron	RVP (psi)	LCS	RVI	BENZ (ppm)
Butane	840	4%	4	3.4	0.04	10.324	0
Isomerate 1	3990	19%	15.428	2.565	0.19	4.921	0.019
Isomerate 2	2940	14%	12.25	1.82	0.14	3.458	0.014
Reformate-1	840	4%	3.912	0.34	0	0.58	0.12
Light Naphtha	2100	10%	7	0.63	0	1	0.35
Heavy Naphtha	2520	12%	6.156	0.48	0	0.684	0.036
MTBE	7770	37%	43.29	3.33	0.37	5.772	0
Total	21000	100%	92.036	12.565	0.74	26.739	0.539

Table 4: 97 Ron Blending Recipe.

97 Ron		Percentage %	Ron	RVP (psi)	LCS	RVI	BENZ (ppm)
Butane	1100	6%	5.5	4.675	0.055	14.1955	0
Isomerate 1	2200	11%	8.932	1.485	0.11	2.849	0.011
Isomerate 2	3400	17%	14.875	2.21	0.17	4.199	0.017
Reformate-1	1600	8%	7.824	0.68	0	1.16	0.24
Light Naphtha	2000	10%	7	0.63	0	1	0.35
Heavy Naphtha	1000	5%	2.565	0.2	0	0.285	0.015
MTBE	8600	43%	50.31	3.87	0.43	6.708	0
Total	20000	100%	97.006	13.75	0.765	30.3965	0.633

Sample of calculation:

- In RON 92 table it shows Butane quantity in the total blended gasoline. The quantity was calculated by multiplying the total quantity of the components by the percentage.
- The percentage are added manually and it can be changed based on the RON.

- The Butane specification multiplied by the percentage of Butane quantity added to total quantity.
- Examples of the calculations.

Butane Quantity In 92 RON Table $= Total\ 92\ RON\ production\ Quentity\ x\ Butane\ \%$

$$= 4\%\ X\ 21000 = 840\ Barrel \tag{2}$$

- Sample of RON calculation:

$$RON = Percentage\ of\ the\ compnent\ x\ specifcation\ of\ the\ Compnent$$

$$RON = 4\ \%\ x\ 100 = 4$$

4.3 Research Octane Number "RON"

Research octane number "RON" is the most important parameter to measure the gasoline quality. The RON describes the fuel behavior in the engine at lower temperature and speeds, and is an attempt to simulate acceleration behavior. The refinery produces two different RONs number, first one 92 RON "primer gasoline" and 97 RON "super gasoline".

4.4 Reid Vapor Pressure

The second critical test done on the gasoline is RVP measuring. The RVP measures the volatility on gasoline and crude oils. The testing procedure is specified by the American Society for Testing Materials "ASTM" at 100 °F (37.8 °C). The ATEM provides an experimental procedure that used internationally to test RVP in the gasoline. The way of taking the sample is to place in the container. The volume of placing the liquid sample is 4 to 1. The absolute pressure at 100 °F (37.8 °C) in the container is the RVP for the mixture.

4.5 Light Component in Gasoline

The component in the gasoline must be checked to ensure the quality of gasoline. Firstly, the impact on gasoline engine performance. The light components have high volatilely so of that will affect when the gasoline exposed to the atmosphere the fuel will evaporate. In the blending the light components of all blended products are measured. Thus, on the blending process is a major concern for production planning.

4.6 Benzene in Gasoline

Benzene is major content on gasoline that must be taken under consideration. Benzene is an organic compound with molecular formula C_6H_6. The benzene is classified as hydrocarbon because it contains six carbons attached with six hydrogen. The benzene compound exists on the crude oil as a major component. The benzene is classified as aromatic hydrocarbon. The reason of classification is the pi bond structure between the carbon and hydrogen. The benzene has different features such as is colorless, highly flammable liquid with sweet smell. The benzene is main responsible for the smell in the petrol station. The benzene is major component on more complex chemical's manufacturer business such as Ethylbenzene and Cumene in gasoline blending benzene is major component due to the high RON of benzene. The high number of octanes is because the benzene is aromatic derivatives like toluene and xylene. The total content of benzene in gasoline is 25%. However, the benzene is content is reduced to 1% due the side effect on the human.

4.7 The Excel Sheet Method

The MS Excel sheet will provide a full year plan for the production. Moreover, the given demand quantity along with inventory status are presented in the sheet. The export and import dates are planned in the sheet. The inventory status is the cause to import and export any quantity for refinery. In case the production is lower than the

demand, the import is become a priority for the planning team. Since the refinery is assumed to be the only refinery in Qatar. The tanks status is presented in the MS Excel sheet where, the ullage and maximum storage are shown. The ullage is the gap between the current level of the tank and the maximum point level of the tank. The duration of filling the tanks can be calculated. In addition, to the duration of current inventory level that can satisfy the local demand.

Sample of the calculation:

Plan production and inventory plan 2020:

Table 5: 92 RON Production Plan

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
02/01/2020	21,000	19,200	0	103,600	300,000	5	196,400	9	16	96,000
03/01/2020	21,000	19,200	0	105,400	300,000	5	194,600	9	16	96,000
04/01/2020	21,000	19,200	0	107,200	300,000	6	192,800	9	16	96,000
05/01/2020	21,000	19,200	0	109,000	300,000	6	191,000	9	16	96,000
06/01/2020	21,000	19,200	0	110,800	300,000	6	189,200	9	16	96,000
07/01/2020	21,000	19,200	0	112,600	300,000	6	187,400	9	16	96,000
08/01/2020	21,000	19,200	0	114,400	300,000	6	185,600	9	16	96,000
09/01/2020	21,000	19,200	0	116,200	300,000	6	183,800	9	16	96,000
10/01/2020	21,000	19,200	0	118,000	300,000	6	182,000	9	16	96,000

- The production quantity is must be specified by the planner.
- The demand is given by the local supplier.
- Import and Export dates and quantity are specified the by the planner.
- Inventory level is calculated using the equation below:

$$Inventory\ level = Production + \ invenory + import - demand \quad (3)$$

Inventory level = 21000 + 101800+0-19200= 103,600 Barrels

- Maximum capacity is the maximum storages capacity it's 300,000 Barrels.
- Stock days the is maximum inventory days when the tanks are full:

$$\text{Stock days} = \frac{\text{Current Inventory level}}{Demand} \quad (4)$$

$$Stock\ days\ = \frac{103{,}600}{19{,}200} = 5\ days$$

- Ullage is the empty gap between the maximum storage level and the current level:

$$\text{Ullage} = \text{Maximum storage} - \text{Inventory Level} \quad (5)$$

$$Ullage = \ 300{,}000 - 103{,}600 = 196{,}400 \text{ Barrels}$$

- Ullage filling days:

$$\text{Ullage days} = \frac{\text{Ullage}}{Production} \quad (6)$$

$$Ullage\ Days = \frac{196{,}400}{21{,}000} = 9\ days$$

- Minimum storage quantity:

$$Min\ Quantity = 5\ Days\ x\ Demand$$

$$Min\ Quantity = 5\ x\ 19{,}200 = 96{,}000\ Barrels$$

4.8 Production Planning

The MS Excel sheet provides a full year production plan for all refined products. Correspondingly, the Excel sheet provide the demand that taken from the local supplier. In the Excel sheet it shows the inventory level, import and export amount. Besides, the tanks capacity with how many days it takes to fill the ullage of the tanks. The production of 92 Ron and 97 Ron were planned to be produced more than demand. The reason of producing more than the demand is to build up the inventory. The total capacity of the tanks for 92 Ron and 97 Ron 300,000 barrels and 500,000 barrels accordingly. The Liquefied Petroleum Gas “LPG” is assumed that the production is same as the demand. Since LPG is produced from different plants in Qatar. Unlike the hydrocarbon products that only be produced in the Doha Refinery. For Diesel and Jet A1 the refinery produces less than the local demand. Thus, planning team schedules the imports shipments for Jet A1 and Diesel to cover the shortage of the production. The import comes from Oman and it takes three to four days.

4.9 Inventory Control

The MS Excel sheet displays the inventory status for the planner wither the tanks are full or empty. Furthermore, in the sheet it is showing how many days it takes to fill up the ullage of the tanks. Similarly, it shows the days that tanks can cover the production. The tanks status helps the production planning team to plan import and export quantity. As well, the tanks status help planning team to plan for export date and quantity to avoid an overflow of the products. However, the inventory plays a big role in the refinery shutdowns. The refinery inventory covers the demand till the import shipments are received. In addition, a safe inventory must plan to face any unexpected emergency. The inventory status is

assumed to be dynamic especially for the gasoline tanks. As a result, the gasoline depends on the demand and blending to plan the quantity the will be produced. Moreover, in shutdown cases the gasoline quantity will be produced as well as limited. In some cases, there will be zero production. Thus, the refinery will need to import in order to supply the local customer. Meanwhile Jet A1 and Diesel inventory control are categorized as static. Both products depend on import shipments. The imports to be received when the inventory level reached the minimum level of the tanks within five days of demand. The lead time between imports for Jet A1 is 14 to 15 days on average while for Diesel it is 28 days. However, the number of import shipments will increase during the shutdown period but the process will remain static for most of the year.

4.10 The Import and Export

The import and export help to manage the inventory quantity. Thus, if the quantity of the refined products is reaching the maximum capacity it must be exported to provide some space in the tanks for the coming products. Since the refinery is a continuous process that keeps producing refined products 24/7. Then the produced products are being transferred to the storage tanks. The refinery imports if the produced quantity is less the local demand. Especially in Jet A1 and Diesel products the imports rates are high to satisfy the local demand. Although, the refinery produces the maximum quantity of these two products to reduce the import rates. The import rates for these two products are too high comparing to other three products. The imports usually come from Oman since the closeness of Oman to Qatar. The duration to get the import from Oman are three to four days. However, the refinery must plan the import in advance to notify the refinery in Oman to provide the

import shipments. In case of unexpected shutdown, to get the products from the import shipment it takes 5 to 10 days to find supplier and to arrange the import shipment. The water depth calculation was done to know the maximum quantity that can be exported or imported to the refinery. The assign port to receive the import and export is Mesieed port. The port receiving capacity are provided in the MS Excel sheet. Additionally, to the tank's capacity factor must be taken in account in order to know the quantity that can be imported or exported.

4.11 Jet Al Specification

The Jet A1 are mainly used as airplanes fuel and there is some critical specification that must be tested to ensure Jet A1 is meeting the specification. Firstly, is the sulfur level in Jet A1 must be below 30 ppm and that is specified by Qatar Petroleum ^{0}. Also, the flash point of the jet A1 must be tested to know the lowest temperature point that will cause the ignition of Jet A1 fuel. Flash point test helps to avoid the hydrocarbon vaporizing which will cause high risk because the atmosphere will be full vapor mixture that can easily ignite. Qatar petroleum specified the flash point 38 ^{0}C minimum. Another parameter is the freezing point and it is critical parameter helps producers to know the lowest temperature that will cause the freezing the fuel. The lowest point is maximum -47 ^{0}C as per international standards.

4.12 Diesel Specification

The Diesel fuel is used in trucks, plants, cars and military tanks and there are many other uses for the Diesel. It shows that Diesel is highly wanted products so it must be tested

before supplying it to the customers. There some major parameters that must be tested on Diesel before supplying it to the customers. First test, is sulfur level its must be less than 10 ppm. In Middle East the European Union “EU” specification are followed to reduce the toxic gases emission to the atmosphere. EU came up with euro six standards. In Euro six the sulfur content in the Diesel must below 10 ppm. Also, Centane number is similar to research octane number for the gasoline. It helps to the combustion process in the engine. Also, the density of the Diesel must be tested and it is specified to be between 820 to 833 kg/m^3. Lubricity of the Diesel fuel must be tested too. Lubricity is a measurement for the friction inside the engine Diesel and the result of the test must be below 460 ums.

4.13 Water Depth Calculation

The water depth calculation was done to know the maximum quantity the refinery can import or export [0]. The selected port is Mesiaeed port. The maximum displacement of the ship or it means the ship weight. The way of measuring the ship size is to calculate the displace water volume then converting it a weight. Also. The maximum length of the ship must be measured. The maximum length of a vessel's hull is measured using waterline. This length is important while docking the ship. Also, the maximum beam or the width of the ship must be measured with the length of the ship. The way of measuring the width taking the distance of the between planes passing through the outer far limits of the ship. The beam of the hull (BH) only includes permanently fixed parts of the hull, and beam at waterline (BWL) is the maximum width where the hull intersects the surface of the water. In addition, the maximum draft or draught of the ship in the water. The deepest point water the ship can reach. Thus, it will help to know if the port can accommodate the ship or not.

All of the information above is required to be calculated to estimate the size of the cargo. The calculation is done in the appendix four.

4.14 Production Performance and Inventory Status Charts

The products chart represents the demand, production, inventory level, and export and import. The chart helps to visualize the production verses the demand. Also, it helps to plan export and import dates by providing limits for the minimum and maximum storage capacity for the tanks. The charts are showing the production quarterly period. Thus, it helps to monitor the refinery performance in quarter. The graph will be used in next chapter to show the refinery performance quarterly.

4.15 Live Excel Sheet

The MS Excel sheet is planned to be connected using flow stream in order to get live data from the site. Also, it helps to know the products quantity in the tanks. Therefore, it helps to know the quantity of gasoline that can be blended. In addition, the live Excel sheet helps to manage the other products in the tanks in transferring or import / export. The way of connecting the system to the MS Excel sheet it presented the flow chart below.

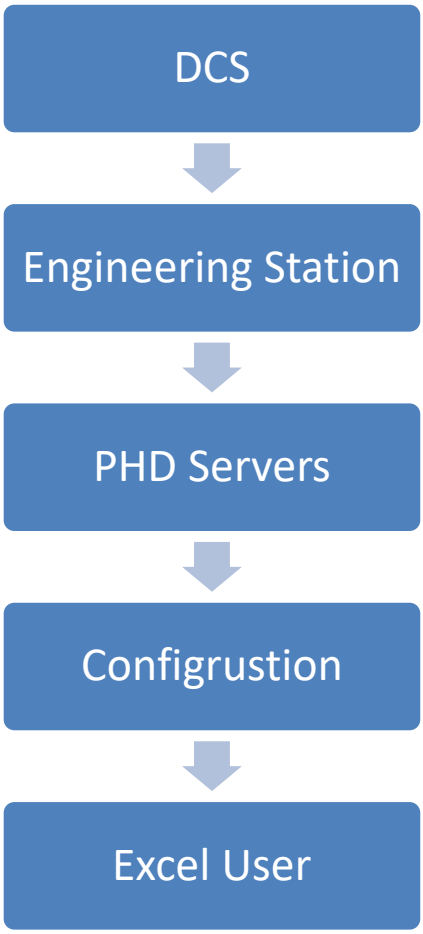

Figure 9: Live Excel Flow Diagram.

DCS stand for Distributed Control System is remote controlling system used by plant supervisor and production planning engineers to monitor the flow, temperature and pressure of hydrocarbon in the pipes. The data transferred to engineering station where the PHD servers are stored. The PHD “process historical data” the data is configured and processed before it is being transferred to the sheet. In order to get live data from the PHD MS Excel sheet must install uniformness application to connect the sheet to the serves.

CHAPTER 5: RESULTS ANALYSIS

In this chapter the result of the integration will addressed using graphs. The graphs are showing the inventory status and production performance. Furthermore, what if scenarios will be discussed in chapter to show the effectiveness of the integration method to manage the refinery.

5.1 The Production Planning and Inventory Control

The Excel sheet provide a full year production plan with the demand. Besides, the inventory status for products are provided in the Excel sheet. Thus, if the demand is higher than the production the inventory will be used to cover the shortage of the production. For the 92 and 97 Ron the production is higher than demand, so the excess quantity is stored in the tanks. The storage must be maintained a safe inventory between 5 days as minimum to face emergency case such as shutdown or war till the resolve or the refinery receive an import shipment. .However, if the stored product is reaching the maximum tanks capacity the refinery plan export to sell the excess quantity. In Jet A1 and Diesel. In the result chapter all the graphs will summarize the production plan quarter performance and, it will show how the inventory been managed quarterly.

5.2 Liquefied Petroleum Gas “LPG”

The LPG production from the refinery is equivalent to the local demand. Since, the LPG is produced from different plants in Qatar.

5.3 92 and 97 Ron Gasoline

In the figure below the first quarter of 92 and 97 RON status is represented. Where you can see the production, demand, export, import and inventory level. The inventory level shown in the figure below is increasing due to the production is higher than the local demand. The inventory line is suddenly decreased on April because the inventory content reaching maximum capacity of the tanks which is 300,000 barrel per day for the 92 Ron and 500,000 barrel per day for 97 Ron. To avoid the overflow the excess quantity is exported to provide some space for the coming products.

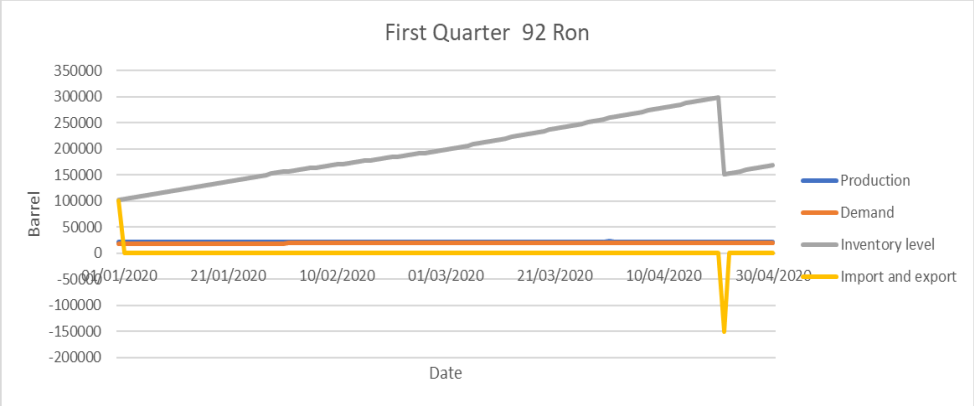

Figure 10: 92 RON First Quarter Production Status.

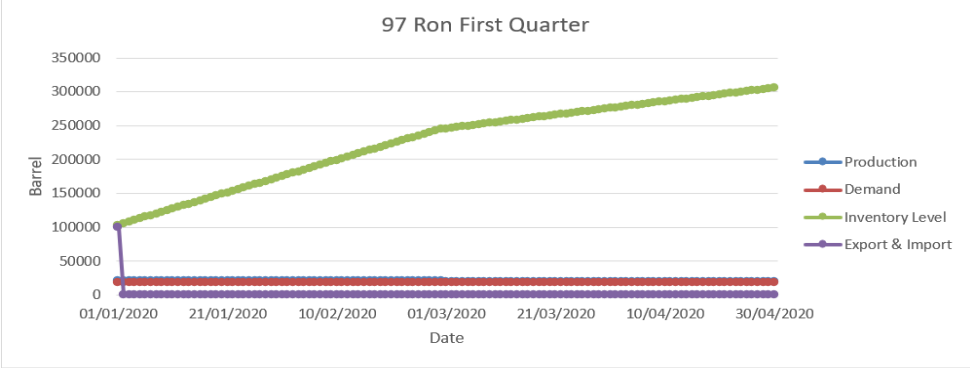

Figure 11: 97 RON First Quarter Production Status.

Another figure is mainly showing the inventory status in the first quarter. The figure provides boundaries such as minimum storage quantity and maximum capacity. The minimum storage stands for keeping safe inventory is five days.

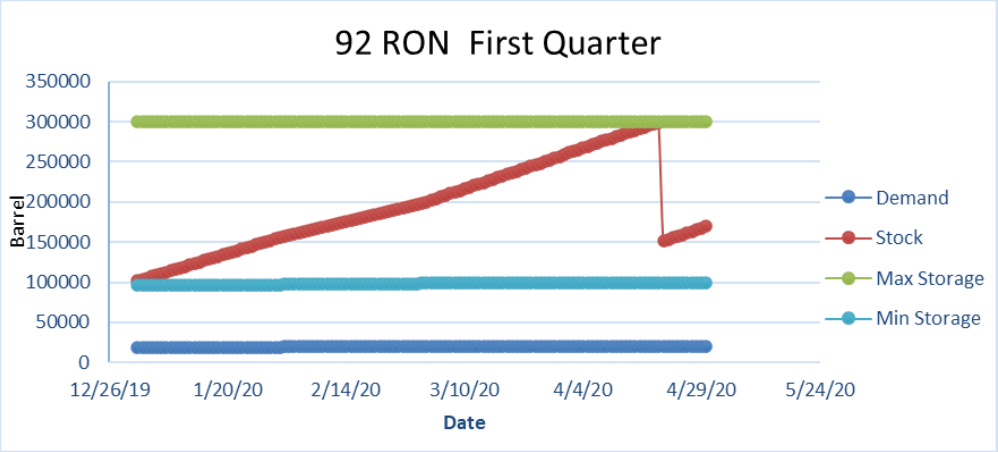

Figure 12: 92 RON Inventory Condition with the Boundaries.

