1. Introduction - Liquid Bulk Market in Santos

First, it is important to define the relevant market for the handling and storage of liquid bulk in the Port Santos Complex, which is composed of the organized port of Santos and the following private terminals:

- TUP DP World Santos;
- TUP Sucrocítrico Cutrale;
- TUP Dow Brasil Sudeste (Dow Maritime Terminal);
- Luiz Antônio Mosque Port Integrator Terminal (Tiplam);
- Private Maritime Terminal of Cubatão (TMPC) owned by Usina Siderúrgica de Minas Gerais - Usiminas;
- Saipem (base for Pipeline Logistics).

In this sense, as the focus of the study is the relevant market for petroleum by-products and chemicals, the private terminals of DP World Santos, Sucrocítrico Cutrale, Private Maritime Terminal of Cubatão (TMPC) and Saipem were excluded from the analysis, as these terminals handle other products that are not of interest to this study.

The handling and storage of petroleum by-products and chemicals on the Right Bank of the Port of Santos occurs at the liquid bulk terminals of the Alamoa region. Specifically, the region houses the following liquid bulk players: Vopak, Ultracargo, Stolthaven, Granel and Transpetro. On the Left Bank, the liquid bulk operation is concentrated at Barnabé Island's Ageo and Adonai Química. The Dow and Tiplam terminals also operate petroleum by-products and chemicals. The following table presents historical throughput statistics for the terminals mentioned above.

Terminal	2016	%	2017	%	2018	%	average	%
Alamoa Transpetro	5.390.566	45%	5.998.696	45%	5.597.815	43%	5.662.359	44%
Alamoa Others	1.927.326	16%	2.333.316	17%	2.487.362	19%	2.249.335	18%
Barnabé Island	3.538.951	30%	4.040.323	30%	3.915.373	30%	3.831.549	30%
DOW	654.419	6%	697.196	5%	712.323	5%	687.979	5%
Tiplam	339.036	3%	281.265	2%	373.556	3%	331.286	3%
Total in ton	11.850.298	100%	13.350.796	100%	13.086.429	100%	12.762.508	100%

Table 1: time series of historical throughput in metric tons Santos 2016 - 2018.
Source: Antaq Statistical Yearbook, adapted by the author.

Given the great dispersion of throughput levels as seen in table 1, it can be inferred that the nature of liquid bulk operations in each terminal must greatly affect the level of products handled at any given year. Thus, a valid study must map these different characteristics in order to adequately reflect them in the financial model.

In the case of **Tiplam,** its **main** operation is focused mostly on solid bulk. T Tiplam's liquid bulk market is part of the agricultural value chain, as it mostly handles raw materials such as ammonia and sulfur for the production of fertilizers. The relevance of ammonia to Tiplam's overall operation is quite insignificant, representing less than 3% of its total throughput. Henceforth, while Tiplam handles some liquid bulk, the terminal is mainly a solid bulk terminal.

The Dow Terminal handles and stores caustic soda and other chemicals products. In 2018, Dow was responsible for approximately 50% of the caustic soda handled at the Port of Santos. Furthermore, the terminal's position on Dow's value chain means that it deals mostly with imports and cabotage lines. Furthermore, the company manufactures Caustic Soda at its plant in Candeias (BA) and ships the product to its own Port terminal in Aratu (BA). Dow's terminal throughput dynamics in Santos depends on a verticalized operation and are focused mostly on the company's own cargo.

The Terminals of Barnabé Island handle Petroleum by-products, Ethanol, Chemicals, Caustic Soda, and Kaolin. There is great diversity in the types of cargo handled in this area, each requiring a high degree of operating specialization. Moreover, the storing of industrial chemicals, the Island's most important activity, is used by nearby plants as an extension of their own inventory, causing overall tank turnover to be quite low. The following table shows the average historical turnover on the Island.

ANNUAL INVENTORY TURNOVER – BARNABÉ ISLAND						
2012 (t)	2013 (t)	2014 (t)	2015 (t)	2016 (t)	2017 (t)	2018 (t)
2.064.067	1.975.186	1.757.989	2.631.865	3.428.908	4.040.323	3.915.373
478.897	478.897	478.897	478.897	525.150	525.150	525.150
4,31	4,12	3,67	5,50	6,57	7,69	7,46

Table 2 - Average Inventory Turnover for the terminals on Barnabé Island.
Source: Prepared by the author using Antaq database.

Vopak, Ultracargo, Stolthaven, Granel and Transpetro operate in the **Alamoa** region, handling and storing liquid bulk. Amongst the terminals in Alamoa, Transpetro specializes in the handling of heavy and light petroleum from State of São Paulo´s refineries, and LPG while the other terminals deal with a wider range of liquid bulk products, and mostly industrial chemicals. As a subsidiary of Petrobras, Transpetro's operation are focused on shipping its parent company's refineries' final product, in an interconnected system of pipelines, yielding an average turnover of 28 times a year. Meanwhile, the terminals of Vopak, Ultracargo, Granel and Stolthaven, located outside the area Organized Port of Santos, handle mainly chemicals, ethanol, caustic soda, and vegetable oil, resulting in a much lower turnover of less than 8 times a year.

In 2018, the Alamoa region annual throughput was 8,085,177 tons of petroleum by-products and other chemicals. Transpetro accounted for 6,080,303 tons (75%), while the remaining 2,004,874 tons (25%) was distributed amongst all the other terminals.

In conclusion, Transpetro's higher productivity is as much an effect of its integrated, specialized, logistical system as it is the natural consequence of higher output dynamics in petroleum by-products' market vis a vis industrial chemicals.

1.1 Market Analysis of Petroleum by-products

This section presents the market analysis for the lease area **STS08A,** intended for the handling and storage of liquid bulk, as designated by the Federal Government's plans.

The market analysis chapter elaborates on two main topics: throughput and price projection for the entire contractual horizon. The objective is to verify the economic viability of the enterprise under the prevailing market conditions, guiding the dimensions and the size of the project.

Projections were prepared to:

- Assess the scale and design of the necessary facilities;
- Build a financial model to assess the projects' economic viability; and
- Establish the appropriate contractual terms for the operation of the area/facility.

2. The Market for Petroleum by-products in Brazil

The market for liquid and gaseous fuels in Brazil is composed of petroleum by-products such as liquefied petroleum gas – LPG, gasoline, diesel oil, heavy fuel oil, aviation kerosene, and biofuels, especially ethanol and biodiesel.

According to The Energy Research Company (EPE), total energy demand for the transportation sector will increase on average, 2.4% p.a. between 2019 and 2029, driven by growth of demand for diesel oil and aviation kerosene. The fundamentals for these growth projections rely on the expected growth in the Agribusiness sector and the recovery of aggregate demand in civil construction and retail sectors, both dependent on roadway transportation.

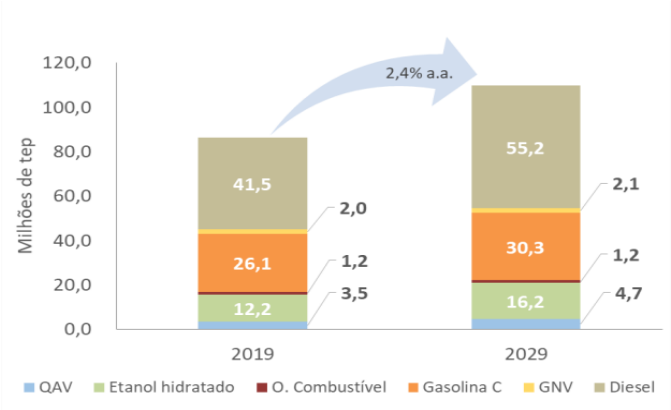


Figure 1: Energy demand for the transportation sector.
Source: PDE/2029.

Diesel oil is the most widely used liquid fuel in Brazil. Diesel oil powers internal combustion and compression ignition engines used in road, rail, and marine transportation, as well as in electric power generators.

This study also took into account the fact that part of the increase in demand for diesel is partially offset by an increase in biodiesel. In fact, according to Resolution No. 16, of October 29, 2018, of the National Energy Policy Council (CNPE), the mandatory minimum increase in the percentage of biodiesel went into effect in 2019 and will get progressively higher until 2022. The study considered the official schedule set forth in the Resolution and reproduced it in the table below:

Initial dates of minimum required quotas	On 01/6/2019 or 03 months after the completion of required tests and clinical trials, as provided for in Art. 1, whichever deadline is longer.	01/03/2020	01/03/2021	01/03/2022
Minimum percentages of mandatory biodiesel composition.	11%	12%	13%	15%

Table 3 - Schedule for the addition of biodiesel to diesel oil.
Source: CNPE Resolution No. 16.

Nevertheless, despite the addition of internally sourced biodiesel to diesel fuel's composition, the country is expected to continue importing type A volumes of diesel oil, given that the growth in demand is driven by the transportation sector.

The Brazilian dynamics of fuel supply are mostly determined by the logic of transferring fuel surpluses from one region to another with a deficit.

