Implementation of Ultra Low Sulfur Diesel Fuel in Brazil

Calidad ambiental de diésel y otros combustibles: Mejores prácticas internacionales

Dec. 2020

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General View About PETROBRAS

- Publicly-held company operating on an integrated basis and specializing in the oil, natural gas and energy industry

**Net Revenue**
R$ 302.2 billion

**Net Profit**
R$ 40.1 billion

**Shareholders**
More than 500,000

**Number of Employees**
46,416

**Daily Output**
2.77 MMboed

**Production Wells**
6,587 (oil and gas)

**Production Platforms**
107

**Refineries**
13

**Oil product production**
1,873 MMBpd

**Biofuels**
5 biodiesel plants

**Thermoelectric Plants**
20 operated plants

**Wind Energy**
Joint Ventures in 4 plants

**Solar Energy**
1 photovoltaic solar power plant

Source: Sustainability Report - 2019
Historically, different types of diesel were sold in Brazil according to geographical reasoning.

### Interior Diesel

<table>
<thead>
<tr>
<th>PPM</th>
<th>3500</th>
<th>2000</th>
<th>1800</th>
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### Metropolitan Diesel

<table>
<thead>
<tr>
<th>PPM</th>
<th>2000</th>
<th>500</th>
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Dec. 2008 Shares

- **Interior**: 73%
- **Metrop.**: 27%

With the evolution of pollutant emissions standards, this scenario has changed...
Stringent emission standards for heavy duty vehicles were introduced in the last years

Progression of European standards

Progression of Brazilian standards

Since phase P6 (EURO IV equivalent) was not implemented in Brazil, in October 2008 PETROBRAS, ANP, IBAMA and Vehicle Producers signed an Agreement with the Federal Public Ministry

Source: CONAMA
The Agreement signed in Oct. 2008 established great challenges to the Brazilian market.

**Agreement Guidelines**
- Replacement of 1800 ppm by 500 ppm diesel (automotive applications)
- Introduction of Ultra Low Sulfur Diesel
- Launch of Off-Road Diesel on Jan. 2014

**Regulatory Ambience**
- ANP Supply Plan
- ANP Resolutions:
  - On-Road Diesel Specifications
  - Implementation Timetable
  - Off-Road Diesel Specification
- CONAMA Resolutions:
  - Disciplined requirements for P-7 phase
  - Air monitoring and selection of areas for the use of ULSD

**Investment Plans**
- Project portfolio associated with the accomplishment of quantity and quality
  - Refining units
  - New refinery
  - Logistics Adjustments
- Infrastructure adjustments for distributors and retailers
Regarding the replacement of 1800 ppm diesel by 500 ppm diesel, the targets set for each year were fully complied.

We replaced at about 574 kbpd of high sulfur diesel in 5,714 municipalities.

Complete replacement by year:
- 2009: 206 municipalities
- 2010: 413 municipalities
- 2011: 559 municipalities
- 2012: 1,258 municipalities
- 2013: 385 municipalities
- 2014: 3,099 municipalities

Map of municipalities with 500 ppm by:
- 2009: 35 municipalities
- 2010: 23% of municipalities
- 2011: 28% of municipalities
- 2012: 33% of municipalities
- 2013: 44% of municipalities
- 2014: 43% of municipalities
- S-50 - 2009: 9% of municipalities

Diesel Oil Share - Petrobras Sales:
- 2010: 11%
- 2011: 19.2%
- 2012: 45.2%
- 2013: 59%
- 2014: 100%

Base Year: 2009
The ULSD was sold to meet the specific regions and municipalities demands between 2009 and 2011. With the implementation of phase P7, the product became available in services stations across the country.

**Timeline:**
- **JAN.09:** Rio de Janeiro, São Paulo (Bus)
- **MAY.09:** Recife / Fortaleza / Belém (All fleet)
- **AUG.09:** Curitiba (Bus), Belo Horizonte, Salvador, Porto Alegre, São Paulo (Bus)
- **JAN.10:** MR B. Santista, Campinas / S. J. Campos, Rio de Janeiro (Bus)
- **JAN.11:** Nationwide
- **JAN.12:** Nationwide Launch of 10 ppm diesel
- **JAN.13:** Nationwide Service stations and fleets