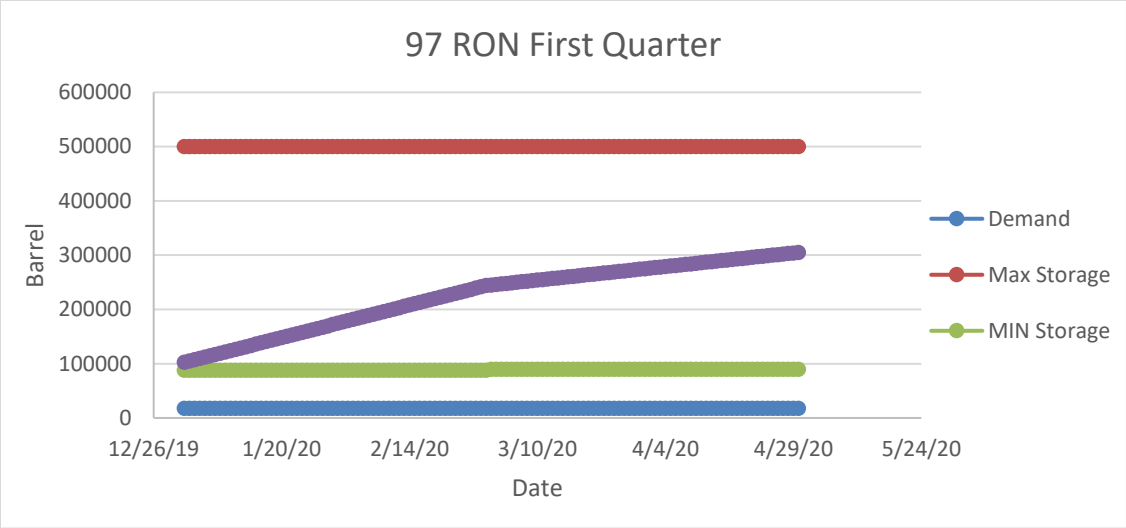

Figure 13: 97 RON Inventory Condition with the Boundaries.

5.4 Jet A1 Fuel and Light Gas Oil:

In figures below, the Jet A1 and Diesel production are way less than the local demand. The refinery imports needed quantity every week to supply to the local customer. The line figures below are fluctuating unlike the gasoline figure because of the high rates of import and high demand from the local. Moreover, the production line from the refinery it is showing along with the demand in the chart to see the difference between them.

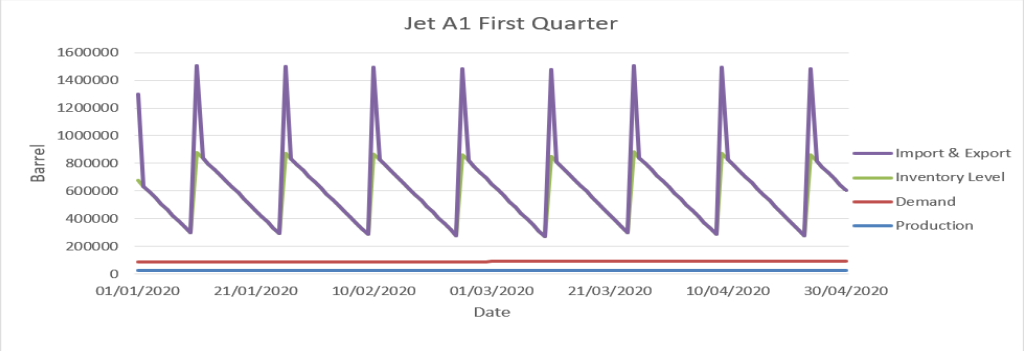

Figure 14: Jet A1First Quarter Inventory Condition.

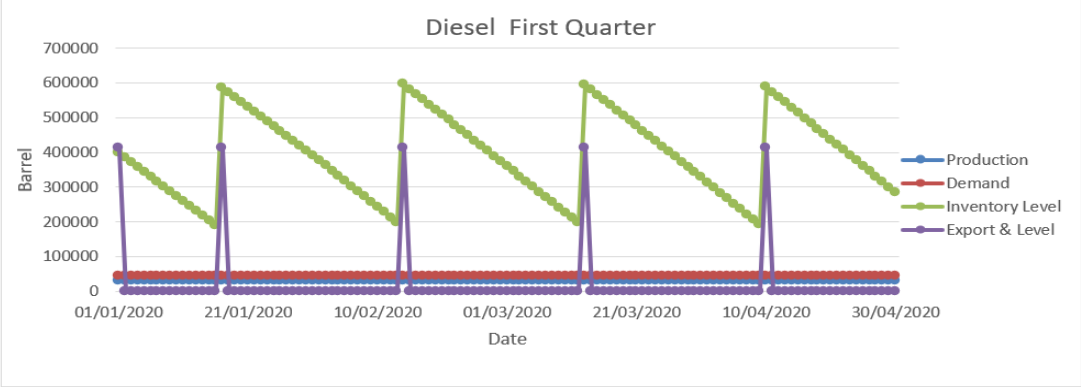

Figure 15: Diesel First Quarter Inventory Condition.

In addition, the inventory provides the boundaries where the refinery must import some quantity to have a safe stock. The imports help to cover the gap between the production and the demand. The inventory line is unstable due to the large demand and large imported quantity. The minimum quantity that must be maintain in the tanks is between 5 to 10 days.

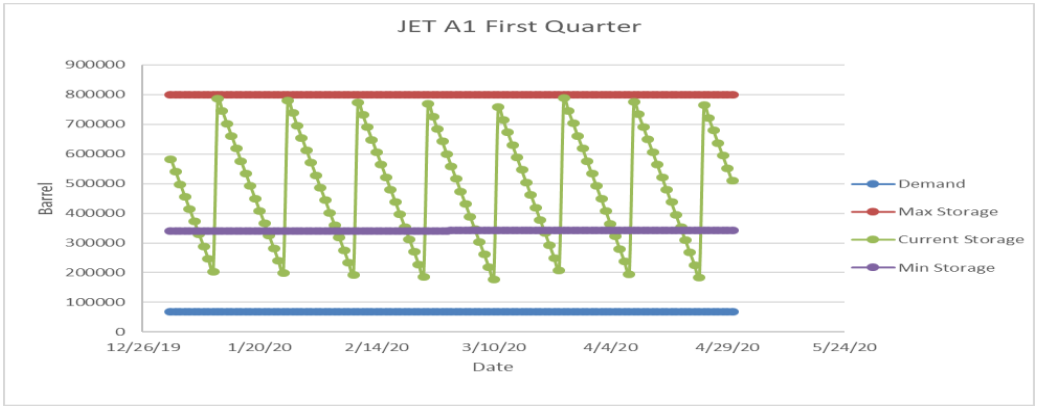

Figure 16: Jet A1 Inventory Condition with the Boundaries.

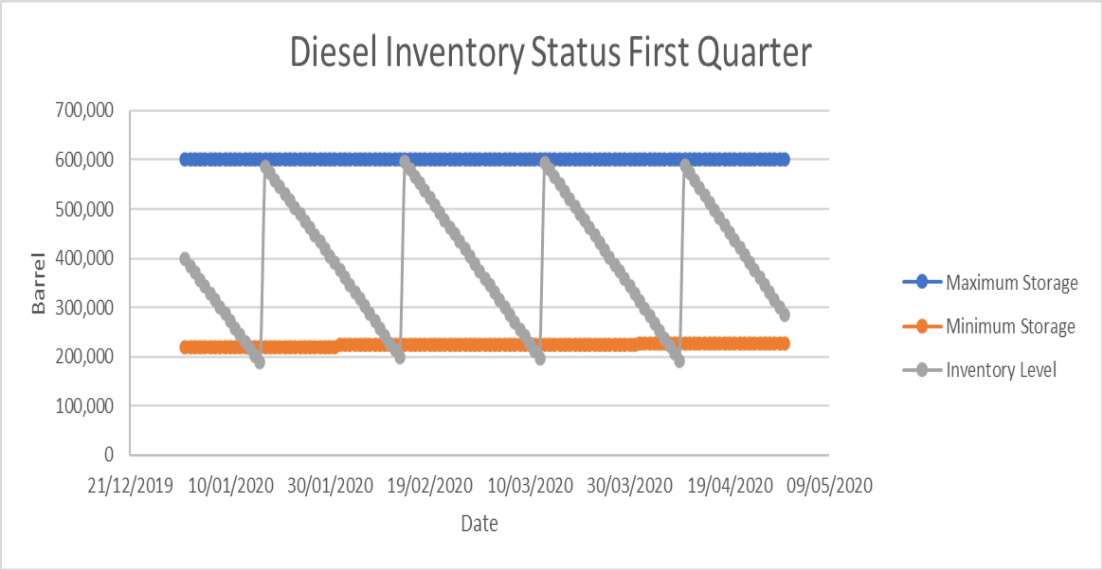

Figure 17: Diesel Inventory Condition with the Boundaries.

5.5 What If Analysis

In this section it will discuss different scenarios of shutdowns that will affect the production. Both of planned and unplanned shutdown will be shown in this section for all refinery productions. In this scenario it shows the importance of having safe inventory for the refinery products.

- Case one un-planned Shutdown in 97 RON Production for 30 days:

Table 6:97RON Production in Febrary.

Day	Production	Demand	INV Level	Import
01/02/2020	0	17600	156800	0
02/02/2020	0	17600	139200	0
03/02/2020	0	17600	121600	0
04/02/2020	0	17600	454000	350000
05/02/2020	0	17600	436400	0
06/02/2020	0	17600	418800	0
07/02/2020	0	17600	401200	0

Table 7: 97RON Production in February (cont.)

Day	Production	Demand	INV Level	Import
08/02/2020	0	17600	383600	0
09/02/2020	0	17600	366000	0
10/02/2020	0	17600	348400	0
11/02/2020	0	17600	330800	0
12/02/2020	0	17600	313200	0
13/02/2020	0	17600	295600	0
14/02/2020	0	17600	278000	0
15/02/2020	0	17600	260400	0
16/02/2020	0	17600	242800	0
17/02/2020	0	17600	225200	0
18/02/2020	0	17600	207600	0
19/02/2020	0	17600	190000	0
20/02/2020	0	17600	172400	0
21/02/2020	0	17600	154800	0
22/02/2020	0	17600	137200	0
23/02/2020	0	17600	119600	0
24/02/2020	0	17600	452000	350000
25/02/2020	0	17600	434400	0
26/02/2020	0	17600	416800	0
27/02/2020	0	17600	399200	0
28/02/2020	0	17600	381600	0
29/02/2020	0	17600	364000	0

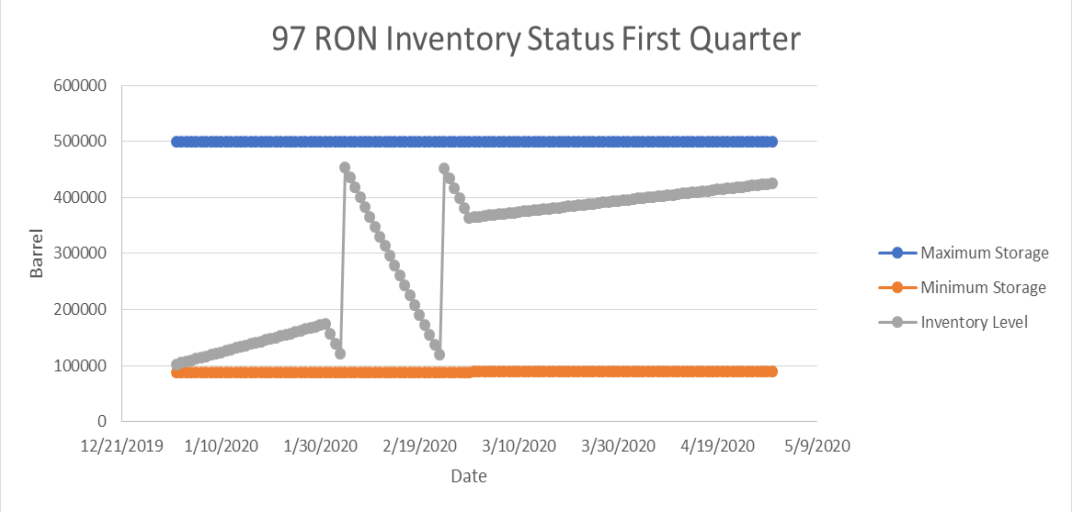

Figure 18: Inventory status with Shutdown in February.

In the table (5) it can be seen that the planning team planned to import shipments to build

up the inventory for the refinery. The maximum import quantity for is 680,000 bbl. and maximum storage capacity is 500,000 bbl. The team planned to imports 350,000bbl two times in February to build up the refinery inventory. In the figure above it shows the inventory status after the shutdown. Moreover, the shutdown effects the quantity of 92 RON and LPG. Their quantity will increase due to the increase in the feed. For Jet A1 and Diesel there are no increase in quantity due to the unit capacity and planned import. In table below the blending recipe for shutdown is shown.

Table 8: Shutdown Blending Recipe for 92 RON.

92 Ron		Percentage %	Ron	RVP (psi)	LCS	RVI	BENZ (ppm)
Butane	210	1%	1	0.01	0.01	2.581	0
Isomerate 1	3990	19%	15.428	0.19	0.19	4.921	0.019
Isomerate 2	2940	14%	12.25	0.14	0.14	3.458	0.014
Reformate-1	840	4%	3.912	0	0	0.58	0.12
Light Naphtha	2100	10%	7	0	0	1	0.35
Heavy Naphtha	2520	12%	6.156	0	0	0.684	0.036
MTBE	8400	40%	46.8	0.4	0.4	6.24	0
Total	25000	100%	92.546	0.74	0.74	19.464	0.539

- Case Two planned Shutdown in 97 RON production for 20 days:

Table 9: 97RON Production in August.

Day	Production	Demand	INV Level	Import
01/08/2020	21000	17200	464000	0
02/08/2020	21000	17200	467800	0
03/08/2020	21000	17200	471600	0
04/08/2020	21000	17200	475400	0
05/08/2020	21000	17200	479200	0
06/08/2020	21000	17200	483000	0
07/08/2020	21000	17200	486800	0
08/08/2020	21000	17200	490600	0
09/08/2020	21000	17200	494400	0

Table 10: 97RON Production in August (cont.)

10/08/2020	21000	17200	498200	0
11/08/2020	0	17200	481000	0
12/08/2020	0	17200	463800	0
13/08/2020	0	17200	446600	0
14/08/2020	0	17200	429400	0
15/08/2020	0	17200	412200	0
16/08/2020	0	17200	395000	0
17/08/2020	0	17200	377800	0
18/08/2020	0	17200	360600	0
19/08/2020	0	17200	343400	0
20/08/2020	0	17200	326200	0
21/08/2020	0	17200	309000	0
22/08/2020	0	17200	291800	0
23/08/2020	0	17200	274600	0
24/08/2020	0	17200	257400	0
25/08/2020	0	17200	240200	0
26/08/2020	0	17200	223000	0
27/08/2020	0	17200	205800	0
28/08/2020	0	17200	188600	0
29/08/2020	0	17200	171400	0
30/08/2020	0	17200	154200	0
31/08/2020	0	17200	137000	0

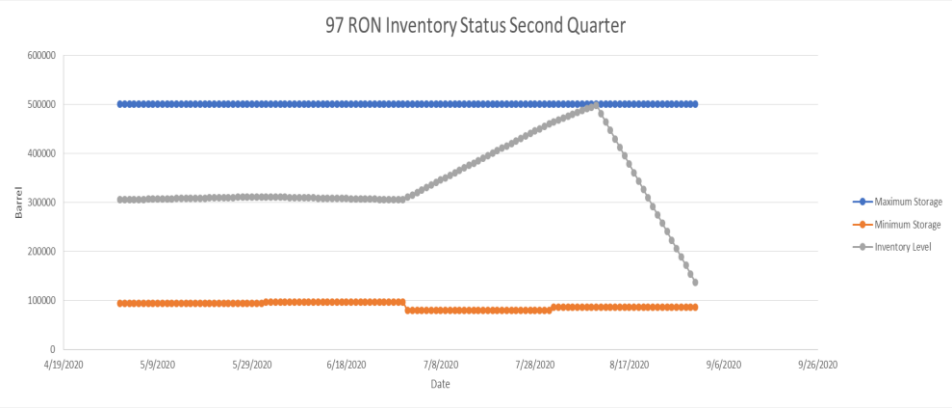

Figure 19:Inventory status with Shutdown in August.

The planned shutdown is taken after the planning team build up the inventory to minimize

the import shipments to the refinery. The planning team coordinate with the crude feed supplier to reduce the feed quantity to 76000 -74000 due the circulating the extra quantity of gasoline with feed.

- Case three unplanned partial shutdown for 30 days in 97 RON:

Table 11: 92 RON Inventory Condition With the Boundaries.

Day	Production (Barrels)	Demand (Barrels)	INV Level (Barrels)	Import (Barrels)
4/1/2020	9,000	18000	266,000	0
4/2/2020	9,000	18000	257,000	0
4/3/2020	9,000	18000	248,000	0
4/4/2020	9,000	18000	239,000	0
4/5/2020	9,000	18000	230,000	0
4/6/2020	9,000	18000	221,000	0
4/7/2020	9,000	18000	212,000	0
4/8/2020	9,000	18000	203,000	0
4/9/2020	9,000	18000	194,000	0
4/10/2020	9,000	18000	185,000	0
4/12/2020	9,000	18000	167,000	0
4/13/2020	9,000	18000	158,000	0
4/14/2020	9,000	18000	149,000	0
4/15/2020	9,000	18000	140,000	0
4/16/2020	9,000	18000	131,000	0
4/17/2020	9,000	18000	122,000	0
4/18/2020	9,000	18000	113,000	0
4/19/2020	9,000	18000	104,000	0
4/20/2020	9,000	18000	245,000	150,000
4/21/2020	9,000	18000	236,000	0
4/22/2020	9,000	18000	227,000	0
4/23/2020	9,000	18000	218,000	0
4/24/2020	9,000	18000	209,000	0
4/25/2020	9,000	18000	200,000	0
4/26/2020	9,000	18000	191,000	0
4/27/2020	9,000	18000	182,000	0
4/28/2020	9,000	18000	173,000	0
4/29/2020	9,000	18000	164,000	0
4/30/2020	9,000	18000	155,000	0

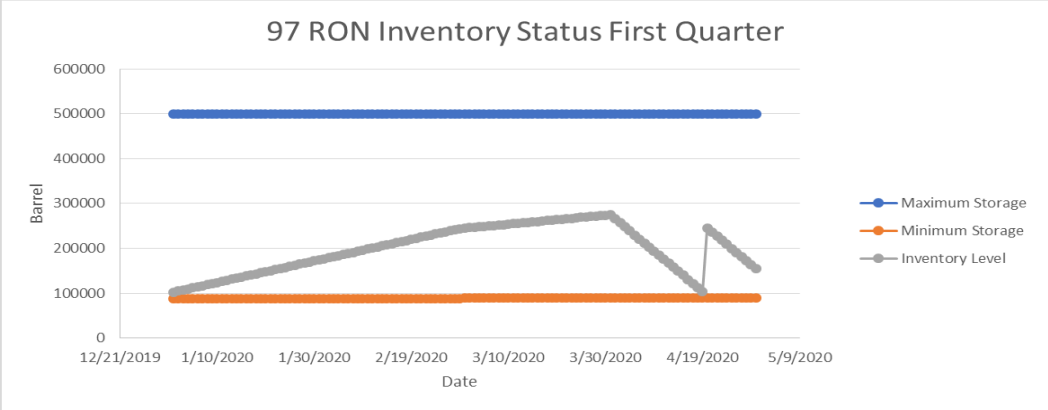

Figure 20: Inventory status with Shutdown in April.

The refinery usually has a minor shutdown that reduces the production of the refinery. The partial shutdown means one or more units produces less than normal capacity. In the case above the production is reduce the production of 97 RON to less than 50% as per the plan. The team allows to minimize the production and planned an import shipment with 150,000 bbl. to build up the inventory. The quantity for 92 RON increases to 25000 bbl. and LPG increases to 500 bbl., due to 97 RON reduction. For Jet A1 and Diesel there are no change in the plan because they have planned shipments. In tables below the new blending recipe for the gasoline 92and 97 RON:

Table 12:Blending Recipe for 92 RON in Shutdown.

	92 RON	Percentage %	Ron	RVP (psi)	LCS	RVI	BENZ (ppm)
Butane	210	1%	1	0.01	0.01	2.581	0
Isomerate 1	3990	19%	15.428	0.19	0.19	4.921	0.019
Isomerate 2	2940	14%	12.25	0.14	0.14	3.458	0.014
Reformate-1	840	4%	3.912	0	0	0.58	0.12
Light Naphtha	2100	10%	7	0	0	1	0.35
Heavy Naphtha	2520	12%	6.156	0	0	0.684	0.036
MTBE	8400	40%	46.8	0.4	0.4	6.24	0
Total	25000	100%	92.546	0.74	0.74	19.464	0.539

Table 13: Blending Recipe for 97 RON in Shutdown.

	97 Ron	Percentage %	Ron	RVP (psi)	LCS	RVI	BENZ (ppm)
Butane	495	6%	6	5	0.055	14	0
Isomerate 1	2200	11%	9	1	0.110	3	0
Isomerate 2	3400	17%	15	2	0.170	4	0
Reformate-1	1600	8%	8	1	0.000	1	0
Light Naphtha	2000	10%	7	1	0.000	1	0
Heavy Naphtha	1000	5%	3	0	0.000	0	0
MTBE	8600	43%	50	4	0.430	7	0
Total	9000	100%	97.006	13.75	0.765	30.3965	0.633

- Case four planned Shutdown for five days:

Table 14: 97 RON production in May.

Day	Production (Barrels)	Demand (Barrels)	INV Level (Barrels)	Import (Barrels)
5/1/2020	0	18800	286,200	0
5/2/2020	0	18800	267,400	0
5/3/2020	0	18800	248,600	0
5/4/2020	0	18800	229,800	0
5/5/2020	0	18800	211,000	0
5/6/2020	19,000	18800	211,200	0
5/7/2020	19,000	18800	211,400	0
5/8/2020	19,000	18800	211,600	0
5/9/2020	19,000	18800	211,800	0
5/10/2020	19,000	18800	212,000	0
5/11/2020	19,000	18800	212,200	0
5/12/2020	19,000	18800	212,400	0
5/13/2020	19,000	18800	212,600	0
5/14/2020	19,000	18800	212,800	0
5/15/2020	19,000	18800	213,000	0
5/16/2020	19,000	18800	213,200	0
5/17/2020	19,000	18800	213,400	0
5/18/2020	19,000	18800	213,600	0
5/19/2020	19,000	18800	213,800	0
5/20/2020	19,000	18800	214,000	0
5/21/2020	19,000	18800	214,200	0

Table 15: 97 RON production in May (Cont.)

