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 of Santos Complex, which is comprised 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).

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 products that differ from the ones handled by the terminal object of this study.

The handling and storage of petroleum and chemicals products on the Right Bank of the Port of Santos occurs at the liquid bulk terminals of the Alamoa region. More specifically, the region houses the following liquid bulk players: Vopak, Ultracargo, Stolthaven, Granel and Transpetro. On the Left Bank, liquid bulk operation is concentrated at Barnabé Island's Ageo and Adonai Química. Petroleum by-products and chemicals are also handled at the Dow and Tiplam terminals. 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.

Based on the historical throughput, the afore-mentioned terminals have specific operating characteristics due to the products they handle. Therefore, it is important to analyze the operational characteristics of each terminal that handles liquid bulk products, chemical products, and petroleum by-products

In the case of the **Tiplam, Terminal,** the main operation is focused on solid bulk. More specifically, the terminal handles the flow of agricultural solid bulk. In addition, Tiplam handles imported raw materials used for the production of fertilizers such as ammonia and sulfur. In the case of ammonia, solid bulk operations are residual.

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 in 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). Thus, Dow's terminal throughput dynamics in Santos depend on a verticalized operation and are focused mainly on the company´s ow 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 storage facilities used for storing of industrial chemicals, the Island's most important activity, are also 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 that on Barnabé Island.
Source: Elaborated 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 petroleum by-products, while the other terminals handle a wider diverse range of liquid bulk products, and mostly industrial chemicals. As a subsidiary of Petrobras, Tranpetro's operations are focused on shipping the final product from the parent company's refineries, via an interconnected system of pipelines, yielding an average turnover of 28 times a year. Meanwhile, 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 corresponding to 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 (75%), while the remaining 2,004,874 tons (25%) were distributed amongst all the other terminals.

In conclusion, Transpetro's higher productivity when compared to the other terminals in Ilha Barnabé and Alemoa is much higher. This attests to Transpetro Terminal´s appropriate logistic structure, as well as its internal structure comprised of tanks, pipelines, pump, control systems and safety criteria, all of which are specifically sized for this level of operating performance.

1.1. Market Analysis of liquid bulk petroleum by-products

This section presents the market analysis for the lease area **STS08,** intended for the handling and storage of liquid bulk, as specified in the Federal Government's plan.

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 are used 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 gas 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.

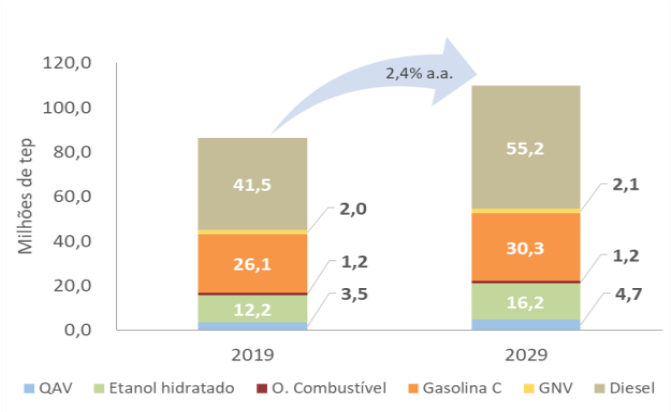


Figure 1: Energy demand for the transportation sector.
Source: PDE/2029.

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), there is a mandatory minimum increase in the percentage of biodiesel that started in 2019 and will be getting progressively higher until 2022. The study considered the official schedule established in the Resolution and reproduced in the table below:

Initial dates of minimum required quotas	On 01/6/2019 or 03 months after the conclusion of required tests and trials, as provided for in Art. 1, whichever deadline is longer.	03/01/2020	03/01/2021	03/01/2022
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 will probably need to continue to import 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:

