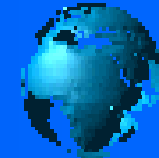




PETROBRAS



23rd World Gas Conference, Amsterdam 2006



USING CNG (COMPRESSED NATURAL GAS) AND LNG (LIQUEFIED NATURAL GAS) TO DEVELOP NEW MARKETS IN BRAZIL

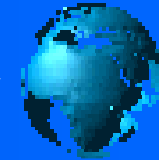
Jorge R. A. Hijjar

Market Development Manager

Marketing & Trading of Natural Gas and Power



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1

Introduction

2

CNG and Small LNG Project
Analysis

3

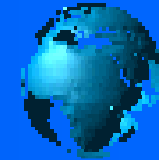
The Use of CNG and LNG to
Develop New Markets in Brazil

4

The On-going Projects in Brazil

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Conclusions



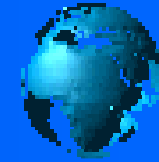
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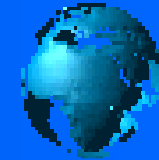


Introduction

- ◆ By historical reasons, the Brazilian economy was initially developed close to the coast;
- ◆ Gas fields and Oil fields with associated gas are located offshore;
- ◆ Pipeline Network was built close to the coast.

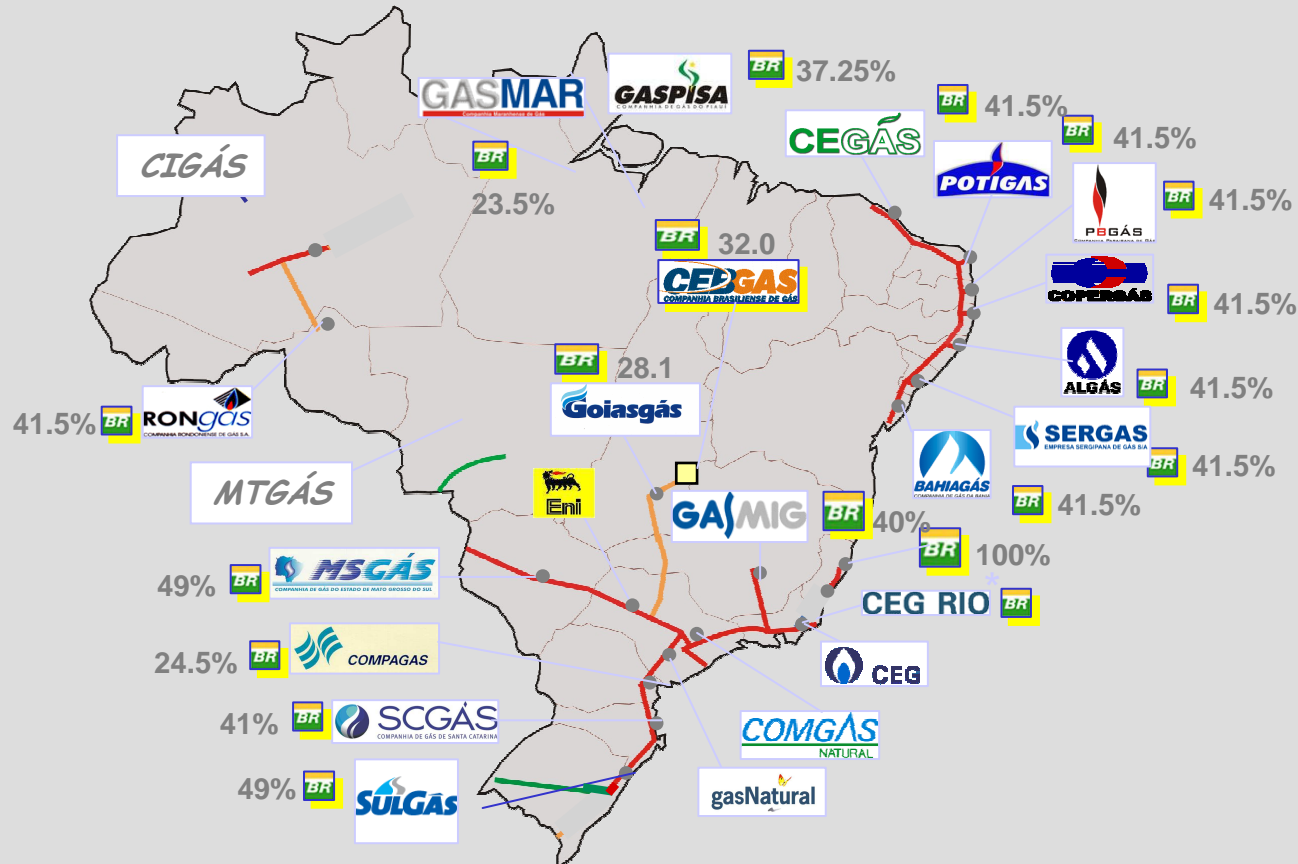


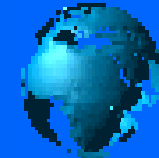
- ◆ 90's => New regulation, LDC's creation, New pipeline to import natural gas from Bolivia;
- ◆ Need to achieve new markets;
- ◆ Relatively sparse transportation and distribution pipeline network;
- ◆ CNG and LNG were/are supposed to play important role to develop new markets



1 Introduction (cont.)

◆ Brazilian LDC's (total:23)





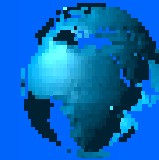
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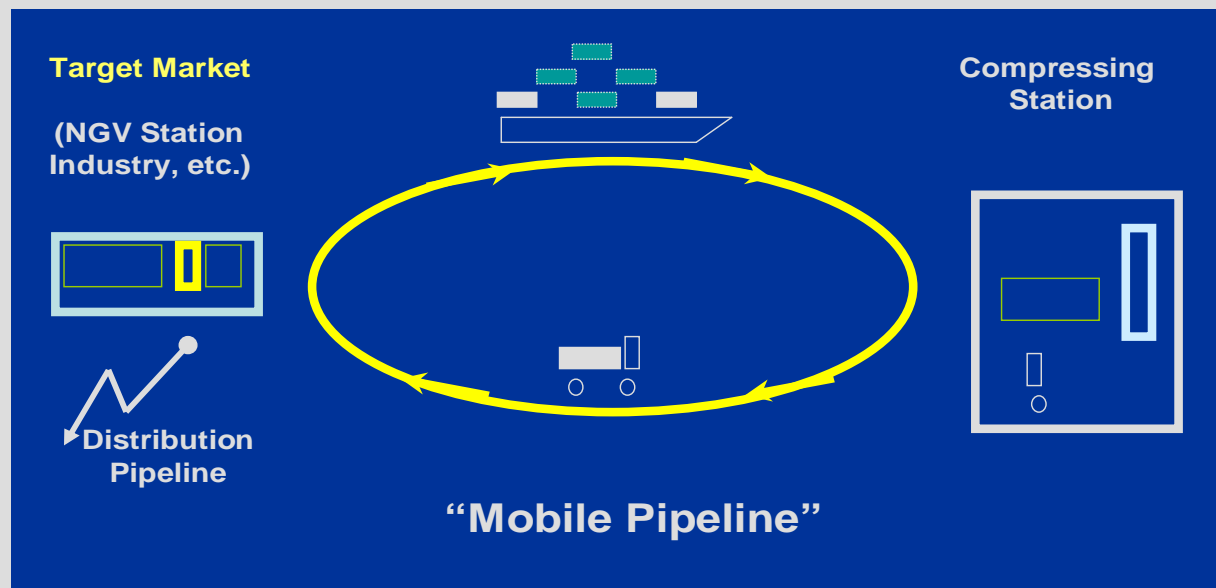
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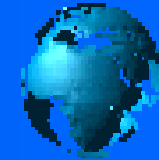


2 CNG and Small LNG Project Analysis

2.1 The CNG Project

- ◆ **Compressing Station (220-250 kgf/cm²);**
- ◆ **Cylinders Transportation (trucks, trains, boats);**
- ◆ **Receiving Station (close to customers).**