Day	Production (Barrels)	Demand (Barrels)	INV Level (Barrels)	Import (Barrels)
5/22/2020	19,000	18800	214,400	0
5/23/2020	19,000	18800	214,600	0
5/24/2020	19,000	18800	214,800	0
5/25/2020	19,000	18800	215,000	0
5/26/2020	19,000	18800	215,200	0
5/27/2020	19,000	18800	215400	0
5/28/2020	19,000	18800	215,600	0
5/29/2020	19,000	18800	215,800	0
5/30/2020	19,000	18800	216,000	0
5/31/2020	19,000	18800	216,200	0

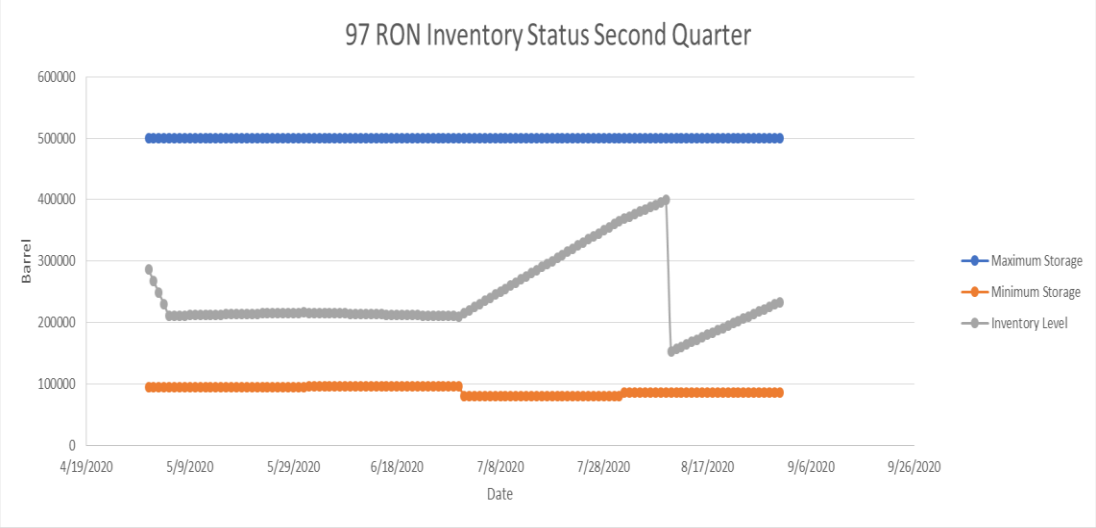

Figure 21: Inventory status with Shutdown in May.

The refinery sometimes has short shutdowns for changing catalyst, replacing pump or to do some maintenance job for some critical equipment. The shut is requested by the maintenance team and operation team but the date of the shutdown is specified by the planning team.

- Case Five unplanned shutdown in six days

Table 16: 97 RON Production in September.

Day	Production (Barrels)	Demand (Barrels)	INV Level (Barrels)	Import (Barrels)
9/1/2020	0	19,200	308,800	0
9/2/2020	0	19,200	289,600	0
9/3/2020	0	19,200	270,400	0
9/4/2020	0	19,200	251,200	0
9/5/2020	0	19,200	232,000	0
9/6/2020	21,000	19,200	233,800	0
9/7/2020	21,000	19,200	235,600	0
9/8/2020	21,000	19,200	237,400	0
9/9/2020	21,000	19,200	239,200	0
9/10/2020	21,000	19,200	241,000	0
9/11/2020	21,000	19,200	242,800	0
9/12/2020	21,000	19,200	244,600	0
9/13/2020	21,000	19,200	246,400	0
9/14/2020	21,000	19,200	248,200	0
9/15/2020	21,000	19,200	250,000	0
9/16/2020	21,000	19,200	251,800	0
9/17/2020	21,000	19,200	253,600	0
9/18/2020	21,000	19,200	255,400	0
9/19/2020	21,000	19,200	257,200	0
9/20/2020	21,000	19,200	259,000	0
9/21/2020	21,000	19,200	260,800	0
9/22/2020	21,000	19,200	262,600	0
9/23/2020	21,000	19,200	264,400	0
9/24/2020	21,000	19,200	266,200	0
9/25/2020	21,000	19,200	268,000	0
9/26/2020	21,000	19,200	269,800	0
9/27/2020	21,000	19,200	271,600	0
9/28/2020	21,000	19,200	273,400	0
9/29/2020	21,000	19,200	275,200	0
9/30/2020	21,000	19,200	277,000	0

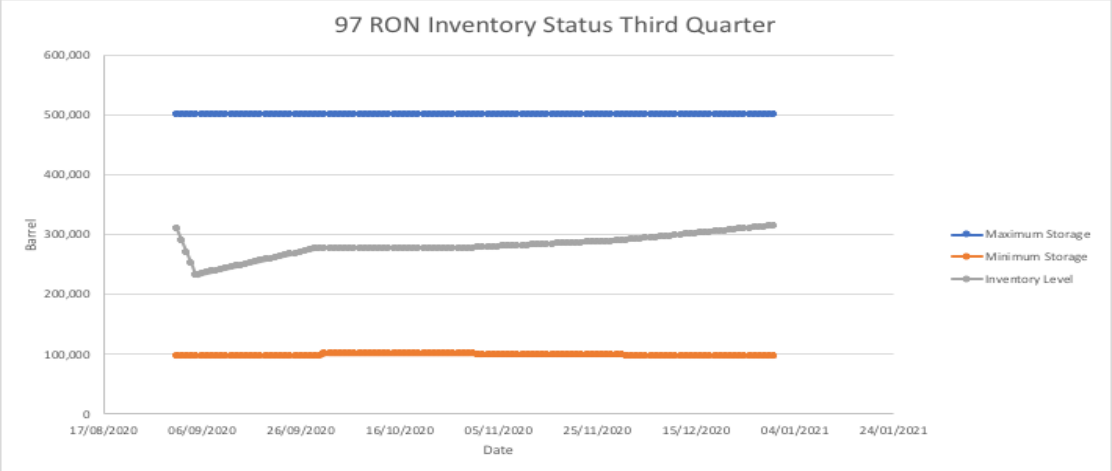

Figure 22:Inventory status with Shutdown in September.

The unplanned shutdown for short time between the first and fifth of September. The product in the inventory was enough to supply the product to the customers for 16 days. Thus, the planning team didn't need to import products.

- Case Six Planned and un-planned Shutdown for Jet A1 and Diesel:

  The plan for Jet A1 and Diesel is design to depend mainly on import shipments. Since the production for these products are less than the demand. Thus, in case of planned shutdown the planning team will plan more import shipments. In case of emergency the team must have at least five days inventory till import come.

CHAPTER 6: CONCLUSION

The research report provides an effective methodology that helps integrate the production planning and inventory control. The MS Excel sheets provide an overview of the production plan, export, import and inventory level. Furthermore, the methodology demonstrates how to perform blending processes in the Excel sheet. That helps the refineries' planning departments eliminate some of the current applications that were used to issue the blending recipe to the operation. The result of the blending will impact the overall plan and this is due to the quantity of the crude oil coming in at 83,660 barrels. Most of it flows to the upper trays to produce gasoline. Thus, the increase of the quantity of one of the products will impact the other products quantity. Furthermore, water depth calculation was done to determine the maximum and minimum import and export quantities that the refinery port is able to receive. However, before the refinery is able to import or export any amount, they must check the inventory status and plan which day the inventory tanks are ready to receive the shipment.

In the case of gasoline products, there are two reasons the refinery produces more than the local demand which allows the export and selling of excess quantity. The first reason is to provide some space in the tanks for the coming products. The second reason is to make some profits for the refinery. In total, the refinery sells three products that are the residue 92 RON and 97 RON. For the other products including Diesel and Jet A1, the production is less than the demand. However, the team aims to produce the maximum quantity for the aforementioned products and to reduce their import rate. The refinery imports the Jet A1 and Diesel from Oman because it takes two to three days to ship the quantity to Qatar. The

duties for production planning and inventory control have related tasks to manage the refinery which make the integration possible. The future plans are to expand the refinery to increase production, especially for Jet A1 and Diesel production. Furthermore, the increasing of other hydrocarbons quantities to match the increase of population in the state of Qatar. Currently, the production for Jet A1 is 26,000 barrels per day. However, Hamad International Airport demands 60, 000 barrels per day. The planning team is forced to import the quantity to satisfy the demand. The refinery management will lose a large sum of money in the importing cost. The same applies to the Diesel production where there is a substantial gap between the demand and production. Hence, the planning team will have to import Diesel to satisfy local needs.

6.1 Future research:

For future research, scheduling can be integrated in the production planning and inventory control. The integration method can be done using simulation methods. The simulation will help the planner apply different scenarios to manage the production. It will also provide more accurate results before making any final decisions. The MS Excel sheet solver can be used to calculate the optimal quantities for all products. Additionally, tanks' tag numbers can be included to monitor each one individually.

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APPENDIXES

Appendix One Blending Calculation:

Table 17: Blending Compenets.

Bending Components			
Component	UNIT	Production Barrels	BAL Barrels
Butane	7	1940	1940
Isomerate 1	8	6190	6190
Isomerate 2	9	6340	6340
Reformate-1	3	2540	2540
Light Naphtha	8	4100	4100
Tr Hvy Nap	2	3520	3520
MTBE	Import	16370	16370

Table 18: Blending Specification.

Component Specification					
Blending Components	Ron	LCS	RVP (psi)	RVI	Benz (ppm)
Butane	100	1	85	258.1	0
Isomerate 1	81.2	1	13.5	25.9	0.1
Isomerate 2	87.5	1	13	24.7	0.1
Reformate-1	97.8	0	8.5	14.5	3
Light Naphtha	70	0	6.3	10	3.5
Tr Hvy Nap	51.3	0	4	5.7	0.3
MTBE	117	1	9	15.6	0

Table 19: 92 Ron Blending Recipe.

92 Ron		Percentage %	Ron	RVP (psi)	LCS	RVI	BENZ (ppm)
Butane	840	4%	4	3.4	0.04	10.324	0
Isomerate 1	3990	19%	15.428	2.565	0.19	4.921	0.019
Isomerate 2	2940	14%	12.25	1.82	0.14	3.458	0.014
Reformate-1	840	4%	3.912	0.34	0	0.58	0.12
Light Naphtha	2100	10%	7	0.63	0	1	0.35
Heavy Naphtha	2520	12%	6.156	0.48	0	0.684	0.036
MTBE	7770	37%	43.29	3.33	0.37	5.772	0

Total	21000	100%	92.036	12.565	0.74	26.739	0.539

Table 20: 97 Ron Blending Recipe.

97 Ron		Percentage %	Ron	RVP (psi)	LCS	RVI	BENZ (ppm)
Butane	1100	6%	5.5	4.675	0.055	14.1955	0
Isomerate 1	2200	11%	8.932	1.485	0.11	2.849	0.011
Isomerate 2	3400	17%	14.875	2.21	0.17	4.199	0.017
Reformate-1	1600	8%	7.824	0.68	0	1.16	0.24
Light Naphtha	2000	10%	7	0.63	0	1	0.35
Heavy Naphtha	1000	5%	2.565	0.2	0	0.285	0.015
MTBE	8600	43%	50.31	3.87	0.43	6.708	0
Total	20000	100%	97.006	13.75	0.765	30.3965	0.633

Sample of calculation:

- In RON 92 table Butane quantity in the total blended gasoline is indicated by multiplying the total quantity of the components by the percentage.
- The percentage are added manually and it can be changed based on the RON.
- The Butane Specification multiply by the percentage of butane quantity added.
- Examples of the calculations.

Butane Quantity In 92 RON Table $= Total\ gasoline\ quantity\ x\ Added\ compnent\ percentage$

$$\text{Butane quantity in the RON} = 21000\ x\ 4\% = 840\ Barrels$$

- Sample of RON calculation:

$$RON = Percentage\ of\ the\ compnent\ x\ specifcation\ of\ the\ Compnent$$

$$RON = 4\ \%\ x\ 100 = 4$$

$$Butane\ RVP = 85\ x\ 4\% = 3.4$$

$$Butane\ RVI = 258.1\ x\ 4\% = 10.324$$

$$Butane\ LCs = 1\ x4\% = 0.04$$

$$Butane\ Benzane = 0\ x\ 4\% = 0$$

Appendix Two Water Depth Calculation:

- The port dimensions are taken Qatar Petroleum website.

Table 21 Mesiaeed Port Demisions [30].

Mesiaeed Port			
MAX Displacement	MAX loading	MAX Beam	MAX Draft
8000 MT	240 TEU	45 m	12.5 m

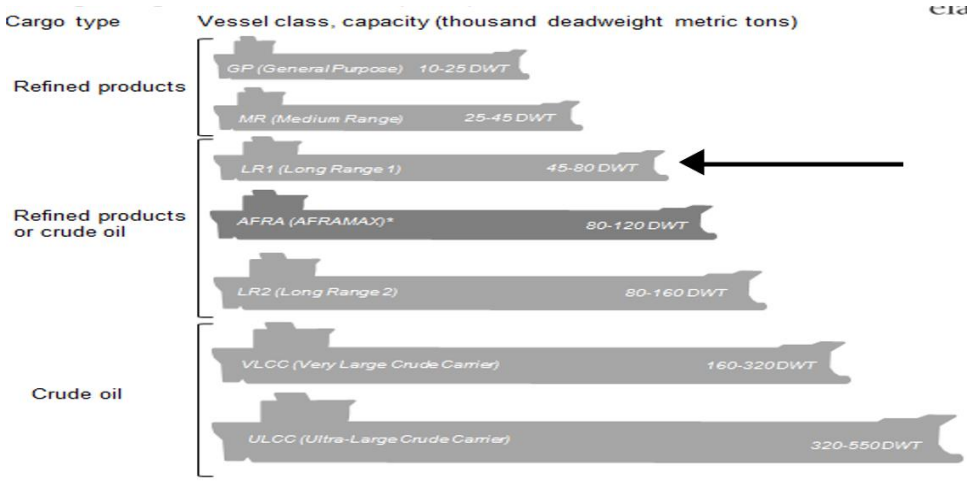

Figure 23: Ships Sizes [27].

Table 22 Ship Capacity Calculation.

MAX MT 80,000		
Product	Conversion Factor	MT to Bbl.
LPG	11.6	928000
Gasoline	8.5	680,000
JET A1	7.8	624,000
LGO	7.5	600,000
Residue	6.7	536,000

- The conversion factor is multiplied by the maximum metric ton.

$$LPG\ Maximum\ Import\ Quantity = 11.6\ x\ 80{,}000 = 928000\ Barrels$$

$$Gasoline\ Maximum\ Import\ Quantity = 8.5\ x\ 80{,}000 = 680{,}000\ Barrels$$

$$Jet\ A1\ Maximum\ Import\ Quantity = 7.8\ x\ 80{,}000 = 624{,}000\ Barrels$$

$$LGO\ Maximum\ Import\ Quantity = 7.5\ x\ 80{,}000 = 600{,}000\ Barrels$$

$$Residue\ Maximum\ Import\ Quantity = 6.7\ x\ 80{,}000 = 536{,}000\ Barrels$$

Appendix Three 92 RON Production Plan calculation:

Table 23: 92 RON Production Plan.

