



GAs NETwork Simulation and Optimization software using stochastic methods for uncertain demand with the integration of the tariff models to be used by the Gas Network Developer and the off takers. GANESO[®] software case study in the Spanish Gas System.

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HOST ASSOCIATION



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HOST PARTNERS



PRINCIPAL SPONSORS



▶ Developer and Operator of natural gas infrastructure


LSO
LNG Terminal
Operator


Mugardos LNG Terminal
3.6 bcm/year
300,000 m³ LNG

Truck loading
10,000 trucks
per year



TSO
Transmission System
Operator

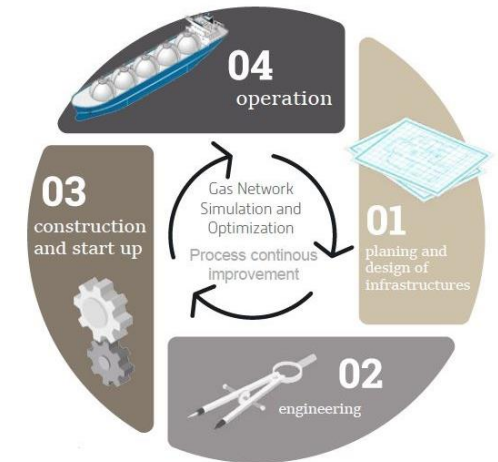
Gas pipeline