Figure 2 shows that Brazil's Midwest is the only region with no offsetting fuel production of its own. Moreover, the Midwest is likely to continue to be 100% dependent on inter-regional transfer until at least 2029. The two diagrams below surmise the level of inter-regional fuel dependence discussed above:

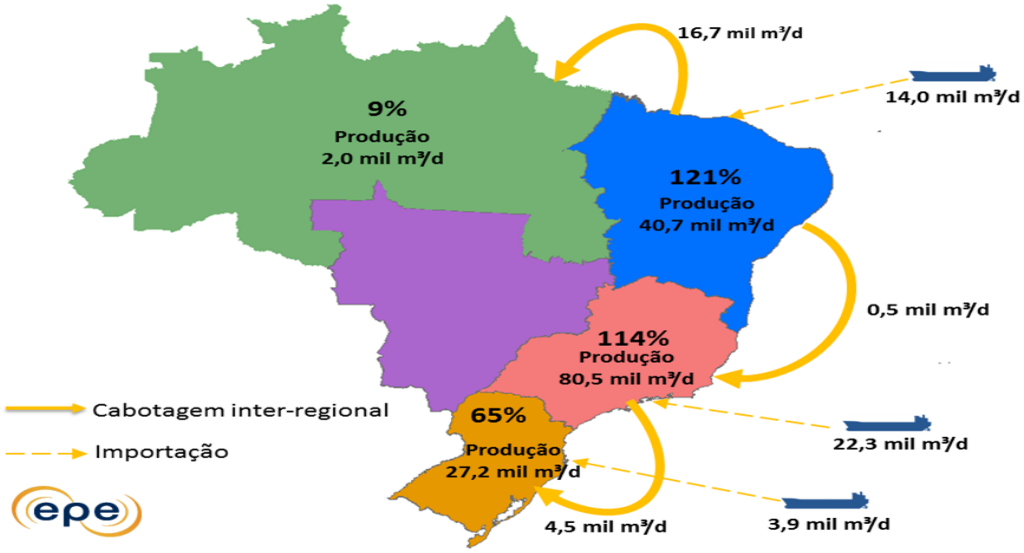


Figure 2: Meeting inter-regional diesel oil dependence (import & cabotage lines).
Source: PDE/2029.

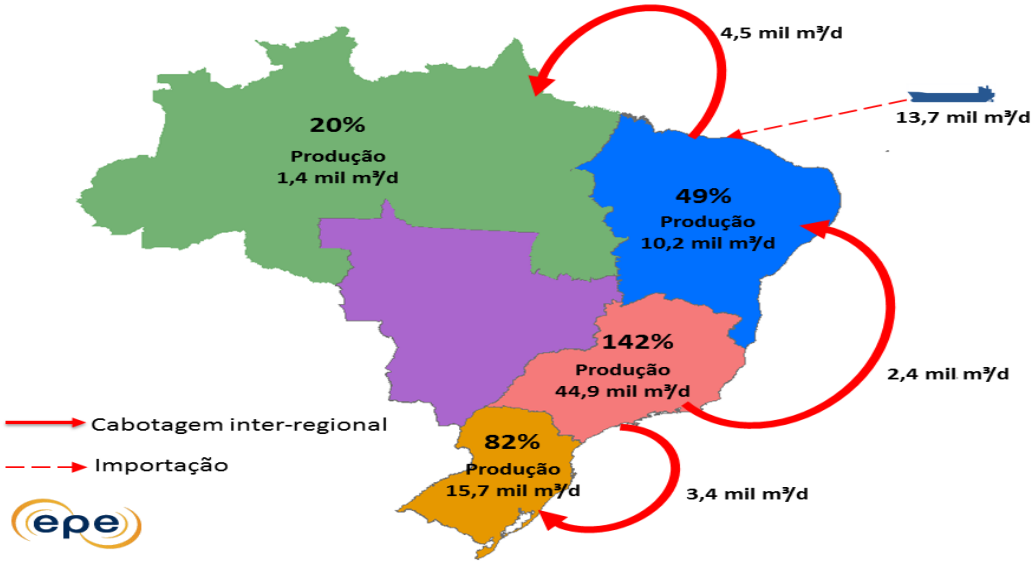


Figure 3: Meeting inter-regional gasoline dependence (import & cabotage lines).
Source: PDE/2029.

Gasoline is the second most highly consumed fuel in Brazil, coming just behind diesel oil. The types of gasolines sold in the country are the following: gasoline A (without ethanol), sold by producers and importers of gasoline; and gasoline C, containing 27% of anhydrous ethanol, sold to gas stations and then to final consumers.

Regarding heavy fuel oil, the country is expected to become a net exporter of this product. In the domestic market, this fuel is used to power industrial processes, thermal power plants and long-haul/cabotage vessels (bunker).

According to information from PDE/2029, Brazilian crude extracted from the pre-salt layer generally has a low sulfur content, enabling the production of a bunker with 0.5% sulfur, which meets the new specifications of IMO 2020. This poses a commercial opportunity for refining companies.

Regarding the organization of the Brazilian fuel market according to the National Agency of Petroleum, Natural Gas and Biofuels - ANP, the sector is segmented as follows: suppliers, distributors, retailers, and consumers.

It is important to highlight that in Brazil, fuel supply markets have gradually opened up, ever since the Petroleum Law of 1997 went into effect. In short, the new law broke up state monopoly on fuel supply, allowed free competition, extinguished several subsidies, and terminated import controls. According to industry data, Petrobras still has a hegemonic position in the supply of fossil-fuel products in the Brazilian market; however, its participation has been decreasing over the last few years, as a greater number of agents entered the market, making it less concentrated.

This situation is attested to by the increase in the number of no-brand gas stations. In 2016, such gas stations accounted for 41.1% of the gas stations in the country, according to the ANP.

The following figure shows segmentation and key industry numbers.

Figure 4: Fuel Supply Agents in Brazil.
Source: Management Bulletin No. 53 - December/2016, Supply Superintendence of ANP.

In general, competition between companies occurs mainly at the logistical level. Hence, given the pivotal role of logistical costs in the formation of the final price, the tendency is that competition will intensify as distribution centers get closer to the center of demand.

Amongst the several demand forecasts evaluated, the one selected for its highest degree of relevance to this study was the "Ten-Year Energy Expansion Plan - PDE 2029", of the Energy Research Company (EPE), linked to the Ministry of Mines and Energy (MME). The PDE 2029 provides regional fuel consumption forecasts up to the end of 2029.

However, PDE's 2029 forecast considering only a 10-year time horizon would be insufficient to cover **STS08A's** long-term lease structure, which runs for 25 years.

Thus, EPL requested that EPE reformulate its demand forecast for petroleum by-products and biofuels so as to cover **STS08A's** relevant time horizon. Thus, EPE through its Superintendence of Petroleum by-products and Biofuels issued Clarification Note - NE-EPE-DPG-SDB-02, showing EPL's requested forecast for the country's Southeast and Midwest.

Additionally, due to covid-19's impacts on the national market for petroleum by-products and biofuels, EPE also issued Clarification Note – **NE-EPE-DPG-SDB-2020-11** in which it updates the demand projections for petroleum by-products and biofuels at the national and regional level (Southeast and Midwest).

2.1 Liquefied Petroleum Gas Market in Brazil- LPG

LPG is the main source of energy used in Brazilian households. LPG has a robust distribution network throughout the country. According to EPE, the national demand for LPG is expected to increase at a rate of around 0.3% p.a. for the period from 2020 to 2045. In the case of STS08A, its LPG demand is driven by growth in the country's Southeast and Midwest regions, as they lie within the terminal's area of influence.

LPG is produced in refineries, natural gas processing units (UPGNs) and petrochemical plants. The national production of LPG is not enough to meet all national demand. Thus, LPG supply is complemented by imports that enter Brazil mainly through the ports of Suape (approximately 67%) and Santos (approximately 27%).

However, this study identified a possible decrease in LPG imports, given the expansion of **Natural Gas Processing Units** (LPUs)**. More** specifically, PDE mapped the two following significant projects: Comperj, which is likely to start up operations by 2021; and the development of a natural gas production operation in the Sergipe-Alagoas Basin. Thus, on page number 286 of the PDE report table 11-12 showing falling import demand during the 10 years between 2019 and 2029.

Projections of Petroleum by-products – EPE							
Southeast	2020 (m^3)	2030 (m^3)	2040 (m^3)	2045 (m^3)	2020-2030	2030-2040	2020-2045
GLP	3.283	3.573	3.866	3.977	0,85%	0,79%	0,77%
Midwest	2020	2030	2040	2045	2020-2030	2030-2040	2020-2045
GLP	1.120	1.299	1.438	1.482	1,49%	1,0%	1,1%
Grand Total	**3.140**	**3.329**	**3.478**	**3.527**	**0,59%**	**0,4%**	**0,5%**

Table 4: LPG Demand Growth Rate.
Source: from the Clarification Note - EPE.

Summary Results – EPE				
Internal Energy Supply - LPG m^3 (MM)				
	2019	2024	2029	% 2019-2029
Production	10,5	13,3	15,1	43,8%
Imports	3,5	2,2	1,8	-48,6%

Table 5: Growth/Decrease Rate of LPG Production and Import.
Source: from PDE/2029.

Faced with the prospect of growth in the Brazilian market in the coming years, EPE´s conclusion is that investments in the country's logistical infrastructure are required to ensure adequate supply of energy.

For the future scenario, several government studies estimate the consumption of petroleum by-products in Brazil. These studies form the database used to arrive at a demand for petroleum by-products at the level of the Port of Santos, which will be shown in the coming chapters.

3. Throughput Projection

3.1. Methodology

Demand projections were structured in two stages, reflecting two major blocks of competitive evaluation, namely, macro demand analysis and micro demand analysis.

In the macro demand analysis, the study seeks to identify how cargo is produced and consumed in the country and how it might flow to or from the country's Ports. Hence, such scenario corresponds an inter-port competition.

For micro demand, the study seeks to identify how cargoes destined to a Port Complex are distributed amongst existing terminals. This scenario reflects the intra-port competition.

The potential demand for port facilities in Brazil has been the subject of several studies at the national and regional levels. For the estimation of potential demand related to **STS08A,** the following studies were the basis for the demand projection:

- Note of clarification – NE-EPE-DPG-SDB-2020-11;

- 10-Year Energy Expansion Plan - PDE 2029, energy research company - EPE; [1]and
- Time series of the historical volumes handled in the Alamoa Terminal during the last five years, by Product and by Point of Reception and Delivery, sourced from ANP Ordinance No. 251, of 11/07/2000;
- Master Plan for the Santos Port Complex (2019);
- National Logistics Plan - PNLP (2019).