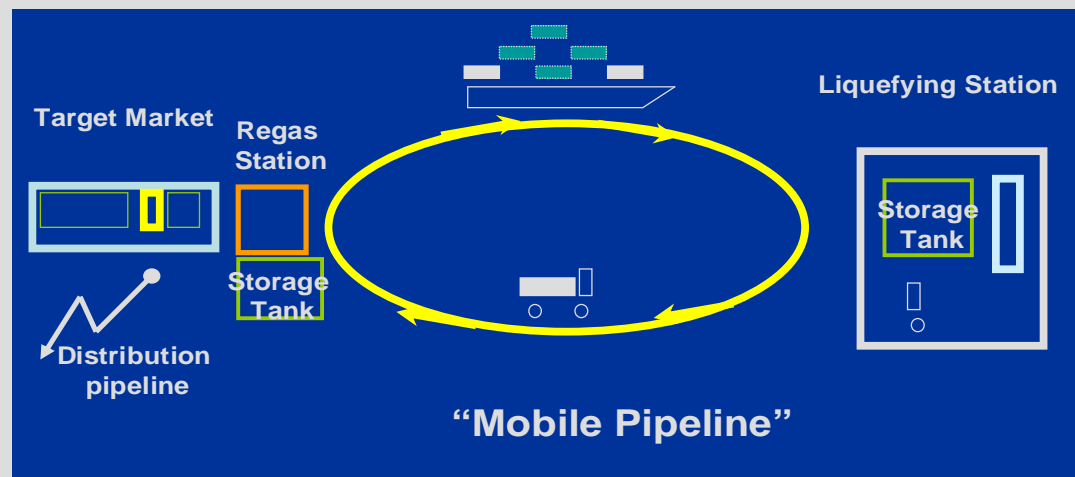


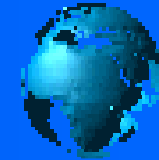


2 CNG and Small LNG Project Analysis (cont.)

2.2 The Small LNG Project

- ◆ Liquefaction Unit (-163 °C - Storage);
- ◆ Transportation (trucks, trains, boats);
- ◆ Receiving Station (Regas and Storage – close to customers);





2 CNG and Small LNG Project Analysis (cont.)

2.3 Basic Differences

◆ CNG

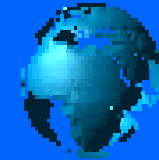
- ◆ Shrinkage of ~300 times
- ◆ High pressure heavy cylinders
- ◆ CAPEX ↓
- ◆ OPEX ↑

◆ LNG

- ◆ Shrinkage of ~600 times
- ◆ Light tanks
- ◆ CAPEX ↑
- ◆ OPEX ↓

◆ Comparison => CNG, LNG, Pipeline

- ◆ Feasibility of Logistics;
- ◆ Economics;
- ◆ Environmental Aspects;
- ◆ Normally accepted concept:
 - ◆ Small demand, small distance => CNG
 - ◆ Greater demand, longer distance => LNG
 - ◆ Really big demand => pipeline
 - ◆ Specific cases => ?



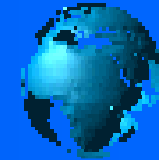
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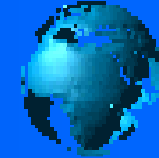


3 The Use of CNG and LNG to Develop New Markets in Brazil

◆ 2 ways

3.1 Supply CNG or LNG on economic long term basis

- ◆ LDCs tend to reach more profitable markets;**
- ◆ small markets away from direct influence of pipeline network are normally not considered on developing plan in the near future;**
- ◆ great opportunity for CNG and small LNG projects;**
- ◆ risk of a pipeline to be built reaching that market => work together with LDCs.**

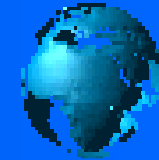


3 The Use of CNG and LNG to Develop New Markets in Brazil

3.2 Supply CNG or LNG temporarily to a far market

- ◆ **LDCs began planning the development of some markets away from the existing pipelines (so-called interiorization plans);**
 - ◆ **either build a pipeline to some specific location or;**
 - ◆ **supply a small market by means of CNG or LNG => make that market big => build a pipeline => displace the CNG or LNG project to serve another farther location to start that process again => consecutive expansion of gas supply.**