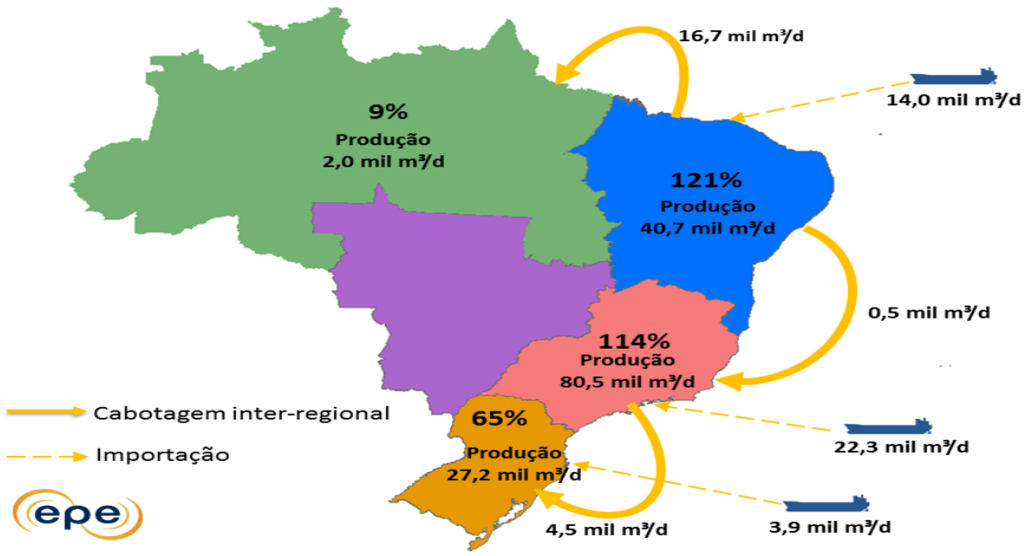


Figure 2: Meeting inter-regional diesel oil dependence (imports & cabotage lines).
Source: PDE/2029.

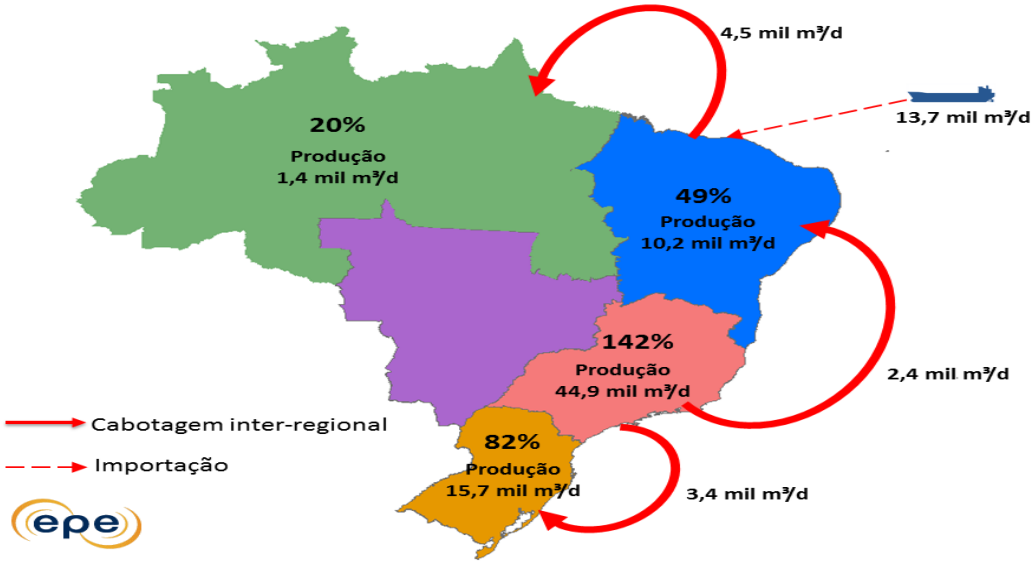


Figure 3: Meeting inter-regional gasoline dependence (imports & cabotage lines).
Source: PDE/2029.

Gasoline is the second most 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, a commercial opportunity for refining companies.

According to the National Petroleum, Natural Gas and Biofuels Agency/ANP, the Brazilian fuel market comprises the following sectors: suppliers, distributors, vendors and consumers.

It is important to highlight that , the fuel supply market in Brazil has gradually opened up since the advent of the Petroleum Law of 1997. In short, the new law broke up the 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 growth is attested to by the increase in the number of the so-called “brandless” gasoline stations. According to the ANP, in 2016, 41.1% of the gas stations in Brazil were not under any brand.

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, competition tends to intensify as the distribution center comes 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 brings regionalized 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 **STS08'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 **STS08'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 and 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 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 production takes place 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 reach the country mainly through the ports of Suape (around 67%) and Santos (around 27%).