At the national level, these studies are the official planning instruments of the port and energy sectors, used for the purpose of attracting investments and identifying opportunities.

Within the port sector, these studies enable the participation of civil society in the development of ports as well as their relationship with cities and the environment. This allows the insights to be integrated into the policies for the expansion of the national transport infrastructure and for the rational use of government funds.

3.1.1. National Port Logistics Plan - PNLP

Within the port sector, the PNLP is the instrument with the broadest scope in terms of planning and aims to give civil society and policy makers a high-level, long-term view of the adequacy of the country's ports in regard to capacity, operations logistics and access to meet future demand.

With regard to cargo projections, the PNLP organizes the country's ports under several different clusters. For more details, see the report " Projeção de Demanda e Carregamento da Malha – Ano base 2018" of the PNLP (2019).

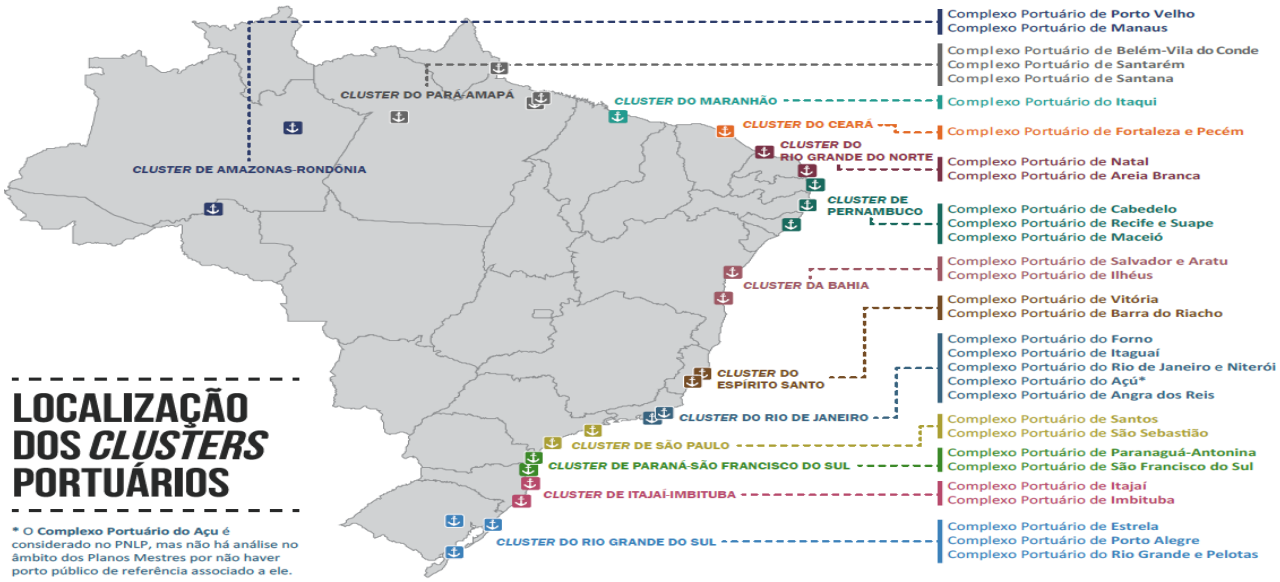


Figure 5 - Location of Port Clusters.
Source: "Projeção de Demanda e Carregamento da Malha – Ano base 2018" (PNLP, 2019).

[1] EPE. ENERGY RESEARCH COMPANY, (2019). 10-Year Energy Expansion Plan - PDE 2029. Available in <http://www.epe.gov.br/pt/publicacoes-dados-abertos/publicacoes/plano-decenal-de-expansao-de-energia-pde>, accessed February 2020.

The rationale for organizing forecasts under a cluster of ports assumes that ports within the same cluster compete to handle some or most of the same cargo.

The downside of using this methodology is the lack of Port level demand forecasts, as the highest granularity of forecasted volumes is the cluster, which may have several ports under it. Furthermore, especially in the case of the Port of Santos, where there are several terminals that specialize in the same type of cargo, the projections are also of little help in allocating demand to the relevant terminals within the port.

The upside is that the methodology follows three simple steps: (1) projection of demand flows from Brazil, (2) its allocation in *port clusters* and (3) validation/adjustments of results.

The demand projection uses an econometric model that explains historical behavior of a given cargo demand as it responds to changes in variables believed to drive exports, imports and cabotage volume. Among these variables, the study highlights GDP, exchange rates and average price in (only for *commodities).* Thus, it is assumed that a positive change in income results in a positive impact on cargo demand, and that an increase in the exchange rate (devaluation of the Brazilian real) has a negative impact on imports, but positive impact on exports. In addition, the model also considers that there is information in the past values of volumes themselves, which is not captured by the other external variables. Hence, the model assumes an inertia-based variable, which is related to the historical volume trend pattern.

After generating an array of projected volumes, segmented by source-destination, the next step is to allocate these demands *to each national* port cluster, optimizing the selection according to the lowest possible logistical *cost*. Implementation depends on a mathematical algorithm, where the georeferenced analysis system evaluates and selects the best alternatives for cargo flow, based on three main parameters: origin-destination matrix, logistics network and logistics costs. It is worth noting that, in addition to the existing logistics network, the analysis encompasses different infrastructure scenarios, where mapped expansions of roads, railways and waterways contemplated in the Federal Government´s plans become part of the transportation network planned for 2025, 2035, 2045 and 2055 , are considered and may change the previously optimal route.

The last stage of evaluation in the PNLP and the Master Plan for The Port of Santos refers to modeled results which are checked during technical visits to the Port Authority and its users. The interviews conducted during this stage allow for the gathering of information that is not found in historical statistics, such as: new investments, development of new products/markets, and other commercial decisions. Finally, relevant information gathered during the technical visits is incorporated in the model and the final demand scenarios are created.

Such scenarios seek to assimilate the inherent uncertainty in demand projections. Namely, this study assumes three possible states: a base case, with demand at trend level and two others with demand above and below the trend. The level of each state is established by changing assumptions in relation to one or more independent variables. In the projections of economic variables, such as cargo volume at ports, it is of fundamental importance to evaluate the uncertainty of the estimated parameters. As such, in this study, scenario formulation considers the two following types of shocks:

» **Type 1 Shock**: Considers different GDP growth paths for Brazil and its main trading partners. For optimistic and pessimistic scenarios, the study considers the average deviation and elasticity of Brazil's GDP and of its main trading partners.

» **Type 2 Shock**: This shock has more of a qualitative nature as it depends on input from interviews with the relevant industry players and institutions. This shock aims to incorporate changes in the level of throughput projection, resulting from possible investments in new production facilities, such as new plants and expansions of existing manufacturing units. It is worth noting that for such shock to be eligible for consideration in the demand forecast, the industry agent supplying the information must corroborate it by providing planning authorities with some relevant documentation, proving that the project is likely to be concluded.

3.1.2. Master Plan of the Port Complex of Santos

With the same perspective of macro demand, but addressing the Port Complex, and no longer a *Cluster,* the ***Master Plan*** is the Government´s planning instrument at the port unit level. In essence, the series of master plans aim at transferring the methodology insight and directives contained in the National Port Logistics Plan - PNLP, to each individual port. Likewise, findings from the Master Plan are used to direct actions, improvements, as well as short, medium, and long-term investments in each port.

The obvious advantage of using the Master Plan as a basis for generating forecasts is its higher level of granularity, encompassing demand at the level of the port. Hence, it is possible to directly identify macro demand for the Port Complex, which may eventually involve the Organized Port and Private Terminals located in nearby areas. In such cases, the competition between them resembles an intra-port competition.

On the other hand, it is worth mentioning that the Master Plan's granularity still does not drill down to the level of demand projection for each terminal within a Port Unit. Thus, in these types of studies, macro demand is based on the Master Plan's forecast, and relies on its own methodology to arrive at the individual terminal's micro demand.

Hence, these studies assume that micro demand allocation is basically a function of size and number of current and future players. Future facility sizing uses static storage capacity projections as proxy for total demand to be absorbed by this new terminal.

In cases where the terminal is operational, the terminal's current share of the demand is taken into account and includes a gradual convergence towards long-term, equilibrium . Equilibrium is defined as the point at which the terminal's market share equals the percentage of total capacity that terminal represents.

Finally, after determining the Port Complex's macro demand and allocating it to the level of the terminal, the enterprise can be evaluated, and its viability ascertained.

However, in the specific case of STS08 & **08A**, the demand forecast could not be based on the demand forecast established by the Master Plan for the Port of Santos Complex, due to the following reasons:

- Petrobras's Strategic Repositioning involving divestment of several of its assets, after which Petrobras will concentrate its operations on the exploration and production of oil and gas;
- Petrobras entered into a Termination Agreement with Brazil's anti-trust agency (CADE) through which Petrobras commits to sell eight oil refineries and assets related to the transportation of petroleum by-products.
- Publication of Resolution No. 9 of May 9, 2019, which establishes the guidelines to drive free competition in Brazil-s refining sector.

Therefore, this study decided to use Clarification Note - NE-EPE-DPG-SDB-2020-11 and the Ten-Year Energy Expansion Plan - PDE 2029 in its forecast as these instruments represent more adequately the new market dynamics going forward.

