



# NATURAL GAS SUSTAINABILITY OF INTEGRATED ANALYSIS AS A TRANSPORTATION FUEL IN HEAVY VEHICLES: THE PAULISTA BLUE CORRIDOR

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Research Centre  
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cleaner energy for a sustainable future

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# Overview

This project will develop a simulation model inspired by the blue corridors concept. Blue corridors are routes for road transport (usually trucks) using natural gas (compressed - CNG - or liquefied - LNG). The diesel, mainly used by trucks, is the energy source that most presses Brazilian refining capacity, generating deficits of billions of dollars annually in the Brazilian trade balance. On the other hand, Brazil has abundant natural gas reserves and currently the world has recognized natural gas as a more sustainable energy solution for the transport sector, especially loads road transport (trucks).



# Construction of Blue Corridor in São Paulo State

- The goal is to propose an initial plan for a Blue Corridor in the São Paulo State, which is a route for heavy road vehicles that run on natural gas, considering its environmental and economical aspects.
- This presentation present, a Blue Corridor and LNG Infrastructure for São Paulo state through data collected and results obtained and represented by maps.

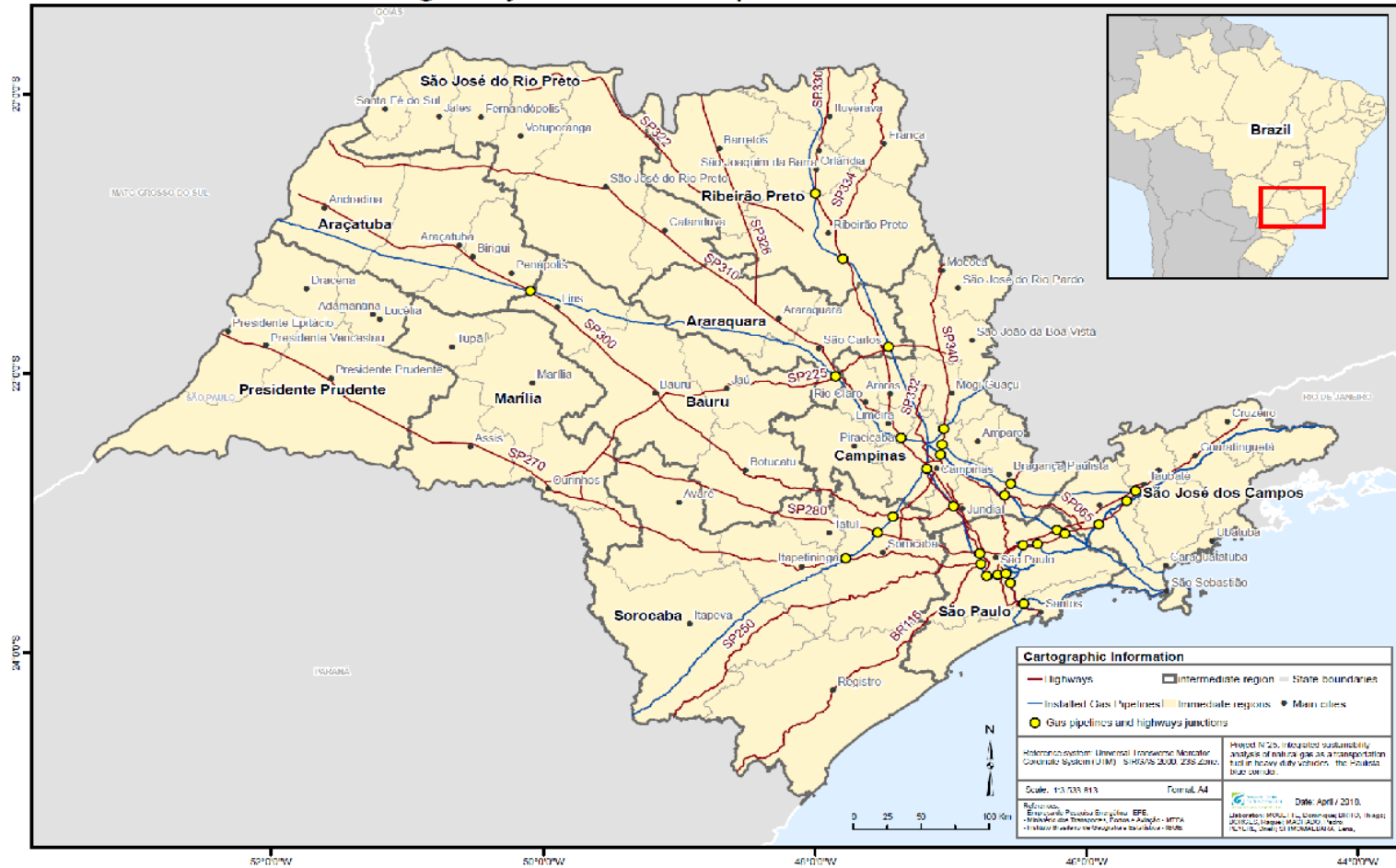


Map 1- Highways in the state of São Paulo



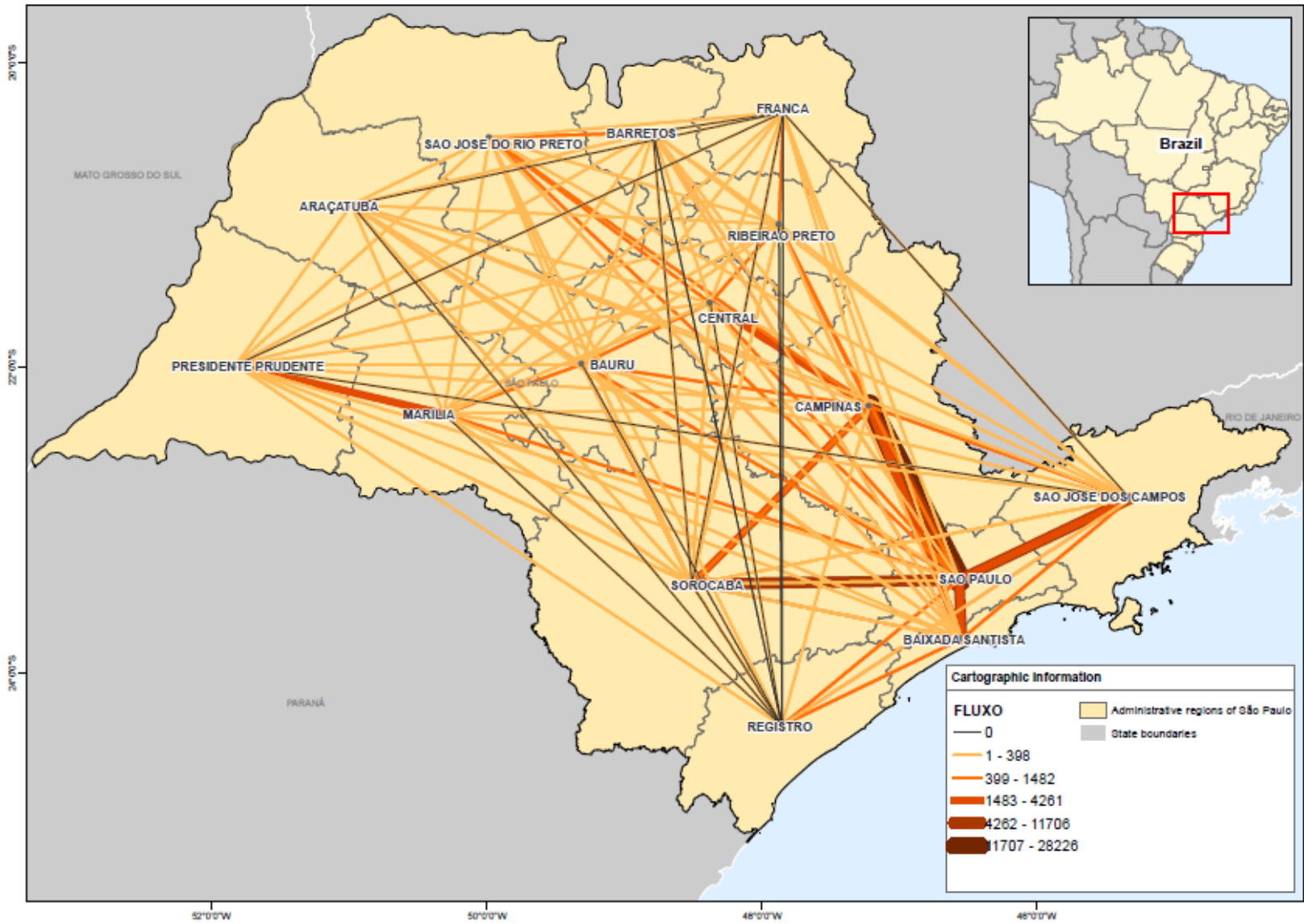
Map 2 - Highways selected from the State of São Paulo