- ◆ **Many LDCs tend to have partners to implement that program.**



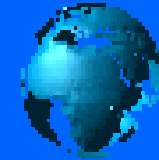
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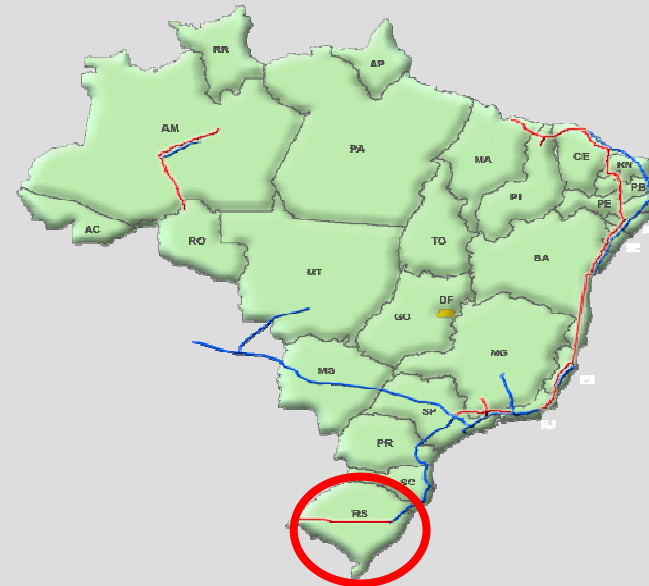


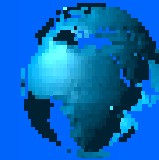
4 The On-going Projects in Brazil

4.1 CNG Projects

◆ State of Rio Grande do Sul

- ◆ first one in Brazil => 2001**
- ◆ 5,000 m³/day**
- ◆ 40 km**
- ◆ Temporary Supply basis**
- ◆ Industrial Customer**
- ◆ when the pipeline was built, the equipments were displaced to serve another location**

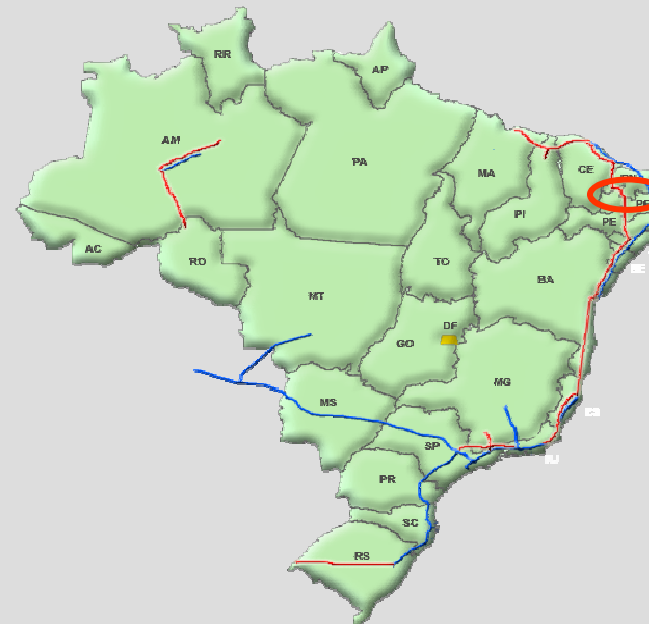




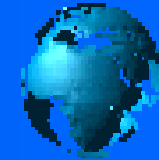
4 The On-going Projects in Brazil (cont.)

◆ State of Paraiba

- ◆ interiorization plan**
- ◆ 4,000 m³/day**
- ◆ 40 km**
- ◆ Customer => NG Filling Station**



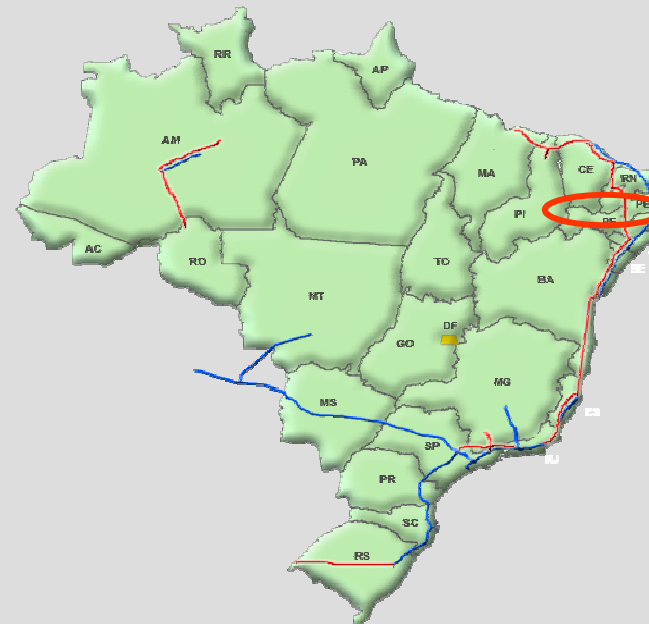
OBS: Brazil has the second biggest fleet of NG Vehicles