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
1/1/2020	21,000	19,200	100,000	101,800	300,000	5	198,200	9	16	96,000
1/2/2020	21,000	19,200	0	103,600	300,000	5	196,400	9	16	96,000
1/3/2020	21,000	19,200	0	105,400	300,000	5	194,600	9	16	96,000
1/4/2020	21,000	19,200	0	107,200	300,000	6	192,800	9	16	96,000
1/5/2020	21,000	19,200	0	109,000	300,000	6	191,000	9	16	96,000
1/6/2020	21,000	19,200	0	110,800	300,000	6	189,200	9	16	96,000
1/7/2020	21,000	19,200	0	112,600	300,000	6	187,400	9	16	96,000
1/8/2020	21,000	19,200	0	114,400	300,000	6	185,600	9	16	96,000
1/9/2020	21,000	19,200	0	116,200	300,000	6	183,800	9	16	96,000
1/10/2020	21,000	19,200	0	118,000	300,000	6	182,000	9	16	96,000
1/11/2020	21,000	19,200	0	119,800	300,000	6	180,200	9	16	96,000
1/12/2020	21,000	19,200	0	121,600	300,000	6	178,400	8	16	96,000
1/13/2020	21,000	19,200	0	123,400	300,000	6	176,600	8	16	96,000
1/14/2020	21,000	19,200	0	125,200	300,000	7	174,800	8	16	96,000
1/15/2020	21,000	19,200	0	127,000	300,000	7	173,000	8	16	96,000
1/16/2020	21,000	19,200	0	128,800	300,000	7	171,200	8	16	96,000
1/17/2020	21,000	19,200	0	130,600	300,000	7	169,400	8	16	96,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
1/19/2020	21,000	19,200	0	134,200	300,000	7	165,800	8	16	96,000
1/20/2020	21,000	19,200	0	136,000	300,000	7	164,000	8	16	96,000
1/21/2020	21,000	19,200	0	137,800	300,000	7	162,200	8	16	96,000
1/22/2020	21,000	19,200	0	139,600	300,000	7	160,400	8	16	96,000
1/23/2020	21,000	19,200	0	141,400	300,000	7	158,600	8	16	96,000
1/24/2020	21,000	19,200	0	143,200	300,000	7	156,800	7	16	96,000
1/25/2020	21,000	19,200	0	145,000	300,000	8	155,000	7	16	96,000
1/26/2020	21,000	19,200	0	146,800	300,000	8	153,200	7	16	96,000
1/27/2020	21,000	19,200	0	148,600	300,000	8	151,400	7	16	96,000
1/28/2020	21,000	19,200	0	150,400	300,000	8	149,600	7	16	96,000
1/29/2020	21,000	19,200	0	152,200	300,000	8	147,800	7	16	96,000
1/30/2020	21,000	19,200	0	154,000	300,000	8	146,000	7	16	96,000
1/31/2020	21,000	19,200	0	155,800	300,000	8	144,200	7	16	96,000
2/1/2020	21,000	19,200	0	157,200	300,000	8	142,800	7	15	98,000
2/2/2020	21,000	19,200	0	158,600	300,000	8	141,400	7	15	98,000
2/3/2020	21,000	19,200	0	160,000	300,000	8	140,000	7	15	98,000
2/4/2020	21,000	19,200	0	161,400	300,000	8	138,600	7	15	98,000
2/5/2020	21,000	19,200	0	162,800	300,000	8	137,200	7	15	98,000
2/6/2020	21,000	19,200	0	164,200	300,000	8	135,800	6	15	98,000
2/7/2020	21,000	19,200	0	165,600	300,000	8	134,400	6	15	98,000
2/8/2020	21,000	19,200	0	167,000	300,000	9	133,000	6	15	98,000
2/9/2020	21,000	19,200	0	168,400	300,000	9	131,600	6	15	98,000
2/10/2020	21,000	19,200	0	169,800	300,000	9	130,200	6	15	98,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
2/12/2020	21,000	19,200	0	172,600	300,000	9	127,400	6	15	98,000
2/13/2020	21,000	19,200	0	174,000	300,000	9	126,000	6	15	98,000
2/14/2020	21,000	19,600	0	175,400	300,000	9	124,600	6	15	98,000
2/15/2020	21,000	19,600	0	176,800	300,000	9	123,200	6	15	98,000
2/16/2020	21,000	19,600	0	178,200	300,000	9	121,800	6	15	98,000
2/17/2020	21,000	19,600	0	179,600	300,000	9	120,400	6	15	98,000
2/18/2020	21,000	19,600	0	181,000	300,000	9	119,000	6	15	98,000
2/19/2020	21,000	19,600	0	182,400	300,000	9	117,600	6	15	98,000
2/20/2020	21,000	19,600	0	183,800	300,000	9	116,200	6	15	98,000
2/21/2020	21,000	19,600	0	185,200	300,000	9	114,800	5	15	98,000
2/22/2020	21,000	19,600	0	186,600	300,000	10	113,400	5	15	98,000
2/23/2020	21,000	19,600	0	188,000	300,000	10	112,000	5	15	98,000
2/24/2020	21,000	19,600	0	189,400	300,000	10	110,600	5	15	98,000
2/25/2020	21,000	19,600	0	190,800	300,000	10	109,200	5	15	98,000
2/26/2020	21,000	19,600	0	192,200	300,000	10	107,800	5	15	98,000
2/27/2020	21,000	19,600	0	193,600	300,000	10	106,400	5	15	98,000
2/28/2020	21,000	19,600	0	195,000	300,000	10	105,000	5	15	98,000
2/29/2020	21,000	19,600	0	196,400	300,000	10	103,600	5	15	98,000
3/1/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
3/2/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
3/3/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
3/4/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
3/5/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
3/7/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
3/8/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
3/9/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
3/10/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/11/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/12/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/13/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/14/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/15/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/16/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/17/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/18/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/19/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/20/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/21/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/22/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/23/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/24/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/25/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/26/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/27/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/28/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
3/29/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
3/31/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
4/1/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
4/2/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
4/3/2020	20000	20000	0	196,400	300,000	10	103,600	5	15	100,000
4/4/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/5/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/6/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/7/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/8/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/9/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/10/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/11/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/12/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/13/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/14/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/15/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/16/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/17/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/18/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/19/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/20/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/21/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/22/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
4/24/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/25/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/26/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/27/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/28/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/29/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
4/30/2020	20,000	20,000	0	196,400	300,000	10	103,600	5	15	100,000
5/1/2020	20,000	20,800	0	195,600	300,000	9	104,400	5	14	104,000
5/2/2020	20,000	20,800	0	194,800	300,000	9	105,200	5	14	104,000
5/3/2020	20,000	20,800	0	194,000	300,000	9	106,000	5	14	104,000
5/4/2020	20,000	20,800	0	193,200	300,000	9	106,800	5	14	104,000
5/5/2020	20,000	20,800	0	192,400	300,000	9	107,600	5	14	104,000
5/6/2020	20,000	20,800	0	191,600	300,000	9	108,400	5	14	104,000
5/7/2020	20,000	20,800	0	190,800	300,000	9	109,200	5	14	104,000
5/8/2020	20,000	20,800	0	190,000	300,000	9	110,000	6	14	104,000
5/9/2020	20,000	20,800	0	189,200	300,000	9	110,800	6	14	104,000
5/10/2020	20,000	20,800	0	188,400	300,000	9	111,600	6	14	104,000
5/11/2020	20,000	20,800	0	187,600	300,000	9	112,400	6	14	104,000
5/12/2020	20,000	20,800	0	186,800	300,000	9	113,200	6	14	104,000
5/13/2020	20,000	20,800	0	186,000	300,000	9	114,000	6	14	104,000
5/14/2020	20,000	20,800	0	185,200	300,000	9	114,800	6	14	104,000
5/15/2020	20,000	20,800	0	184,400	300,000	9	115,600	6	14	104,000
5/16/2020	20,000	20,800	0	183,600	300,000	9	116,400	6	14	104,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
5/18/2020	20,000	20,800	0	182,000	300,000	9	118,000	6	14	104,000
5/19/2020	20,000	20,800	0	181,200	300,000	9	118,800	6	14	104,000
5/20/2020	20,000	20,800	0	180,400	300,000	9	119,600	6	14	104,000
5/21/2020	20,000	20,800	0	179,600	300,000	9	120,400	6	14	104,000
5/22/2020	20,000	20,800	0	178,800	300,000	9	121,200	6	14	104,000
5/23/2020	20,000	20,800	0	178,000	300,000	9	122,000	6	14	104,000
5/24/2020	20,000	20,800	0	177,200	300,000	9	122,800	6	14	104,000
5/25/2020	20,000	20,800	0	176,400	300,000	8	123,600	6	14	104,000
5/26/2020	20,000	20,800	0	175,600	300,000	8	124,400	6	14	104,000
5/27/2020	20,000	20,800	0	174,800	300,000	8	125,200	6	14	104,000
5/28/2020	20,000	20,800	0	174,000	300,000	8	126,000	6	14	104,000
5/29/2020	20,000	20,800	0	173,200	300,000	8	126,800	6	14	104,000
5/30/2020	20,000	20,800	0	172,400	300,000	8	127,600	6	14	104,000
5/31/2020	20,000	20,800	0	171,600	300,000	8	128,400	6	14	104,000
6/1/2020	20,000	20,800	0	170,800	300,000	8	129,200	6	14	104,000
6/2/2020	20,000	20,800	0	170,000	300,000	8	130,000	7	14	104,000
6/3/2020	20,000	20,800	0	169,200	300,000	8	130,800	7	14	104,000
6/4/2020	20,000	20,800	0	168,400	300,000	8	131,600	7	14	104,000
6/5/2020	20,000	20,800	0	167,600	300,000	8	132,400	7	14	104,000
6/6/2020	20,000	20,800	0	166,800	300,000	8	133,200	7	14	104,000
6/7/2020	20,000	20,800	0	166,000	300,000	8	134,000	7	14	104,000
6/8/2020	20,000	20,800	0	165,200	300,000	8	134,800	7	14	104,000
6/9/2020	20,000	20,800	0	164,400	300,000	8	135,600	7	14	104,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
6/11/2020	20,000	20,800	0	162,800	300,000	8	137,200	7	14	104,000
6/12/2020	20,000	20,800	0	162,000	300,000	8	138,000	7	14	104,000
6/13/2020	20,000	20,800	0	161,200	300,000	8	138,800	7	14	104,000
6/14/2020	20,000	20,800	0	160,400	300,000	8	139,600	7	14	104,000
6/15/2020	20,000	20,800	0	159,600	300,000	8	140,400	7	14	104,000
6/16/2020	20,000	20,800	0	158,800	300,000	8	141,200	7	14	104,000
6/17/2020	20,000	20,800	0	158,000	300,000	8	142,000	7	14	104,000
6/18/2020	20,000	20,800	0	157,200	300,000	8	142,800	7	14	104,000
6/19/2020	20,000	20,800	0	156,400	300,000	8	143,600	7	14	104,000
6/20/2020	20,000	20,800	0	155,600	300,000	7	144,400	7	14	104,000
6/21/2020	20,000	20,800	0	154,800	300,000	7	145,200	7	14	104,000
6/22/2020	20,000	20,800	0	154,000	300,000	7	146,000	7	14	104,000
6/23/2020	20,000	20,800	0	153,200	300,000	7	146,800	7	14	104,000
6/24/2020	20,000	20,800	0	152,400	300,000	7	147,600	7	14	104,000
6/25/2020	20,000	20,800	0	151,600	300,000	7	148,400	7	14	104,000
6/26/2020	20,000	20,800	0	150,800	300,000	7	149,200	7	14	104,000
6/27/2020	20,000	20,800	0	150,000	300,000	7	150,000	8	14	104,000
6/28/2020	20,000	20,800	0	149,200	300,000	7	150,800	8	14	104,000
6/29/2020	20,000	20,800	0	148,400	300,000	7	151,600	8	14	104,000
6/30/2020	20,000	20,800	0	147,600	300,000	7	152,400	8	14	104,000
7/1/2020	20,000	17,600	0	150,000	300,000	9	150,000	8	17	88,000
7/2/2020	20,000	17,600	0	152,400	300,000	9	147,600	7	17	88,000
7/3/2020	20,000	17,600	0	154,800	300,000	9	145,200	7	17	88,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
7/5/2020	20,000	17,600	0	159,600	300,000	9	140,400	7	17	88,000
7/6/2020	20,000	17,600	0	162,000	300,000	9	138,000	7	17	88,000
7/7/2020	20,000	17,600	0	164,400	300,000	9	135,600	7	17	88,000
7/8/2020	20,000	17,600	0	166,800	300,000	9	133,200	7	17	88,000
7/9/2020	20,000	17,600	0	169,200	300,000	10	130,800	7	17	88,000
7/10/2020	20,000	17,600	0	171,600	300,000	10	128,400	6	17	88,000
7/11/2020	20,000	17,600	0	174,000	300,000	10	126,000	6	17	88,000
7/12/2020	20,000	17,600	0	176,400	300,000	10	123,600	6	17	88,000
7/13/2020	20,000	17,600	0	178,800	300,000	10	121,200	6	17	88,000
7/14/2020	20,000	17,600	0	181,200	300,000	10	118,800	6	17	88,000
7/15/2020	20,000	17,600	0	183,600	300,000	10	116,400	6	17	88,000
7/16/2020	20,000	17,600	0	186,000	300,000	11	114,000	6	17	88,000
7/17/2020	20,000	17,600	0	188,400	300,000	11	111,600	6	17	88,000
7/18/2020	20,000	17,600	0	190,800	300,000	11	109,200	5	17	88,000
7/19/2020	20,000	17,600	0	193,200	300,000	11	106,800	5	17	88,000
7/20/2020	20,000	17,600	0	195,600	300,000	11	104,400	5	17	88,000
7/21/2020	20,000	17,600	0	198,000	300,000	11	102,000	5	17	88,000
7/22/2020	20,000	17,600	0	200,400	300,000	11	99,600	5	17	88,000
7/23/2020	20,000	17,600	0	202,800	300,000	12	97,200	5	17	88,000
7/24/2020	20,000	17,600	0	205,200	300,000	12	94,800	5	17	88,000
7/25/2020	20,000	17,600	0	207,600	300,000	12	92,400	5	17	88,000
7/26/2020	20,000	17,600	0	210,000	300,000	12	90,000	5	17	88,000
7/27/2020	20,000	17,600	0	212,400	300,000	12	87,600	4	17	88,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
7/30/2020	20,000	17,600	0	219,600	300,000	12	80,400	4	17	88,000
7/31/2020	20,000	17,600	0	222,000	300,000	13	78,000	4	17	88,000
8/1/2020	20,000	18,800	0	223,200	300,000	12	76,800	4	16	94,000
8/2/2020	20,000	18,800	0	224,400	300,000	12	75,600	4	16	94,000
8/3/2020	20,000	18,800	0	225,600	300,000	12	74,400	4	16	94,000
8/4/2020	20,000	18,800	0	226,800	300,000	12	73,200	4	16	94,000
8/5/2020	20,000	18,800	0	228,000	300,000	12	72,000	4	16	94,000
8/6/2020	20,000	18,800	0	229,200	300,000	12	70,800	4	16	94,000
8/7/2020	20,000	18800	0	230,400	300,000	12	69,600	3	16	94,000
8/8/2020	20,000	18800	0	231,600	300,000	12	68,400	3	16	94,000
8/9/2020	20,000	18800	0	232,800	300,000	12	67,200	3	16	94,000
8/10/2020	20,000	18800	0	234,000	300,000	12	66,000	3	16	94,000
8/11/2020	20,000	18800	0	235,200	300,000	13	64,800	3	16	94,000
8/12/2020	20,000	18800	0	236,400	300,000	13	63,600	3	16	94,000
8/13/2020	20,000	18800	0	237,600	300,000	13	62,400	3	16	94,000
8/14/2020	20,000	18800	0	238,800	300,000	13	61,200	3	16	94,000
8/15/2020	20,000	18800	0	240,000	300,000	13	60,000	3	16	94,000
8/16/2020	20,000	18800	0	241,200	300,000	13	58,800	3	16	94,000
8/17/2020	20,000	18800	0	242,400	300,000	13	57,600	3	16	94,000
8/18/2020	20,000	18800	0	243,600	300,000	13	56,400	3	16	94,000
8/19/2020	20,000	18800	0	244,800	300,000	13	55,200	3	16	94,000
8/20/2020	20,000	18800	0	246,000	300,000	13	54,000	3	16	94,000
8/21/2020	20,000	18800	0	247,200	300,000	13	52,800	3	16	94,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
8/24/2020	20,000	18800	0	250,800	300,000	13	49,200	2	16	94,000
8/25/2020	20,000	18800	0	252,000	300,000	13	48,000	2	16	94,000
8/26/2020	20,000	18800	0	253,200	300,000	13	46,800	2	16	94,000
8/27/2020	20,000	18800	0	254,400	300,000	14	45,600	2	16	94,000
8/28/2020	20,000	18800	0	255,600	300,000	14	44,400	2	16	94,000
8/29/2020	20,000	18800	0	256,800	300,000	14	43,200	2	16	94,000
8/30/2020	20,000	18800	0	258,000	300,000	14	42,000	2	16	94,000
8/31/2020	20,000	18800	0	259,200	300,000	14	40,800	2	16	94,000
9/1/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/2/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/3/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/4/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/5/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/6/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/7/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/8/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/9/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/10/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/11/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/12/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/13/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/14/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/15/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
9/18/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/19/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/20/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/21/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/22/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/23/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/24/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/25/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/26/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/27/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/28/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/29/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
9/30/2020	20000	20000	0	259,200	300,000	13	40,800	2	15	100,000
10/1/2020	21000	20400	0	259,800	300,000	13	40,200	2	15	102,000
10/2/2020	21000	20400	0	260,400	300,000	13	39,600	2	15	102,000
10/3/2020	21000	20400	0	261,000	300,000	13	39,000	2	15	102,000
10/4/2020	21000	20400	0	261,600	300,000	13	38,400	2	15	102,000
10/5/2020	21000	20400	0	262,200	300,000	13	37,800	2	15	102,000
10/6/2020	21000	20400	0	262,800	300,000	13	37,200	2	15	102,000
10/7/2020	21000	20400	0	263,400	300,000	13	36,600	2	15	102,000
10/8/2020	21000	20400	0	264,000	300,000	13	36,000	2	15	102,000
10/9/2020	21000	20400	0	264,600	300,000	13	35,400	2	15	102,000
10/10/2020	21000	20400	0	265,200	300,000	13	34,800	2	15	102,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
10/13/2020	21000	20400	0	267,000	300,000	13	33,000	2	15	102,000
10/14/2020	21000	20400	0	267,600	300,000	13	32,400	2	15	102,000
10/15/2020	21000	20400	0	268,200	300,000	13	31,800	2	15	102,000
10/16/2020	21000	20400	0	268,800	300,000	13	31,200	1	15	102,000
10/17/2020	21000	20400	0	269,400	300,000	13	30,600	1	15	102,000
10/18/2020	21000	20400	0	270,000	300,000	13	30,000	1	15	102,000
10/19/2020	21000	20400	0	270,600	300,000	13	29,400	1	15	102,000
10/20/2020	21000	20400	0	271,200	300,000	13	28,800	1	15	102,000
10/21/2020	21000	20400	0	271,800	300,000	13	28,200	1	15	102,000
10/22/2020	21000	20400	0	272,400	300,000	13	27,600	1	15	102,000
10/23/2020	21000	20400	0	273,000	300,000	13	27,000	1	15	102,000
10/24/2020	21000	20400	0	273,600	300,000	13	26,400	1	15	102,000
10/25/2020	21000	20400	0	274,200	300,000	13	25,800	1	15	102,000
10/26/2020	21000	20400	0	274,800	300,000	13	25,200	1	15	102,000
10/27/2020	21000	20400	0	275,400	300,000	14	24,600	1	15	102,000
10/28/2020	21000	20400	0	276,000	300,000	14	24,000	1	15	102,000
10/29/2020	21000	20400	0	276,600	300,000	14	23,400	1	15	102,000
10/30/2020	21000	20400	0	277,200	300,000	14	22,800	1	15	102,000
10/31/2020	21000	20400	0	277,800	300,000	14	22,200	1	15	102,000
11/1/2020	21000	20400	0	278,400	300,000	14	21,600	1	15	102,000
11/2/2020	21000	20400	0	279,000	300,000	14	21,000	1	15	102,000
11/3/2020	21000	20400	0	279,600	300,000	14	20,400	1	15	102,000
11/4/2020	21000	20400	0	280,200	300,000	14	19,800	1	15	102,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
11/7/2020	21000	20400	0	282,000	300,000	14	18,000	1	15	102,000
11/8/2020	21000	20400	0	282,600	300,000	14	17,400	1	15	102,000
11/9/2020	21000	20400	0	283,200	300,000	14	16,800	1	15	102,000
11/10/2020	21000	20400	0	283,800	300,000	14	16,200	1	15	102,000
11/11/2020	21000	20400	0	284,400	300,000	14	15,600	1	15	102,000
11/12/2020	21000	20400	0	285,000	300,000	14	15,000	1	15	102,000
11/13/2020	21000	20400	0	285,600	300,000	14	14,400	1	15	102,000
11/14/2020	21000	20400	0	286,200	300,000	14	13,800	1	15	102,000
11/15/2020	21000	20400	0	286,800	300,000	14	13,200	1	15	102,000
11/16/2020	21000	20400	0	287,400	300,000	14	12,600	1	15	102,000
11/17/2020	21000	20400	0	288,000	300,000	14	12,000	1	15	102,000
11/18/2020	21000	20400	0	288,600	300,000	14	11,400	1	15	102,000
11/19/2020	21000	20400	0	289,200	300,000	14	10,800	1	15	102,000
11/20/2020	21000	20400	0	289,800	300,000	14	10,200	0	15	102,000
11/21/2020	21000	20400	0	290,400	300,000	14	9,600	0	15	102,000
11/22/2020	21000	20400	0	291,000	300,000	14	9,000	0	15	102,000
11/23/2020	21000	20400	0	291,600	300,000	14	8,400	0	15	102,000
11/24/2020	21000	20400	0	292,200	300,000	14	7,800	0	15	102,000
11/25/2020	21000	20400	0	292,800	300,000	14	7,200	0	15	102,000
11/26/2020	21000	20400	0	293,400	300,000	14	6,600	0	15	102,000
11/27/2020	21000	20400	0	294,000	300,000	14	6,000	0	15	102,000
11/28/2020	21000	20400	0	294,600	300,000	14	5,400	0	15	102,000
11/29/2020	21000	20400	0	295,200	300,000	14	4,800	0	15	102,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
12/2/2020	21000	20400	0	297,000	300,000	15	3,000	0	15	102,000
12/3/2020	21000	20400	0	297,600	300,000	15	2,400	0	15	102,000
12/4/2020	21000	20400	0	298,200	300,000	15	1,800	0	15	102,000
12/5/2020	21000	20400	-150,000	148,800	300,000	7	151,200	7	15	102,000
12/6/2020	21000	20400	0	149,400	300,000	7	150,600	7	15	102,000
12/7/2020	21000	20400	0	150,000	300,000	7	150,000	7	15	102,000
12/8/2020	21000	20400	0	150,600	300,000	7	149,400	7	15	102,000
12/9/2020	21000	20400	0	151,200	300,000	7	148,800	7	15	102,000
12/10/2020	21000	20400	0	151,800	300,000	7	148,200	7	15	102,000
12/11/2020	21000	20400	0	152,400	300,000	7	147,600	7	15	102,000
12/12/2020	21000	20400	0	153,000	300,000	8	147,000	7	15	102,000
12/13/2020	21000	20400	0	153,600	300,000	8	146,400	7	15	102,000
12/14/2020	21000	20400	0	154,200	300,000	8	145,800	7	15	102,000
12/15/2020	21000	20400	0	154,800	300,000	8	145,200	7	15	102,000
12/16/2020	21000	20400	0	155,400	300,000	8	144,600	7	15	102,000
12/17/2020	21000	20400	0	156,000	300,000	8	144,000	7	15	102,000
12/18/2020	21000	20400	0	156,600	300,000	8	143,400	7	15	102,000
12/19/2020	21000	20400	0	157,200	300,000	8	142,800	7	15	102,000
12/20/2020	21000	20400	0	157,800	300,000	8	142,200	7	15	102,000
12/21/2020	21000	20400	0	158,400	300,000	8	141,600	7	15	102,000
12/22/2020	21000	20400	0	159,000	300,000	8	141,000	7	15	102,000
12/23/2020	21000	20400	0	159,600	300,000	8	140,400	7	15	102,000
12/24/2020	21000	20400	0	160,200	300,000	8	139,800	7	15	102,000

DATE	PRODN.	LOCAL DEMAND	EXPORT & IMPORT PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
12/27/2020	21000	20400	0	162,000	300,000	8	138,000	7	15	102,000
12/28/2020	21000	20400	0	162,600	300,000	8	137,400	7	15	102,000
12/29/2020	21000	20400	0	163,200	300,000	8	136,800	7	15	102,000
12/30/2020	21000	20400	0	163,800	300,000	8	136,200	6	15	102,000
12/31/2020	21000	20400	0	164,400	300,000	8	135,600	6	15	102,000

Sample of Calculation:

- The demand is given from the local supplier and production is planned Excel Sheet user.
- The inventory level is calculated by:

$$Inventory\ Level = Production + import + inventory\ level\ of\ the\ perivous\ day - deamnd$$

$$Inventory\ level\ for\ the\ second\ of\ Jan = 21000 + 0 + 100800 - 19200 = 103600\ Barrels$$

- Maximum capacity is the maximum storages capacity it's 300,000 Barrels.
- Stock Days is maximum days the inventory can supply without production:

$$\text{Stock days} = \frac{\text{Current Inventory level}}{Demand}$$

$$Stock\ days = \frac{103600}{19200} = 5\ days$$

- Ullage is the empty gap between the maximum storage level and the current level:

$$\text{Ullage} = \text{Maximum storage} - \text{Inventory Level}$$

$$Ullage = 300{,}000 - 103600 = 196400\ Barrels$$

- Ullage filling days:

$$\text{Ullage days} = \frac{\text{Ullage}}{Production}$$

$$Ullage\ Days = \frac{196400}{20000} = 10\ days$$

Appendix Four 97 RON Production Plan:

Table 24: 97 RON Production Plan

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
1/1/2020	20,000	17,600	100000	102,400	500,000	6	397,600	20	6	88,000
1/2/2020	20,000	17,600	0	104,800	500,000	6	395,200	20	6	88,000
1/3/2020	20,000	17,600	0	107,200	500,000	6	392,800	20	6	88,000
1/4/2020	20,000	17,600	0	109,600	500,000	6	390,400	20	6	88,000
1/5/2020	20,000	17,600	0	112,000	500,000	6	388,000	19	6	88,000
1/6/2020	20,000	17,600	0	114,400	500,000	7	385,600	19	7	88,000
1/7/2020	20,000	17,600	0	116,800	500,000	7	383,200	19	7	88,000
1/8/2020	20,000	17,600	0	119,200	500,000	7	380,800	19	7	88,000
1/9/2020	20,000	17,600	0	121,600	500,000	7	378,400	19	7	88,000
1/10/2020	20,000	17,600	0	124,000	500,000	7	376,000	19	7	88,000
1/11/2020	20,000	17,600	0	126,400	500,000	7	373,600	19	7	88,000
1/12/2020	20,000	17,600	0	128,800	500,000	7	371,200	19	7	88,000
1/13/2020	20,000	17,600	0	131,200	500,000	7	368,800	18	7	88,000
1/14/2020	20,000	17,600	0	133,600	500,000	8	366,400	18	8	88,000
1/15/2020	20,000	17,600	0	136,000	500,000	8	364,000	18	8	88,000
1/16/2020	20,000	17,600	0	138,400	500,000	8	361,600	18	8	88,000
1/17/2020	20,000	17,600	0	140,800	500,000	8	359,200	18	8	88,000
1/18/2020	20,000	17,600	0	143,200	500,000	8	356,800	18	8	88,000
1/19/2020	20,000	17,600	0	145,600	500,000	8	354,400	18	8	88,000