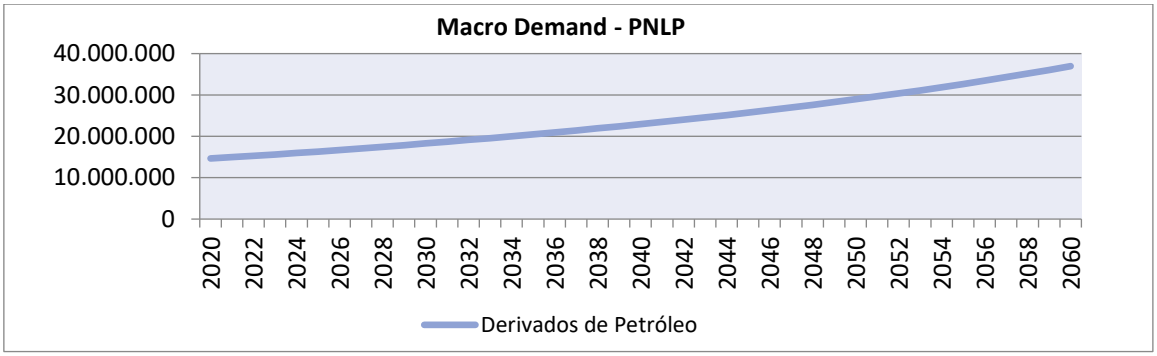
Macro Demand

The area known as **STS08A** is located in the Organized Port of Santos, part of the São Paulo Cluster. According to data in the report "Projeção de Demanda e Carregamento da Malha " (Base Year 2018), published in 2019, total petroleum by-products' demand predicted for the period 2020 to 2060 yields an average growth rate of 2.34%, as shown in the following table.

SAO PAULO CLUSTER	
Year	**EVOLUTION (%)**
2018 – 2025	2,14%
2025 – 2035	2,32%
2035 – 2045	2,30%
2045 – 2055	2,41%
2055 – 2060	2,53%
2020 – 2060	**2,34%**
2020 – 2045	**2,27%**

Table 6: Demand projection for petroleum by-products in São Paulo cluster.
Source: " Projeção de Demanda e Carregamento da Malha " (Base Year, 2018).

Also, according to the PNLP, the expected demand for petroleum by-products is expected to come to 37 million tons by 2060. The following graph shows PNLP's forecasted volumes for the cluster.



Graph 1: Base scenario for Petroleum by-products throughput in the São Paulo Cluster (in tons).
Source: created by the author with data from PNLP (2019).

As the port of Santos is the only Port in the cluster of São Paulo that handles finished petroleum by-products, the dynamic forecasted for the cluster represents the exact same dynamic at the port level.

However, as pointed out before, the PLNP forecast still would not have the required granularity at the terminal level, which curtails the projections' usefulness for this project.

Furthermore, in the case of STS08 & **STS08A** the market dynamics behind macro and micro demand are bound to be quite different. Namely, **STS08A's** demand is a function of São Paulo refineries' own demand, as well as the overall market demand potential.

The terminal's reliance on its refineries located in the nearby hinterland can be historically ascertained through ANP's Ordinance Number 251 of 07/11/2020, whereby the agency shows Transpetro's historical volume between 2014 and 2019, dividing it into different products and into points of reception/delivery.

From the rates of change presented in EPE's Clarification Note - NE-EPE-DPG-SDB-2020-11 and in the Ten-Year Energy Expansion Plan - PDE 2029, it is possible to estimate the port's trend volume scenario for the 25-year time horizon. In view of **STS08A's** broad area of influence, the relevant growth rates for projecting the terminal's future volume corresponds to EPE's expected average for the country. The following table shows the relevant products and their respective growth rates considered in the terminal's evaluation.

EPE Update/ 08/21/2020 in m³/year x 1000							
Projections of Petroleum by-products - EPE - Brazil							
National	2020	2030	2040	2045	**2020-2030**	**2030-2040**	**2020-2045**
Gasoline A	24.487	27.317	33.942	34.394	**1,10%**	**2,20%**	**1,37%**
Diesel oil A	50.574	69.106	80.200	85.845	**3,17%**	**1,50%**	**2,14%**
Heavy Fuel oil *(bunker)*	4.742	6.637	8.251	9.115	**3,42%**	**2,20%**	**2,65%**
Total	79.803	103.060	122.393	129.354	**2,59%**	**1,73%**	**1,95%**

Table 7: Fuel Demand Growth Rate.
Source: Clarification Note - EPE.

Thus, the present study adopts the information given in the EPE's Clarification Note - NE-EPE-DPG-SDB-02/2020 and in the 10-year Energy Expansion Plan - PDE 2029, which contains s more recent and accurate information than the information found in the Government´s planning instruments.

Nevertheless, the Government's PNLP (2019) does show some convergence with EPE's assessment, as the planning instrument's growth rate for the same period was 2.27%. Indeed, EPE's projection for petroleum by-products lies only 32 basis points below PNLP's trend at 1.95% p.a.

Finally, as terminal **STS08A (Current)** is in operation, it is possible to use its actual, most recent, historical volumes to set base throughput for forecasted volumes. As such, the following table brings the relevant historical throughput data at the terminal level, during the period 2014 – 2019.

Product/t	2014	2015	2016	2017	2018	2019
Diesel	2.127.366	1.659.369	1.481.099	1.920.103	1.906.799	1.246.242
LPG	994.384	1.011.358	1.202.378	907.003	877.643	732.676
Gasoline	1.232.498	1.113.701	1.003.364	1.278.956	1.273.274	1.281.543
Heavy Fuel Oil	3.841.804	3.982.518	3.227.510	3.471.868	3.071.772	3.215.337
TOTAL	**8.196.053**	**7.766.947**	**6.914.351**	**7.577.930**	**7.129.488**	**6.475.798**

Table 8: History of petroleum by-products handled in tons in the Port of Santos 2014 – 2019, by Transpetro.
Source: Resolution No. 251/ANP.

Thus, for matters relating to the evaluation of STS08 & **STS08A's** viability**,** base throughput value was set to 2019's level.

It is worth pointing out that, under current specifications, STS08 and **STS08A** are used as a tool for Petrobras's inventory/production management. Namely, Transpetro aids its parent company by engaging in the following activities: transferring and receiving products from vessels, supplying fuel to vessels (Bunker) moored at the Port of Santos, shipment of products from refineries, and sending LPG to distribution companies located in the Southeast and Midwest.

Other than the standard diesel and gasoline fuels, a key product handled only by this terminal is Bunker. Indeed, the Santos Port Complex is responsible for approximately 40% of supply of bunker in the country, through the terminals located in the Alamoa/Santos region. Bunker is composed of an uneven mixture between heavy fuel and diesel oil, where heavy fuel oil makes up the largest share of the mixture.

Hence, given bunker's relevance to the overall volume handled at the future terminal, and this product's absence from official port statistics, the authors of this study requested a special report from the Port Authority, highlighting historical Vessel fuel consumption. The report showed that Vessel's bunker demand represents 53.73% of total heavy fuel oil handled at Transpetro's terminal. Thus, the study modeled future Bunker demand assuming this same percentage will continue in the future. The following table shows the results from SPA's report:

Vessel's Fuel Consumption	2018	2017	2016	2015	2014
Diesel	18	18	18	18	18
Bunker	1.714	1.714	1.714	1.714	1.714
Total (t)	1.732	1.732	1.732	1.732	1.732
Total participation	60,27%	54,22%	57,16%	49,72%	47,28%
Average	53,73%				

Table 9: Time series of vessel consumption in tons at the Port of Santos 2014 - 2018.
Source: SPA

For the macro demand trend scenario projection, the study utilized EPE's estimated future rates of change, as per Clarification Note - NE-EPE-DPG-SDB-2020-11 and 10-year Energy Expansion Plan - PDE 2029. As mentioned before, the study used 2019 as base throughput. As for the pessimistic and optimistic scenarios, the study assumed 30 basis points above trend for the latter and 20 basis points below for the former.

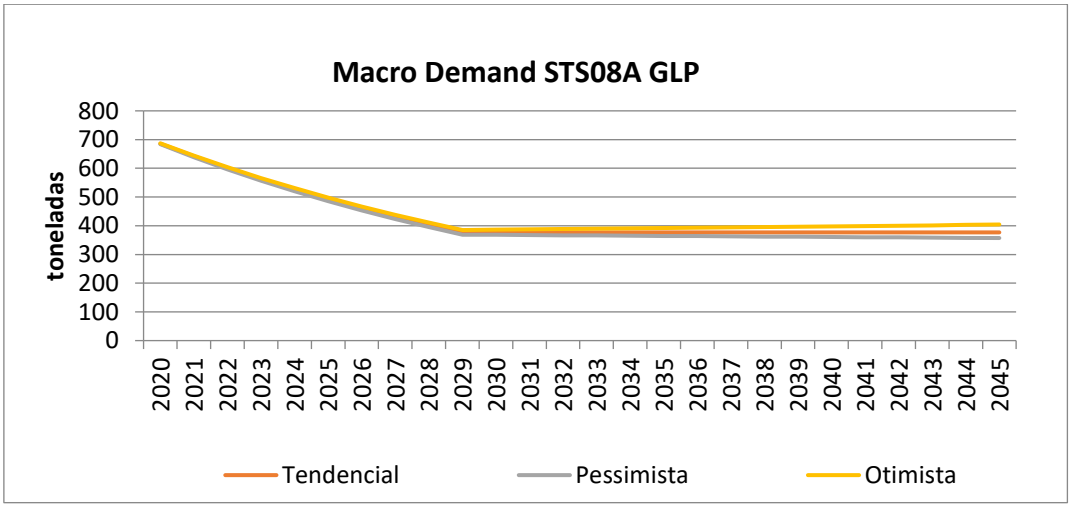
Thus, this study sought to increase the relevance of the results found for **STS08A** by using the most robust industry forecasts. Furthermore, such practice is of special significance given that this contract is expected to be signed in 2021 and to remain in effect for the next 25 years, The contract will expire in 2045.