130 km 80 barg

▶ COMPANY POLICIY


Safety
the priority in all
our operations


Flexibility
to offer new
services to
our customers

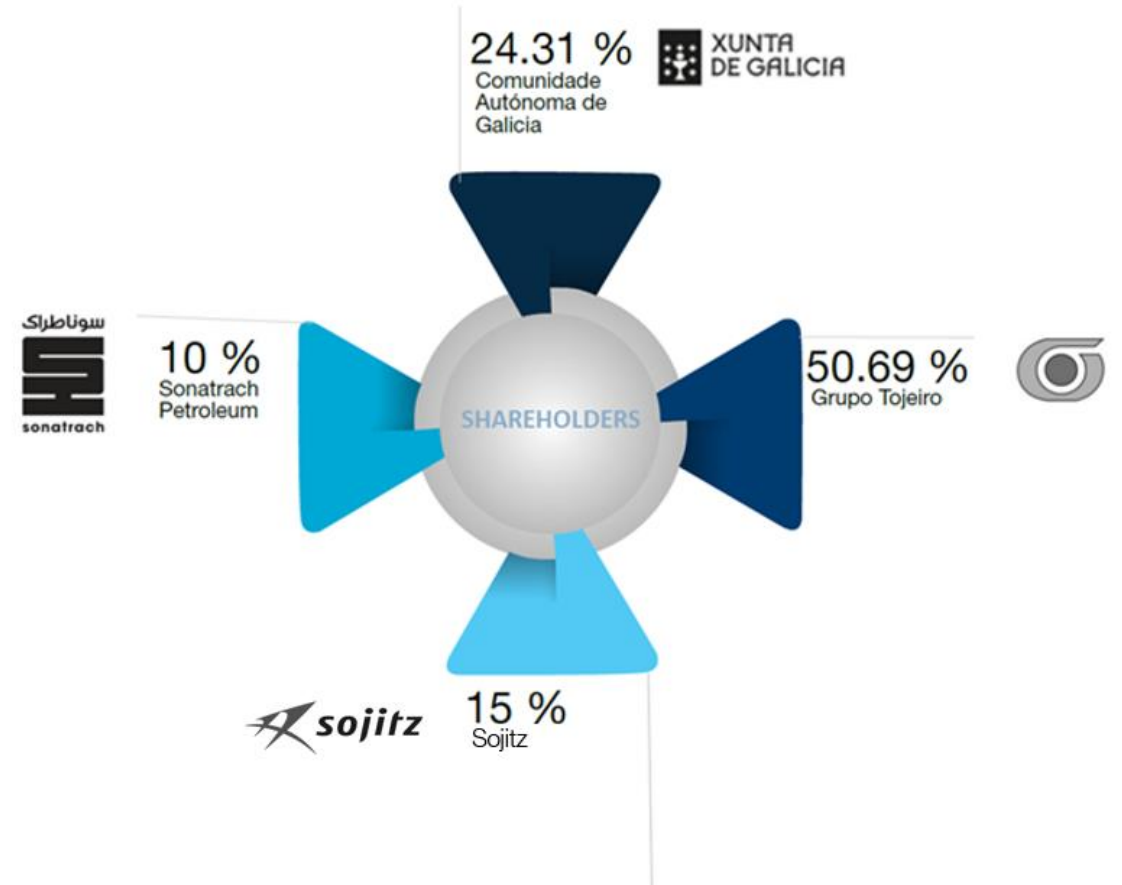

Efficiency
developing
new tools



Public and private capital

Membership /Partnership

- ENTSOG (European Network of Transmission System Operators for Gas)
- GIE (Gas Infrastructure Europe)
- SEDIGAS (Spanish Gas Association)
- GASNAM (Spanish Association of Natural Gas to Mobility)
- MIBGAS (Iberian Gas Market)



Infrastructure

TSO (130 km)

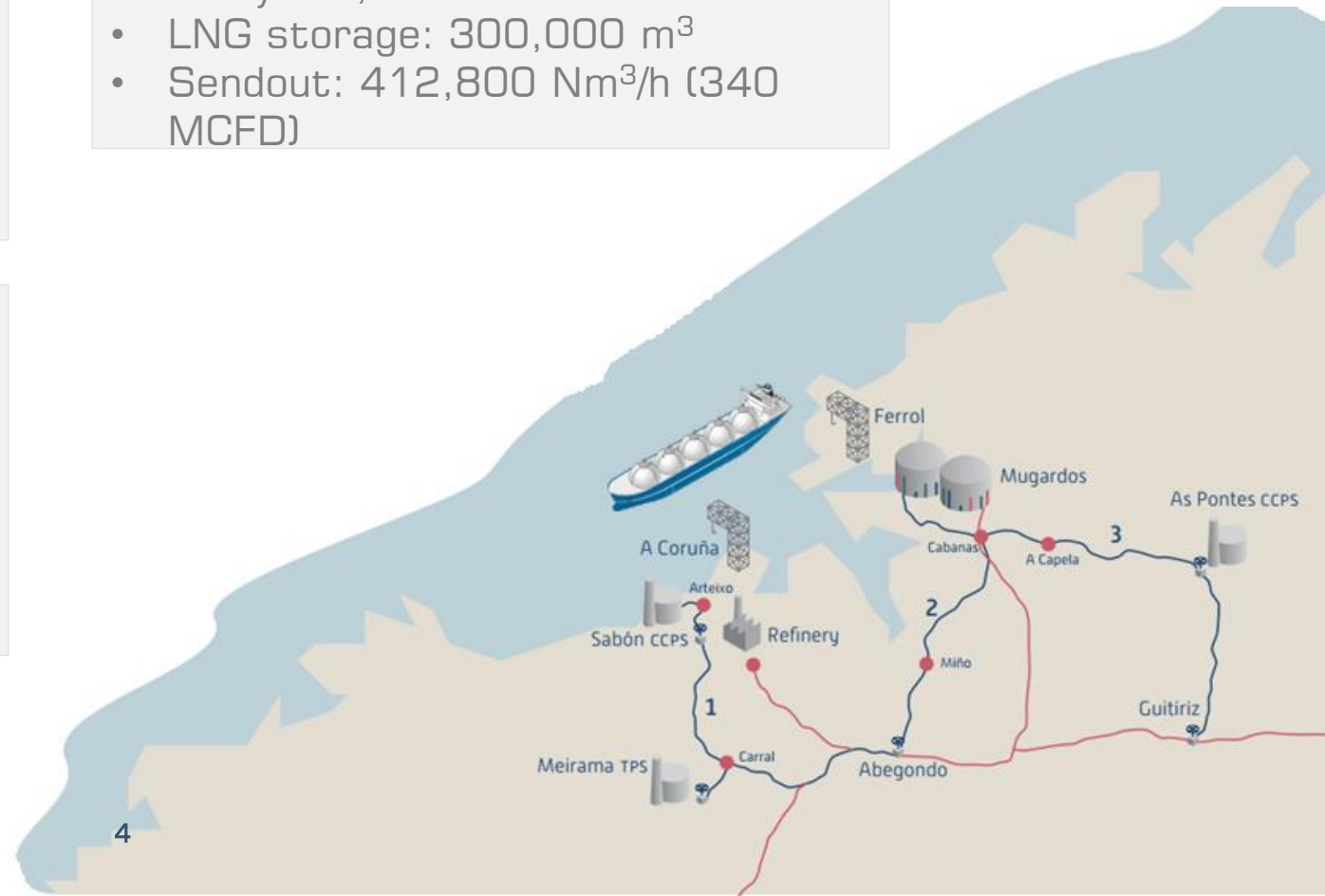
- 1: Abegondo-Sabón
- 2: Cabanas-Abegondo
- 3: Mugardos-As Pontes-Guitiriz
- Pressure: 55 to 82 bar(g)
- Diameter: 10" to 36"

