Innovarpel 2025

TECHNICAL DAYS

DIGITAL TRANSFORMATION
& INDUSTRIAL CYBERSECURITY
IN THE OIL&GAS INDUSTRY

arpel 40 YEARS

JUNE, 24 & 25
Rio de Janeiro, Brazil

Consumption Forecasting in Natural Gas Transportation Operations Using Machine Learning (ML) Techniques such as XGBoost

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Introduction

Natural Gas Transportation

91

DELIVERY POINTS

15

ENTRY POINTS

11

COMPRESSION STATIONS

4.500

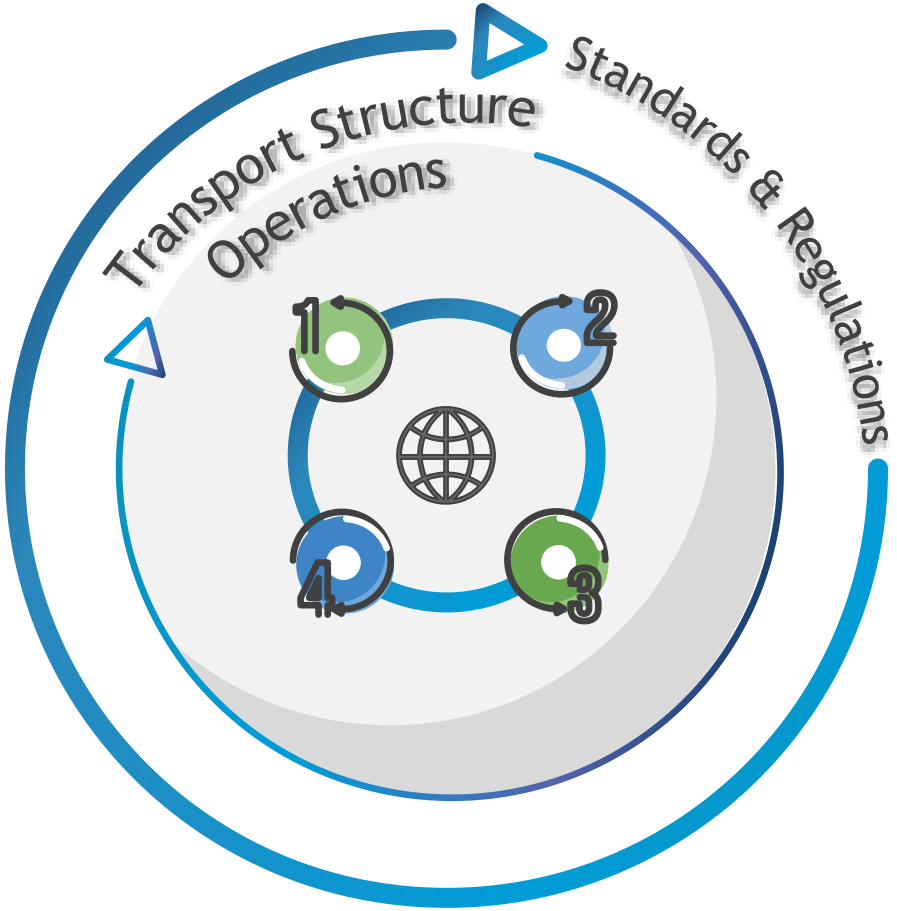
KM OF GAS PIPELINES

Brazilian Largest Natural Gas Network

Introduction

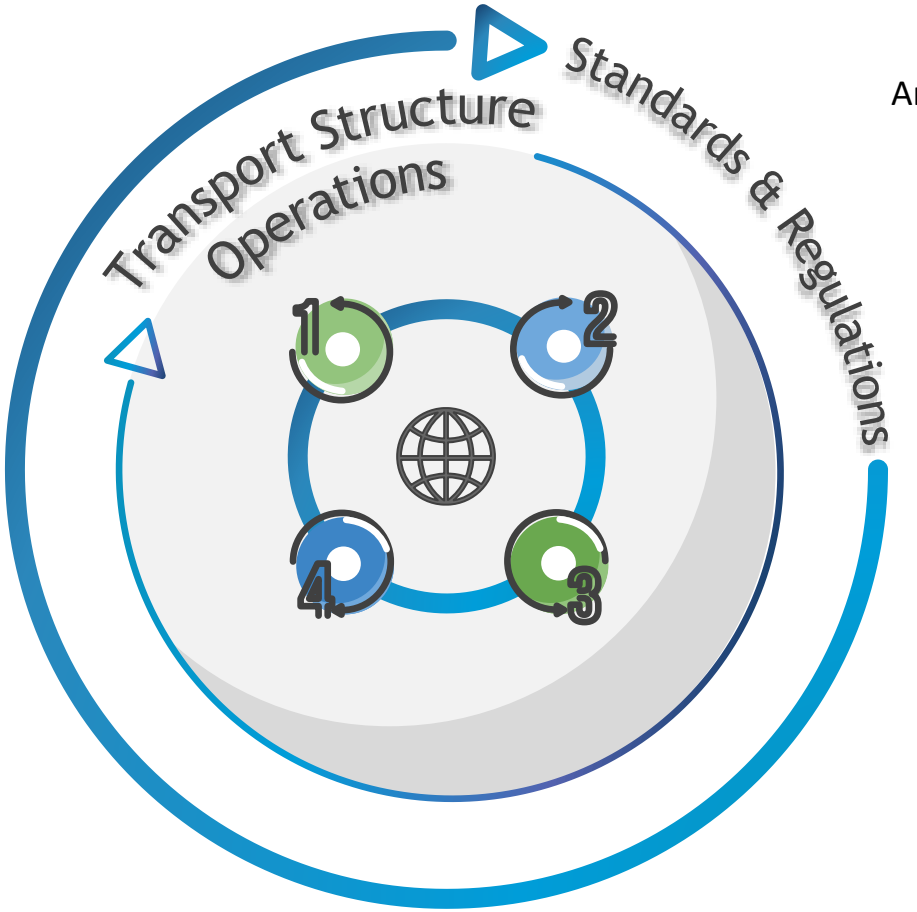
01 Commercial Operation

Responsible for connecting with the commercial area, receiving nominations from shippers, and carrying out the scheduling, certification and allocation process.