The following tables show the expected macro demand for petroleum by-products and GLP handled each year at & **STS08A**. The individual demand for **STS08A** will be a share of the overall macro demand presented below. For LGP's , we used the rates presented in table 5.

MACRO DEMAND STS08A - Santos Port Complex
Liquid Bulk (LPG)

DEMAND SCENARIOS (ton)			
year	Trend	pessimistic	optimistic
2020	686	684	687
2021	641	639	644
2022	600	596	604
2023	562	557	566
2024	525	520	531
2025	492	485	498
2026	460	453	467
2027	430	423	438
2028	403	395	411
2029	377	369	385
2030	377	368	386
2031	377	367	387
2032	377	367	388
2033	377	366	390
2034	377	365	391
2035	377	364	392
2036	377	364	393
2037	377	363	394
2038	377	362	395
2039	377	362	397
2040	377	361	398
2041	377	360	399
2042	377	359	400
2043	377	359	401
2044	377	358	403
2045	377	357	404

Table 10: Macro Demand Projection for **STS08A**, period 2020 - 2045.
Source: based on EPE growth rates (2020).

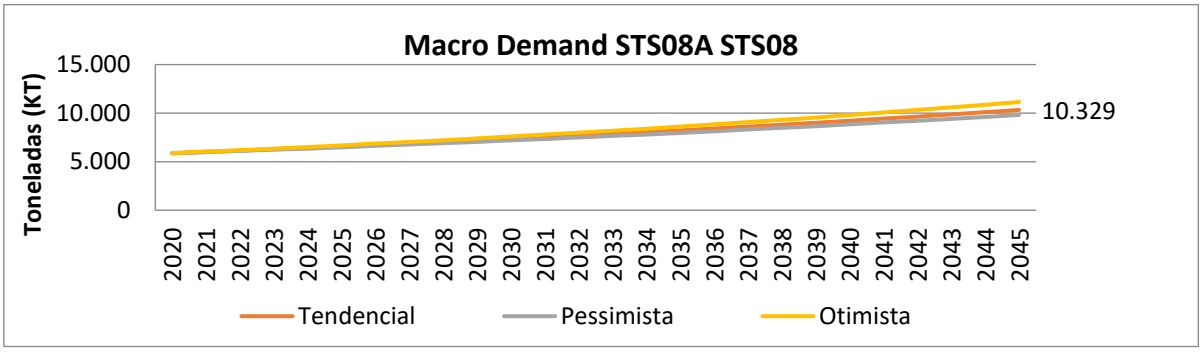


Graph 2: Projection for LPG volume in the Santos Port Complex.
Source: based on EPE growth rates (2020).

MACRO DEMAND STS08A STS08 - Santos Port Complex - Petroleum by-products			
DEMAND SCENARIOS (ton '000)			
year	Trend	pessimist	optimistic
2020	5.872	5.861	5.890
2021	6.005	5.981	6.040
2022	6.140	6.104	6.195
2023	6.279	6.230	6.353
2024	6.421	6.359	6.516
2025	6.567	6.490	6.683
2026	6.716	6.624	6.855
2027	6.868	6.761	7.031
2028	7.024	6.901	7.212
2029	7.184	7.045	7.397
2030	7.348	7.191	7.588
2031	7.515	7.341	7.784
2032	7.687	7.493	7.985
2033	7.862	7.650	8.191
2034	8.042	7.809	8.403
2035	8.226	7.973	8.621
2036	8.415	8.139	8.844
2037	8.608	8.310	9.074
2038	8.806	8.484	9.309
2039	9.008	8.662	9.551
2040	9.215	8.844	9.800
2041	9.428	9.030	10.055
2042	9.645	9.221	10.317
2043	9.868	9.415	10.586
2044	10.096	9.614	10.863
2045	10.329	9.817	11.146

Table 11: Macro Demand Projection for STS08 & **STS08A** 2020 - 2045.
Source: based on EPE growth rates (2020).

For illustration purposes, the following graph shows the variations between the different scenarios.



Graph 3: Volume projection for different scenarios at the Santos Port Complex.
Source: based on EPE's growth rates (2020).

After projecting overall liquid bulk macro demand at the Alamoa terminal under different scenarios, the study's next step is to use these results to estimate **STS08A's** micro demand.

3.3. Micro Demand

To estimate port demand at **STS08A's** terminal level, the study conducted an evaluation of the competitive market dynamics at the Port Complex level, including analysis of the current and future capacity of existing and projected facilities in the region of influence.

In this sense, the current capacity of the existing facilities in the Port of Santos Complex was determined based on the following information and assumptions:

- Division and Expansion of the original lease area **STS08A**;
- Estimated average inventory turnover;
- Estimated share of storage capacity;
- Static capacity of existing installations;
- Operational transition rule for Terminals **STS08A** and STS08.

The existing **STS08A** liquid bulk terminal is in operation, but under a precarious contractual situation, due to the termination of its lease in 2019. The area currently occupies 255,569 m² and has an existing storage capacity of 346,136 m³, with a focus on the handling of petroleum by-products.

The proposed division of the area into two distinct terminals (**STS08A** and STS08) intends to foster the increase in supply of available static capacity to match future demand, and to maximize the value of state assets, as the new configuration will incorporate unused land adjacent to the terminal.

It is worth pointing out that the proposed division plan of the areas was careful to not disrupt the flow of petroleum by-products from São Paulo's refineries. As pointed out before, the output from these refineries is paramount to Brazil's energy security, representing **53,217,000 m³** of refining capacity. As such, any planned intervention at the terminal level must not compromise the integrity of the country's energy logistics. Therefore, **STS08A** will maintain its current vocation as a gatekeeper and production regulator to São Paulo's refineries.

One of the main factors that point to the refineries' dependence on STS08A is their lack of storage capacity for heavy fuel oil. According to the refineries, the buildup of this fuel within the refining complex will eventually collapse the system's production capacity. Thus, the adequate flow of inventory to the port terminal is essential to the country's energy security.

For dynamic capacity modeling purposes, the average annual inventory turnover was set as being equal to the historical average of the current liquid bulk player at the Alamoa region of the Port of Santos, encompassing a period of six years. Furthermore, the historical average was increased by 10% in order to represent a higher level of productivity in the future.

Product/m³	2014	2015	2016	2017	2018	2019
Diesel	2.532.579	1.975.439	1.763.213	2.285.837	2.269.999	1.483.621
LPG	1.801.421	1.832.171	2.178.221	1.643.122	1.589.933	1.327.312
Gasoline	1.661.049	1.500.945	1.352.243	1.723.600	1.716.003	1.727.147
Heavy Fuel Oil	3.792.501	3.931.410	3.186.091	3.427.313	3.032.351	3.174.074
TOTAL	**9.787.550**	**9.239.965**	**8.479.768**	**9.079.932**	**8.608.286**	**7.712.154**
LPG static capacity	83.002	83.002	83.002	83.002	83.002	83.002
Petroleum by-products static capacity	263.134	263.134	263.134	263.134	263.134	263.134
Total static capacity	346.136	346.136	346.136	346.136	346.136	346.136
LPG Turnover	**21,70**	**22,07**	**26,24**	**19,80**	**19,16**	**15,99**
Petroleum by-products Turnover	**30,35**	**28,15**	**23,95**	**28,26**	**26,67**	**24,26**
Average LPG Turnover	**20,83**					
Average LPG w/ 10%	**23,0**					
Average Petroleum by-products	**26,94**					

Average Petroleum by-products w/10%	**30,0**

Table 12 historical average turnover of the current liquid bulk player at the Alamoa region of the Port of Santos
Source: based on data from SPA, Antaq and ANP.

For comparability purposes, the model does not use cubic meters for measuring terminal throughput. Therefore, the values shown above must be transformed into their metric ton equivalent. The study estimates the average density of products handled at **STS08** as a function of the expected weighted average of the terminal's future products mix. Hence, for the subgroup of petroleum by-products (excludes LPG), the expected average density is **0,91 tons/m³.** In the case of LPG, the relevant average density used is **0,552 t/m³**.

The following table presents the sample used to estimate **STS08A's** future average product density.

Product Market Share	Project Volume 2021-2045 in m³	density	Volume Project 2021-2045 in t
Other heavy fuel oils	53.884.482	1,013	54.584.981
Bunker	63.387.077	1,0	63.387.077
Diesel	50.464.984	0,84	42.390.586
Gasoline	52.478.208	0,742	38.938.830
Grand Total	220.214.751		199.301.475
1. Weighted density considers the future mix of products			**0,91**

Table 13 - Weighted average density of petroleum by-products for **STS08A.**
Source: miscellaneous sources.

To identify the Port of Santo's petroleum by-products' static capacity, the study relied on information available in the Master Plan for the Port Santos Complex (2019) and information provided by ANP.

The following table shows the existing static capacity for petroleum by-products in the Port of Santos Complex before the proposed division of the original area into two.

Terminal STS08 Existing Storage Capacity	**Static Capacity (m³)**
GLP	83.002
Petrol	19.994
Petrol	19.994
Petrol	19.996
Petrol	19.996
fuel oil	19.994
fuel oil	22.468
fuel oil	22.452
fuel oil	22.484
fuel oil	22.498
DIESEL	19.994
DIESEL	19.994
DIESEL OCB 7	5.648
DIESEL	8.163
DIESEL	8.163
FUEL OIL OCB 6	5.648
FUEL OIL OCB 8	5.648
Total	**346.136**

Table 14: existing static capacity for petroleum by-products in the Port of Santos Complex.
Source: ANP data.

The data collected above is key to estimate **STS08's** micro demand. As stated elsewhere in this document, the relevant **STS08's** market share of the macro demand is set as equal to the terminal's capacity share. Thus,

in estimating the terminal's capacity, the study must consider current installed capacity as well as future expansions.