However, this study identified a likely 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 come online by 2021; and the development of a natural gas production in the Sergipe-Alagoas Basin. Page

285 of PDE-s report has a table showing falling import demand during the 10 years between 2019 and 2029. Table 4 shows projected demand while table 5 specifies how the forecasted demand is likely to be met.

Projections of Petroleum by-products – EPE							
Southeast	2020 (m³)	2030 (m³)	2040 (m³)	2045 (m³)	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 m³ (MM)				
	2019	2024	2029	% 2019-2029
Production	10,5	13,3	15,1	43,8%
Import	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 concludes that investments in the country's logistical infrastructure is 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 broken down into two stages, reflecting two major blocks of competitive evaluation, as follows: 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 from or to the country's Ports. Hence, such scenario corresponds to inter-port competition.

For micro demand, the study seeks to identify how cargoes destined to a Port Complex are distributed among existing terminals. This scenario corresponds to an 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 **STS08,** 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 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, integrating insights to policymaking for the expansion of the national transportation infrastructure and rational use of state assets.

3.1.1. National Port Logistics Plan - PNLP

Within the port sector, the PNLP is the instrument with a broader 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 port relating 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" do PNLP (2019).

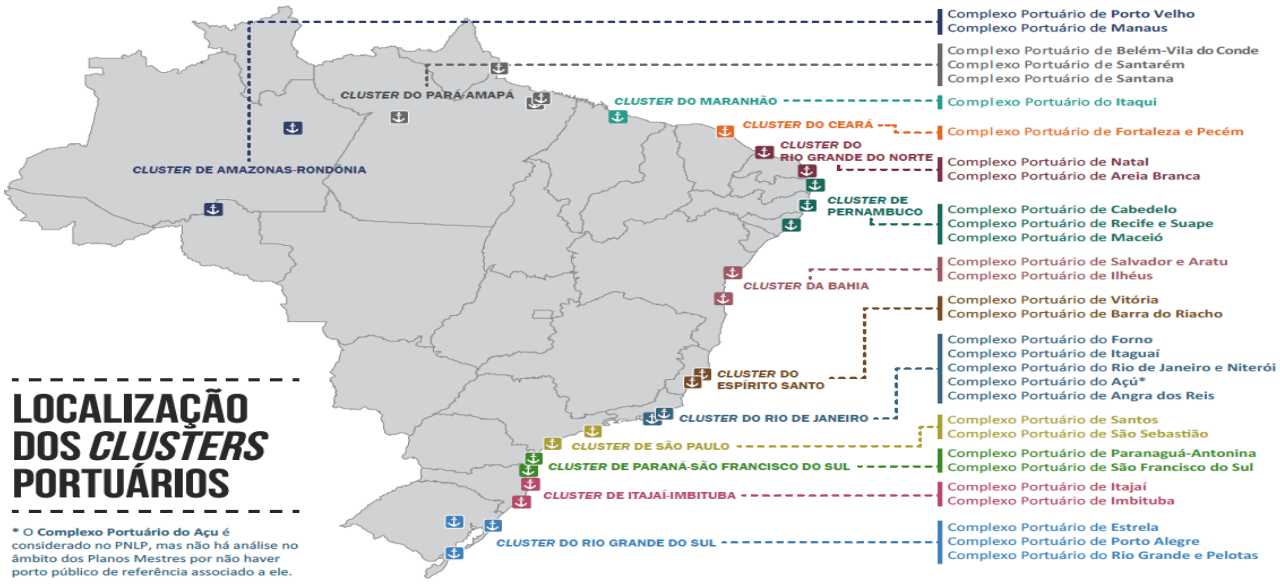


Figure 5 - Location of Port Clusters.
Source: Projeção de Demanda e Carregamento da Malha – Ano base 2018 (PNLP, 2019).

[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 (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 negative impact on imports, but positive impact for exports. In addition, the model also considers that there is information on 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 a range 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 in road, rail and waterway are considered and may change the previously optimal route.

In the last stage of evaluation in the PNLP and the Master Plan for The Port of Santos, modeled results 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 into 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 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, the 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 that of its main trade partners.