Introduction

01 Commercial Operation

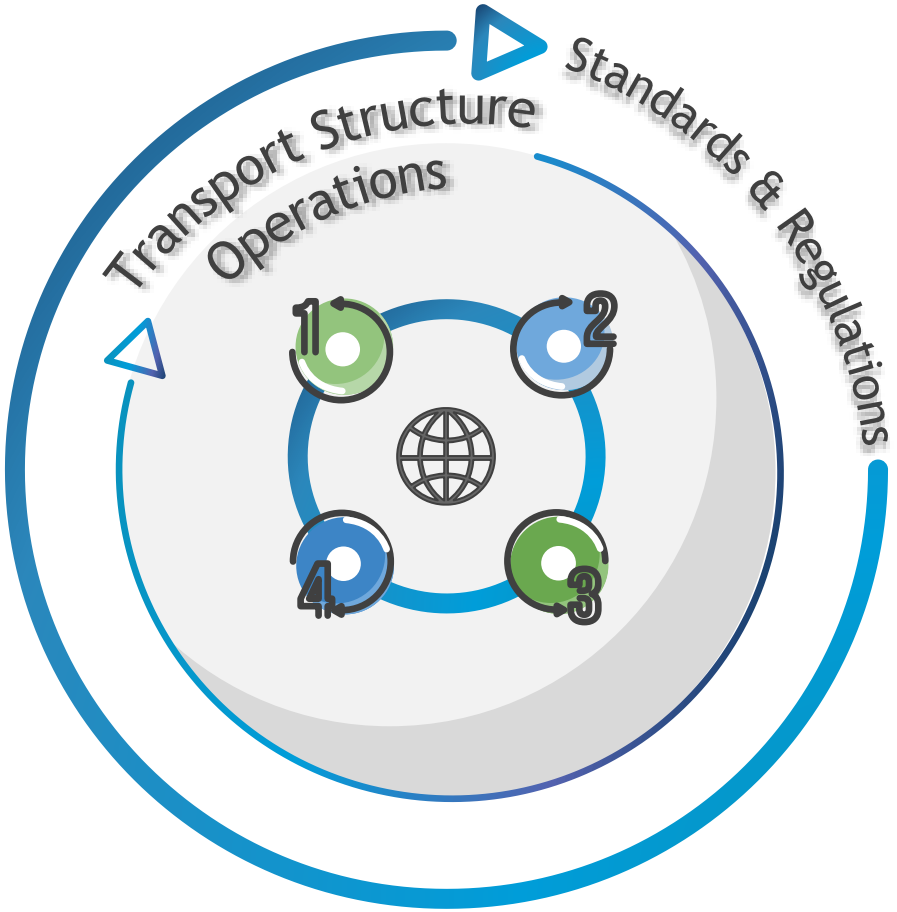


Logistics And Operations Engineering 02

Analysis of scheduling with interface to the CSC, focal point for hydraulic studies under operational conditions, origination, and conceptual projects, serving as the connection to new business opportunities.

Introduction

01 Commercial Operation



Logistics And Operations Engineering 02

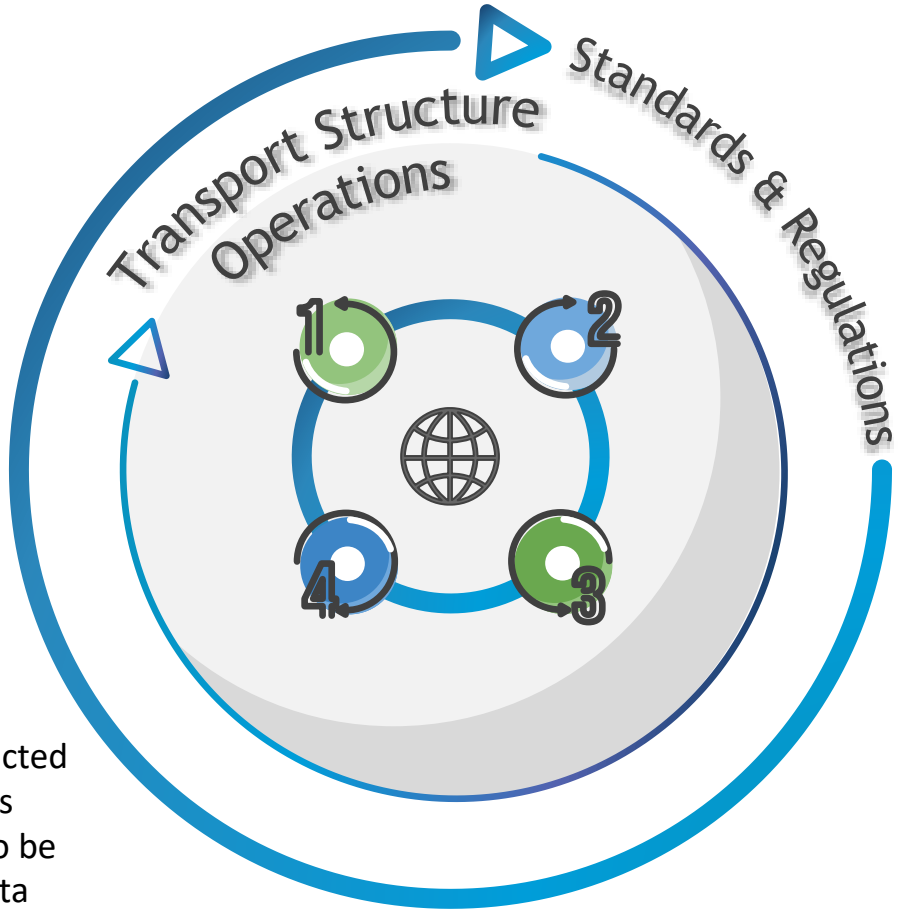
Operations 03

Executes operational instructions, controls and supervises the system, while also providing guidance and mobilizing the field team.