# Highways and Gas Pipelines Junctions

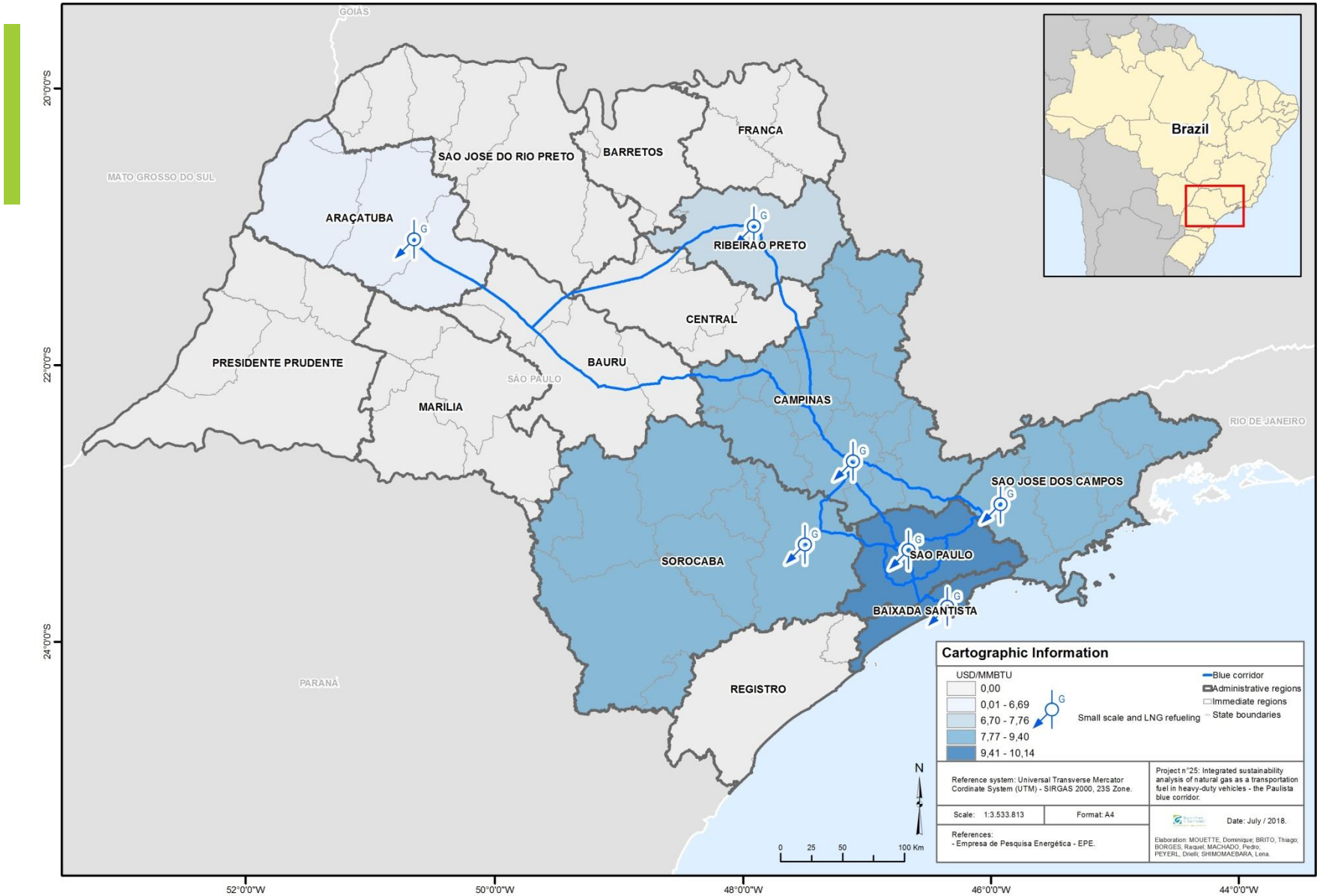


Map 3 - Highways and Natural Gas Pipelines Junctions in the State of São Paulo





Map 4 – origin and destination matrix.



Map 5 - Example of Blue corridor : scenario 1.



# Analysis of the blue corridor

- Determining LNG price per region;
- Determining GEE and pollution emissions.

Table: exemple LNG price per region – Scenario 1 (without gas price)

Region	USD/MMBTU
Araçatuba	7.98
Ribeirão Preto	6.64
Sorocaba	4.88
Campinas	4,86
São Paulo	4.91
São José dos Campos	5.24