» **Type 2 Shock**: This shock is 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 the 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 state instrument for planning at the port unit level. In essence, the series of master plans aims 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 to direct actions, improvements, and 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 reach 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, while relying 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 exists, the terminal's current share of the demand is taken into account while a gradual convergence towards long run equilibrium occurs. 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 several divestments of its assets, concentrating 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 took on the commitment to sell eight oil refineries and assets related to the transportation of petroleum by-products.
- Publication of Resolution No. 9 of May 9, 2019, setting guidelines for the promotion of free competition in the refining sector within the country.

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 better represent the new market dynamics going forward.

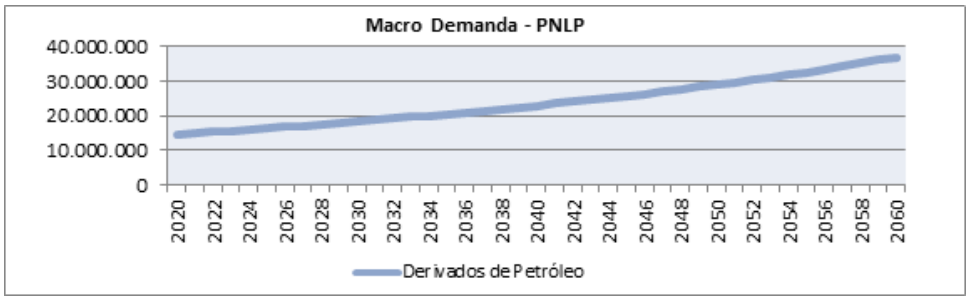
Macro Demand

The area known as **STS08** is located in the Organized Port of Santos, part of the São Paulo Cluster. According to data in "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).

Still according to the PNLP, the expected demand for petroleum by-products is expected to reach 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 São Paulo cluster 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, **STS08'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 **STS08's** expansive 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/ 21/08/2020 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 is based on the information in the EPE's Clarification Note - NE-EPE-DPG-SDB-02/2020 and in the 10-year Energy Expansion Plan - PDE 2029, which presents more recent and accurate information than the State'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 **STS08 (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 the 2019 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 fuels of diesel and gasoline, a key product handled only by this terminal is Bunker. Indeed, the Santos Port Complex is responsible for approximately 40% of the supply of bunker in the country, through the terminals located in the Alamoa/Santos region. Bunker is composed of an uneven mixture of heavy fuel and diesel oil, where heavy fuel oil makes up the largest portion 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 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 based thruput. As for the pessimistic and optimistic cases, the study assumed 30 basis points above trend for the latter and 20 basis points below for the former.

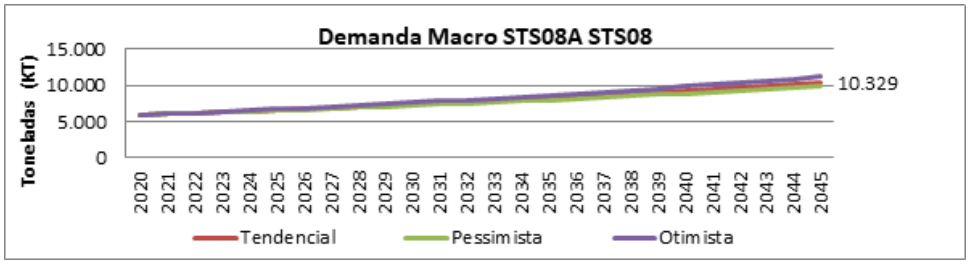
In this way, this study sought to increase the relevance of the results found for **STS08** by using the most robust industry forecasts. Furthermore, such practice is of special significance given that this contract is expected to be signed in 2021 and to remain in effect for the next 25 years, ending in the year 2045.

The following table shows the expected demand for petroleum by-products handled each year in **STS08** & STS08A. The individual demand for **STS08** will be a share of the overall macro demand presented below.

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 10: 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 2: 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 **STS08's** micro demand.

3.3. Micro Demand

To estimate port demand at **STS08's** terminal level, the study conducts 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 **STS08**;
- Estimated average inventory turnover;
- Estimated share storage capacity;
- Static capacity of existing installations;
- Operational transition rule for Terminals STS08A and **STS08**.

The existing **STS08** 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 handling petroleum by-products.