Introduction

01 Commercial Operation

Logistics And Operations Engineering 02



04 Metering & Performance

Ensures the alignment of activities conducted by with legal and regulatory requirements and establishes guidelines for the tasks to be carried out by the field team. Develop data solutions and implement process improvements in operational area.

Operations 03

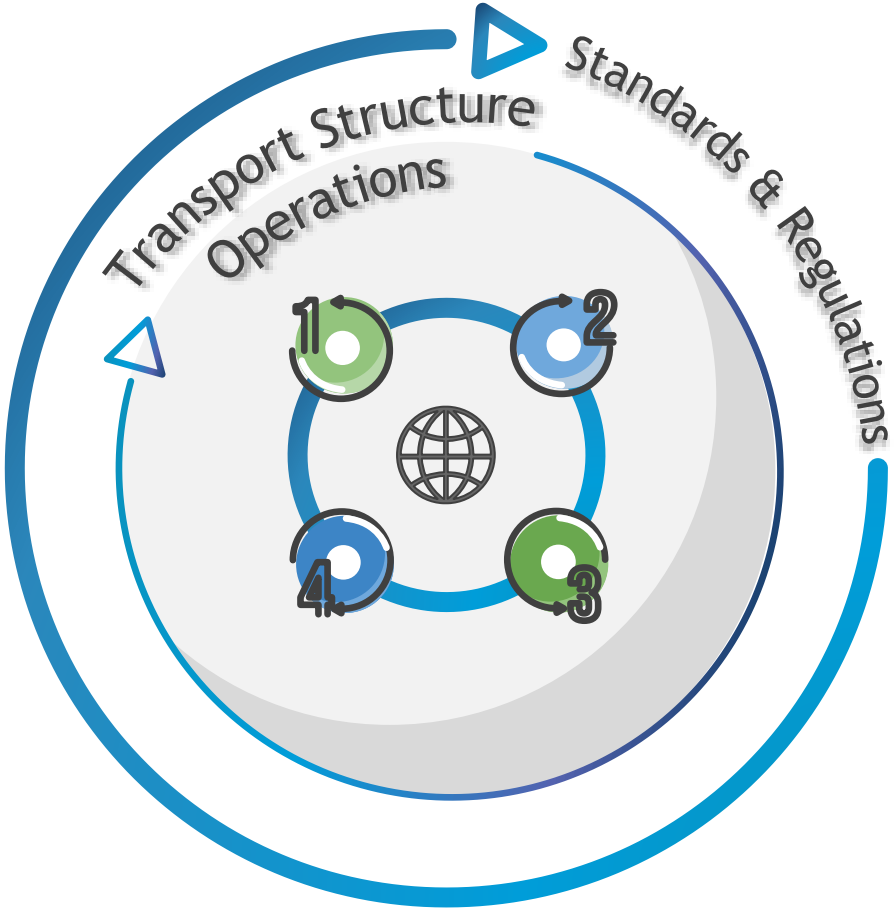
Introduction

01 Commercial Operation

02 Logistics And Operations Engineering

03 Operations

04 Metering & Performance



Machine Learning

Introduction

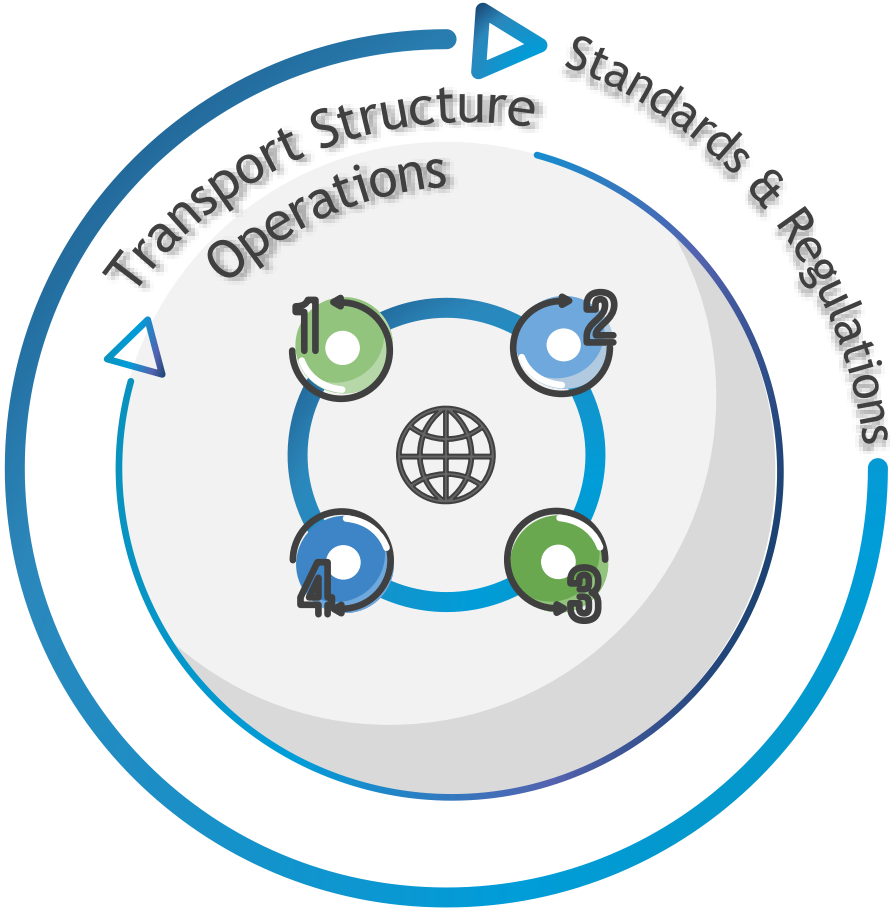
Machine Learning

01 Commercial Operation

02 Logistics And Operations Engineering

03 Operations

04 Metering & Performance



Objective

01 Commercial Operation

02 Logistics And Operations Engineering

03 Operations

Machine Learning

01 Optimization for volume certification processes

02 Enhanced and assertive operational planning

03 Continuous availability of consumption data

Methodology

Database

- Operational measurement
- Flow rate data from the outlet point every 10 minutes from January 2021 until the time of analysis.
- PI System

Development Environment

- Visual Studio Code
- Python
- PI AF SDK

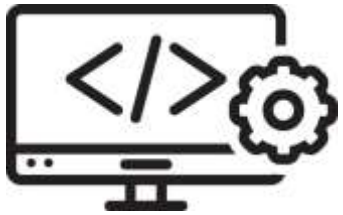
Methodology

Data Treatment

- Frozen data
- Data outside the physical limits of the measurement point
- IQR (Interquartile Range) Methodology

Model Development

- XGBoost
- Train-Test Split: 80/20 (Pareto Principle)
- Error Metrics: RMSE and MAPE



Results

Enhanced and assertive operational planning

67

Consumption forecasting models developed for 67 exit points

68%

Up to 68% reduction in the monthly average MAPE for an exit point, when comparing the model's performance to the accuracy of the original nomination