Hence, in order to consistently model future capacity of existing facilities that make up the terminal's competitive environment, it is necessary to adequately size the terminals themselves.

3.4. Sizing

To arrive at an optimal size for **STS08A** , a comparability analysis was carried out between total demand forecasted for the Santos Port Complex and the necessary port handling capacity to meet projected demand.

In this respect, considering the importance and complexity of the operations related to production flow by means of pipelines owned by refineries located in the State of São Paulo, and LPG imports for national supply, a transition plan was established in regard to the allocation of the necessary tanks to ensure production and flow from the referred oil refineries.

The following premises were considered to define the transition plan and the sizing

- **1st Demand Period (1st year to 2nd Contract year) - STS08A**
  - Maintenance and operation of LPG with existing static capacity (tanks and spheres) of 83,002 m³ (45,817t);
  - Two-year use of the existing static capacity of 39,525 m³ (35,771 t) located in terminal **STS08**;
  - Operation with the existing static capacity of 229,864 m³ (208,034 t);
  - Investment in additional static capacity of 24,380 m³ (22,065 t);
  - Captures 100% of Macro Demand in this period.
- **1st Demand Period (1st year to 2nd Contract year) - STS08**
  - There will be no operation in this period due to construction intended to add 3 new tanks or 67,500 m³ (61,090 t) worth of static capacity to the complex. The estimated time to complete the expansion is 03 years.
- **2nd Demand Period (3rd Contract year) - STS08A**
  - Operation uses full static capacity (existing + expansion) of 254,244 m³ (230,099 t);
  - Market share based on capacity share calculation using the above level of capacity;
  - Captures 100% of Macro Demand in this period.
- **2nd Demand Period (3rd Contract year)** - **STS08**
  - There will be no operation in this period due to construction intended to add 3 new tanks or 67,500 m³ (61,090 t) worth of static capacity to the complex. The estimated time to complete the expansion is 03 years.
  - STS08A delivers static capacity of 39,525 m³ (35,771 t) to **STS08**. However, additional capacity cannot yet be used since acquiring necessary environmental licenses will take some time.
- **3rd Demand Period (4th year to 5th Contract year**) - **STS08A**
  - Operation uses full static capacity (existing + expansion) of 254,244 m³ (230,099 t);
  - Captures 70,4% of Macro Demand in this period.
- **3rd Demand Period (4th year to 5th Contract year**) - **STS08**

- Operation uses partial static capacity (existing + partial expansion) of 107,025 m³ (96,861 t);
- Starts work on 57,220 m³ of additional capacity (51,786 t);
- Market share based on capacity share calculation using just operating capacity;
- Captures 29.4% of Macro Demand in this period.

- **4th Demand Period (6th year to 25th Contract year) - STS08A**
  - Operation uses full static capacity (existing + expansion) of 254,244 m³ (230,099 t);
  - Captures 60.8% of Macro Demand in this period.
- **4th Demand Period (6th year to 25th Contract year) - STS08**
  - Operation uses full static capacity (existing + expansion) of 164,245 m³ (148,647 t);
  - Captures 39.2% of Macro Demand in this period.

- The project's capacity sizing determined above is expected to be enough to meet trend level demand by the end of the contractual horizon, that is, until the year 2045. An operational safety coefficient was added to allow for an excess capacity of 10% to cover monthly handling fluctuations. The overcapacity's objective is to permit demand to fluctuate above trend without stressing the system.

Regarding the two lease areas' formal project classification, **STS08A** is a ***brownfield area*** with both **reversible and non-reversible assets**, and capacity expansion of up to **22,065 t.** In STS08A's case, given its existing functioning facilities, the contract´s first year is also the first year of operation. The study assumes that the time between beginning and end of expansion construction is 2 years, with new assets coming online in the 3rd contract year. In the case of **STS08A's** expansion, the study was able to reduce the time to conclusion by one year, given the existence of basic tank storage infrastructure already in place.

As for GLP, the study assumes no additional capacity during the 25-year contract. The existing current capacity is sufficient to meet current and future demand.

In the case of STS08, the area is also ***brownfield*** with **reversible and non-reversible assets**, and total capacity expansion of up to **112,876 t**. However, in contrast with STS08A, STS08 can only begin operating by the fourth contract year. Regarding the execution of expansion projects, the following deadlines for implementation of additional capacities apply: three (3) years for the deployment of **61,090 t** of additional capacity, and three (3) additional years for implementing the remaining **51,786 t**. Hence, STS08 will only operate with full capacity by the sixth (6) contract year.

As mentioned before, the size of the project must have enough capacity to cover highest level (peak) demand in the trend scenario. In the case of STS08 and **08A**, peak demand will occur in **2045,** when total yearly throughput will come to **10,329,446** tons of **petroleum by-products.**

In addition, total capacity must not only meet future peak demand, but must also allow for a small safety surplus. In the case of STS08 & **08A,** an operational safety coefficient, that would satisfactorily absorb short term variations, was set at 10% of macro demand.

Thus, the yearly dynamic capacity that the combined terminals must be able deploy to meet the project's specifications is **11,362,391** tons of petroleum by-products.

In the case of GLP, as mentioned before, the current size of the project already has enough capacity to cover highest level (peak) demand in the trend scenario. GLP's highest throughput is expected to occur in **2045**, when the terminal is expected to handle **376.805 ton/year** of GLP.

As for the other petroleum by-products, the study also assumes a set surplus over the expected peak demand. Thus, the same 10% is applied to the maximum volume, yielding a total required capacity of **415.485 ton/year,** as shown in the table below.

STS08A's peak demand in 2045 – trend scenario	**376.805**
+ 10% Safety Margin (t)	**37.680**
= Required Future Dynamic capacity (t)	**414.485**
- Current Dynamic capacity available (t)	**1.049.212**
= Total surplus capacity (t)	**634.726**

Table 15: Required Capacity of LPG 2021 - 2045.
Source: EPL.

Finally, after establishing the proper size, allocation, and chronology of capacity levels, it is possible to break down macro demand proportionally to each one of the terminals.

The following table shows the allocation of capacity for each of the two terminals, at all the four different phases.

DIMENSIONAMENTO DAS INSTALAÇÕES FUTURAS

Instalação Portuária	Capacidade Estática Existente (m³)	Capacidade Estática Existente (t)	Capacidade Dinâmica TOTAL (t)	Instalação Portuária	Capacidade Estática Existente (t)	Capacidade Estática Adicional (t)	Capacidade Estática TOTAL (t)	Capacidade Dinâmica TOTAL (t)	Instalação Portuária	Capacidade Estática Existente (t)	Capacidade Estática Adicional (t)	Capacidade Estática TOTAL (t)	Capacidade Dinâmica TOTAL (t)	Instalação Portuária	Capacidade Estática Existente (t)	Capacidade Estática Adicional (t)	Capacidade Estática TOTAL (t)	Cap Dinâmica TOTAL (t)
1ª Fase (1º ano ao 2º ano)				2ª Fase (3º ano)					3ª Fase (4º ano ao 5º ano)					4ª Fase (6º ano ao 25º ano)				
STS08A 1ª fase	39.525	35.771	1.073.142	STS08A 2ª fase		22.065	22.065	661.941	STS08A 3ª fase		22.065	22.065	661.941	STS08A 4ª fase		22.065	22.065	661.941
STS08A Derivados s/ GLP	229.864	208.034	6.241.031	STS08A Derivados s/ GLP	208.034		208.034	6.241.031	STS08A Derivados s/ GLP	208.034		208.034	6.241.031	STS08A Derivados s/ GLP	208.034		208.034	6.241.031
Total STS08A	269.389	243.806	7.314.173	Total STS08A (1)	208.034		230.099	6.902.971	Total STS08A (1)	208.034		230.099	6.902.971	Total STS08A	208.034		230.099	6.902.971
STS08 Derivados				STS08 Derivados					STS08 Derivados 3ª fase	35.771	61.090	96.861	2.905.833	STS08 Derivados 4ª fase	96.861	51.786	148.647	4.459.419
TOTAL	269.389	243.806	7.314.173	TOTAL	208.034	22.065	230.099	6.902.971	TOTAL	243.806	83.154	326.960	9.808.804	TOTAL	304.895		378.746	11.362.391

1- No período de transição considerou-se a divisão de mercado em função da capacidade estática a ser implantada
2- A partir de 2026 considerou-se a divisão de mercado em função de sua capacidade potencial

Table 16: *Capacity share* 2021 - 2045.
Source: EPL.

In conclusion, **STS08A's** micro demand for petroleum by-products will be modeled as a function of the following series of market shares: **100%** during the period **2021 – 2023, 70.4%** share in period **2024 – 2025, 60.8%** share for periods on and after **2026.** In the case of LPG, the terminal's market share is 100% for the entire contract. Thus, the study arrives at the fair micro demand by multiplying the shares above by the macro demand, which is itself a function of the different scenarios and expected production at São Paulo's refineries.

The following tables presents **STS08A's** projected time series for dynamic capacity, macro, and micro demand.