Santos	5.30
Total	5.11

# Economic Comparison of Diesel Oil and Natural Gas

- To analyze the economic viability of Natural Gas fleets, this project aims at analyzing through a Montecarlo analysis the minimum price for freight transport using natural gas-based trucks in the State of São Paulo. A Sensitivity analysis will also be performed based on a tornado plot.

# Economic Comparison of Diesel Oil and Natural Gas

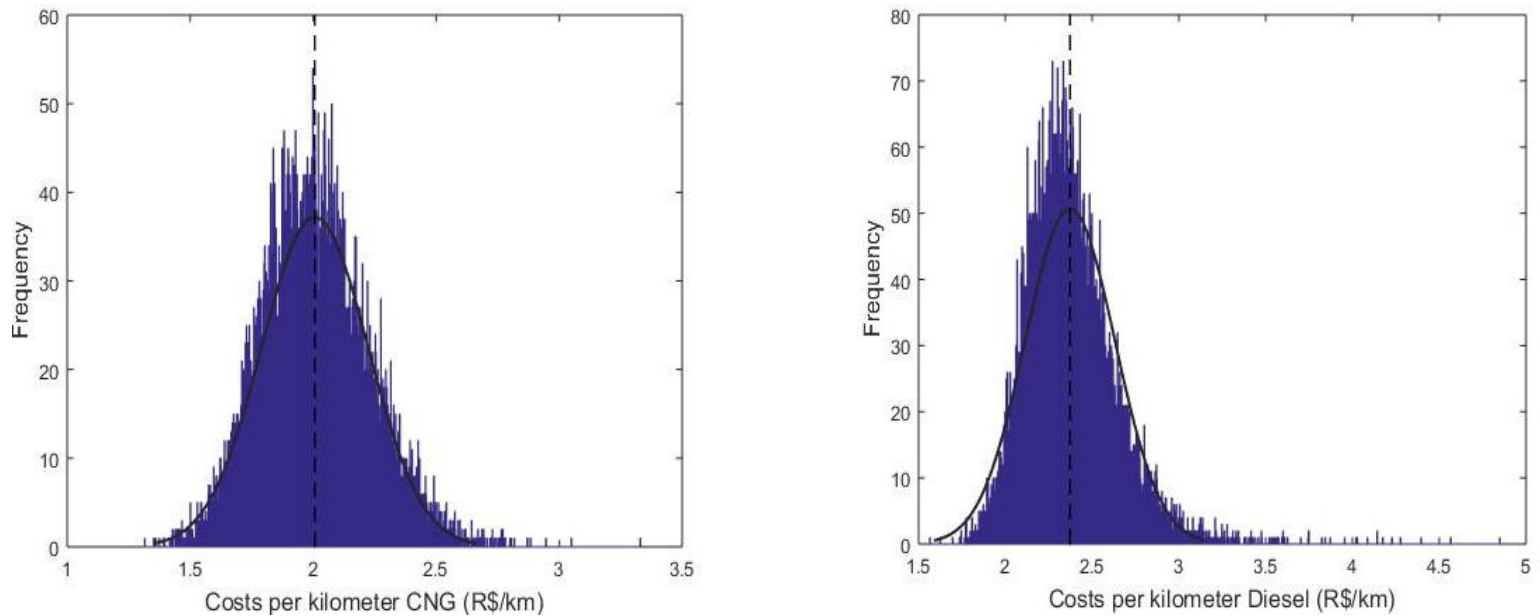


Figure 1 – Cost per kilometer of compressed natural gas (left) and diesel (right) trucks.