The proposed division of the area into two distinct terminals (STS08A **and STS08)** intends to foster increased supply available static capacity to match future demand, and to maximize the value of state assets, as the new configuration incorporates 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 y	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 11 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 (excluding LPG), the expected average density is **0,91 tons/m³.**

The following table presents the sample used to estimate **STS08'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 12 - Weighted average density of petroleum by-products for **STS08.**
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 13: existing static capacity for petroleum by-products in the Port of Santos Complex.
Source: built from ANP data.

The data collected above is key to establish **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 **STS08** and 08A, this study sought to align future capacity with expected future demand at the level of the Santos Port Complex.

In this sense, the optimization issue also considered the unique value of these terminals to the national energy supply. In fact, this study was careful to create a secure transition plan to minimize the chance of disruption to São Paulo's refineries and to the national supply of LPG. Indeed, the plan reserves capacity so as to guarantee adequate support to the refineries in the terminal's hinterland.

The following list surmises, chronologically, the different phases for the implementation of **STS08** & 08A transition and ultimate size:

- **1st Demand Period (1st Contract 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 contract year to 2nd Contract year) - STS08**
  - There will be no operation in this period due to construction work to add 3 new tanks or 67,500 m³ (61,090 t) worth of static capacity to the complex. The estimated time to conclude 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 work to add 3 new tanks or 67,500 m³ (61,090 t) worth of static capacity to the complex. The estimated time to conclude 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 Contract 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 Contract 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 Contract 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 Contract 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.

- To be emphasized is that the project's capacity sizing determined above intends to be enough to meet trend level demand by the end of the contractual horizon in 2045, while also allowing for an excess capacity of 10%. The overcapacity's objective is to permit demand to fluctuate above trend without stressing the system.

Regarding the implementation of new capacity at the Santos Port Complex terminals, the following assumptions were considered in relation to the start of operations and pre-operating deadlines for the installations object of the bids:

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 first year of contract 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 cut the time to conclusion by one year, given the existence of basic tank storage infrastructure already in place.

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 occurs in **2045,** when total yearly throughput reaches **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.

Finally, after settling on the proper size, allocation, and chronology of capacity levels, it is possible to establish macro demand proportionally to each one of the terminals.

The following table surmises the allocation of capacity for each of the two terminals, and 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 14: *Capacity share* 2021 - 2045.
Source: EPL.

In conclusion, **STS08's** micro demand will be modeled as a function of the following series of market shares: **without participation** in the period **2021 – 2023, 29.6%** share in period **2024 – 2025, 39.2%** share for periods on and after **2026.** 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 the São Paulo's refineries.

The following table presents **STS08's** projected time series for dynamic capacity, macro and micro demand.