STS08A Byproducts (in thousand tons)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Trend Scenario																									
Waterway Macro Demand	6.005	6.140	6.279	6.421	6.567	6.716	6.868	7.024	7.184	7.348	7.515	7.687	7.862	8.042	8.226	8.415	8.608	8.806	9.008	9.215	9.428	9.645	9.868	10.096	10.329
Waterway Micro Demand- Fuel Oil	1.568	1.609	1.652	1.193	1.225	1.085	1.114	1.144	1.174	1.205	1.237	1.270	1.303	1.338	1.373	1.410	1.447	1.485	1.524	1.565	1.606	1.649	1.693	1.737	1.783
Waterway Micro Demand- Bunker	1.820	1.869	1.918	1.386	1.422	1.260	1.294	1.328	1.363	1.399	1.436	1.474	1.513	1.553	1.595	1.637	1.680	1.725	1.770	1.817	1.865	1.915	1.965	2.017	2.071
Waterway Micro Demand -Diesel	1.300	1.328	1.356	975	996	878	897	916	936	956	976	997	1.018	1.040	1.062	1.085	1.108	1.132	1.156	1.181	1.206	1.232	1.258	1.285	1.313
Waterway Micro Demand - Gasoline	1.317	1.335	1.353	965	979	856	868	880	892	904	916	929	942	955	968	981	994	1.008	1.022	1.036	1.050	1.064	1.079	1.094	1.109
% of Market (Waterway)	**100%**	**100%**	**100%**	**70%**	**70%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**
Potential Micro Demand	6.005	6.140	6.279	4.519	4.621	4.080	4.173	4.267	4.364	4.464	4.566	4.670	4.777	4.886	4.998	5.112	5.230	5.350	5.473	5.599	5.728	5.860	5.995	6.134	6.275
Storage Capacity Limit	7.314	7.314	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903
Captured Micro Demand	**6.005**	**6.140**	**6.279**	**4.519**	**4.621**	**4.080**	**4.173**	**4.267**	**4.364**	**4.464**	**4.566**	**4.670**	**4.777**	**4.886**	**4.998**	**5.112**	**5.230**	**5.350**	**5.473**	**5.599**	**5.728**	**5.860**	**5.995**	**6.134**	**6.275**
Petroleum Byproducts	6.005	6.140	6.279	4.519	4.621	4.080	4.173	4.267	4.364	4.464	4.566	4.670	4.777	4.886	4.998	5.112	5.230	5.350	5.473	5.599	5.728	5.860	5.995	6.134	6.275
Pessimistic Scenario	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
Waterway Macro Demand	5.981	6.104	6.230	6.359	6.490	6.624	6.761	6.901	7.045	7.191	7.341	7.493	7.650	7.809	7.973	8.139	8.310	8.484	8.662	8.844	9.030	9.221	9.415	9.614	9.817
Waterway Micro Demand - Fuel Oil	1.561	1.600	1.639	1.182	1.211	1.071	1.097	1.124	1.151	1.179	1.208	1.238	1.268	1.299	1.331	1.364	1.397	1.431	1.466	1.502	1.539	1.577	1.615	1.655	1.695
Waterway Micro Demand - Bunker	1.813	1.858	1.903	1.372	1.406	1.243	1.274	1.305	1.337	1.370	1.403	1.437	1.473	1.509	1.546	1.583	1.622	1.662	1.703	1.744	1.787	1.831	1.876	1.921	1.969
Waterway Micro Demand - Diesel	1.295	1.320	1.346	965	984	866	883	900	917	935	953	972	991	1.010	1.029	1.049	1.070	1.091	1.112	1.133	1.155	1.178	1.200	1.224	1.247
Waterway Micro Demand - Gasoline	1.312	1.327	1.342	956	967	845	854	864	874	885	895	905	916	927	938	949	960	971	982	994	1.005	1.017	1.029	1.041	1.053
% of Market (Waterway)	**100%**	**100%**	**100%**	**70%**	**70%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**
Potential Micro Demand	5.981	6.104	6.230	4.475	4.567	4.024	4.108	4.193	4.280	4.369	4.460	4.552	4.647	4.744	4.844	4.945	5.048	5.154	5.263	5.373	5.486	5.602	5.720	5.841	5.964
Storage Capacity Limit	7.314	7.314	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903
Captured Micro Demand	**5.981**	**6.104**	**6.230**	**4.475**	**4.567**	**4.024**	**4.108**	**4.193**	**4.280**	**4.369**	**4.460**	**4.552**	**4.647**	**4.744**	**4.844**	**4.945**	**5.048**	**5.154**	**5.263**	**5.373**	**5.486**	**5.602**	**5.720**	**5.841**	**5.964**
Petroleum Byproducts	5.981	6.104	6.230	4.475	4.567	4.024	4.108	4.193	4.280	4.369	4.460	4.552	4.647	4.744	4.844	4.945	5.048	5.154	5.263	5.373	5.486	5.602	5.720	5.841	5.964
Optimistic Scenario	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
Waterway Macro Demand	6.040	6.195	6.353	6.516	6.683	6.855	7.031	7.212	7.397	7.588	7.784	7.985	8.191	8.403	8.621	8.844	9.074	9.309	9.551	9.800	10.055	10.317	10.586	10.863	11.146
Waterway Micro Demand - Fuel Oil	1.577	1.623	1.671	1.211	1.246	1.108	1.140	1.174	1.209	1.244	1.281	1.319	1.358	1.398	1.439	1.481	1.525	1.570	1.616	1.664	1.713	1.763	1.815	1.869	1.924
Waterway Micro Demand - Bunker	1.831	1.885	1.941	1.406	1.447	1.286	1.324	1.363	1.403	1.445	1.487	1.531	1.576	1.623	1.671	1.720	1.771	1.823	1.877	1.932	1.989	2.048	2.108	2.170	2.234
Waterway Micro Demand - Diesel	1.308	1.340	1.372	989	1.013	896	918	940	963	987	1.011	1.036	1.061	1.087	1.113	1.140	1.168	1.197	1.226	1.256	1.286	1.318	1.350	1.383	1.417
Waterway Micro Demand - Gasoline	1.325	1.347	1.369	980	996	874	889	904	919	934	950	965	982	998	1.015	1.031	1.049	1.066	1.084	1.102	1.120	1.139	1.158	1.177	1.197
% of Market (Waterway)	**100%**	**100%**	**100%**	**70%**	**70%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**
Potential Micro Demand	6.040	6.195	6.353	4.586	4.703	4.164	4.271	4.381	4.494	4.610	4.729	4.851	4.976	5.105	5.237	5.373	5.513	5.656	5.803	5.954	6.109	6.268	6.431	6.599	6.772
Storage Capacity Limit	7.314	7.314	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903	6.903
Captured Micro Demand	**6.040**	**6.195**	**6.353**	**4.586**	**4.703**	**4.164**	**4.271**	**4.381**	**4.494**	**4.610**	**4.729**	**4.851**	**4.976**	**5.105**	**5.237**	**5.373**	**5.513**	**5.656**	**5.803**	**5.954**	**6.109**	**6.268**	**6.431**	**6.599**	**6.772**
Petroleum Byproducts	6.040	6.195	6.353	4.586	4.703	4.164	4.271	4.381	4.494	4.610	4.729	4.851	4.976	5.105	5.237	5.373	5.513	5.656	5.803	5.954	6.109	6.268	6.431	6.599	6.772

Table 17 : Micro Demand Projection for Terminal **STS08A**.
Source: miscellaneous data.

STS08A (GLP) (in thousand tons)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Trend Scenario																									
Waterway Macro Demand	641	600	562	525	492	460	430	403	377	377	377	377	377	377	377	377	377	377	377	377	377	377	377	377	377
% of Martket (Waterway)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Potential Micro Demand	641	600	562	525	492	460	430	403	377	377	377	377	377	377	377	377	377	377	377	377	377	377	377	377	377
Storage Capacity Limit	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049
Captured Micro Demand	**641**	**600**	**562**	**525**	**492**	**460**	**430**	**403**	**377**	**377**	**377**	**377**	**377**	**377**	**377**	**377**	**377**	**377**	**377**	**377**	**377**	**377**	**377**	**377**	**377**
LPG	**641**	600	562	525	492	460	430	403	377	377	377	377	377	377	377	377	377	377	377	377	377	377	377	377	377
Pessimistic Scenario	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
Waterway Macro Demand	639	596	557	520	485	453	423	395	369	368	367	367	366	365	364	364	363	362	362	361	360	359	359	358	357
% of Market (Waterway)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Potential Micro Demand	639	596	557	520	485	453	423	395	369	368	367	367	366	365	364	364	363	362	362	361	360	359	359	358	357
Storage Capacity Limit	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049
Captured Micro Demand	**639**	**596**	**557**	**520**	**485**	**453**	**423**	**395**	**369**	**368**	**367**	**367**	**366**	**365**	**364**	**364**	**363**	**362**	**362**	**361**	**360**	**359**	**359**	**358**	**357**
LPG	639	596	557	520	485	453	423	395	369	368	367	367	366	365	364	364	363	362	362	361	360	359	359	358	357
Optimistic Scenario	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
Waterway Macro Demand	644	604	566	531	498	467	438	411	385	386	387	388	390	391	392	393	394	395	397	398	399	400	401	403	404
% of Market (Waterway)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Potential Micro Demand	644	604	566	531	498	467	438	411	385	386	387	388	390	391	392	393	394	395	397	398	399	400	401	403	404
Storage Capacity Limit	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049	1.049
Captured Micro Demand	**644**	**604**	**566**	**531**	**498**	**467**	**438**	**411**	**385**	**386**	**387**	**388**	**390**	**391**	**392**	**393**	**394**	**395**	**397**	**398**	**399**	**400**	**401**	**403**	**404**
LPG	644	604	566	531	498	467	438	411	385	386	387	388	390	391	392	393	394	395	397	398	399	400	401	403	404

Table 18: Micro Demand Projection for Terminal **STS08A,** LPG.
Source: Own and different sources of data

4. Estimated Service Prices

The price estimates for liquid bulk terminals are intended to compensate the terminal for services rendered, such as handling and storage of products.

The prices in this feasibility study are for reference purposes only, and do not oblige the lease holder. The reference prices merely represent a best estimate and are used as input variable to value the enterprise.