# Economic Comparison of Diesel Oil and Natural Gas

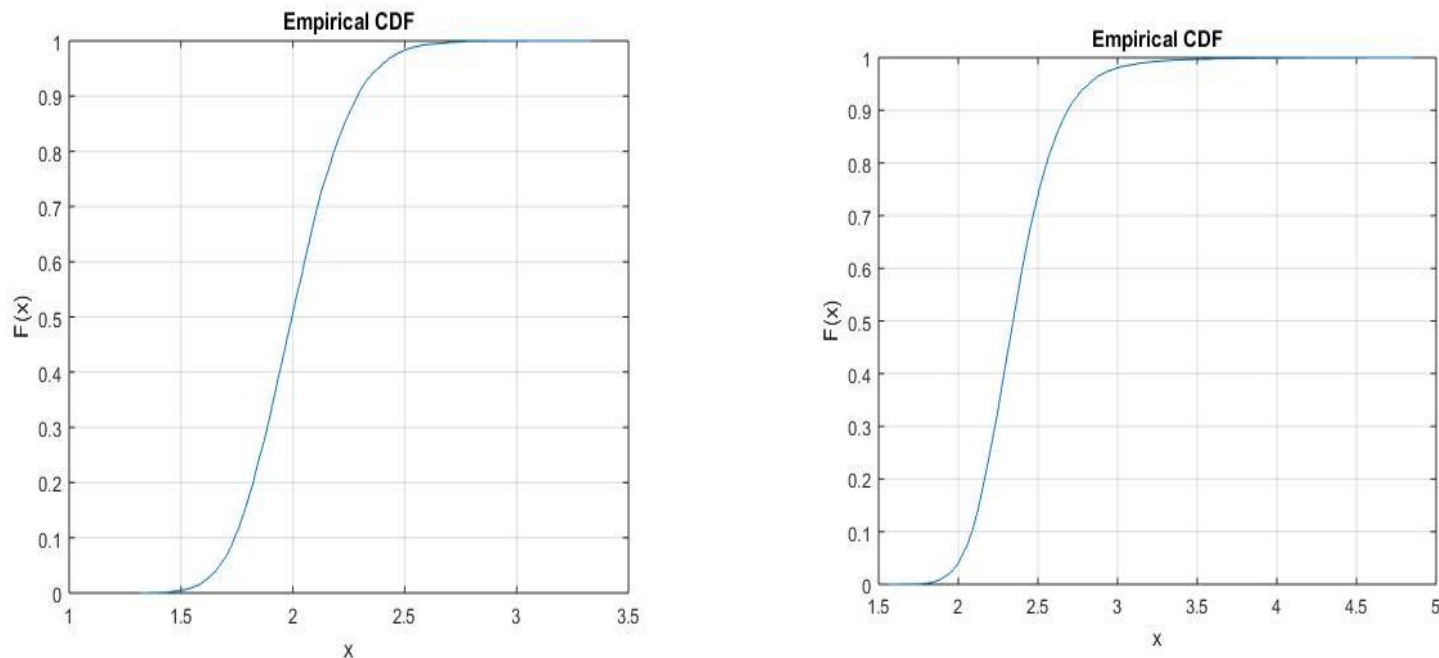


Figure 4 – Accumulated probabilities of compressed natural gas trucks (left) and diesel trucks (right) prices per kilometer.