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
1/21/2020	20,000	17,600	0	150,400	500,000	9	349,600	17	9	88,000
1/22/2020	20,000	17,600	0	152,800	500,000	9	347,200	17	9	88,000
1/23/2020	20,000	17,600	0	155,200	500,000	9	344,800	17	9	88,000
1/24/2020	20,000	17,600	0	157,600	500,000	9	342,400	17	9	88,000
1/25/2020	20,000	17,600	0	160,000	500,000	9	340,000	17	9	88,000
1/26/2020	20,000	17,600	0	162,400	500,000	9	337,600	17	9	88,000
1/27/2020	20,000	17,600	0	164,800	500,000	9	335,200	17	9	88,000
1/28/2020	20,000	17,600	0	167,200	500,000	10	332,800	17	10	88,000
1/29/2020	20,000	17,600	0	169,600	500,000	10	330,400	17	10	88,000
1/30/2020	20,000	17,600	0	172,000	500,000	10	328,000	16	10	88,000
1/31/2020	20,000	17,600	0	174,400	500,000	10	325,600	16	10	88,000
2/1/2020	20,000	17,600	0	176,800	500,000	10	323,200	16	10	88,000
2/2/2020	20,000	17,600	0	179,200	500,000	10	320,800	16	10	88,000
2/3/2020	20,000	17,600	0	181,600	500,000	10	318,400	16	10	88,000
2/4/2020	20,000	17,600	0	184,000	500,000	10	316,000	16	10	88,000
2/5/2020	20,000	17,600	0	186,400	500,000	11	313,600	16	11	88,000
2/6/2020	20,000	17,600	0	188,800	500,000	11	311,200	16	11	88,000
2/7/2020	20,000	17,600	0	191,200	500,000	11	308,800	15	11	88,000
2/8/2020	20,000	17,600	0	193,600	500,000	11	306,400	15	11	88,000
2/9/2020	20,000	17,600	0	196,000	500,000	11	304,000	15	11	88,000
2/10/2020	20,000	17,600	0	198,400	500,000	11	301,600	15	11	88,000
2/11/2020	20,000	17,600	0	200,800	500,000	11	299,200	15	11	88,000
2/12/2020	20,000	17,600	0	203,200	500,000	12	296,800	15	12	88,000
2/13/2020	20,000	17,600	0	205,600	500,000	12	294,400	15	12	88,000
2/14/2020	20,000	17,600	0	208,000	500,000	12	292,000	15	12	88,000

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
2/16/2020	20,000	17,600	0	212,800	500,000	12	287,200	14	12	88,000
2/17/2020	20,000	17,600	0	215,200	500,000	12	284,800	14	12	88,000
2/18/2020	20,000	17,600	0	217,600	500,000	12	282,400	14	12	88,000
2/19/2020	20,000	17,600	0	220,000	500,000	13	280,000	14	13	88,000
2/20/2020	20,000	17,600	0	222,400	500,000	13	277,600	14	13	88,000
2/21/2020	20,000	17,600	0	224,800	500,000	13	275,200	14	13	88,000
2/22/2020	20,000	17,600	0	227,200	500,000	13	272,800	14	13	88,000
2/23/2020	20,000	17,600	0	229,600	500,000	13	270,400	14	13	88,000
2/24/2020	20,000	17,600	0	232,000	500,000	13	268,000	13	13	88,000
2/25/2020	20,000	17,600	0	234,400	500,000	13	265,600	13	13	88,000
2/26/2020	20,000	17,600	0	236,800	500,000	13	263,200	13	13	88,000
2/27/2020	20,000	17,600	0	239,200	500,000	14	260,800	13	14	88,000
2/28/2020	20,000	17,600	0	241,600	500,000	14	258,400	13	14	88,000
2/29/2020	20,000	17,600	0	244,000	500,000	14	256,000	13	14	88,000
3/1/2020	19,000	18,000	0	245,000	500,000	14	255,000	13	14	90,000
3/2/2020	19,000	18,000	0	246,000	500,000	14	254,000	13	14	90,000
3/3/2020	19,000	18,000	0	247,000	500,000	14	253,000	13	14	90,000
3/4/2020	19,000	18,000	0	248,000	500,000	14	252,000	13	14	90,000
3/5/2020	19,000	18,000	0	249,000	500,000	14	251,000	13	14	90,000
3/6/2020	19,000	18,000	0	250,000	500,000	14	250,000	13	14	90,000
3/7/2020	19,000	18,000	0	251,000	500,000	14	249,000	13	14	90,000
3/8/2020	19,000	18,000	0	252,000	500,000	14	248,000	13	14	90,000
3/9/2020	19,000	18,000	0	253,000	500,000	14	247,000	13	14	90,000
3/10/2020	19,000	18,000	0	254,000	500,000	14	246,000	13	14	90,000
3/11/2020	19,000	18,000	0	255,000	500,000	14	245,000	13	14	90,000

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
3/13/2020	19,000	18,000	0	257,000	500,000	14	243,000	13	14	90,000
3/14/2020	19,000	18,000	0	258,000	500,000	14	242,000	13	14	90,000
3/15/2020	19,000	18,000	0	259,000	500,000	14	241,000	13	14	90,000
3/16/2020	19,000	18,000	0	260,000	500,000	14	240,000	13	14	90,000
3/17/2020	19,000	18,000	0	261,000	500,000	15	239,000	13	15	90,000
3/18/2020	19,000	18,000	0	262,000	500,000	15	238,000	13	15	90,000
3/19/2020	19,000	18,000	0	263,000	500,000	15	237,000	12	15	90,000
3/20/2020	19,000	18,000	0	264,000	500,000	15	236,000	12	15	90,000
3/21/2020	19,000	18,000	0	265,000	500,000	15	235,000	12	15	90,000
3/22/2020	19,000	18,000	0	266,000	500,000	15	234,000	12	15	90,000
3/23/2020	19,000	18,000	0	267,000	500,000	15	233,000	12	15	90,000
3/24/2020	19,000	18,000	0	268,000	500,000	15	232,000	12	15	90,000
3/25/2020	19,000	18,000	0	269,000	500,000	15	231,000	12	15	90,000
3/26/2020	19,000	18,000	0	270,000	500,000	15	230,000	12	15	90,000
3/27/2020	19,000	18,000	0	271,000	500,000	15	229,000	12	15	90,000
3/28/2020	19,000	18,000	0	272,000	500,000	15	228,000	12	15	90,000
3/29/2020	19,000	18,000	0	273,000	500,000	15	227,000	12	15	90,000
3/30/2020	19,000	18,000	0	274,000	500,000	15	226,000	12	15	90,000
3/31/2020	19,000	18,000	0	275,000	500,000	15	225,000	12	15	90,000
4/1/2020	19,000	18,000	0	276,000	500,000	15	224,000	12	15	90,000
4/2/2020	19,000	18,000	0	277,000	500,000	15	223,000	12	15	90,000
4/3/2020	19,000	18,000	0	278,000	500,000	15	222,000	12	15	90,000
4/4/2020	19,000	18,000	0	279,000	500,000	16	221,000	12	16	90,000
4/5/2020	19,000	18,000	0	280,000	500,000	16	220,000	12	16	90,000
4/6/2020	19,000	18,000	0	281,000	500,000	16	219,000	12	16	90,000

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
4/8/2020	19,000	18,000	0	283,000	500,000	16	217,000	11	16	90,000
4/9/2020	19,000	18,000	0	284,000	500,000	16	216,000	11	16	90,000
4/10/2020	19,000	18,000	0	285,000	500,000	16	215,000	11	16	90,000
4/11/2020	19,000	18,000	0	286,000	500,000	16	214,000	11	16	90,000
4/12/2020	19,000	18,000	0	287,000	500,000	16	213,000	11	16	90,000
4/13/2020	19,000	18,000	0	288,000	500,000	16	212,000	11	16	90,000
4/14/2020	19,000	18,000	0	289,000	500,000	16	211,000	11	16	90,000
4/15/2020	19,000	18,000	0	290,000	500,000	16	210,000	11	16	90,000
4/16/2020	19,000	18,000	0	291,000	500,000	16	209,000	11	16	90,000
4/17/2020	19,000	18,000	0	292,000	500,000	16	208,000	11	16	90,000
4/18/2020	19,000	18,000	0	293,000	500,000	16	207,000	11	16	90,000
4/19/2020	19,000	18,000	0	294,000	500,000	16	206,000	11	16	90,000
4/20/2020	19,000	18,000	0	295,000	500,000	16	205,000	11	16	90,000
4/21/2020	19,000	18,000	0	296,000	500,000	16	204,000	11	16	90,000
4/22/2020	19,000	18,000	0	297,000	500,000	17	203,000	11	17	90,000
4/23/2020	19,000	18,000	0	298,000	500,000	17	202,000	11	17	90,000
4/24/2020	19,000	18,000	0	299,000	500,000	17	201,000	11	17	90,000
4/25/2020	19,000	18,000	0	300,000	500,000	17	200,000	11	17	90,000
4/26/2020	19,000	18,000	0	301,000	500,000	17	199,000	10	17	90,000
4/27/2020	19,000	18,000	0	302,000	500,000	17	198,000	10	17	90,000
4/28/2020	19,000	18,000	0	303,000	500,000	17	197,000	10	17	90,000
4/29/2020	19,000	18,000	0	304,000	500,000	17	196,000	10	17	90,000
4/30/2020	19,000	18,000	0	305,000	500,000	17	195,000	10	17	90,000
5/1/2020	19,000	18,800	0	305,200	500,000	16	194,800	10	16	94,000
5/2/2020	19,000	18,800	0	305,400	500,000	16	194,600	10	16	94,000

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
5/4/2020	19,000	18,800	0	305,800	500,000	16	194,200	10	16	94,000
5/5/2020	19,000	18,800	0	306,000	500,000	16	194,000	10	16	94,000
5/6/2020	19,000	18,800	0	306,200	500,000	16	193,800	10	16	94,000
5/7/2020	19,000	18,800	0	306,400	500,000	16	193,600	10	16	94,000
5/8/2020	19,000	18,800	0	306,600	500,000	16	193,400	10	16	94,000
5/9/2020	19,000	18,800	0	306,800	500,000	16	193,200	10	16	94,000
5/10/2020	19,000	18,800	0	307,000	500,000	16	193,000	10	16	94,000
5/11/2020	19,000	18,800	0	307,200	500,000	16	192,800	10	16	94,000
5/12/2020	19,000	18,800	0	307,400	500,000	16	192,600	10	16	94,000
5/13/2020	19,000	18,800	0	307,600	500,000	16	192,400	10	16	94,000
5/14/2020	19,000	18,800	0	307,800	500,000	16	192,200	10	16	94,000
5/15/2020	19,000	18,800	0	308,000	500,000	16	192,000	10	16	94,000
5/16/2020	19,000	18,800	0	308,200	500,000	16	191,800	10	16	94,000
5/17/2020	19,000	18,800	0	308,400	500,000	16	191,600	10	16	94,000
5/18/2020	19,000	18,800	0	308,600	500,000	16	191,400	10	16	94,000
5/19/2020	19,000	18,800	0	308,800	500,000	16	191,200	10	16	94,000
5/20/2020	19,000	18,800	0	309,000	500,000	16	191,000	10	16	94,000
5/21/2020	19,000	18,800	0	309,200	500,000	16	190,800	10	16	94,000
5/22/2020	19,000	18,800	0	309,400	500,000	16	190,600	10	16	94,000
5/23/2020	19,000	18,800	0	309,600	500,000	16	190,400	10	16	94,000
5/24/2020	19,000	18,800	0	309,800	500,000	16	190,200	10	16	94,000
5/25/2020	19,000	18,800	0	310,000	500,000	16	190,000	10	16	94,000
5/26/2020	19,000	18,800	0	310,200	500,000	17	189,800	10	17	94,000
5/27/2020	19,000	18,800	0	310,400	500,000	17	189,600	10	17	94,000
5/28/2020	19,000	18,800	0	310,600	500,000	17	189,400	10	17	94,000

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
5/30/2020	19,000	18,800	0	311,000	500,000	17	189,000	10	17	94,000
5/31/2020	19,000	18,800	0	311,200	500,000	17	188,800	10	17	94,000
6/1/2020	19,000	19,200	0	311,000	500,000	16	189,000	10	16	96,000
6/2/2020	19,000	19,200	0	310,800	500,000	16	189,200	10	16	96,000
6/3/2020	19,000	19,200	0	310,600	500,000	16	189,400	10	16	96,000
6/4/2020	19,000	19,200	0	310,400	500,000	16	189,600	10	16	96,000
6/5/2020	19,000	19,200	0	310,200	500,000	16	189,800	10	16	96,000
6/6/2020	19,000	19,200	0	310,000	500,000	16	190,000	10	16	96,000
6/7/2020	19,000	19,200	0	309,800	500,000	16	190,200	10	16	96,000
6/8/2020	19,000	19,200	0	309,600	500,000	16	190,400	10	16	96,000
6/9/2020	19,000	19,200	0	309,400	500,000	16	190,600	10	16	96,000
6/10/2020	19,000	19,200	0	309,200	500,000	16	190,800	10	16	96,000
6/11/2020	19,000	19,200	0	309,000	500,000	16	191,000	10	16	96,000
6/12/2020	19,000	19,200	0	308,800	500,000	16	191,200	10	16	96,000
6/13/2020	19,000	19,200	0	308,600	500,000	16	191,400	10	16	96,000
6/14/2020	19,000	19,200	0	308,400	500,000	16	191,600	10	16	96,000
6/15/2020	19,000	19,200	0	308,200	500,000	16	191,800	10	16	96,000
6/16/2020	19,000	19,200	0	308,000	500,000	16	192,000	10	16	96,000
6/17/2020	19,000	19,200	0	307,800	500,000	16	192,200	10	16	96,000
6/18/2020	19,000	19,200	0	307,600	500,000	16	192,400	10	16	96,000
6/19/2020	19,000	19,200	0	307,400	500,000	16	192,600	10	16	96,000
6/20/2020	19,000	19,200	0	307,200	500,000	16	192,800	10	16	96,000
6/21/2020	19,000	19,200	0	307,000	500,000	16	193,000	10	16	96,000
6/22/2020	19,000	19,200	0	306,800	500,000	16	193,200	10	16	96,000
6/23/2020	19,000	19,200	0	306,600	500,000	16	193,400	10	16	96,000

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
6/25/2020	19,000	19,200	0	306,200	500,000	16	193,800	10	16	96,000
6/26/2020	19,000	19,200	0	306,000	500,000	16	194,000	10	16	96,000
6/27/2020	19,000	19,200	0	305,800	500,000	16	194,200	10	16	96,000
6/28/2020	19,000	19,200	0	305,600	500,000	16	194,400	10	16	96,000
6/29/2020	19,000	19,200	0	305,400	500,000	16	194,600	10	16	96,000
6/30/2020	19,000	19,200	0	305,200	500,000	16	194,800	10	16	96,000
7/1/2020	21,000	16,000	0	310,200	500,000	19	189,800	9	19	80,000
7/2/2020	21,000	16,000	0	315,200	500,000	20	184,800	9	20	80,000
7/3/2020	21,000	16,000	0	320,200	500,000	20	179,800	9	20	80,000
7/4/2020	21,000	16,000	0	325,200	500,000	20	174,800	8	20	80,000
7/5/2020	21,000	16,000	0	330,200	500,000	21	169,800	8	21	80,000
7/6/2020	21,000	16,000	0	335,200	500,000	21	164,800	8	21	80,000
7/7/2020	21,000	16,000	0	340,200	500,000	21	159,800	8	21	80,000
7/8/2020	21,000	16,000	0	345,200	500,000	22	154,800	7	22	80,000
7/9/2020	21,000	16,000	0	350,200	500,000	22	149,800	7	22	80,000
7/10/2020	21,000	16,000	0	355,200	500,000	22	144,800	7	22	80,000
7/11/2020	21,000	16,000	0	360,200	500,000	23	139,800	7	23	80,000
7/12/2020	21,000	16,000	0	365,200	500,000	23	134,800	6	23	80,000
7/13/2020	21,000	16,000	0	370,200	500,000	23	129,800	6	23	80,000
7/14/2020	21,000	16,000	0	375,200	500,000	23	124,800	6	23	80,000
7/15/2020	21,000	16,000	0	380,200	500,000	24	119,800	6	24	80,000
7/16/2020	21,000	16,000	0	385,200	500,000	24	114,800	5	24	80,000
7/17/2020	21,000	16,000	0	390,200	500,000	24	109,800	5	24	80,000
7/18/2020	21,000	16,000	0	395,200	500,000	25	104,800	5	25	80,000
7/19/2020	21,000	16,000	0	400,200	500,000	25	99,800	5	25	80,000

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
7/21/2020	21,000	16,000	0	410,200	500,000	26	89,800	4	26	80,000
7/22/2020	21,000	16,000	0	415,200	500,000	26	84,800	4	26	80,000
7/23/2020	21,000	16,000	0	420,200	500,000	26	79,800	4	26	80,000
7/24/2020	21,000	16,000	0	425,200	500,000	27	74,800	4	27	80,000
7/25/2020	21,000	16,000	0	430,200	500,000	27	69,800	3	27	80,000
7/26/2020	21,000	16,000	0	435,200	500,000	27	64,800	3	27	80,000
7/27/2020	21,000	16,000	0	440,200	500,000	28	59,800	3	28	80,000
7/28/2020	21,000	16,000	0	445,200	500,000	28	54,800	3	28	80,000
7/29/2020	21,000	16,000	0	450,200	500,000	28	49,800	2	28	80,000
7/30/2020	21,000	16,000	0	455,200	500,000	28	44,800	2	28	80,000
7/31/2020	21,000	16,000	0	460,200	500,000	29	39,800	2	29	80,000
8/1/2020	21,000	17,200	0	464,000	500,000	27	36,000	2	27	86,000
8/2/2020	21,000	17,200	0	467,800	500,000	27	32,200	2	27	86,000
8/3/2020	21,000	17,200	0	471,600	500,000	27	28,400	1	27	86,000
8/4/2020	21,000	17,200	0	475,400	500,000	28	24,600	1	28	86,000
8/5/2020	21,000	17,200	0	479,200	500,000	28	20,800	1	28	86,000
8/6/2020	21,000	17,200	0	483,000	500,000	28	17,000	1	28	86,000
8/7/2020	21,000	17,200	0	486,800	500,000	28	13,200	1	28	86,000
8/8/2020	21,000	17,200	0	490,600	500,000	29	9,400	0	29	86,000
8/9/2020	21,000	17,200	0	494,400	500,000	29	5,600	0	29	86,000
8/10/2020	21,000	17,200	-250,000	248,200	500,000	14	251,800	12	14	86,000
8/11/2020	21,000	17,200	0	252,000	500,000	15	248,000	12	15	86,000
8/12/2020	21,000	17,200	0	255,800	500,000	15	244,200	12	15	86,000
8/13/2020	21,000	17,200	0	259,600	500,000	15	240,400	11	15	86,000
8/14/2020	21,000	17,200	0	263,400	500,000	15	236,600	11	15	86,000

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
8/16/2020	21,000	17,200	0	271,000	500,000	16	229,000	11	16	86,000
8/17/2020	21,000	17,200	0	274,800	500,000	16	225,200	11	16	86,000
8/18/2020	21,000	17,200	0	278,600	500,000	16	221,400	11	16	86,000
8/19/2020	21,000	17,200	0	282,400	500,000	16	217,600	10	16	86,000
8/20/2020	21,000	17,200	0	286,200	500,000	17	213,800	10	17	86,000
8/21/2020	21,000	17,200	0	290,000	500,000	17	210,000	10	17	86,000
8/22/2020	21,000	17,200	0	293,800	500,000	17	206,200	10	17	86,000
8/23/2020	21,000	17,200	0	297,600	500,000	17	202,400	10	17	86,000
8/24/2020	21,000	17,200	0	301,400	500,000	18	198,600	9	18	86,000
8/25/2020	21,000	17,200	0	305,200	500,000	18	194,800	9	18	86,000
8/26/2020	21,000	17,200	0	309,000	500,000	18	191,000	9	18	86,000
8/27/2020	21,000	17,200	0	312,800	500,000	18	187,200	9	18	86,000
8/28/2020	21,000	17,200	0	316,600	500,000	18	183,400	9	18	86,000
8/29/2020	21,000	17,200	0	320,400	500,000	19	179,600	9	19	86,000
8/30/2020	21,000	17,200	0	324,200	500,000	19	175,800	8	19	86,000
8/31/2020	21,000	17,200	0	328,000	500,000	19	172,000	8	19	86,000
9/1/2020	21,000	19,200	0	329,800	500,000	17	170,200	8	17	96,000
9/2/2020	21,000	19,200	0	331,600	500,000	17	168,400	8	17	96,000
9/3/2020	21,000	19,200	0	333,400	500,000	17	166,600	8	17	96,000
9/4/2020	21,000	19,200	0	335,200	500,000	17	164,800	8	17	96,000
9/5/2020	21,000	19,200	0	337,000	500,000	18	163,000	8	18	96,000
9/6/2020	21,000	19,200	0	338,800	500,000	18	161,200	8	18	96,000
9/7/2020	21,000	19,200	0	340,600	500,000	18	159,400	8	18	96,000
9/8/2020	21,000	19,200	0	342,400	500,000	18	157,600	8	18	96,000
9/9/2020	21,000	19,200	0	344,200	500,000	18	155,800	7	18	96,000

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
9/11/2020	21,000	19,200	0	347,800	500,000	18	152,200	7	18	96,000
9/12/2020	21,000	19,200	0	349,600	500,000	18	150,400	7	18	96,000
9/13/2020	21,000	19,200	0	351,400	500,000	18	148,600	7	18	96,000
9/14/2020	21,000	19,200	0	353,200	500,000	18	146,800	7	18	96,000
9/15/2020	21,000	19,200	0	355,000	500,000	18	145,000	7	18	96,000
9/16/2020	21,000	19,200	0	356,800	500,000	19	143,200	7	19	96,000
9/17/2020	21,000	19,200	0	358,600	500,000	19	141,400	7	19	96,000
9/18/2020	21,000	19,200	0	360,400	500,000	19	139,600	7	19	96,000
9/19/2020	21,000	19,200	0	362,200	500,000	19	137,800	7	19	96,000
9/20/2020	21,000	19,200	0	364,000	500,000	19	136,000	6	19	96,000
9/21/2020	21,000	19,200	0	365,800	500,000	19	134,200	6	19	96,000
9/22/2020	21,000	19,200	0	367,600	500,000	19	132,400	6	19	96,000
9/23/2020	21,000	19,200	0	369,400	500,000	19	130,600	6	19	96,000
9/24/2020	21,000	19,200	0	371,200	500,000	19	128,800	6	19	96,000
9/25/2020	21,000	19,200	0	373,000	500,000	19	127,000	6	19	96,000
9/26/2020	21,000	19,200	0	374,800	500,000	20	125,200	6	20	96,000
9/27/2020	21,000	19,200	0	376,600	500,000	20	123,400	6	20	96,000
9/28/2020	21,000	19,200	0	378,400	500,000	20	121,600	6	20	96,000
9/29/2020	21,000	19,200	0	380,200	500,000	20	119,800	6	20	96,000
9/30/2020	21,000	19,200	0	382,000	500,000	20	118,000	6	20	96,000
10/1/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/2/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/3/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/4/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/5/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
10/7/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/8/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/9/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/10/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/11/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/12/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/13/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/14/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/15/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/16/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/17/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/18/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/19/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/20/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/21/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/22/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/23/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/24/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/25/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/26/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/27/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/28/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/29/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/30/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000
10/31/2020	20,000	20,000	0	382,000	500,000	19	118,000	6	19	100,000

