

1. CONTEXT



Legal metrology has a major challenge dealing with the huge global fuel market. Even small measurement errors can lead to major economic distortions and major financial losses.

Only in Brazil, more than 127 billion liters of fuel were traded in 2024. A market of approximately 125 billion dollars.

In Santa Catarina, a state with 7.61 million inhabitants in southern Brazil, there are 1,850 liquid fuel retail stations with approximately 19,000 fuel dispenser used in commercial transactions.

These fuel dispensers receive the annual metrological verification of the Santa Catarina Metrology Institute (Imetro-SC).

This paper presents the economic distortion avoided by Imetro-SC in the trade of gasoline, ethanol and diesel in Santa Catarina in 2024.



2. THE METROLOGICAL VERIFICATION OF FUEL DISPENSERS IN SANTA CATARINA

When performing the metrological verification of a fuel dispenser, Imetro-SC identifies the measurement error that generates an economic distortion. In cases of errors greater than the maximum permissible ones, the fuel dispenser is interdicted for repair, ceasing the loss that generates the economic distortion.



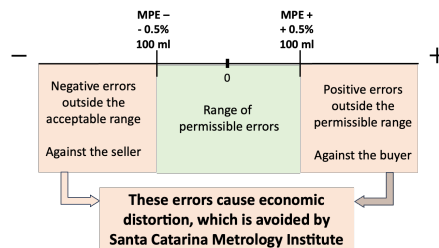
At this moment, there is the avoided economic distortion. This control occurs annually in thousands of fuel dispensers throughout the state of Santa Catarina in southern Brazil.



3. MAXIMUM PERMISSIBLE ERROR (MPE) and ECONOMIC DISTORTION (ED)

Maximum permissible error (MPE) is the maximum permissible difference between the value measured at the dispenser and the value measured at the standard volume measurement.

In Brazil, the range of permissible errors for liquid fuel dispenser goes from – 0.5% to + 0.5%.



The economic distortion (ED) is given by the multiplication amongst V , IMI and e , where V represents the amount of fuel traded, IMI the ratio between fuel dispensers with errors greater than the maximum permissible, over the total of the fuel dispensers, and e the mean error.

$$ED = V \cdot IMI \cdot e$$

It is worth noting that positive economic distortion represents losses to consumer and negative value seller losses.

4. FUEL MARKET INFORMATION IN SANTA CATARINA IN 2024

Table 1 show the information of fuel market in Santa Catarina and the inputs for the economic distortion computation in 2024.

The index (+) shows the values regarding positive errors and (–) the negative ones. Economic distortion in computed separated to positive and negative measuring errors in order to show both, consumer and seller losses.

Table 1. Fuel market information at Santa Catarina in 2024						
Fuel	e +	e -	Fuel price	Volume traded	V	IMI + / IMI -
Gasoline	0.0106	0.0080	\$1.01	3,227,120,000l	\$3,274,440,612.35	0.0037 / 0.0031
Ethanol	0.0068	0.0095	\$0.73	135,614,440l	\$98,881,655.21	0.0034 / 0.0023
Diesel	0.0101	0.0107	\$0.97	3,081,078,000l	\$3,002,002,084.17	0.0055 / 0.0043

Measuring instruments information is given by the National Institute of Metrology, Quality and Technology (Inmetro) information management system, where data from tests are obtained.

Fuel market information is given by the Brazilian National Agency for Petroleum, Natural Gas and Biofuels (ANP).

All the values are given in USD using 2024 exchange value compared to Brazilian currency, according to Brazil Central Bank data, where 1 USD = 6.1991.

5. RESULTS OF ECONOMIC DISTORTION AVOIDED BY IMETRO-SC IN 2024

Economic distortion avoided against the consumer:

Gasoline \$ 129,352.00

Ethanol \$ 2,253.63

Diesel \$ 166,644.40



Here, the work of Imetro-SC protected the consumer!

Economic distortion avoided against the seller:

Gasoline \$ - 81,827.18

Ethanol \$ - 2,114.52

Diesel \$ - 139,287.49



Here, the work of Imetro-SC helped the seller!

Economic distortion avoided against the consumer and seller:

Gasoline \$ 219,179.18

Ethanol \$ 4,368.15

Diesel \$ 305,931.89

TOTAL \$ 529,479.22



The Legal Metrology is important for consumers and sellers!

6. CONCLUSIONS

The periodic verification carried out by Imetro-SC on liquid fuel dispensers in Santa Catarina in 2024 prevented an economic distortion of over US\$ 500,000.

The losses avoided for consumers in Santa Catarina were greater than the losses avoided for liquid fuel sellers in 2024. However, contrary to expectations, the losses avoided for the seller were very significant, very close to the losses suffered by the consumer, which shows the importance of legal metrology for this productive sector.

Knowing the economic distortion in a given sector helps direct efforts to ensure that measurement errors remain within admissible limits.

It is hoped that this work can contribute in some way to other National Metrology Institutes calculating the impact of their actions in reducing economic distortion in the fuel trade, thus contributing to ensuring fair trade and fair competition in their markets around the world.

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Dr Soratto's email: presidente@imetro.sc.gov.br
Dr Rodrigues Filho's email: bafilho@inmetro.gov.br

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