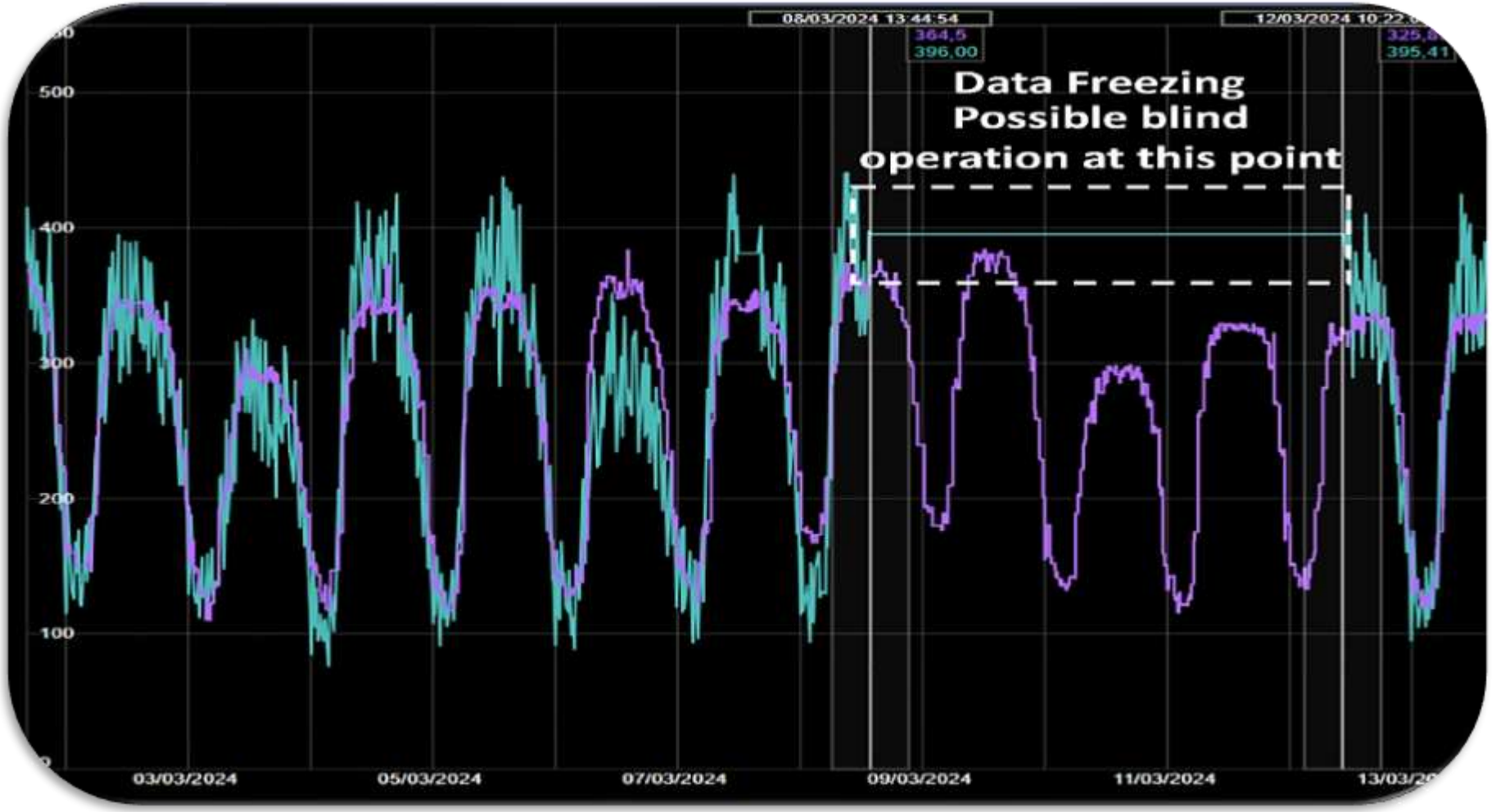
60%

In a daily analysis, 60% of the exit points showed a lower forecast MAPE compared to the nomination

A 10% improvement was achieved in the monthly average MAPE across all points.