Main Users

- 1,200 MW power plants
- 120,000 b/day refinery
- Alumina-Aluminum smelting
- Steel smelting
- > 280,000 people

LSO (Mugardos LNG terminal)

- Jetty: 15,0000 m³ to Qmax
- LNG storage: 300,000 m³
- Sendout: 412,800 Nm³/h (340 MCFD)



► Expertise and Know-How

REGANOSA SERVICES

Supported by our expertise and know-how since the establishment of the company in 1999:

OPERATION AND MAINTENANCE
TRAINING
TECHNICAL ADVICE

GANESO (GAs NEtwork Simulation and

Gas NEtwork) Simulation and Optimization software with an easy-going interface adapted to the use of Google Earth.

Useful tool for gas network planners and developers made by the most efficient TSO of Europe,



▶ GANESO ® Q&A for gas network developers

HOW IT WILL WORK?

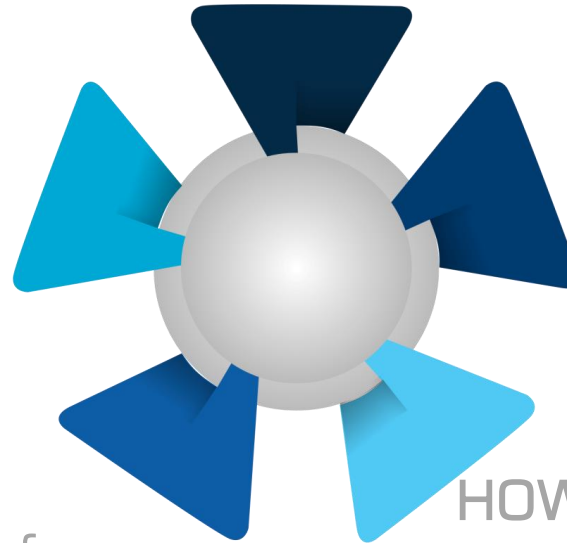
- Dynamic and static simulation
- Bottlenecks
- Gas quality analysis
- N-1 scenarios

HOW TO PAY IT?

- ACER and EU models for Entry/Exit Tariff calculations
- Time based Tariff models depending on infrastructure and demand

WHERE TO START ?

- Google Earth environment.
- Multi scenario data base



WHEN TO DEVELOP?

- Stochastic analysis based in demand and price uncertainty
- Optimization of CAPEX

HOW TO OPERATE?

- OPEX optimization
- BOG and compression stations management
- Line pack
- On-line and real time energy balance

▶ GANESO ® What is it used for?



Modules to be used alone or combined

- | | |
|-------------------------------|-------------------------|
| 1-Simulation | 5-Planning (stochastic) |
| 2-Optimization | 6-Linepack |
| 3-Entry-Exit | 7-Quality |
| 4-Non-Steady or Dynamic state | 8-Limit Demand |
| | 9-Scenario generator |

For future development and networks extension

It provides data about points in the system which are likely to be **saturated** and the extensions needed to avoid them, both in gas pipelines and compression stations

Supports the decision making process for the new gas pipeline and compression stations projects based in demand and gas price probabilistic scenarios