# Economic Comparison of Diesel Oil and Natural Gas

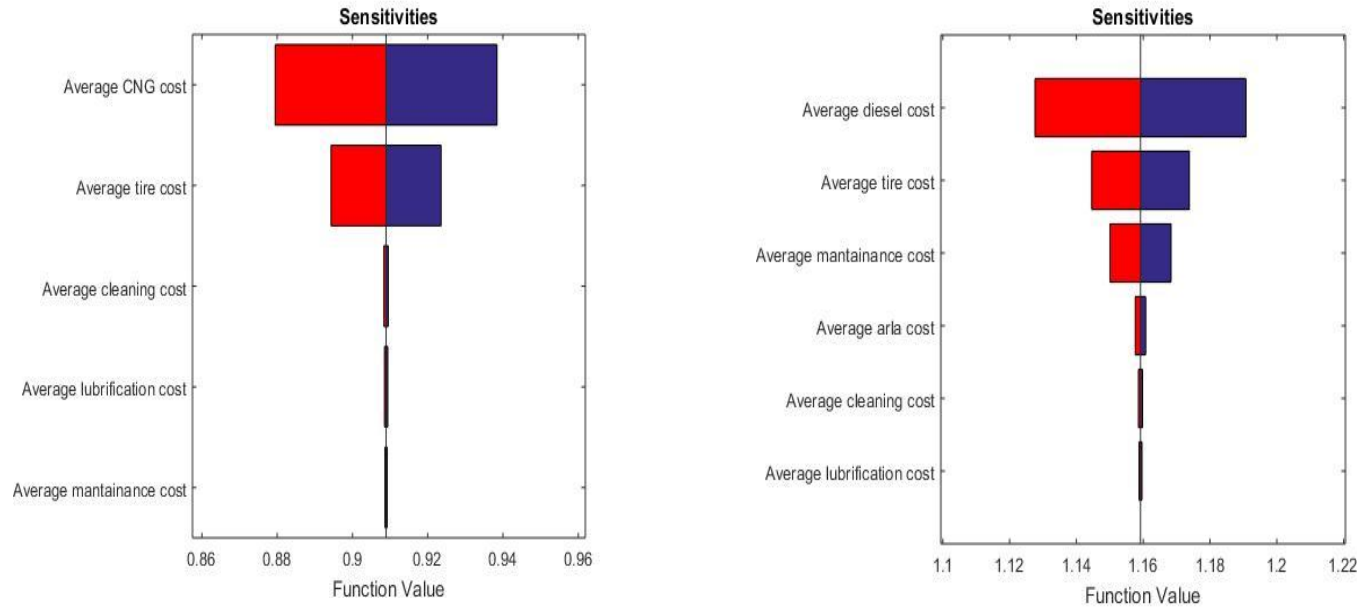




Figure 5 – Sensitivity analysis of compressed natural gas (left) and diesel (right) trucks variable price per kilometer.



# Questionnaire to Fleet Owners and Truck Drivers

- To collect information through interviews about the possibility of using natural gas.
- Target audience: truck drivers and station owners

Questionnaire

Nome: \_\_\_\_\_ Data: \_\_\_\_/\_\_\_\_/\_\_\_\_

Empresa/Próprio: \_\_\_\_\_

Local: \_\_\_\_\_ Tipo de carga: \_\_\_\_\_

QUESTIONÁRIO

Prezado Senhor(a),

Estamos realizando um estudo relativo ao uso do gás natural, motivado pela entrada deste combustível no Estado de São Paulo. Para isso, estamos promovendo uma consulta com o propósito de analisar a importância do gás natural, sua rede de fornecimento/abastecimento e os equipamentos necessários para sua aplicação.

Para obter essas informações, gostaríamos de contar com a sua colaboração para o preenchimento do questionário abaixo.

**Obrigado!**

Tempo estimado: 8 minutos.

1) Qual o tipo de combustível do seu veículo?

(...) Diesel → (...) GNV → (...) Gasolina → (...) Etanol →

(...) Outros (especifique) \_\_\_\_\_

2) Você já teve alguma experiência com veículos a gás natural (pequeno ou grande porte)?

(...) Sim → (...) Não

## Next steps

- Finalizing emissions calculations for publication by the end of September 2018 of blue corridor scenarios;
- Calculation of LNG truck prices in Brazil;
- Finalizing economic comparisons between diesel and natural gas options;
- Continuing application of questionnaires;
- Questionnaire results analysis and publication.



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