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
11/2/2020	20,000	19,600	0	382,800	500,000	20	117,200	6	20	98,000
11/3/2020	20,000	19,600	0	383,200	500,000	20	116,800	6	20	98,000
11/4/2020	20,000	19,600	0	383,600	500,000	20	116,400	6	20	98,000
11/5/2020	20,000	19,600	0	384,000	500,000	20	116,000	6	20	98,000
11/6/2020	20,000	19,600	0	384,400	500,000	20	115,600	6	20	98,000
11/7/2020	20,000	19,600	0	384,800	500,000	20	115,200	6	20	98,000
11/8/2020	20,000	19,600	0	385,200	500,000	20	114,800	6	20	98,000
11/9/2020	20,000	19,600	0	385,600	500,000	20	114,400	6	20	98,000
11/10/2020	20,000	19,600	0	386,000	500,000	20	114,000	6	20	98,000
11/11/2020	20,000	19,600	0	386,400	500,000	20	113,600	6	20	98,000
11/12/2020	20,000	19,600	0	386,800	500,000	20	113,200	6	20	98,000
11/13/2020	20,000	19,600	0	387,200	500,000	20	112,800	6	20	98,000
11/14/2020	20,000	19,600	0	387,600	500,000	20	112,400	6	20	98,000
11/15/2020	20,000	19,600	0	388,000	500,000	20	112,000	6	20	98,000
11/16/2020	20,000	19,600	0	388,400	500,000	20	111,600	6	20	98,000
11/17/2020	20,000	19,600	0	388,800	500,000	20	111,200	6	20	98,000
11/18/2020	20,000	19,600	0	389,200	500,000	20	110,800	6	20	98,000
11/19/2020	20,000	19,600	0	389,600	500,000	20	110,400	6	20	98,000
11/20/2020	20,000	19,600	0	390,000	500,000	20	110,000	6	20	98,000
11/21/2020	20,000	19,600	0	390,400	500,000	20	109,600	5	20	98,000
11/22/2020	20,000	19,600	0	390,800	500,000	20	109,200	5	20	98,000
11/23/2020	20,000	19,600	0	391,200	500,000	20	108,800	5	20	98,000
11/24/2020	20,000	19,600	0	391,600	500,000	20	108,400	5	20	98,000
11/25/2020	20,000	19,600	0	392,000	500,000	20	108,000	5	20	98,000
11/26/2020	20,000	19,600	0	392,400	500,000	20	107,600	5	20	98,000

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
11/28/2020	20,000	19,600	0	393,200	500,000	20	106,800	5	20	98,000
11/29/2020	20,000	19,600	0	393,600	500,000	20	106,400	5	20	98,000
11/30/2020	20,000	19,600	0	394,000	500,000	20	106,000	5	20	98,000
12/1/2020	20,000	19,200	0	394,800	500,000	21	105,200	5	21	96,000
12/2/2020	20,000	19,200	0	395,600	500,000	21	104,400	5	21	96,000
12/3/2020	20,000	19,200	0	396,400	500,000	21	103,600	5	21	96,000
12/4/2020	20,000	19,200	0	397,200	500,000	21	102,800	5	21	96,000
12/5/2020	20,000	19,200	0	398,000	500,000	21	102,000	5	21	96,000
12/6/2020	20,000	19,200	0	398,800	500,000	21	101,200	5	21	96,000
12/7/2020	20,000	19,200	0	399,600	500,000	21	100,400	5	21	96,000
12/8/2020	20,000	19,200	0	400,400	500,000	21	99,600	5	21	96,000
12/9/2020	20,000	19,200	0	401,200	500,000	21	98,800	5	21	96,000
12/10/2020	20,000	19,200	0	402,000	500,000	21	98,000	5	21	96,000
12/11/2020	20,000	19,200	0	402,800	500,000	21	97,200	5	21	96,000
12/12/2020	20,000	19,200	0	403,600	500,000	21	96,400	5	21	96,000
12/13/2020	20,000	19,200	0	404,400	500,000	21	95,600	5	21	96,000
12/14/2020	20,000	19,200	0	405,200	500,000	21	94,800	5	21	96,000
12/15/2020	20,000	19,200	0	406,000	500,000	21	94,000	5	21	96,000
12/16/2020	20,000	19,200	0	406,800	500,000	21	93,200	5	21	96,000
12/17/2020	20,000	19,200	0	407,600	500,000	21	92,400	5	21	96,000
12/18/2020	20,000	19,200	0	408,400	500,000	21	91,600	5	21	96,000
12/19/2020	20,000	19,200	0	409,200	500,000	21	90,800	5	21	96,000
12/20/2020	20,000	19,200	0	410,000	500,000	21	90,000	5	21	96,000
12/21/2020	20,000	19,200	0	410,800	500,000	21	89,200	4	21	96,000
12/22/2020	20,000	19,200	0	411,600	500,000	21	88,400	4	21	96,000

DATE	PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	NET STOCK	ULLAGE	ULLAGE	Max Stock	Min Storage
Day	BBL/Day	BBL/Day	Barrels	Barrels	Barrels	Days	Barrel	Days	Days	Days
12/24/2020	20,000	19,200	0	413,200	500,000	22	86,800	4	22	96,000
12/25/2020	20,000	19,200	0	414,000	500,000	22	86,000	4	22	96,000
12/26/2020	20,000	19,200	0	414,800	500,000	22	85,200	4	22	96,000
12/27/2020	20,000	19,200	0	415,600	500,000	22	84,400	4	22	96,000
12/28/2020	20,000	19,200	0	416,400	500,000	22	83,600	4	22	96,000
12/29/2020	20,000	19,200	0	417,200	500,000	22	82,800	4	22	96,000
12/30/2020	20,000	19,200	0	418,000	500,000	22	82,000	4	22	96,000
12/31/2020	20,000	19,200	0	418,800	500,000	22	81,200	4	22	96,000

- The demand is given from the local supplier and production is planned Excel Sheet user.
- The inventory level is calculated by:

$$Inventory\ Level = Production + import + inventory\ level\ of\ the\ perivous\ day - deamnd$$

$$Inventory\ level\ for\ the\ second\ of\ Jan\ = 20000 + 0 + 102400 - 17600 = 122800\ Barrels$$

- Maximum capacity is the maximum storages capacity its 500,000 Barrels.
- Stock Days is maximum days the inventory can supply without production:

$$\text{Stock days} = \frac{\text{Current Inventory level}}{Demand}$$

$$Stock\ days\ = \frac{101600}{19200} = 5\ days$$

- Ullage is the empty gap between the maximum storage level and the current level:

$$\text{Ullage} = \text{Maximum storage} - \text{Inventory Level}$$

$$Ullage = 500{,}000 - 101600 = 398400\ \text{Barrels}$$

- Ullage filling days:

$$\text{Ullage days} = \frac{\text{Ullage}}{Production}$$

$$Ullage\ Days = \frac{398400}{20000} = 20\ days$$

Appendix Five Jet A Production Plan:

Table 25: Jet A1 Production Plan.

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
1/1/2020	26,000	68,000	624,000	582,000	800,000	12	9	340,000
1/2/2020	26,000	68,000	0	540,000	800,000	12	8	340,000
1/3/2020	26,000	68,000	0	498,000	800,000	12	7	340,000
1/4/2020	26,000	68,000	0	456,000	800,000	12	7	340,000
1/5/2020	26,000	68,000	0	414,000	800,000	12	6	340,000
1/6/2020	26,000	68,000	0	372,000	800,000	12	5	340,000
1/7/2020	26,000	68,000	0	330,000	800,000	12	5	340,000
1/8/2020	26,000	68,000	0	288,000	800,000	12	4	340,000
1/9/2020	26,000	68,000	0	246,000	800,000	12	4	340,000
1/10/2020	26,000	68,000	0	204,000	800,000	12	3	340,000
1/11/2020	26,000	68,000	624,000	786,000	800,000	12	12	340,000
1/12/2020	26,000	68,000	0	744,000	800,000	12	11	340,000
1/13/2020	26,000	68,000	0	702,000	800,000	12	10	340,000
1/14/2020	26,000	68,000	0	660,000	800,000	12	10	340,000
1/15/2020	26,000	68,000	0	618,000	800,000	12	9	340,000
1/16/2020	26,000	68,000	0	576,000	800,000	12	8	340,000
1/17/2020	26,000	68,000	0	534,000	800,000	12	8	340,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
1/19/2020	26,000	68,000	0	450,000	800,000	12	7	340,000
1/20/2020	26,000	68,000	0	408,000	800,000	12	6	340,000
1/21/2020	26,000	68,000	0	366,000	800,000	12	5	340,000
1/22/2020	26,000	68,000	0	324,000	800,000	12	5	340,000
1/23/2020	26,000	68,000	0	282,000	800,000	12	4	340,000
1/24/2020	26,000	68,000	0	240,000	800,000	12	4	340,000
1/25/2020	26,000	68,000	0	198,000	800,000	12	3	340,000
1/26/2020	26,000	68,000	624,000	780,000	800,000	12	11	340,000
1/27/2020	26,000	68,000	0	738,000	800,000	12	11	340,000
1/28/2020	26,000	68,000	0	696,000	800,000	12	10	340,000
1/29/2020	26,000	68,000	0	654,000	800,000	12	10	340,000
1/30/2020	26,000	68,000	0	612,000	800,000	12	9	340,000
1/31/2020	26,000	68,000	0	570,000	800,000	12	8	340,000
2/1/2020	26,000	68,000	0	528,000	800,000	12	8	340,000
2/2/2020	26,000	68,000	0	486,000	800,000	12	7	340,000
2/3/2020	26,000	68,000	0	444,000	800,000	12	7	340,000
2/4/2020	26,000	68,000	0	402,000	800,000	12	6	340,000
2/5/2020	26,000	68,000	0	360,000	800,000	12	5	340,000
2/6/2020	26,000	68,000	0	318,000	800,000	12	5	340,000
2/7/2020	26,000	68,000	0	276,000	800,000	12	4	340,000
2/8/2020	26,000	68,000	0	234,000	800,000	12	3	340,000
2/9/2020	26,000	68,000	0	192,000	800,000	12	3	340,000
2/10/2020	26,000	68,000	624,000	774,000	800,000	12	11	340,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
2/13/2020	26,000	68,000	0	648,000	800,000	12	10	340,000
2/14/2020	26,000	68,000	0	606,000	800,000	12	9	340,000
2/15/2020	26,000	68,000	0	564,000	800,000	12	8	340,000
2/16/2020	26,000	68,000	0	522,000	800,000	12	8	340,000
2/17/2020	26,000	68,000	0	480,000	800,000	12	7	340,000
2/18/2020	26,000	68,000	0	438,000	800,000	12	6	340,000
2/19/2020	26,000	68,000	0	396,000	800,000	12	6	340,000
2/20/2020	26,000	68,000	0	354,000	800,000	12	5	340,000
2/21/2020	26,000	68,000	0	312,000	800,000	12	5	340,000
2/22/2020	26,000	68,000	0	270,000	800,000	12	4	340,000
2/23/2020	26,000	68,000	0	228,000	800,000	12	3	340,000
2/24/2020	26,000	68,000	0	186,000	800,000	12	3	340,000
2/25/2020	26,000	68,000	624,000	768,000	800,000	12	11	340,000
2/26/2020	26,000	68,000	0	726,000	800,000	12	11	340,000
2/27/2020	26,000	68,000	0	684,000	800,000	12	10	340,000
2/28/2020	26,000	68,000	0	642,000	800,000	12	9	340,000
2/29/2020	26,000	68,000	0	600,000	800,000	12	9	340,000
3/1/2020	26,000	68,400	0	557,600	800,000	12	8	342,000
3/2/2020	26,000	68,400	0	515,200	800,000	12	8	342,000
3/3/2020	26,000	68,400	0	472,800	800,000	12	7	342,000
3/4/2020	26,000	68,400	0	430,400	800,000	12	6	342,000
3/5/2020	26,000	68,400	0	388,000	800,000	12	6	342,000
3/6/2020	26,000	68,400	0	345,600	800,000	12	5	342,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
3/9/2020	26,000	68,400	0	218,400	800,000	12	3	342,000
3/10/2020	26,000	68,400	0	176,000	800,000	12	3	342,000
3/11/2020	26,000	68,400	624,000	757,600	800,000	12	11	342,000
3/12/2020	26,000	68,400	0	715,200	800,000	12	10	342,000
3/13/2020	26,000	68,400	0	672,800	800,000	12	10	342,000
3/14/2020	26,000	68,400	0	630,400	800,000	12	9	342,000
3/15/2020	26,000	68,400	0	588,000	800,000	12	9	342,000
3/16/2020	26,000	68,400	0	545,600	800,000	12	8	342,000
3/17/2020	26,000	68,400	0	503,200	800,000	12	7	342,000
3/18/2020	26,000	68,400	0	460,800	800,000	12	7	342,000
3/19/2020	26,000	68,400	0	418,400	800,000	12	6	342,000
3/20/2020	26,000	68,400	0	376,000	800,000	12	5	342,000
3/21/2020	26,000	68,400	0	333,600	800,000	12	5	342,000
3/22/2020	26,000	68,400	0	291,200	800,000	12	4	342,000
3/23/2020	26,000	68,400	0	248,800	800,000	12	4	342,000
3/24/2020	26,000	68,400	0	206,400	800,000	12	3	342,000
3/25/2020	26,000	68,400	624,000	788,000	800,000	12	12	342,000
3/26/2020	26,000	68,400	0	745,600	800,000	12	11	342,000
3/27/2020	26,000	68,400	0	703,200	800,000	12	10	342,000
3/28/2020	26,000	68,400	0	660,800	800,000	12	10	342,000
3/29/2020	26,000	68,400	0	618,400	800,000	12	9	342,000
3/30/2020	26,000	68,400	0	576,000	800,000	12	8	342,000
3/31/2020	26,000	68,400	0	533,600	800,000	12	8	342,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
4/3/2020	26,000	68,400	0	406,400	800,000	12	6	342,000
4/4/2020	26,000	68,400	0	364,000	800,000	12	5	342,000
4/5/2020	26,000	68,400	0	321,600	800,000	12	5	342,000
4/6/2020	26,000	68,400	0	279,200	800,000	12	4	342,000
4/7/2020	26,000	68,400	0	236,800	800,000	12	3	342,000
4/8/2020	26,000	68,400	0	194,400	800,000	12	3	342,000
4/9/2020	26,000	68,400	624,000	776,000	800,000	12	11	342,000
4/10/2020	26,000	68,400	0	733,600	800,000	12	11	342,000
4/11/2020	26,000	68,400	0	691,200	800,000	12	10	342,000
4/12/2020	26,000	68,400	0	648,800	800,000	12	9	342,000
4/13/2020	26,000	68,400	0	606,400	800,000	12	9	342,000
4/14/2020	26,000	68,400	0	564,000	800,000	12	8	342,000
4/15/2020	26,000	68,400	0	521,600	800,000	12	8	342,000
4/16/2020	26,000	68,400	0	479,200	800,000	12	7	342,000
4/17/2020	26,000	68,400	0	436,800	800,000	12	6	342,000
4/18/2020	26,000	68,400	0	394,400	800,000	12	6	342,000
4/19/2020	26,000	68,400	0	352,000	800,000	12	5	342,000
4/20/2020	26,000	68,400	0	309,600	800,000	12	5	342,000
4/21/2020	26,000	68,400	0	267,200	800,000	12	4	342,000
4/22/2020	26,000	68,400	0	224,800	800,000	12	3	342,000
4/23/2020	26,000	68,400	0	182,400	800,000	12	3	342,000
4/24/2020	26,000	68,400	624,000	764,000	800,000	12	11	342,000
4/25/2020	26,000	68,400	0	721,600	800,000	12	11	342,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
4/28/2020	26,000	68,400	0	594,400	800,000	12	9	342,000
4/29/2020	26,000	68,400	0	552,000	800,000	12	8	342,000
4/30/2020	26,000	68,400	0	509,600	800,000	12	7	342,000
5/1/2020	26,000	68,000	0	467,600	800,000	12	7	340,000
5/2/2020	26,000	68,000	0	425,600	800,000	12	6	340,000
5/3/2020	26,000	68,000	0	383,600	800,000	12	6	340,000
5/4/2020	26,000	68,000	0	341,600	800,000	12	5	340,000
5/5/2020	26,000	68,000	0	299,600	800,000	12	4	340,000
5/6/2020	26,000	68,000	0	257,600	800,000	12	4	340,000
5/7/2020	26,000	68,000	0	215,600	800,000	12	3	340,000
5/8/2020	26,000	68,000	624,000	797,600	800,000	12	12	340,000
5/9/2020	26,000	68,000	0	755,600	800,000	12	11	340,000
5/10/2020	26,000	68,000	0	713,600	800,000	12	10	340,000
5/11/2020	26,000	68,000	0	671,600	800,000	12	10	340,000
5/12/2020	26,000	68,000	0	629,600	800,000	12	9	340,000
5/13/2020	26,000	68,000	0	587,600	800,000	12	9	340,000
5/14/2020	26,000	68,000	0	545,600	800,000	12	8	340,000
