

# IS6055 Prescriptive Analytics Group Project

**Due Date: 12th April**

**Weight: 50% of module**

**Project report: A single pdf file which should be uploaded only by the group representative.**

## Planning Production and Transportation Activities at ABSA

You are an operations research analyst working at ABSA Oil. Your responsibilities include planning purchasing, production, and transportation activities. You are required to make recommendations to management, based upon your findings, to help them make data-driven decisions regarding ABSA operations.

For the ABSA, submit a detailed report:

- Overviewing the planning problem for ABSA.
- Describing all analyses that you carried out and models you built.
- Expressing all assumptions that you made and limitations of your analyses/models.
- Presenting your recommendations with visually appealing illustrations.
- Discussing in what possible ways your analyses can be extended in the future, and what additional data are needed for that purpose..

## ABSA Oil.

ABSA Oil is a global company, owning 4 refineries in Europe (Greece, Poland, Spain and the UK).

In these refineries, mainly 6 different types of petroleum products are produced, which are:

- 3 types of gasoline
  - 87 – Regular
  - 89 – Plus
  - 92 – Premium
- Jet Fuel
- Diesel Fuel
- Heating Oil

Each product is produced by blending 4 types of crude oils. These oils are supplied by:

- BP
- Chevron
- Petróleos de Venezuela
- Statoil

## All oils are not created equal.

The two most important properties determining a crude's value are its density (measured as API specific gravity) and its Sulphur content (measured per mass).

Crude oil is considered "heavy" if it has long hydrocarbon chains, or "light" if it has short hydrocarbon chains.

Crude Oil	Light	Medium	Heavy
API Gravity	34 or higher	31 - 33	30 or below

Crude is considered "sweet" if it is low in Sulphur content (<0.5%/weight), or "sour" if high (> 1.0%/weight). Generally, the higher the API gravity (the "lighter" it is), the more valuable the crude.

## ABSA's Suppliers.

Product Name	API gravity	Sulphur Content	Operating Company	Location of Field	Port of Sale
Azeri BTC	36.1	0.14%	BP	Azerbaijan	Ceyhan, Turkey
Poseidon Streams	29.6	1.97%	Chevron	United States	Houma
Laguna	10.9	5.4%	Petróleos de Venezuela	Venezuela	Puerto Miranda
Snøhvit Condensate	60.1	0.019%	Statoil	Norway	Melkøya

## Oil prices & supply quotas.

Product Name	Price per Barrel	Monthly supply quota (barrels)
Azeri BTC	\$57	645,000
Poseidon Streams	\$48	575,000
Laguna	\$35	550,000
Snøhvit Condensate	\$71	645,000

## Chartering.

The act of hiring a ship to carry cargo is called chartering. Tankers are hired by the following types of charter agreements:

- A **voyage charter** is the hiring of a vessel and crew for a voyage between a load port and a discharge port. The charterer pays the vessel owner on a per-ton or lump-sum basis. The owner pays the port costs (excluding stevedoring), fuel costs and crew costs. A voyage charter specifies a period, known as laytime, for loading and unloading the cargo. If laytime is exceeded, the charterer must pay demurrage. If laytime is saved, the charter party may require the shipowner to pay despatch to the charterer.
- A **Contract of Affreightment, COA**, is a contract similar to a voyage charter, but ship-owner undertakes to carry a number of cargoes within a specified period of time on a specified route. Agreed frequency of cargoes may require more than one ship.
- A **time charter** is the hiring of a vessel for a specific period of time; the owner still manages the vessel, but the charterer selects the ports and directs the vessel where to go. The charterer pays for all fuel the vessel consumes, port charges, commissions, and a daily hire to the owner of the vessel.
- A **trip time charter** is a comparatively short time charter agreed for a specified route only (as opposed to the standard time charter where charterer is free to employ the vessel within agreed trading areas).
- A **bareboat charter or demise charter** is an arrangement for the hiring of a vessel whereby no administration or technical maintenance is included as part of the agreement. The charterer obtains possession and full control of the vessel along with the legal and financial responsibility for it. The charterer pays for all operating expenses, including fuel, crew, port expenses and P&I and hull insurance. In commercial demise chartering, a subtype of bareboat chartering, the charter period may last for many years and may end with the charterer acquiring title (ownership) of the ship. In this case, a demise charter is a form of hire-purchase from the owners, who may well have been the shipbuilders. Demise chartering is common for tankers and bulk-carriers.
- A completed chartering contract is known as a **charter-party**.