Thus, the actual prices to be established in the contract will be defined freely by the winner of the bid, as long as they remain below **the Price Ceiling.** The **price ceiling** will be clearly stated in the lease documents before the future lessee's final signature.

The need to include price control mechanisms is due to the following:

- Terminal **STS08A** is the operator responsible for the flow of petroleum by-products from refineries located in the State of São Paulo, and for the delivery of LPG to distributors in the Southeast and Midwest.
- In this sense, regulation by means of a price ceiling is the most appropriate way to safeguard the supply of petroleum by-products to the market. Otherwise, the future lease holder can use its advantageous position in the logistical value chain to overcharge for the handling and storage of these essential products;
- Furthermore, the terminal plays a strategic role within the petroleum by-products' domestic supply chain. Hence, given that this market is extremely sensitive to input price fluctuations, abusive price increases can be passed on and affect individual consumers. Furthermore, overcharges can also disrupt the production in the refineries. As for LPG, the related risk is even more concentrated, given the country's dependence on this product's import by **STS08A.**

Therefore, for the purposes of financial evaluation, revenues are estimated using the **Price Ceiling** for all flows handled in the terminal.

It is important to point out that the price ceiling provision applies only to services rendered for the refineries in the State of São Paulo. More specifically, the ceiling applies to the petroleum by-products linked to the refineries, such as: Heavy fuel oil, bunker oil diesel oil and gasoline. Thus, handling and storage operations of petroleum by-products that do not affect these refineries **are not** bound by the Ceiling limitation.

It is worth clarifying that there are two types of fuel handling and storage facilities in Brazil: namely, port terminals with access to the water and distribution centers.

The port terminals carry out mostly port operations such as receiving the vessels, carrying out loading and unloading operations, and storing of products for a certain period. This type of terminal provides such services to third parties for a fee.

Port terminal activities are regulated by ANP via Ordinance No. 251/2000. Art. 3, which states that third parties must have fair access to the terminal's services as follows: "The Operators shall, while considering

available capacity and normal service conditions, and in a non-discriminatory manner, service any third party interested in handling products in the terminal".

By regulatory determination, port terminals are required to keep their websites up to date, with the following information:

- Availability (capacities);
- Rates/reference prices for standardized services;
- General service conditions of the terminal;
- Historical monthly time series of volumes handled in the Terminal for the 12 (twelve) months, by product and by point of receipt/delivery.

On the other hand, distribution centers are operated by fuel distribution companies and may or may not contract a port terminal for berth operations. The main task of these centers is to supply a region through its chain of gas stations. Hence, distribution centers will most likely transact with companies within their own economic groups.

For the purposes of modeling the **STS08** and STS08A**,** considering their natural vocation, which is the handling of petroleum by-products and LPG, different prices per ton based on length of stay and types of services rendered were adopted. The referred prices were defined based on price lists informed according to ANP Ordinance No. 251/2000, which establishes that the prices of terminals shall :

- Reflect the modalities of the services, as well as the size of the vessels and the time of operations, where applicable;
- Consider product and volumes involved;
- Consider losses and contamination levels of the handled product ;
- Consider the current tax burden;
- Not be discriminatory. That is, prices shall not incorporate costs attributable to other shippers or other terminals, or incorporate subsidies of any kind, or outside compensations;
- Consider the costs of operation and maintenance and may include a fair return on the investment.

For modeling purposes, the different services rendered at the terminal were consolidated into one single average price. The characteristics of the majority of the products being handled were considered to determine the relevant basket of services and their respective prices. According to historical statistics, the average length of storage for petroleum by-products and LPG was 15 days. In summary, the prices correspond to the following services provided:

- Dark Petroleum Fuels (Bunker) – Storage for a period of 15 days and fuel supply to vessels including all necessary accessory services;
- Dark Petroleum Fuels - Storage for a period of 15 days and berth operation;
- Clear Petroleum Fuels - Storage for a period of 15 days and berth operation;
- Liquified petroleum gas – LPG – handling and storage for a period of 15 days.

In relation to the prices charged by the referred terminal, a basic remuneration was defined for each type of service possibly requested by users. The conversion rate in each product´s density was considered for petroleum (dark and clear) by-products and for LGP.

The price list below indicates whether taxes are already included, or if they will be grossed up upon sale. The taxes levied on the terminal's revenue are: PIS, COFINS and ISS.

It is worth noting that the prices below are quoted in cubic meters when the specific weight of the product is below or equal to 1kg/liter and per metric ton when the product's specific weight is greater than 1kg/liter. The table below specifies the four main classes of products handled by **STS08A's**, standardized on a per ton basis.

Type of Service	Price (m^3)	Price (T)	with tax	discounted
Dark - storage 15 days + ship supply	57,80	58,38	61,30	**49,04**
Dark - storage 15 days + handling	47,98	48,46	50,89	**40,71**
Clear - storage 15 days + handling	42,55	53,86	56,55	**45,24**
GLP - storage 15 days + handling	84,33	152,77	160,41	**128,33**

Table 19 Alamoa port terminal reference prices (in R$).
Source: data from the company's website.

Hence, as shown in the list above, the gross average price for bunker storage and supply is **R$ 57,8/m³** or **R$ 58,38/ton.** Meanwhile, the quote for handling and storing dark petroleum by-products is **R$ 47,98/m³** or **R$ 48,46/ton,** while for handling and storing clear petroleum the quote is **R$ 42,55/m³** or **53,86/ton.** Finally, the same basket for services for clear LPG is **R$ 84,33/m³,** or **152,77/ton**. It is important to emphasize that these prices represent maximum quotes. Indeed, the final price will offer discounts depending on each client's volume and method of payment.

Therefore, the final price used in the model considers a discount of **20%** over the initial quote. Consequently, the bunker net average service fee is **R$ 49,04/ton.** As for dark, clear petroleum by-products and LPG, the final prices are **R$ 40,71/ton** and **R$** 45,24**/ton R$ 128,33/ton,** respectively. The 20% discount assumption was validated during interviews with industry players and trade unions representing the fuel distribution sector.

Thus, for modeling purposes, a discount of **20%** was applied to the initial quote. The initial quotes themselves are pulled from the list of prices published in **September 2019.**

5. Minimum Required Volume - MME

The Minimum Required Volume indicator is a risk-sharing mechanism between the lessee and the Federal Government. The metric is based on minimum throughput targets that must be met at the terminal on any given year.

The preference for the throughput metric lies in the fact that it synthesizes important underlying fundamentals like static capacity and inventory turnover, while being easily measurable, transparent, and unambiguous.

To define the right MME target for **STS08A,** the study sampled the volatility in a regional throughput series of petroleum by-products in the period from 2000 to 2019. To this end, the study used Comex Stat Brazil's open database on foreign trade.

The methodology selected uses the volatility extracted from the sample to create a lower throughput limit. The factor used to establish this lower limit is a generalized standard deviation named α (alpha). In the list below the method´s application is divided into four simple steps:

- Step 1: Calculate the standard deviation of the sampled universe for the relevant period;
- Step 2: Calculate the arithmetic mean of the values in the sampling universe for the relevant period;
- Step 3: Generalize the standard deviation of "step 1" by dividing it by the average in "step 2";
- Step 4: Subtract one from the alpha in "step 3" and find the lower limit by calculating the product between it and the trend (base) volume. The application of the factor in step 4 over the entire series will define the yearly MME target.

For the area **STS08A,** the α (alpha) variation band is **59.94%** for liquid petroleum by-products and **37,89%** for LGP , as shown in the tables below.

Petroleum by-products (SH27)	**2020**	**2015**	**2010**	**2005**	**2000**
	6.169.701	1.437.095	1.927.946	1.466.561	1.166.634
Average	**2.508.495**				
standard deviation	**1.336.748**				
a (alpha)	**53,29%**				

Table 20: Alpha for area **STS08A** - Liquid Petroleum by-products.
Source: EPL.

LPG	**2019**	**2015**	**2010**	**2005**	**2000**
	435.425	480.495	906.723	238.867	1.092.128
average	**614.752k**				
standard deviation	**232.929k**				
a (alpha)	**37,89%**				

Table 21: Alpha for area **STS08A** - LPG
Source: EPL

In the case of **STS08A,** after arriving at its relevant alpha, the result of applying step four for its expected volume yields the following minimum yearly targets:

Ano	**STS08A Derivados**	**MME**
2021	6.005	2.805
2022	6.140	2.868
2023	6.279	2.933
2024	4.519	2.111
2025	4.621	2.159
2026	4.080	1.906

2027	4.173	1.949
2028	4.267	1.993
2029	4.364	2.039
2030	4.464	2.085
2031	4.566	2.133
2032	4.670	2.181
2033	4.777	2.231
2034	4.886	2.282
2035	4.998	2.334
2036	5.112	2.388
2037	5.230	2.443
2038	5.350	2.499
2039	5.473	2.556
2040	5.599	2.615
2041	5.728	2.675
2042	5.860	2.737
2043	5.995	2.800
2044	6.134	2.865
2045	6.275	2.931
Redutor (alpha)		**53,29%**

Table 22: Minimum Required Volume - MME (in Kt) area **STS08A.**
Source: EPL.

Ano	STS08A GLP	MME
2021	641	398
2022	600	373
2023	562	349
2024	525	326
2025	492	305
2026	460	286
2027	430	267
2028	403	250
2029	377	234
2030	377	234
2031	377	234
2032	377	234
2033	377	234
2034	377	234
2035	377	234
2036	377	234
2037	377	234
2038	377	234
2039	377	234
2040	377	234
2041	377	234
2042	377	234
2043	377	234
2044	377	234
2045	377	234
Redutor (alpha)		**37,89%**

vTable 23: Minimum Required Volume – MME (in Kt) **STS08A - LPG**
Fonte: EPL