STS08 (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	0	0	0	502	516	701	720	739	758	778	799	820	842	864	887	911	935	959	985	1.011	1.038	1.065	1.093	1.122	1.152
Waterway Micro Demand- Bunker	0	0	0	583	599	814	836	858	881	904	928	952	978	1.004	1.030	1.057	1.085	1.114	1.144	1.174	1.205	1.237	1.270	1.303	1.338
Waterway Micro Demand -Diesel	0	0	0	410	419	567	579	592	604	617	631	644	658	672	686	701	716	731	747	763	779	796	813	830	848
Waterway Micro Demand - Gasoline	0	0	0	406	412	553	561	568	576	584	592	600	608	617	625	634	642	651	660	669	678	688	697	706	716
% of Market (Waterway)	**0%**	**0%**	**0%**	**30%**	**30%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**
Potential Micro Demand	**0**	**0**	**0**	**1.902**	**1.945**	**2.636**	**2.696**	**2.757**	**2.819**	**2.884**	**2.949**	**3.017**	**3.086**	**3.156**	**3.229**	**3.303**	**3.378**	**3.456**	**3.535**	**3.617**	**3.700**	**3.785**	**3.873**	**3.962**	**4.054**
Storage Capacity Limit	0	0		2.906	2.906	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459
Captured Micro Demand	**0**	**0**	**0**	**1.902**	**1.945**	**2.636**	**2.696**	**2.757**	**2.819**	**2.884**	**2.949**	**3.017**	**3.086**	**3.156**	**3.229**	**3.303**	**3.378**	**3.456**	**3.535**	**3.617**	**3.700**	**3.785**	**3.873**	**3.962**	**4.054**
Petroleum Byproducts	0	0	0	1.902	1.945	2.636	2.696	2.757	2.819	2.884	2.949	3.017	3.086	3.156	3.229	3.303	3.378	3.456	3.535	3.617	3.700	3.785	3.873	3.962	4.054
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	0	0	0	497	510	692	709	726	744	762	781	800	819	839	860	881	902	925	947	970	994	1.018	1.043	1.069	1.095
Waterway Micro Demand - Bunker	0	0	0	578	592	803	823	843	864	885	906	929	951	975	998	1.023	1.048	1.074	1.100	1.127	1.154	1.183	1.212	1.241	1.272
Waterway Micro Demand - Diesel	0	0	0	406	414	559	570	581	593	604	616	628	640	652	665	678	691	704	718	732	746	761	775	791	806
Waterway Micro Demand - Gasoline	0	0	0	402	407	546	552	558	565	572	578	585	592	599	606	613	620	627	634	642	649	657	665	672	680
% of Market (Waterway)	**0%**	**0%**	**0%**	**30%**	**30%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**
Potential Micro Demand	0	0	0	1.884	1.923	2.600	2.654	2.709	2.765	2.822	2.881	2.941	3.002	3.065	3.129	3.194	3.261	3.330	3.400	3.471	3.544	3.619	3.695	3.773	3.853
Storage Capacity Limit	0	0	0	2.906	2.906	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459
Captured Micro Demand	**0**	**0**	**0**	**1.884**	**1.923**	**2.600**	**2.654**	**2.709**	**2.765**	**2.822**	**2.881**	**2.941**	**3.002**	**3.065**	**3.129**	**3.194**	**3.261**	**3.330**	**3.400**	**3.471**	**3.544**	**3.619**	**3.695**	**3.773**	**3.853**
Petroleum Byproducts	0	0	0	1.884	1.923	2.600	2.654	2.709	2.765	2.822	2.881	2.941	3.002	3.065	3.129	3.194	3.261	3.330	3.400	3.471	3.544	3.619	3.695	3.773	3.853
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	0	0	0	510	525	716	737	758	781	804	827	852	877	903	929	957	985	1.014	1.044	1.075	1.107	1.139	1.173	1.207	1.243
Waterway Micro Demand - Bunker	0	0	0	592	609	831	855	881	907	933	961	989	1.018	1.048	1.079	1.111	1.144	1.178	1.212	1.248	1.285	1.323	1.362	1.402	1.443
Waterway Micro Demand - Diesel	0	0	0	416	427	579	593	608	622	638	653	669	685	702	719	737	755	773	792	811	831	851	872	893	915
Waterway Micro Demand - Gasoline	0	0	0	412	419	565	574	584	593	603	613	624	634	645	655	666	677	689	700	712	724	736	748	761	773
% of Market (Waterway)	**0%**	**0%**	**0%**	**30%**	**30%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**
Potential Micro Demand	0	0	0	1.930	1.980	2.690	2.759	2.830	2.903	2.978	3.055	3.134	3.215	3.298	3.383	3.471	3.561	3.654	3.749	3.846	3.946	4.049	4.155	4.263	4.375
Storage Capacity Limit	0	0	0	2.906	2.906	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459	4.459
Captured Micro Demand	**0**	**0**	**0**	**1.930**	**1.980**	**2.690**	**2.759**	**2.830**	**2.903**	**2.978**	**3.055**	**3.134**	**3.215**	**3.298**	**3.383**	**3.471**	**3.561**	**3.654**	**3.749**	**3.846**	**3.946**	**4.049**	**4.155**	**4.263**	**4.375**
Petroleum Byproducts	0	0	0	1.930	1.980	2.690	2.759	2.830	2.903	2.978	3.055	3.134	3.215	3.298	3.383	3.471	3.561	3.654	3.749	3.846	3.946	4.049	4.155	4.263	4.375

Table 15 : Micro Demand Projection for Terminal STS08.
Source: miscellaneous data.

4. Estimated Service Prices

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

The prices in this feasibility studies are for reference purposes only, and do not imply any obligation to the lease holder. The prices referred to herein merely represent a best estimate and are used as input variable to value the enterprise.