**Diesel Reductions:**
- **Particulate Matter:** -80%
- **NOx:** -98%

**Implementation Details:**
- **Integrated Solution for Emissions Reduction**
- **DIESEL S-50**
  - Euro V Motors
  - SCR
  - Maximum sulfur content: 10 ppm
  - Minimum Cetane: 48
- **DIESEL S-10**
  - AdBlue
  - SCR
  - Motor Euro V
  - EGR
  - * SCR = Selective Catalytic Reduction
  - ** EGR = Exhaust Gas Recirculation

**DONE**
The implementation of ULSD in Brazil occurred with a high level of complexity

“Multigrade“ transition
3 grades of Diesel (2 with high sulfur content).
S-50 gasoline started in 2014

Production/importation with 10 ppm and PB sales with 10 ppm

Long extension pipelines / complex systems

Source ANP
To ensure the wide availability of the ULSD across the country, ANP promoted actions involving distributors and retailers.

### Additional Resolutions

- Defining criteria for mandatory offer of ULSD by service stations
  - Diesel Oil supply nozzles > Otto Cycle supply nozzles
- Fixing colorful plastic sticker to inform the type of diesel offered in each pump

### Infrastructure Adjustments 2012

- **PETROBRAS**
  - 14 sale points (among a total of 37)
- **DISTRIBUTORS**
  - 49 bases (among a total of 280)
- **RETAIL**
  - 4,225 service stations (among a total of 38 thousand)
To ensure the success of phase P7 and achieve environmental gains, Petrobras brought together a team of specialists.

The Management Committee was created in Sep. 2009 with the objective to guarantee the fulfillment of the actions determined for Petrobras in the Agreement.

[70]: total of meetings realized up to Jul. 2015

*ELO-s: Efficiency in Logistics Operations of Moving and Storage of ULSD Products
Diesel Offer Plan informed the distributors and retailers the path to participate in a joint partnership

1ª Ed: Aug. 2010
2ª Ed: May 2013

Content

- Details of the offer of several grades over the years
- Petrobras investments and schedule
- Necessary adjustments to distributors
- Local operating conditions
The ELO-s project was implemented in order to guarantee the efficiency in logistics operations related to the ULSD

Successful introduction of ULSD across the country

*ELO-s: Efficiency in Logistics Operations of Moving and Storage of ULSD Products*
Tests were performed to evaluate the evolution of the ULSD sulfur content along the supply chain.
Significant investments were done in production and logistics in order to ensure market supply

Between 2005 and 2019, more than US$ 100 bi were invested in Downstream.

We estimate an additional US$ 3.7 bi thru 2025.

Source: 2021-2025 Strategic Plan

Logistics: Segregation adjustments in 25 terminals and installation of 235 valves

9 new HDT units since 2010 and internal adjustments in the refineries

Refining Capex: 2021-2025

Operational Efficiency

HSE

HCC GASLUB

HDT REDUC, REVAP and REPLAN

Operational Continuity

Other

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The Management Committee adapted a road map method of analysing the risks related to the fulfillment of the projects.

**Implementation Process**

- ANP Supply Plan
- Petrobras Offer Plan
- Action plans to guarantee deadlines
- Definition of temporary solutions
- Notify ANP
- Adjustments at refineries and terminals
- Adjustments at distribution and resale
- Operators training
- Periodical Monitoring by:
  - Management Committee
  - TG Sindicom
  - TG ANP
  - Ministry of Mining & Energy

**Concluded**
- As expected or low probability of occurrence
- Tendency to delay or moderate probability of occurrence
- Expired or high probability or occurrence
- Risks addressed and treated
It was dedicated effort by all players in a continuous communication process.
The success in the implemented strategy led to the outstanding results regarding the ULSD...

- 32 Petrobras points of sales
  - 2012
  - 2013
  - 2014
  - 2015
  - 2019
  - 2020
  - 2021 (expected)

- Expansion of the retail network*:
  - 4,225 stations in 2012 vs. 32,773 in 2020

- Continued demand and market share growth*:
  - Market-share in 2020 (up to October): 53%

- 2,7% of non-conformities in regard to diesel quality (Basis: Jan-Oct/2020)*
  - 21,000 samples

*Source: ANP
At Petrobras, respect for people and the environment is part of our vision, and it is deeply connected to our business. We work to ensure a sustainable future for the next generations and performing with social responsibility in all of our activities is a challenge we are proud to overcome everyday.

Thank You!

Gracias!

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