5/15/2020	26,000	68,000	0	503,600	800,000	12	7	340,000
5/16/2020	26,000	68,000	0	461,600	800,000	12	7	340,000
5/17/2020	26,000	68,000	0	419,600	800,000	12	6	340,000
5/18/2020	26,000	68,000	0	377,600	800,000	12	6	340,000
5/19/2020	26,000	68,000	0	335,600	800,000	12	5	340,000
5/20/2020	26,000	68,000	0	293,600	800,000	12	4	340,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
5/23/2020	26,000	68,000	624,000	791,600	800,000	12	12	340,000
5/24/2020	26,000	68,000	0	749,600	800,000	12	11	340,000
5/25/2020	26,000	68,000	0	707,600	800,000	12	10	340,000
5/26/2020	26,000	68,000	0	665,600	800,000	12	10	340,000
5/27/2020	26,000	68,000	0	623,600	800,000	12	9	340,000
5/28/2020	26,000	68,000	0	581,600	800,000	12	9	340,000
5/29/2020	26,000	68,000	0	539,600	800,000	12	8	340,000
5/30/2020	26,000	68,000	0	497,600	800,000	12	7	340,000
5/31/2020	26,000	68,000	0	455,600	800,000	12	7	340,000
6/1/2020	26,000	68,000	0	413,600	800,000	12	6	340,000
6/2/2020	26,000	68,000	0	371,600	800,000	12	5	340,000
6/3/2020	26,000	68,000	0	329,600	800,000	12	5	340,000
6/4/2020	26,000	68,000	0	287,600	800,000	12	4	340,000
6/5/2020	26,000	68,000	0	245,600	800,000	12	4	340,000
6/6/2020	26,000	68,000	0	203,600	800,000	12	3	340,000
6/7/2020	26,000	68,000	624,000	785,600	800,000	12	12	340,000
6/8/2020	26,000	68,000	0	743,600	800,000	12	11	340,000
6/9/2020	26,000	68,000	0	701,600	800,000	12	10	340,000
6/10/2020	26,000	68,000	0	659,600	800,000	12	10	340,000
6/11/2020	26,000	68,000	0	617,600	800,000	12	9	340,000
6/12/2020	26,000	68,000	0	575,600	800,000	12	8	340,000
6/13/2020	26,000	68,000	0	533,600	800,000	12	8	340,000
6/14/2020	26,000	68,000	0	491,600	800,000	12	7	340,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
6/17/2020	26,000	68,000	0	365,600	800,000	12	5	340,000
6/18/2020	26,000	68,000	0	323,600	800,000	12	5	340,000
6/19/2020	26,000	68,000	0	281,600	800,000	12	4	340,000
6/20/2020	26,000	68,000	0	239,600	800,000	12	4	340,000
6/21/2020	26,000	68,000	0	197,600	800,000	12	3	340,000
6/22/2020	26,000	68,000	624,000	779,600	800,000	12	11	340,000
6/23/2020	26,000	68,000	0	737,600	800,000	12	11	340,000
6/24/2020	26,000	68,000	0	695,600	800,000	12	10	340,000
6/25/2020	26,000	68,000	0	653,600	800,000	12	10	340,000
6/26/2020	26,000	68,000	0	611,600	800,000	12	9	340,000
6/27/2020	26,000	68,000	0	569,600	800,000	12	8	340,000
6/28/2020	26,000	68,000	0	527,600	800,000	12	8	340,000
6/29/2020	26,000	68,000	0	485,600	800,000	12	7	340,000
6/30/2020	26,000	68,000	0	443,600	800,000	12	7	340,000
7/1/2020	26,000	68,800	0	400,800	800,000	12	6	344,000
7/2/2020	26,000	68,800	0	358,000	800,000	12	5	344,000
7/3/2020	26,000	68,800	0	315,200	800,000	12	5	344,000
7/4/2020	26,000	68,800	0	272,400	800,000	12	4	344,000
7/5/2020	26,000	68,800	0	229,600	800,000	12	3	344,000
7/6/2020	26,000	68,800	0	186,800	800,000	12	3	344,000
7/7/2020	26,000	68,800	624,000	768,000	800,000	12	11	344,000
7/8/2020	26,000	68,800	0	725,200	800,000	12	11	344,000
7/9/2020	26,000	68,800	0	682,400	800,000	12	10	344,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
7/12/2020	26,000	68,800	0	554,000	800,000	12	8	344,000
7/13/2020	26,000	68,800	0	511,200	800,000	12	7	344,000
7/14/2020	26,000	68,800	0	468,400	800,000	12	7	344,000
7/15/2020	26,000	68,800	0	425,600	800,000	12	6	344,000
7/16/2020	26,000	68,800	0	382,800	800,000	12	6	344,000
7/17/2020	26,000	68,800	0	340,000	800,000	12	5	344,000
7/18/2020	26,000	68,800	0	297,200	800,000	12	4	344,000
7/19/2020	26,000	68,800	0	254,400	800,000	12	4	344,000
7/20/2020	26,000	68,800	0	211,600	800,000	12	3	344,000
7/21/2020	26,000	68,800	624,000	792,800	800,000	12	12	344,000
7/22/2020	26,000	68,800	0	750,000	800,000	12	11	344,000
7/23/2020	26,000	68,800	0	707,200	800,000	12	10	344,000
7/24/2020	26,000	68,800	0	664,400	800,000	12	10	344,000
7/25/2020	26,000	68,800	0	621,600	800,000	12	9	344,000
7/26/2020	26,000	68,800	0	578,800	800,000	12	8	344,000
7/27/2020	26,000	68,800	0	536,000	800,000	12	8	344,000
7/28/2020	26,000	68,800	0	493,200	800,000	12	7	344,000
7/29/2020	26,000	68,800	0	450,400	800,000	12	7	344,000
7/30/2020	26,000	68,800	0	407,600	800,000	12	6	344,000
7/31/2020	26,000	68,800	0	364,800	800,000	12	5	344,000
8/1/2020	26,000	68,800	0	322,000	800,000	12	5	344,000
8/2/2020	26,000	68,800	0	279,200	800,000	12	4	344,000
8/3/2020	26,000	68,800	0	236,400	800,000	12	3	344,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
8/6/2020	26,000	68,800	0	732,000	800,000	12	11	344,000
8/7/2020	26,000	68,800	0	689,200	800,000	12	10	344,000
8/8/2020	26,000	68,800	0	646,400	800,000	12	9	344,000
8/9/2020	26,000	68,800	0	603,600	800,000	12	9	344,000
8/10/2020	26,000	68,800	0	560,800	800,000	12	8	344,000
8/11/2020	26,000	68,800	0	518,000	800,000	12	8	344,000
8/12/2020	26,000	68,800	0	475,200	800,000	12	7	344,000
8/13/2020	26,000	68,800	0	432,400	800,000	12	6	344,000
8/14/2020	26,000	68,800	0	389,600	800,000	12	6	344,000
8/15/2020	26,000	68,800	0	346,800	800,000	12	5	344,000
8/16/2020	26,000	68,800	0	304,000	800,000	12	4	344,000
8/17/2020	26,000	68,800	0	261,200	800,000	12	4	344,000
8/18/2020	26,000	68,800	0	218,400	800,000	12	3	344,000
8/19/2020	26,000	68,800	0	175,600	800,000	12	3	344,000
8/20/2020	26,000	68,800	624,000	756,800	800,000	12	11	344,000
8/21/2020	26,000	68,800	0	714,000	800,000	12	10	344,000
8/22/2020	26,000	68,800	0	671,200	800,000	12	10	344,000
8/23/2020	26,000	68,800	0	628,400	800,000	12	9	344,000
8/24/2020	26,000	68,800	0	585,600	800,000	12	9	344,000
8/25/2020	26,000	68,800	0	542,800	800,000	12	8	344,000
8/26/2020	26,000	68,800	0	500,000	800,000	12	7	344,000
8/27/2020	26,000	68,800	0	457,200	800,000	12	7	344,000
8/28/2020	26,000	68,800	0	414,400	800,000	12	6	344,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
8/31/2020	26,000	68,800	0	286,000	800,000	12	4	344,000
9/1/2020	26,000	68,000	0	244,000	800,000	12	4	340,000
9/2/2020	26,000	68,000	0	202,000	800,000	12	3	340,000
9/3/2020	26,000	68,000	624,000	784,000	800,000	12	12	340,000
9/4/2020	26,000	68,000	0	742,000	800,000	12	11	340,000
9/5/2020	26,000	68,000	0	700,000	800,000	12	10	340,000
9/6/2020	26,000	68,000	0	658,000	800,000	12	10	340,000
9/7/2020	26,000	68,000	0	616,000	800,000	12	9	340,000
9/8/2020	26,000	68,000	0	574,000	800,000	12	8	340,000
9/9/2020	26,000	68,000	0	532,000	800,000	12	8	340,000
9/10/2020	26,000	68,000	0	490,000	800,000	12	7	340,000
9/11/2020	26,000	68,000	0	448,000	800,000	12	7	340,000
9/12/2020	26,000	68,000	0	406,000	800,000	12	6	340,000
9/13/2020	26,000	68,000	0	364,000	800,000	12	5	340,000
9/14/2020	26,000	68,000	0	322,000	800,000	12	5	340,000
9/15/2020	26,000	68,000	0	280,000	800,000	12	4	340,000
9/16/2020	26,000	68,000	0	238,000	800,000	12	4	340,000
9/17/2020	26,000	68,000	0	196,000	800,000	12	3	340,000
9/18/2020	26,000	68,000	624,000	778,000	800,000	12	11	340,000
9/19/2020	26,000	68,000	0	736,000	800,000	12	11	340,000
9/20/2020	26,000	68,000	0	694,000	800,000	12	10	340,000
9/21/2020	26,000	68,000	0	652,000	800,000	12	10	340,000
9/22/2020	26,000	68,000	0	610,000	800,000	12	9	340,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
9/25/2020	26,000	68,000	0	484,000	800,000	12	7	340,000
9/26/2020	26,000	68,000	0	442,000	800,000	12	7	340,000
9/27/2020	26,000	68,000	0	400,000	800,000	12	6	340,000
9/28/2020	26,000	68,000	0	358,000	800,000	12	5	340,000
9/29/2020	26,000	68,000	0	316,000	800,000	12	5	340,000
9/30/2020	26,000	68,000	0	274,000	800,000	12	4	340,000
10/1/2020	26,000	67,200	0	232,800	800,000	12	3	336,000
10/2/2020	26,000	67,200	0	191,600	800,000	12	3	336,000
10/3/2020	26,000	67,200	624,000	774,400	800,000	12	12	336,000
10/4/2020	26,000	67,200	0	733,200	800,000	12	11	336,000
10/5/2020	26,000	67,200	0	692,000	800,000	12	10	336,000
10/6/2020	26,000	67,200	0	650,800	800,000	12	10	336,000
10/7/2020	26,000	67,200	0	609,600	800,000	12	9	336,000
10/8/2020	26,000	67,200	0	568,400	800,000	12	8	336,000
10/9/2020	26,000	67,200	0	527,200	800,000	12	8	336,000
10/10/2020	26,000	67,200	0	486,000	800,000	12	7	336,000
10/11/2020	26,000	67,200	0	444,800	800,000	12	7	336,000
10/12/2020	26,000	67,200	0	403,600	800,000	12	6	336,000
10/13/2020	26,000	67,200	0	362,400	800,000	12	5	336,000
10/14/2020	26,000	67,200	0	321,200	800,000	12	5	336,000
10/15/2020	26,000	67,200	0	280,000	800,000	12	4	336,000
10/16/2020	26,000	67,200	0	238,800	800,000	12	4	336,000
10/17/2020	26,000	67,200	0	197,600	800,000	12	3	336,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
10/20/2020	26,000	67,200	0	698,000	800,000	12	10	336,000
10/21/2020	26,000	67,200	0	656,800	800,000	12	10	336,000
10/22/2020	26,000	67,200	0	615,600	800,000	12	9	336,000
10/23/2020	26,000	67,200	0	574,400	800,000	12	9	336,000
10/24/2020	26,000	67,200	0	533,200	800,000	12	8	336,000
10/25/2020	26,000	67,200	0	492,000	800,000	12	7	336,000
10/26/2020	26,000	67,200	0	450,800	800,000	12	7	336,000
10/27/2020	26,000	67,200	0	409,600	800,000	12	6	336,000
10/28/2020	26,000	67,200	0	368,400	800,000	12	5	336,000
10/29/2020	26,000	67,200	0	327,200	800,000	12	5	336,000
10/30/2020	26,000	67,200	0	286,000	800,000	12	4	336,000
10/31/2020	26,000	67,200	0	244,800	800,000	12	4	336,000
11/1/2020	26,000	66,400	0	204,400	800,000	12	3	332,000
11/2/2020	26,000	66,400	624,000	788,000	800,000	12	12	332,000
11/3/2020	26,000	66,400	0	747,600	800,000	12	11	332,000
11/4/2020	26,000	66,400	0	707,200	800,000	12	11	332,000
11/5/2020	26,000	66,400	0	666,800	800,000	12	10	332,000
11/6/2020	26,000	66,400	0	626,400	800,000	12	9	332,000
11/7/2020	26,000	66,400	0	586,000	800,000	12	9	332,000
11/8/2020	26,000	66,400	0	545,600	800,000	12	8	332,000
11/9/2020	26,000	66,400	0	505,200	800,000	12	8	332,000
11/10/2020	26,000	66,400	0	464,800	800,000	12	7	332,000
11/11/2020	26,000	66,400	0	424,400	800,000	12	6	332,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
11/14/2020	26,000	66,400	0	303,200	800,000	12	5	332,000
11/15/2020	26,000	66,400	0	262,800	800,000	12	4	332,000
11/16/2020	26,000	66,400	0	222,400	800,000	12	3	332,000
11/17/2020	26,000	66,400	0	182,000	800,000	12	3	332,000
11/18/2020	26,000	66,400	624,000	765,600	800,000	12	12	332,000
11/19/2020	26,000	66,400	0	725,200	800,000	12	11	332,000
11/20/2020	26,000	66,400	0	684,800	800,000	12	10	332,000
11/21/2020	26,000	66,400	0	644,400	800,000	12	10	332,000
11/22/2020	26,000	66,400	0	604,000	800,000	12	9	332,000
11/23/2020	26,000	66,400	0	563,600	800,000	12	8	332,000
11/24/2020	26,000	66,400	0	523,200	800,000	12	8	332,000
11/25/2020	26,000	66,400	0	482,800	800,000	12	7	332,000
11/26/2020	26,000	66,400	0	442,400	800,000	12	7	332,000
11/27/2020	26,000	66,400	0	402,000	800,000	12	6	332,000
11/28/2020	26,000	66,400	0	361,600	800,000	12	5	332,000
11/29/2020	26,000	66,400	0	321,200	800,000	12	5	332,000
11/30/2020	26,000	66,400	0	280,800	800,000	12	4	332,000
12/1/2020	26,000	68,800	0	238,000	800,000	12	3	344,000
12/2/2020	26,000	68,800	0	195,200	800,000	12	3	344,000
12/3/2020	26,000	68,800	624,000	776,400	800,000	12	11	344,000
12/4/2020	26,000	68,800	0	733,600	800,000	12	11	344,000
12/5/2020	26,000	68,800	0	690,800	800,000	12	10	344,000
12/6/2020	26,000	68,800	0	648,000	800,000	12	9	344,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
12/9/2020	26,000	68,800	0	519,600	800,000	12	8	344,000
12/10/2020	26,000	68,800	0	476,800	800,000	12	7	344,000
12/11/2020	26,000	68,800	0	434,000	800,000	12	6	344,000
12/12/2020	26,000	68,800	0	391,200	800,000	12	6	344,000
12/13/2020	26,000	68,800	0	348,400	800,000	12	5	344,000
12/14/2020	26,000	68,800	0	305,600	800,000	12	4	344,000
12/15/2020	26,000	68,800	0	262,800	800,000	12	4	344,000
12/16/2020	26,000	68,800	0	220,000	800,000	12	3	344,000
12/17/2020	26,000	68,800	0	177,200	800,000	12	3	344,000
12/18/2020	26,000	68,800	624,000	758,400	800,000	12	11	344,000
12/19/2020	26,000	68,800	0	715,600	800,000	12	10	344,000
12/20/2020	26,000	68,800	0	672,800	800,000	12	10	344,000
12/21/2020	26,000	68,800	0	630,000	800,000	12	9	344,000
12/22/2020	26,000	68,800	0	587,200	800,000	12	9	344,000
12/23/2020	26,000	68,800	0	544,400	800,000	12	8	344,000
12/24/2020	26,000	68,800	0	501,600	800,000	12	7	344,000
12/25/2020	26,000	68,800	0	458,800	800,000	12	7	344,000
12/26/2020	26,000	68,800	0	416,000	800,000	12	6	344,000
12/27/2020	26,000	68,800	0	373,200	800,000	12	5	344,000
12/28/2020	26,000	68,800	0	330,400	800,000	12	5	344,000
12/29/2020	26,000	68,800	0	287,600	800,000	12	4	344,000
12/30/2020	26,000	68,800	0	244,800	800,000	12	4	344,000
12/31/2020	26,000	68,800	0	202,000	800,000	12	3	344,000