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

In this case, the need for some price control mechanisms is due to the following:

- Terminal **STS08** is the operator responsible for the flow of petroleum by-products from refineries located in the State of São Paulo;
- In this sense, regulation through the 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 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 supply chain is extremely sensitive to input price fluctuations, abusive price increases can be passed on to individual consumers, thus adversely affecting them. Furthermore, overcharging can also disrupt the production within refineries.

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

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

It is important to clarify 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. These operations include docking the vessels, boarding, disembarking, and storing of products for a certain period. This type of terminal provides service 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 updated websites 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 given region through their gas station chains. Hence, distribution centers will most likely transact with companies within their own economic groups.

For the purposes of modeling the **STS08** and STS08A**,** considering that their natural vocation is the handling of petroleum by-products and LPG, the prices per ton differ, as they are based on length of stay and types of services rendered. All prices per ton are based on price lists disclosed in accordance with 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 duration of operations, where applicable;
- Consider product and volumes involved;
- Consider losses and contamination levels of the product handled;
- Consider the current tax burden;
- Not be discriminatory. That is, prices shall not incorporate costs attributable to other carriers or other terminals, or incorporate subsidies of any kind, or outside compensations;
- Consider maintenance and operating costs, and possibly consider including a fair return on the investment.

For modeling purposes, the services provided at the terminal are consolidated into one single average price. The characteristics of the majority of the products handled at the terminal 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 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;

In regard to the service fees charged by this terminal, the study defined a broad set of possible services a customer may request.

The terminal´s price list below specifies 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.

The prices below are quoted in cubic meters when the weight of the product is below or equal to 1kg/liter and per metric ton when the product's weight is greater than 1kg/liter. The prices also consider the density conversion rate of each product for dark and light petroleum by-products. The table below specifies the three main classes of products handled by **STS08's**, standardized on a per ton basis.

Type of Service	Price (m^3)	Price (T)	with tax	With discount
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**

Table 16 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$ 57,80/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.** Finally, the same basket of services for clear petroleum by-products is **R$ 42,55/m³,** or **53,86/ton**. With that said, it should be emphasized that these prices represent maximum quotes. Indeed, the final price will offer discounts depending on each client's volume and payment method.

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 and clear petroleum by-products, the final prices are **R$ 40,71/ton** and **R$ 45,24/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 quotes. The initial quotes themselves are pulled from the list of prices published in **June 2020.**

5. Minimum Required Volume - MME

The Minimum Required Volume indicator is a risk mechanism shared by 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 combines important underlying fundamentals like static capacity and inventory turnover, while being easily measurable, transparent, and unambiguous.

To define the right MME target for **STS08,** the study sampled the volatility in a regional throughput series of petroleum by-products spanning 2000 to 2020. The study used Brazil's open database on foreign trade, Comex Stat.

A variation range referred to as alpha factor is based on such data.

The selected methodology uses the volatility extracted from the sample to create a lower throughput limit. The factor used to establish this throughput is a generalized standard deviation named α (alpha). The applied methodology was divided into four steps, as shown below:

- 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: Apply the percentage figure from "step 3" to 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 **STS08,** the α (alpha) variation band is **53,29%** for liquid petroleum by-products, as shown in the table 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 17: Alpha for area STS08 - Liquid Petroleum Derivatives.
Source: Own elaboration.

In the case of **STS08,** after arriving at its relevant alpha, the result of applying step four for its expected volume yields the following minimum yearly targets:

year	**STS08 Liquid Petroleum by-products**	**MME**
2021	0	0
2022	0	0
2023	0	0
2024	1.902	889
2025	1.945	909
2026	2.636	1.231
2027	2.696	1.259
2028	2.757	1.288
2029	2.819	1.317
2030	2.884	1.347
2031	2.949	1.378
2032	3.017	1.409
2033	3.086	1.441
2034	3.156	1.474
2035	3.229	1.508

2036	3.303	1.543
2037	3.378	1.578
2038	3.456	1.614
2039	3.535	1.651
2040	3.617	1.689
2041	3.700	1.728
2042	3.785	1.768
2043	3.873	1.809
2044	3.962	1.851
2045	4.054	1.894
Reducer (alpha)		**53,29%**

Table 18: Minimum Required Volume - MME (in Kt) area **STS08.**
Source: EPL.