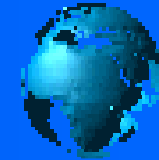


4 The On-going Projects in Brazil (cont.)

◆ State of Pernambuco

- ◆ interiorization plan
- ◆ 4,000 m³/day
- ◆ 120 km
- ◆ Customer => NG Filling Station

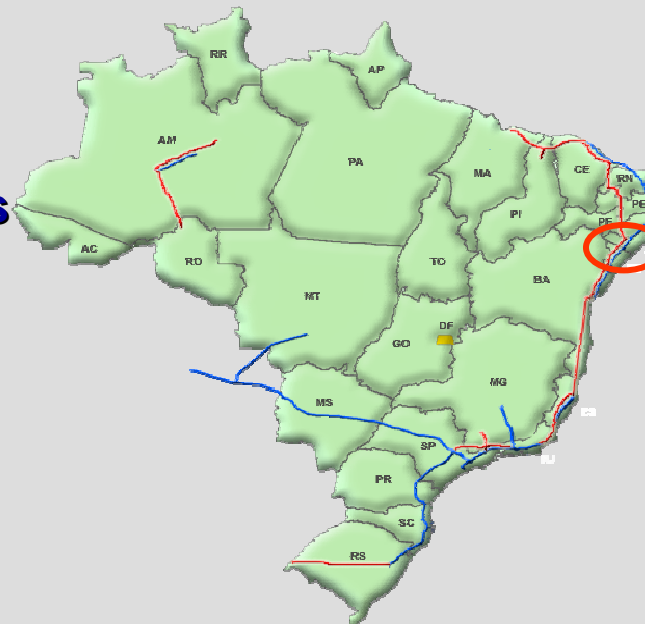


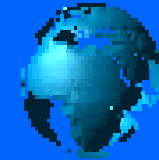


4 The On-going Projects in Brazil (cont.)

◆ State of Alagoas

- ◆ interiorization plan
- ◆ 6,000 m³/day
- ◆ 120 km
- ◆ Customer => NG Filling Stations