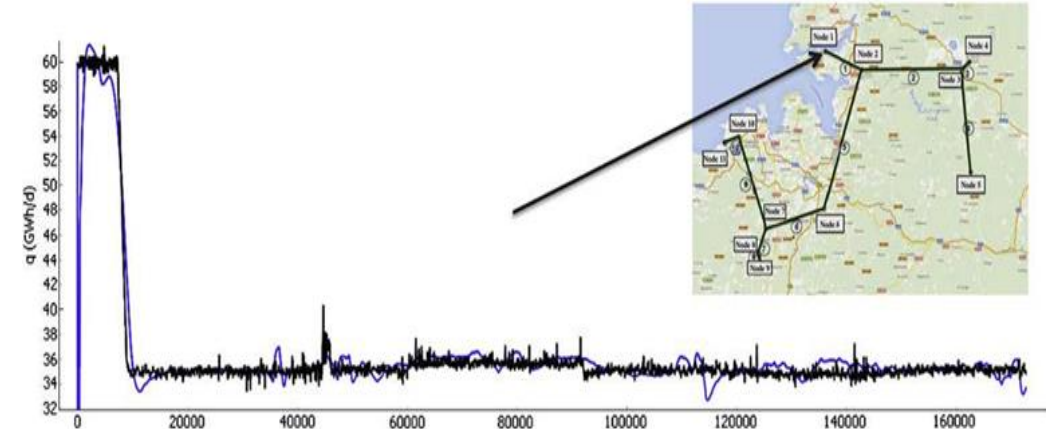
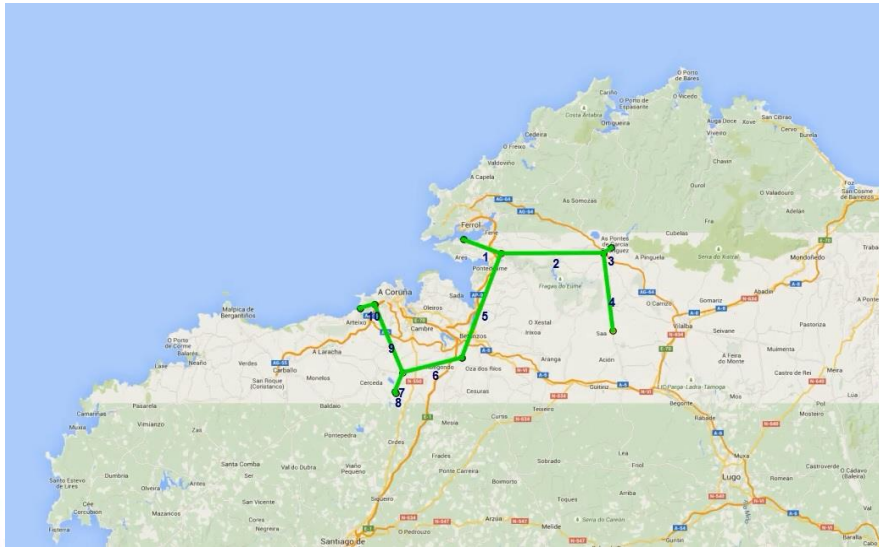
For existing networks

It provides data for an **efficient management of the system**, especially about the active compression stations in different scenarios of demand and the optimum distribution of entries in the transmission network

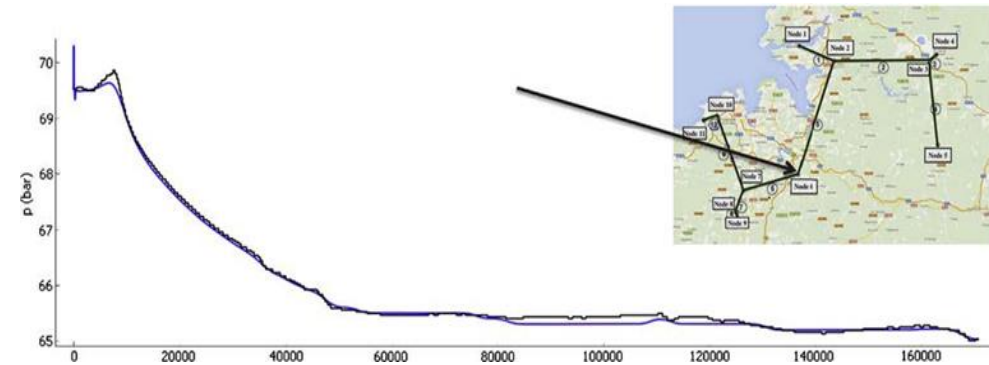
For all cases

It provides the **required rates to assure the return on investment** by means of different methodologies and at the same time, supplies price signals for new facilities and investments