## Freight rates.

One of the key aspects of any **charter-party** is the **freight rate**, or the price specified for carriage of cargo.

The freight rate of a tanker charter-party is specified in one of 4 ways:

- **Lump sum rate:** a fixed price is negotiated for the delivery of a specified cargo, and the ship's owner/operator is responsible to pay for all port costs and other voyage expenses.
- **Rate per ton:** used mostly in chemical tanker chartering and differ from lump sum rates in that port costs and voyage expenses are generally paid by the charterer.
- **Time charter equivalent rate:** specify a daily rate, and port costs and voyage expenses are also generally paid by the charterer.
- **The Worldwide Tanker Nominal Freight Scale**, often referred to as Worldscale rate, (U.S.\$ per ton of crude oil).

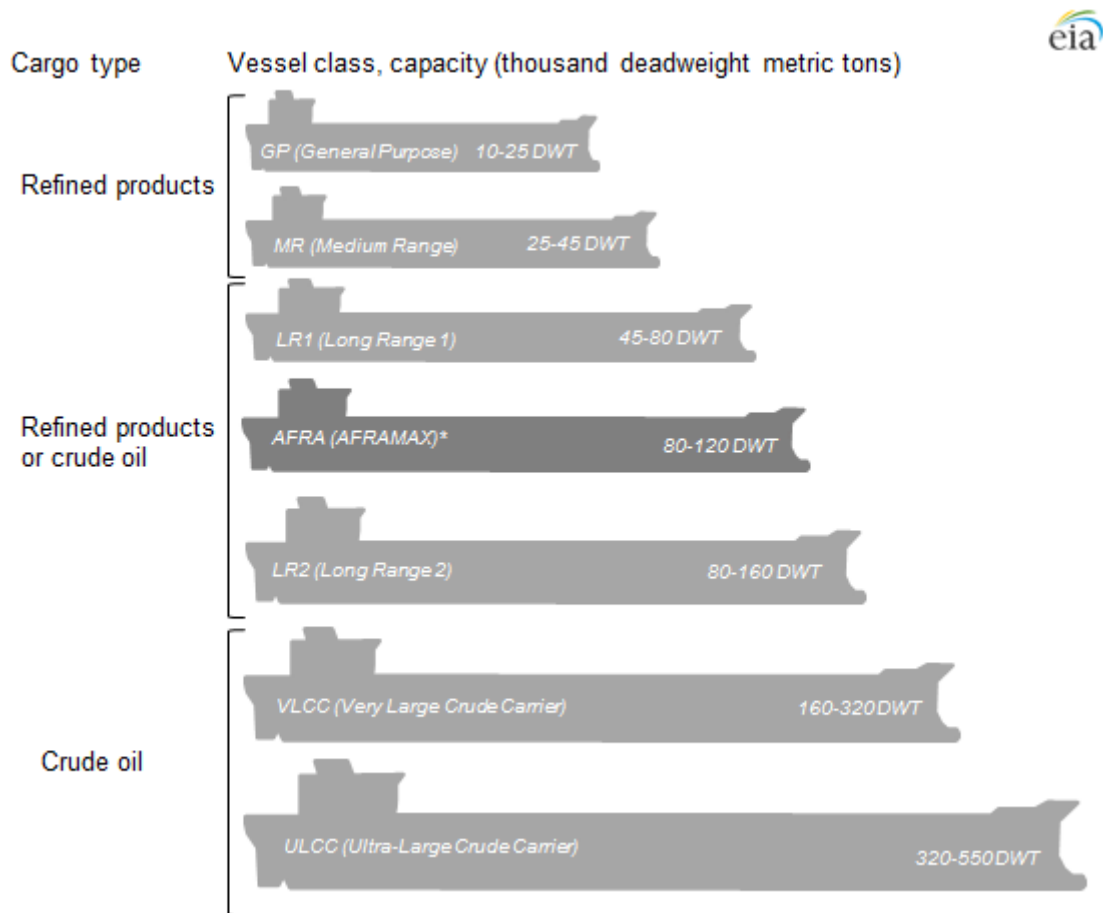
**Worldscale rate** is established and governed jointly by the Worldscale Associations of London and New York. Worldscale establishes a baseline price for carrying a metric ton of product between any two ports in the world.