- The demand is given from the local supplier and production is planned Excel Sheet user.
- The inventory level is calculated by:

$$Inventory\ Level$$

$$= Production + import + inventory\ level\ of\ the\ perivous\ day - deamnd$$

$$Inventory\ level\ for\ the\ second\ of\ Jan\ = 26000 + 0 + 582000 - 68000 = 540000\ \ Barrels$$

- Maximum capacity is the maximum storages capacity its 800,000 Barrels.
- Stock Days is maximum days the inventory can supply without production:

$$\text{Stock days} = \frac{\text{Current Inventory level}}{Demand}$$

$$Stock\ days\ = \frac{540000}{68000} = 8\ ays$$

- Ullage is the empty gap between the maximum storage level and the current level:

$$\text{Ullage} = \text{Maximum storage} - \text{Inventory Level}$$

$$Ullage = 800{,}000 - 540000 = 540000 \text{ Barrels}$$

- Ullage filling days:

$$\text{Ullage days} = \frac{\text{Ullage}}{Production}$$

$$Ullage\ Days = \frac{540000}{26000} = 21\ \ days$$

Appendix Six Diesel Production Plan :

Table 26: Diesel Production Plan.

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BPSD	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
1/1/2020	30,000	44,000	412,500	398,500	600,000	14	9	220,000
1/2/2020	30,000	44,000	0	384,500	600,000	14	9	220,000
1/3/2020	30,000	44,000	0	370,500	600,000	14	8	220,000
1/4/2020	30,000	44,000	0	356,500	600,000	14	8	220,000
1/5/2020	30,000	44,000	0	342,500	600,000	14	8	220,000
1/6/2020	30,000	44,000	0	328,500	600,000	14	7	220,000
1/7/2020	30,000	44,000	0	314,500	600,000	14	7	220,000
1/8/2020	30,000	44,000	0	300,500	600,000	14	7	220,000
1/9/2020	30,000	44,000	0	286,500	600,000	14	7	220,000
1/10/2020	30,000	44,000	0	272,500	600,000	14	6	220,000
1/11/2020	30,000	44,000	0	258,500	600,000	14	6	220,000
1/12/2020	30,000	44,000	0	244,500	600,000	14	6	220,000
1/13/2020	30,000	44,000	0	230,500	600,000	14	5	220,000
1/14/2020	30,000	44,000	0	216,500	600,000	14	5	220,000
1/15/2020	30,000	44,000	0	202,500	600,000	14	5	220,000
1/16/2020	30,000	44,000	0	188,500	600,000	14	4	220,000
1/17/2020	30,000	44,000	412,500	587,000	600,000	14	13	220,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
1/19/2020	30,000	44,000	0	559,000	600,000	14	13	220,000
1/20/2020	30,000	44,000	0	545,000	600,000	14	12	220,000
1/21/2020	30,000	44,000	0	531,000	600,000	14	12	220,000
1/22/2020	30,000	44,000	0	517,000	600,000	14	12	220,000
1/23/2020	30,000	44,000	0	503,000	600,000	14	11	220,000
1/24/2020	30,000	44,000	0	489,000	600,000	14	11	220,000
1/25/2020	30,000	44,000	0	475,000	600,000	14	11	220,000
1/26/2020	30,000	44,000	0	461,000	600,000	14	10	220,000
1/27/2020	30,000	44,000	0	447,000	600,000	14	10	220,000
1/28/2020	30,000	44,000	0	433,000	600,000	14	10	220,000
1/29/2020	30,000	44,000	0	419,000	600,000	14	10	220,000
1/30/2020	30,000	44,000	0	405,000	600,000	14	9	220,000
1/31/2020	30,000	44,000	0	391,000	600,000	14	9	220,000
2/1/2020	30,000	44,800	0	376,200	600,000	13	8	224,000
2/2/2020	30,000	44,800	0	361,400	600,000	13	8	224,000
2/3/2020	30,000	44,800	0	346,600	600,000	13	8	224,000
2/4/2020	30,000	44,800	0	331,800	600,000	13	7	224,000
2/5/2020	30,000	44,800	0	317,000	600,000	13	7	224,000
2/6/2020	30,000	44,800	0	302,200	600,000	13	7	224,000
2/7/2020	30,000	44,800	0	287,400	600,000	13	6	224,000
2/8/2020	30,000	44,800	0	272,600	600,000	13	6	224,000
2/9/2020	30,000	44,800	0	257,800	600,000	13	6	224,000
2/10/2020	30,000	44,800	0	243,000	600,000	13	5	224,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BBL/Day	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
2/12/2020	30,000	44,800	0	213,400	600,000	13	5	224,000
2/13/2020	30,000	44,800	0	198,600	600,000	13	4	224,000
2/14/2020	30,000	44,800	412,500	596,300	600,000	13	13	224,000
2/15/2020	30,000	44,800	0	581,500	600,000	13	13	224,000
2/16/2020	30,000	44,800	0	566,700	600,000	13	13	224,000
2/17/2020	30,000	44,800	0	551,900	600,000	13	12	224,000
2/18/2020	30,000	44,800	0	537,100	600,000	13	12	224,000
2/19/2020	30,000	44,800	0	522,300	600,000	13	12	224,000
2/20/2020	30,000	44,800	0	507,500	600,000	13	11	224,000
2/21/2020	30,000	44,800	0	492,700	600,000	13	11	224,000
2/22/2020	30,000	44,800	0	477,900	600,000	13	11	224,000
2/23/2020	30,000	44,800	0	463,100	600,000	13	10	224,000
2/24/2020	30,000	44,800	0	448,300	600,000	13	10	224,000
2/25/2020	30,000	44,800	0	433,500	600,000	13	10	224,000
2/26/2020	30,000	44,800	0	418,700	600,000	13	9	224,000
2/27/2020	30,000	44,800	0	403,900	600,000	13	9	224,000
2/28/2020	30,000	44,800	0	389,100	600,000	13	9	224,000
2/29/2020	30,000	44,800	0	374,300	600,000	13	8	224,000
3/1/2020	30,000	44,800	0	359,500	600,000	13	8	224,000
3/2/2020	30,000	44,800	0	344,700	600,000	13	8	224,000
3/3/2020	30,000	44,800	0	329,900	600,000	13	7	224,000
3/4/2020	30,000	44,800	0	315,100	600,000	13	7	224,000
3/5/2020	30,000	44,800	0	300,300	600,000	13	7	224,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BPSD	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
3/7/2020	30,000	44,800	0	270,700	600,000	13	6	224,000
3/8/2020	30,000	44,800	0	255,900	600,000	13	6	224,000
3/9/2020	30,000	44,800	0	241,100	600,000	13	5	224,000
3/10/2020	30,000	44,800	0	226,300	600,000	13	5	224,000
3/11/2020	30,000	44,800	0	211,500	600,000	13	5	224,000
3/12/2020	30,000	44,800	0	196,700	600,000	13	4	224,000
3/13/2020	30,000	44,800	412,500	594,400	600,000	13	13	224,000
3/14/2020	30,000	44,800	0	579,600	600,000	13	13	224,000
3/15/2020	30,000	44,800	0	564,800	600,000	13	13	224,000
3/16/2020	30,000	44,800	0	550,000	600,000	13	12	224,000
3/17/2020	30,000	44,800	0	535,200	600,000	13	12	224,000
3/18/2020	30,000	44,800	0	520,400	600,000	13	12	224,000
3/19/2020	30,000	44,800	0	505,600	600,000	13	11	224,000
3/20/2020	30,000	44,800	0	490,800	600,000	13	11	224,000
3/21/2020	30,000	44,800	0	476,000	600,000	13	11	224,000
3/22/2020	30,000	44,800	0	461,200	600,000	13	10	224,000
3/23/2020	30,000	44,800	0	446,400	600,000	13	10	224,000
3/24/2020	30,000	44,800	0	431,600	600,000	13	10	224,000
3/25/2020	30,000	44,800	0	416,800	600,000	13	9	224,000
3/26/2020	30,000	44,800	0	402,000	600,000	13	9	224,000
3/27/2020	30,000	44,800	0	387,200	600,000	13	9	224,000
3/28/2020	30,000	44,800	0	372,400	600,000	13	8	224,000
3/29/2020	30,000	44,800	0	357,600	600,000	13	8	224,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BPSD	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
3/31/2020	30,000	44,800	0	328,000	600,000	13	7	224,000
4/1/2020	30,000	45,200	0	312,800	600,000	13	7	226,000
4/2/2020	30,000	45,200	0	297,600	600,000	13	7	226,000
4/3/2020	30,000	45,200	0	282,400	600,000	13	6	226,000
4/4/2020	30,000	45,200	0	267,200	600,000	13	6	226,000
4/5/2020	30,000	45,200	0	252,000	600,000	13	6	226,000
4/6/2020	30,000	45,200	0	236,800	600,000	13	5	226,000
4/7/2020	30,000	45,200	0	221,600	600,000	13	5	226,000
4/8/2020	30,000	45,200	0	206,400	600,000	13	5	226,000
4/9/2020	30,000	45,200	0	191,200	600,000	13	4	226,000
4/10/2020	30,000	45,200	412,500	588,500	600,000	13	13	226,000
4/11/2020	30,000	45,200	0	573,300	600,000	13	13	226,000
4/12/2020	30,000	45,200	0	558,100	600,000	13	12	226,000
4/13/2020	30,000	45,200	0	542,900	600,000	13	12	226,000
4/14/2020	30,000	45,200	0	527,700	600,000	13	12	226,000
4/15/2020	30,000	45,200	0	512,500	600,000	13	11	226,000
4/16/2020	30,000	45,200	0	497,300	600,000	13	11	226,000
4/17/2020	30,000	45,200	0	482,100	600,000	13	11	226,000
4/18/2020	30,000	45,200	0	466,900	600,000	13	10	226,000
4/19/2020	30,000	45,200	0	451,700	600,000	13	10	226,000
4/20/2020	30,000	45,200	0	436,500	600,000	13	10	226,000
4/21/2020	30,000	45,200	0	421,300	600,000	13	9	226,000
4/22/2020	30,000	45,200	0	406,100	600,000	13	9	226,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BPSD	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
4/24/2020	30,000	45,200	0	375,700	600,000	13	8	226,000
4/25/2020	30,000	45,200	0	360,500	600,000	13	8	226,000
4/26/2020	30,000	45,200	0	345,300	600,000	13	8	226,000
4/27/2020	30,000	45,200	0	330,100	600,000	13	7	226,000
4/28/2020	30,000	45,200	0	314,900	600,000	13	7	226,000
4/29/2020	30,000	45,200	0	299,700	600,000	13	7	226,000
4/30/2020	30,000	45,200	0	284,500	600,000	13	6	226,000
5/1/2020	30,000	44,000	0	270,500	600,000	14	6	220,000
5/2/2020	30,000	44,000	0	256,500	600,000	14	6	220,000
5/3/2020	30,000	44,000	0	242,500	600,000	14	6	220,000
5/4/2020	30,000	44,000	0	228,500	600,000	14	5	220,000
5/5/2020	30,000	44,000	0	214,500	600,000	14	5	220,000
5/6/2020	30,000	44,000	0	200,500	600,000	14	5	220,000
5/7/2020	30,000	44,000	412,500	599,000	600,000	14	14	220,000
5/8/2020	30,000	44,000	0	585,000	600,000	14	13	220,000
5/9/2020	30,000	44,000	0	571,000	600,000	14	13	220,000
5/10/2020	30,000	44,000	0	557,000	600,000	14	13	220,000
5/11/2020	30,000	44,000	0	543,000	600,000	14	12	220,000
5/12/2020	30,000	44,000	0	529,000	600,000	14	12	220,000
5/13/2020	30,000	44,000	0	515,000	600,000	14	12	220,000
5/14/2020	30,000	44,000	0	501,000	600,000	14	11	220,000
5/15/2020	30,000	44,000	0	487,000	600,000	14	11	220,000
5/16/2020	30,000	44,000	0	473,000	600,000	14	11	220,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BPSD	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
5/18/2020	30,000	44,000	0	445,000	600,000	14	10	220,000
5/19/2020	30,000	44,000	0	431,000	600,000	14	10	220,000
5/20/2020	30,000	44,000	0	417,000	600,000	14	9	220,000
5/21/2020	30,000	44,000	0	403,000	600,000	14	9	220,000
5/22/2020	30,000	44,000	0	389,000	600,000	14	9	220,000
5/23/2020	30,000	44,000	0	375,000	600,000	14	9	220,000
5/24/2020	30,000	44,000	0	361,000	600,000	14	8	220,000
5/25/2020	30,000	44,000	0	347,000	600,000	14	8	220,000
5/26/2020	30,000	44,000	0	333,000	600,000	14	8	220,000
5/27/2020	30,000	44,000	0	319,000	600,000	14	7	220,000
5/28/2020	30,000	44,000	0	305,000	600,000	14	7	220,000
5/29/2020	30,000	44,000	0	291,000	600,000	14	7	220,000
5/30/2020	30,000	44,000	0	277,000	600,000	14	6	220,000
5/31/2020	30,000	44,000	0	263,000	600,000	14	6	220,000
6/1/2020	30,000	44,000	0	249,000	600,000	14	6	220,000
6/2/2020	30,000	44,000	0	235,000	600,000	14	5	220,000
6/3/2020	30,000	44,000	0	221,000	600,000	14	5	220,000
6/4/2020	30,000	44,000	0	207,000	600,000	14	5	220,000
6/5/2020	30,000	44,000	0	193,000	600,000	14	4	220,000
6/6/2020	30,000	44,000	412,500	591,500	600,000	14	13	220,000
6/7/2020	30,000	44,000	0	577,500	600,000	14	13	220,000
6/8/2020	30,000	44,000	0	563,500	600,000	14	13	220,000
6/9/2020	30,000	44,000	0	549,500	600,000	14	12	220,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BPSD	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
6/11/2020	30,000	44,000	0	521,500	600,000	14	12	220,000
6/12/2020	30,000	44,000	0	507,500	600,000	14	12	220,000
6/13/2020	30,000	44,000	0	493,500	600,000	14	11	220,000
6/14/2020	30,000	44,000	0	479,500	600,000	14	11	220,000
6/15/2020	30,000	44,000	0	465,500	600,000	14	11	220,000
6/16/2020	30,000	44,000	0	451,500	600,000	14	10	220,000
6/17/2020	30,000	44,000	0	437,500	600,000	14	10	220,000
6/18/2020	30,000	44,000	0	423,500	600,000	14	10	220,000
6/19/2020	30,000	44,000	0	409,500	600,000	14	9	220,000
6/20/2020	30,000	44,000	0	395,500	600,000	14	9	220,000
6/21/2020	30,000	44,000	0	381,500	600,000	14	9	220,000
6/22/2020	30,000	44,000	0	367,500	600,000	14	8	220,000
6/23/2020	30,000	44,000	0	353,500	600,000	14	8	220,000
6/24/2020	30,000	44,000	0	339,500	600,000	14	8	220,000
6/25/2020	30,000	44,000	0	325,500	600,000	14	7	220,000
6/26/2020	30,000	44,000	0	311,500	600,000	14	7	220,000
6/27/2020	30,000	44,000	0	297,500	600,000	14	7	220,000
6/28/2020	30,000	44,000	0	283,500	600,000	14	6	220,000
6/29/2020	30,000	44,000	0	269,500	600,000	14	6	220,000
6/30/2020	30,000	44,000	0	255,500	600,000	14	6	220,000
7/1/2020	30,000	45,600	0	239,900	600,000	13	5	228,000
7/2/2020	30,000	45,600	0	224,300	600,000	13	5	228,000
7/3/2020	30,000	45,600	0	208,700	600,000	13	5	228,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BPSD	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
7/5/2020	30,000	45,600	412,500	590,000	600,000	13	13	228,000
7/6/2020	30,000	45,600	0	574,400	600,000	13	13	228,000
7/7/2020	30,000	45,600	0	558,800	600,000	13	12	228,000
7/8/2020	30,000	45,600	0	543,200	600,000	13	12	228,000
7/9/2020	30,000	45,600	0	527,600	600,000	13	12	228,000
7/10/2020	30,000	45,600	0	512,000	600,000	13	11	228,000
7/11/2020	30,000	45,600	0	496,400	600,000	13	11	228,000
7/12/2020	30,000	45,600	0	480,800	600,000	13	11	228,000
7/13/2020	30,000	45,600	0	465,200	600,000	13	10	228,000
7/14/2020	30,000	45,600	0	449,600	600,000	13	10	228,000
7/15/2020	30,000	45,600	0	434,000	600,000	13	10	228,000
7/16/2020	30,000	45,600	0	418,400	600,000	13	9	228,000
7/17/2020	30,000	45,600	0	402,800	600,000	13	9	228,000
7/18/2020	30,000	45,600	0	387,200	600,000	13	8	228,000
7/19/2020	30,000	45,600	0	371,600	600,000	13	8	228,000
7/20/2020	30,000	45,600	0	356,000	600,000	13	8	228,000
7/21/2020	30,000	45,600	0	340,400	600,000	13	7	228,000
7/22/2020	30,000	45,600	0	324,800	600,000	13	7	228,000
7/23/2020	30,000	45,600	0	309,200	600,000	13	7	228,000
7/24/2020	30,000	45,600	0	293,600	600,000	13	6	228,000
7/25/2020	30,000	45,600	0	278,000	600,000	13	6	228,000
7/26/2020	30,000	45,600	0	262,400	600,000	13	6	228,000
7/27/2020	30,000	45,600	0	246,800	600,000	13	5	228,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BPSD	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
7/29/2020	30,000	45,600	0	215,600	600,000	13	5	228,000
7/30/2020	30,000	45,600	0	200,000	600,000	13	4	228,000
7/31/2020	30,000	45,600	412,500	596,900	600,000	13	13	228,000
8/1/2020	30,000	45,600	0	581,300	600,000	13	13	228,000
8/2/2020	30,000	45,600	0	565,700	600,000	13	12	228,000
8/3/2020	30,000	45,600	0	550,100	600,000	13	12	228,000
8/4/2020	30,000	45,600	0	534,500	600,000	13	12	228,000
8/5/2020	30,000	45,600	0	518,900	600,000	13	11	228,000
8/6/2020	30,000	45,600	0	503,300	600,000	13	11	228,000
8/7/2020	30,000	45,600	0	487,700	600,000	13	11	228,000
8/8/2020	30,000	45,600	0	472,100	600,000	13	10	228,000
8/9/2020	30,000	45,600	0	456,500	600,000	13	10	228,000
8/10/2020	30,000	45,600	0	440,900	600,000	13	10	228,000
8/11/2020	30,000	45,600	0	425,300	600,000	13	9	228,000
8/12/2020	30,000	45,600	0	409,700	600,000	13	9	228,000
8/13/2020	30,000	45,600	0	394,100	600,000	13	9	228,000
8/14/2020	30,000	45,600	0	378,500	600,000	13	8	228,000
8/15/2020	30,000	45,600	0	362,900	600,000	13	8	228,000
8/16/2020	30,000	45,600	0	347,300	600,000	13	8	228,000
8/17/2020	30,000	45,600	0	331,700	600,000	13	7	228,000
8/18/2020	30,000	45,600	0	316,100	600,000	13	7	228,000
8/19/2020	30,000	45,600	0	300,500	600,000	13	7	228,000
8/20/2020	30,000	45,600	0	284,900	600,000	13	6	228,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BPSD	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
8/22/2020	30,000	45,600	0	253,700	600,000	13	6	228,000
8/23/2020	30,000	45,600	0	238,100	600,000	13	5	228,000
8/24/2020	30,000	45,600	0	222,500	600,000	13	5	228,000
8/25/2020	30,000	45,600	0	206,900	600,000	13	5	228,000
8/26/2020	30,000	45,600	0	191,300	600,000	13	4	228,000
8/27/2020	30,000	45,600	412,500	588,200	600,000	13	13	228,000
8/28/2020	30,000	45,600	0	572,600	600,000	13	13	228,000
8/29/2020	30,000	45,600	0	557,000	600,000	13	12	228,000
8/30/2020	30,000	45,600	0	541,400	600,000	13	12	228,000
8/31/2020	30,000	45,600	0	525,800	600,000	13	12	228,000
9/1/2020	30,000	45,600	0	510,200	600,000	13	11	228,000
9/2/2020	30,000	45,600	0	494,600	600,000	13	11	228,000
9/3/2020	30,000	45,600	0	479,000	600,000	13	11	228,000
9/4/2020	30,000	45,600	0	463,400	600,000	13	10	228,000
9/5/2020	30,000	45,600	0	447,800	600,000	13	10	228,000
9/6/2020	30,000	45,600	0	432,200	600,000	13	9	228,000
9/7/2020	30,000	45,600	0	416,600	600,000	13	9	228,000
9/8/2020	30,000	45,600	0	401,000	600,000	13	9	228,000
9/9/2020	30,000	45,600	0	385,400	600,000	13	8	228,000
9/10/2020	30,000	45,600	0	369,800	600,000	13	8	228,000
9/11/2020	30,000	45,600	0	354,200	600,000	13	8	228,000
9/12/2020	30,000	45,600	0	338,600	600,000	13	7	228,000
9/13/2020	30,000	45,600	0	323,000	600,000	13	7	228,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BPSD	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
9/15/2020	30,000	45,600	0	291,800	600,000	13	6	228,000
9/16/2020	30,000	45,600	0	276,200	600,000	13	6	228,000
9/17/2020	30,000	45,600	0	260,600	600,000	13	6	228,000
9/18/2020	30,000	45,600	0	245,000	600,000	13	5	228,000
9/19/2020	30,000	45,600	0	229,400	600,000	13	5	228,000
9/20/2020	30,000	45,600	0	213,800	600,000	13	5	228,000
9/21/2020	30,000	45,600	0	198,200	600,000	13	4	228,000
9/22/2020	30,000	45,600	412,500	595,100	600,000	13	13	228,000
9/23/2020	30,000	45,600	0	579,500	600,000	13	13	228,000
9/24/2020	30,000	45,600	0	563,900	600,000	13	12	228,000
9/25/2020	30,000	45,600	0	548,300	600,000	13	12	228,000
9/26/2020	30,000	45,600	0	532,700	600,000	13	12	228,000
9/27/2020	30,000	45,600	0	517,100	600,000	13	11	228,000
9/28/2020	30,000	45,600	0	501,500	600,000	13	11	228,000
9/29/2020	30,000	45,600	0	485,900	600,000	13	11	228,000
9/30/2020	30,000	45,600	0	470,300	600,000	13	10	228,000
10/1/2020	30,000	45,600	0	454,700	600,000	13	10	228,000
10/2/2020	30,000	45,600	0	439,100	600,000	13	10	228,000
10/3/2020	30,000	45,600	0	423,500	600,000	13	9	228,000
10/4/2020	30,000	45,600	0	407,900	600,000	13	9	228,000
10/5/2020	30,000	45,600	0	392,300	600,000	13	9	228,000
10/6/2020	30,000	45,600	0	376,700	600,000	13	8	228,000
10/7/2020	30,000	45,600	0	361,100	600,000	13	8	228,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BPSD	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
10/9/2020	30,000	45,600	0	329,900	600,000	13	7	228,000
10/10/2020	30,000	45,600	0	314,300	600,000	13	7	228,000
10/11/2020	30,000	45,600	0	298,700	600,000	13	7	228,000
10/12/2020	30,000	45,600	0	283,100	600,000	13	6	228,000
10/13/2020	30,000	45,600	0	267,500	600,000	13	6	228,000
10/14/2020	30,000	45,600	0	251,900	600,000	13	6	228,000
10/15/2020	30,000	45,600	0	236,300	600,000	13	5	228,000
10/16/2020	30,000	45,600	0	220,700	600,000	13	5	228,000
10/17/2020	30,000	45,600	0	205,100	600,000	13	4	228,000
10/18/2020	30,000	45,600	0	189,500	600,000	13	4	228,000
10/19/2020	30,000	45,600	412,500	586,400	600,000	13	13	228,000
10/20/2020	30,000	45,600	0	570,800	600,000	13	13	228,000
10/21/2020	30,000	45,600	0	555,200	600,000	13	12	228,000
10/22/2020	30,000	45,600	0	539,600	600,000	13	12	228,000
10/23/2020	30,000	45,600	0	524,000	600,000	13	11	228,000
10/24/2020	30,000	45,600	0	508,400	600,000	13	11	228,000
10/25/2020	30,000	45,600	0	492,800	600,000	13	11	228,000
10/26/2020	30,000	45,600	0	477,200	600,000	13	10	228,000
10/27/2020	30,000	45,600	0	461,600	600,000	13	10	228,000
10/28/2020	30,000	45,600	0	446,000	600,000	13	10	228,000
10/29/2020	30,000	45,600	0	430,400	600,000	13	9	228,000
10/30/2020	30,000	45,600	0	414,800	600,000	13	9	228,000
10/31/2020	30,000	45,600	0	399,200	600,000	13	9	228,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BPSD	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
11/2/2020	30,000	45,600	0	368,000	600,000	13	8	228,000
11/3/2020	30,000	45,600	0	352,400	600,000	13	8	228,000
11/4/2020	30,000	45,600	0	336,800	600,000	13	7	228,000
11/5/2020	30,000	45,600	0	321,200	600,000	13	7	228,000
11/6/2020	30,000	45,600	0	305,600	600,000	13	7	228,000
11/7/2020	30,000	45,600	0	290,000	600,000	13	6	228,000
11/8/2020	30,000	45,600	0	274,400	600,000	13	6	228,000
11/9/2020	30,000	45,600	0	258,800	600,000	13	6	228,000
11/10/2020	30,000	45,600	0	243,200	600,000	13	5	228,000
11/11/2020	30,000	45,600	0	227,600	600,000	13	5	228,000
11/12/2020	30,000	45,600	0	212,000	600,000	13	5	228,000
11/13/2020	30,000	45,600	0	196,400	600,000	13	4	228,000
11/14/2020	30,000	45,600	412,500	593,300	600,000	13	13	228,000
11/15/2020	30,000	45,600	0	577,700	600,000	13	13	228,000
11/16/2020	30,000	45,600	0	562,100	600,000	13	12	228,000
11/17/2020	30,000	45,600	0	546,500	600,000	13	12	228,000
11/18/2020	30,000	45,600	0	530,900	600,000	13	12	228,000
11/19/2020	30,000	45,600	0	515,300	600,000	13	11	228,000
11/20/2020	30,000	45,600	0	499,700	600,000	13	11	228,000
11/21/2020	30,000	45,600	0	484,100	600,000	13	11	228,000
11/22/2020	30,000	45,600	0	468,500	600,000	13	10	228,000
11/23/2020	30,000	45,600	0	452,900	600,000	13	10	228,000
11/24/2020	30,000	45,600	0	437,300	600,000	13	10	228,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BPSD	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
11/26/2020	30,000	45,600	0	406,100	600,000	13	9	228,000
11/27/2020	30,000	45,600	0	390,500	600,000	13	9	228,000
11/28/2020	30,000	45,600	0	374,900	600,000	13	8	228,000
11/29/2020	30,000	45,600	0	359,300	600,000	13	8	228,000
11/30/2020	30,000	45,600	0	343,700	600,000	13	8	228,000
12/1/2020	30,000	43,200	0	330,500	600,000	14	8	216,000
12/2/2020	30,000	43,200	0	317,300	600,000	14	7	216,000
12/3/2020	30,000	43,200	0	304,100	600,000	14	7	216,000
12/4/2020	30,000	43,200	0	290,900	600,000	14	7	216,000
12/5/2020	30,000	43,200	0	277,700	600,000	14	6	216,000
12/6/2020	30,000	43,200	0	264,500	600,000	14	6	216,000
12/7/2020	30,000	43,200	0	251,300	600,000	14	6	216,000
12/8/2020	30,000	43,200	0	238,100	600,000	14	6	216,000
12/9/2020	30,000	43,200	0	224,900	600,000	14	5	216,000
12/10/2020	30,000	43,200	0	211,700	600,000	14	5	216,000
12/11/2020	30,000	43,200	0	198,500	600,000	14	5	216,000
12/12/2020	30,000	43,200	412,500	597,800	600,000	14	14	216,000
12/13/2020	30,000	43,200	0	584,600	600,000	14	14	216,000
12/14/2020	30,000	43,200	0	571,400	600,000	14	13	216,000
12/15/2020	30,000	43,200	0	558,200	600,000	14	13	216,000
12/16/2020	30,000	43,200	0	545,000	600,000	14	13	216,000
12/17/2020	30,000	43,200	0	531,800	600,000	14	12	216,000
12/18/2020	30,000	43,200	0	518,600	600,000	14	12	216,000

DATE	TOTAL PRODN.	LOCAL DEMAND	Export & Import PLAN	Inventory Level	MAX STORAGE	Ullage	Refinery Stock Days	Min Storage
Days	BPSD	BBL/Day	Barrels	Barrels	Barrels net	Days	Days	Days
12/20/2020	30,000	43,200	0	492,200	600,000	14	11	216,000
12/21/2020	30,000	43,200	0	479,000	600,000	14	11	216,000
12/22/2020	30,000	43,200	0	465,800	600,000	14	11	216,000
12/23/2020	30,000	43,200	0	452,600	600,000	14	10	216,000
12/24/2020	30,000	43,200	0	439,400	600,000	14	10	216,000
12/25/2020	30,000	43,200	0	426,200	600,000	14	10	216,000
12/26/2020	30,000	43,200	0	413,000	600,000	14	10	216,000
12/27/2020	30,000	43,200	0	399,800	600,000	14	9	216,000
12/28/2020	30,000	43,200	0	386,600	600,000	14	9	216,000
12/29/2020	30,000	43,200	0	373,400	600,000	14	9	216,000
12/30/2020	30,000	43,200	0	360,200	600,000	14	8	216,000
12/31/2020	30,000	43,200	0	347,000	600,000	14	8	216,000

- The demand is given from the local supplier and production is planned Excel Sheet user.
- The inventory level is calculated by:

$$Inventory\ Level = Production + import + inventory\ level\ of\ the\ perivous\ day - deamnd$$

$$Inventory\ level\ for\ the\ second\ of\ Jan = 30000 + 0 + 398500 - 44000 = 384500\ Barrels$$

- Maximum capacity is the maximum storages capacity its 600,000 Barrels.
- Stock Days is maximum days the inventory can supply without production:

$$\text{Stock days} = \frac{\text{Current Inventory level}}{Demand}$$

$$Stock\ days = \frac{3845000}{44000} = 9\ days$$

- Ullage is the empty gap between the maximum storage level and the current level:

$$\text{Ullage} = \text{Maximum storage} - \text{Inventory Level}$$

$$Ullage = 800{,}000 - 384500 = 415500 \text{ Barrels}$$

- Ullage filling days:

$$\text{Ullage days} = \frac{\text{Ullage}}{Production}$$

$$Ullage\ Days = \frac{384500}{30000} = 13\ days$$