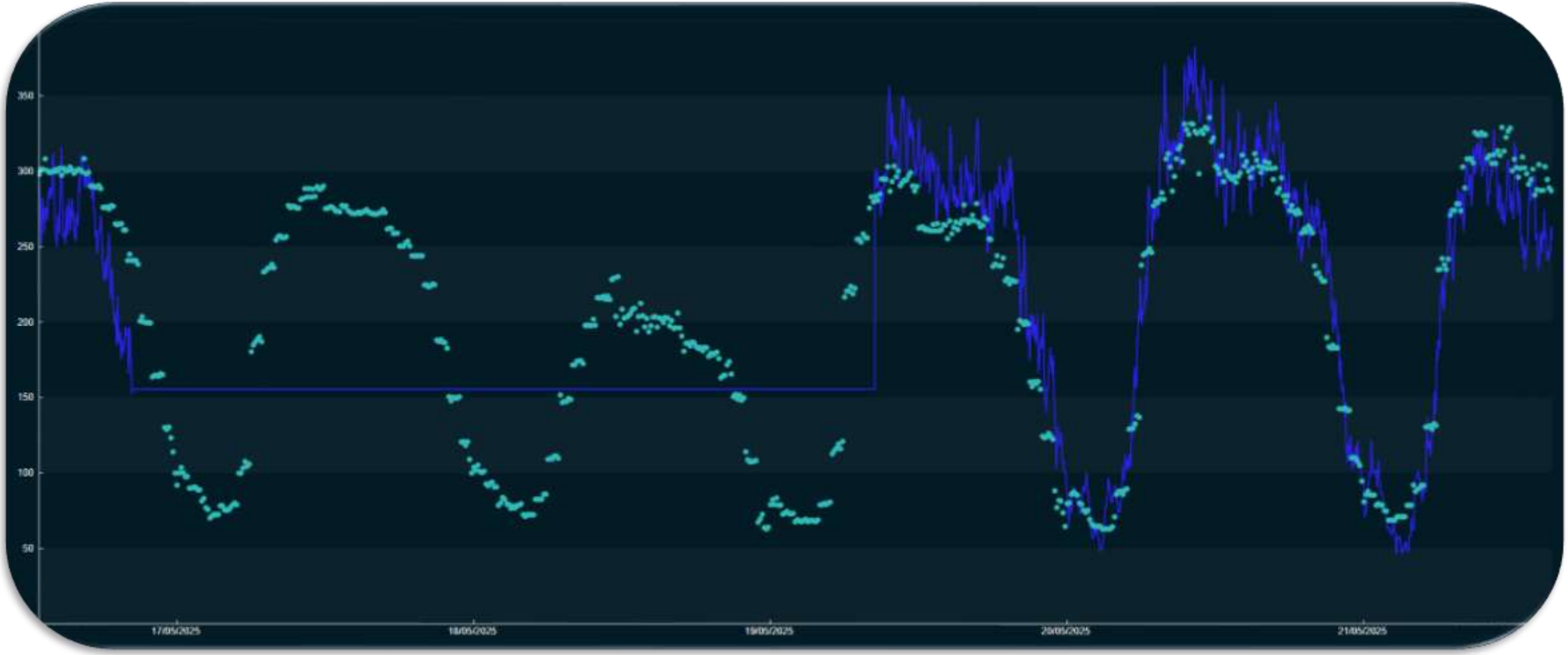
Results

Temporary Condition 100% Available



Results

- Continuous availability of consumption data
- Optimization for volume certification processes



Bussiness Value

Risk Mitigation

The project reduces operational risks by providing accurate forecasts that minimize reliance on client-submitted requests

Operational Safety

The project enhances operational safety by ensuring continuous visibility of gas consumption, even during communication failures

In-house Development Project

TAG

The entire project was developed 100% in-house without any external contracting costs

Thank you

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