In Worldscale negotiations, operators and charterers will determine a price based on a percentage of the Worldscale rate. The baseline rate is expressed as WS 100. If a given charter party settled on 85% of the Worldscale rate, it would be expressed as WS 85.

## AFRA Scale.

In 1954 Shell Oil developed the average freight rate assessment (AFRA) system which classifies tankers of different sizes.

In the below diagram, 1 DWT is equal to 8.45 Barrels.



## Available Tankers for "Trip Time Charter".

Class	Name	DWT	Rates	Name	DWT	Rates
GPT	Gudrun	10,000	\$13k	Rose	12,000	\$14k
	Ingeborg	24,300	\$22k	Cork Cat	25,000	\$23k
	Valborg	20,500	\$20k	Guam	22,350	\$21k
	Estrid	16,700	\$15k	Chance	17,340	\$16k
MRT	Ismini	32,000	\$25k	Viking	34,000	\$26k
	Signe	42,400	\$27k	Limerick	44,700	\$28k
	Venture	26,800	\$23k	York Gulls	28,650	\$25k
	Pretty World	37,450	\$25k	Lancaster	39,315	\$26k
LR1	PTI Volans	61,000	\$30k	Galway	66,000	\$31k
	Trinity	68,000	\$32k	Glasgow	77,000	\$33k
LR2	Garonne	110,000	\$41k	Thorpe	155,000	\$51k
	Torm Rhone	136,500	\$44k	Venus	160,000	\$56k

## Port charges & commissions.

Port of Sale	GPT	MRT	LR1	LR2
Ceyhan	\$109,000	\$112,000	\$124,000	\$135,000
Houma	\$111,000	\$114,000	\$138,000	\$159,000
Puerto Miranda	\$135,000	\$147,000	\$158,000	\$169,000
Melkøya	\$136,000	\$147,000	\$156,000	\$177,000

## Trips in days (speed at 15 knots).

Port of Sale	Greece	Poland	Spain	UK
Ceyhan	2	15	8	12
Houma	20	18	16	15
Puerto Miranda	19	20	14	15
Melkøya	11	3	4	3

## Fuel consumption (\$/h at 15 knots).

GPT	MRT	LR1	LR2
2,500	2,750	3,000	3,250

## Prices, Production costs, Specifications.

The sales price per barrel and the technical specifications of petroleum products are given below.

The cost of processing a barrel of crude oil at any refinery is \$19.

Oil	Sales price (per barrel)	API Gravity	Sulphur
Gasoline-87	\$90.45	40 to 50	< 1.6%
Gasoline-89	\$93.66	50 to 60	< 1.3%
Gasoline-92	\$95.50	60 to 70	< 1.1%
Jet fuel	\$61.25	40 to 45	< 2.2%
Diesel fuel	\$101.64	30 to 35	< 0.6%
Heating oil	\$66.36	24 to 32	< 3.5%



## Refinery capacities & regional demand.

ABSA considers it an obligation to meet demands (figures are in barrels).

<b>Oil</b>	<b>Greece</b>	<b>Poland</b>	<b>Spain</b>	<b>UK</b>
<b>Gasoline-87</b>	35,000	22,000	76,000	98,000
<b>Gasoline-89</b>	45,000	38,000	103,000	52,000
<b>Gasoline-92</b>	50,000	60,000	83,000	223,000
<b>Jet fuel</b>	20,000	25,000	47,000	127,000
<b>Diesel fuel</b>	75,000	35,000	125,000	87,000
<b>Heating oil</b>	25,000	205,000	30,000	13,000

Any excess production can be sold with a 7% discount on the sales prices.

	<b>Greece</b>	<b>Poland</b>	<b>Spain</b>	<b>UK</b>
<b>Oil Capacity</b>	400,000	540,000	625,000	735,000