▶ GANESO ® Dynamic simulation

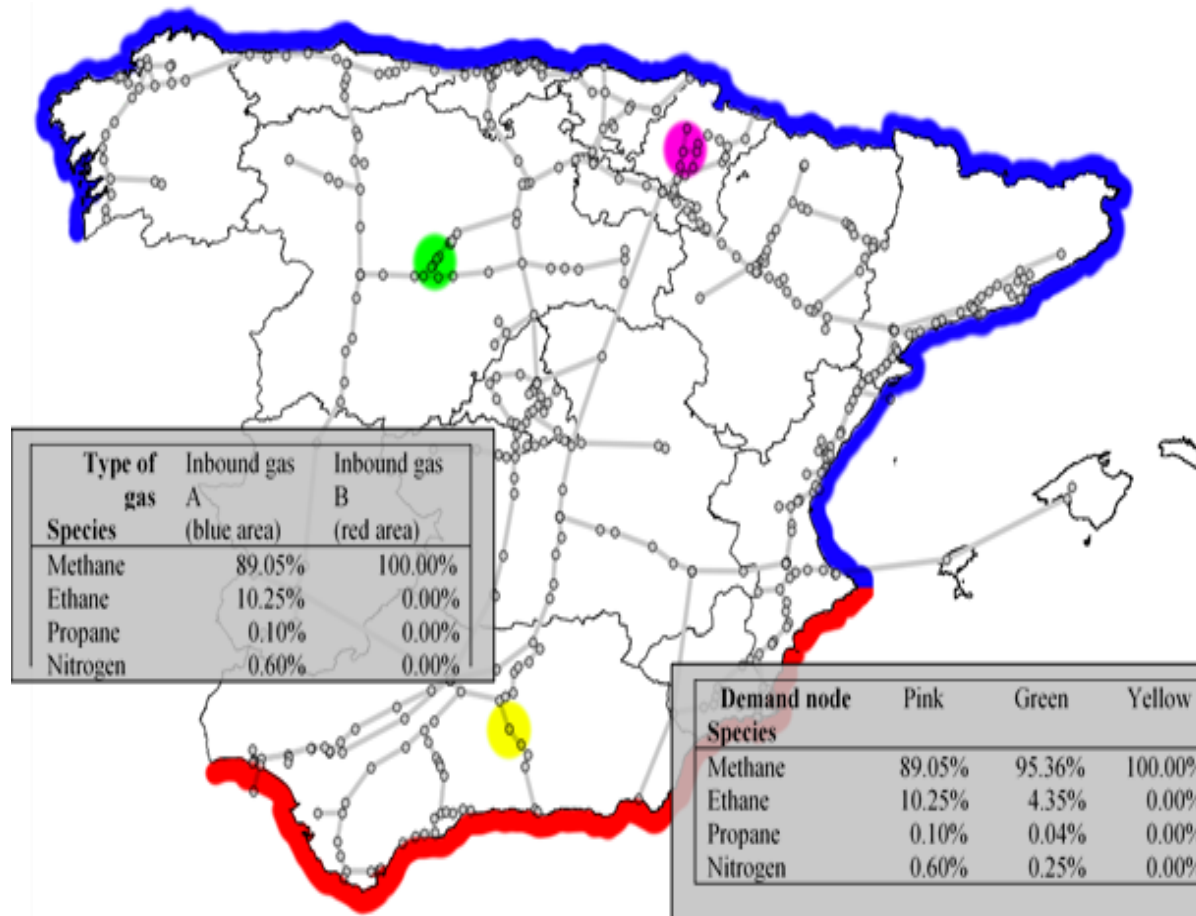


Calibration test. Energy Flow



Calibration test. Pressure values

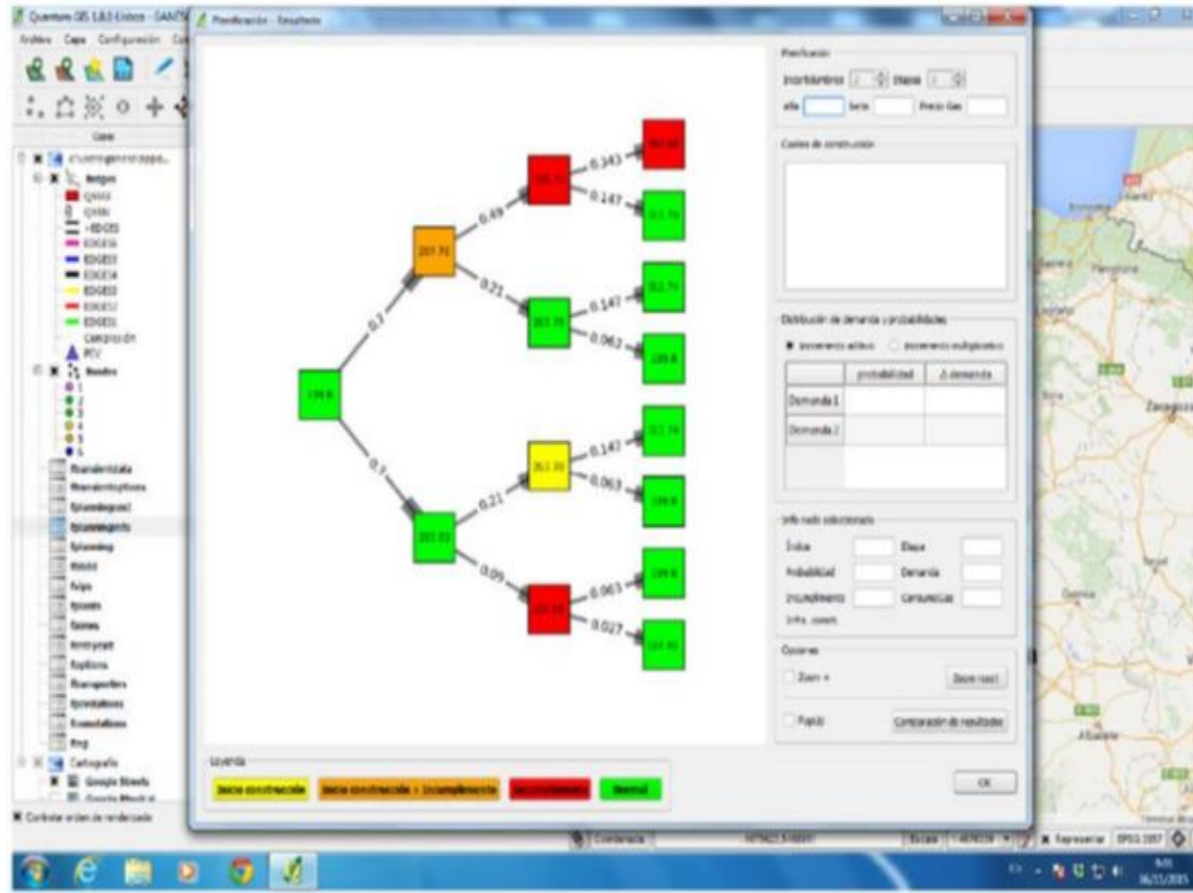
▶ GANESO ® Uncertain gas quality and demand simulations and optimization



Gas Quality propagation

- Direct and reverse quality constrains calculations
- Biogas and biomethane impact analysis in transmission and distribution lines
- Interchangeability of gases evaluation between difference balance zones

▶ GANESO ® Uncertain gas quality and demand simulations and optimization



Time base development analysis for demand and infrastructures

- Identification of difference demand scenarios and different probabilities of materialization
- Simulation of the minimum CAPEX solution to develop the gas network infrastructures that cover the demand at each time gap.
- Optimization of gas network development plans for Greenfields and brownfields

► Conclusions

- Operation optimization:
 - ✓ Detect and correct bottlenecks and optimize the use of compression stations
 - ✓ Interruptible demand optimization
 - ✓ Continuity of supply and gas interchangeability and minimization of OPEX
- Infrastructure planning optimization :
 - ✓ Design Taylor made compression stations in greenfield or brownfield system under uncertain gas quality and operative conditions
 - ✓ Scalable development of infrastructures based in demand scenarios and minimum CAPEX and OPEX. Combination of onshore/offshore entry points and gas pipelines
 - ✓ Entry-Exist tariff calculation based in infrastructure development and offtakers, Optimized fees to warranty the sustainability of the energy system



THANK YOU

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