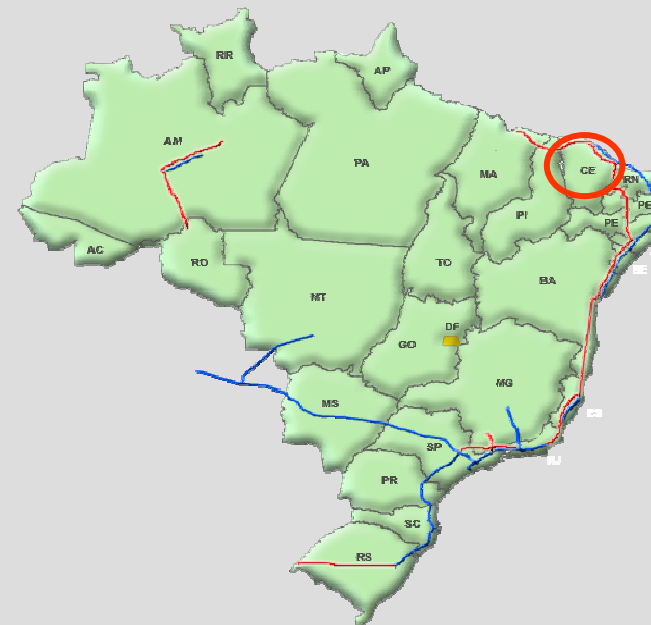


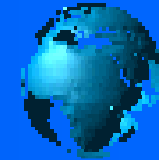


4 The On-going Projects in Brazil (cont.)

◆ State of Ceará

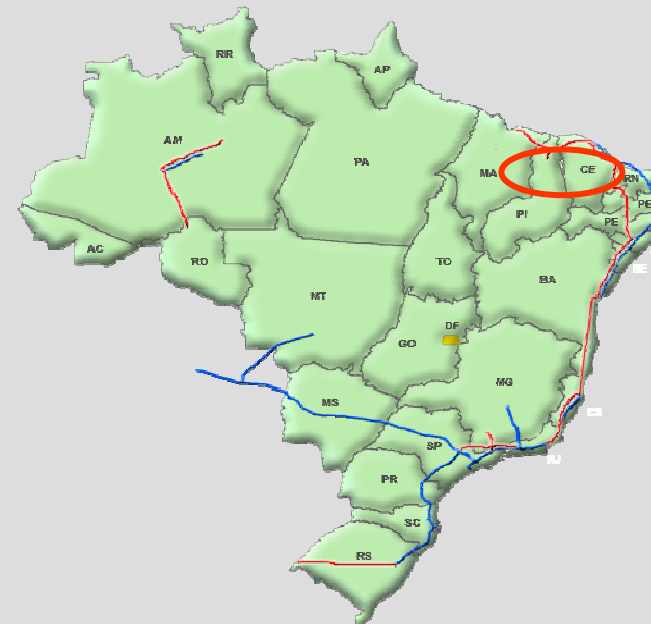
- ◆ 1,500 m³/day
- ◆ 50 km
- ◆ Industrial Customer

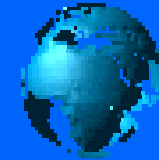




4 The On-going Projects in Brazil (cont.)

- ◆ **State of Piauí**
 - ◆ **5,000 m³/day**
 - ◆ **600 km**
 - ◆ **Customer => NG Filling Station**

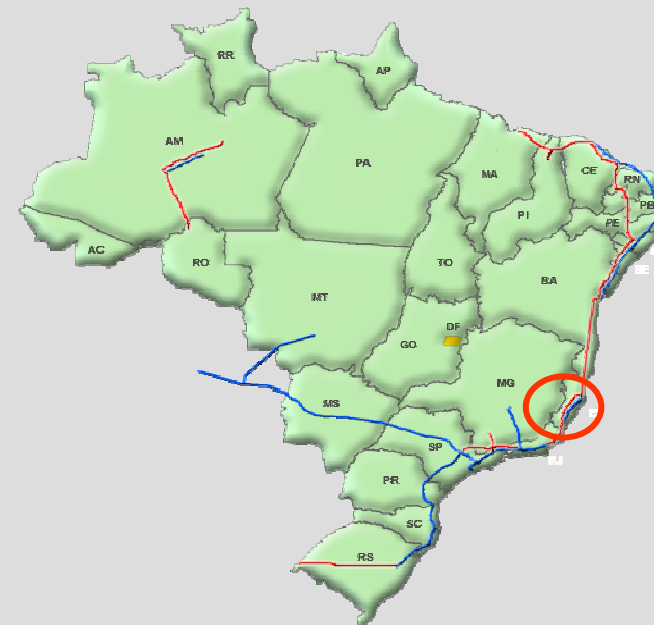


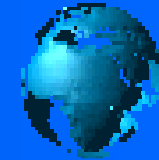


4 The On-going Projects in Brazil (cont.)

◆ State of Espírito Santo

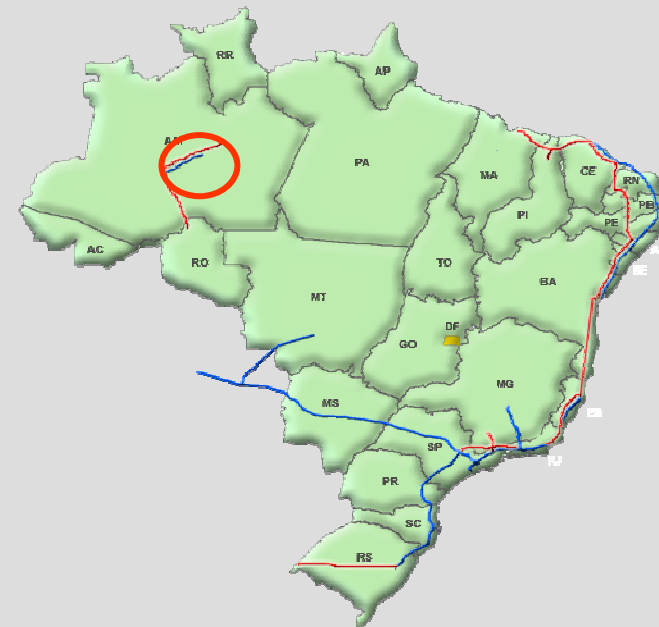
- ◆ 15,000 m³/day
- ◆ 60 km (average)
- ◆ Industrial Customers and NG Filling Stations

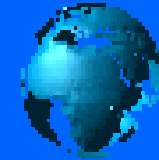




4 The On-going Projects in Brazil (cont.)

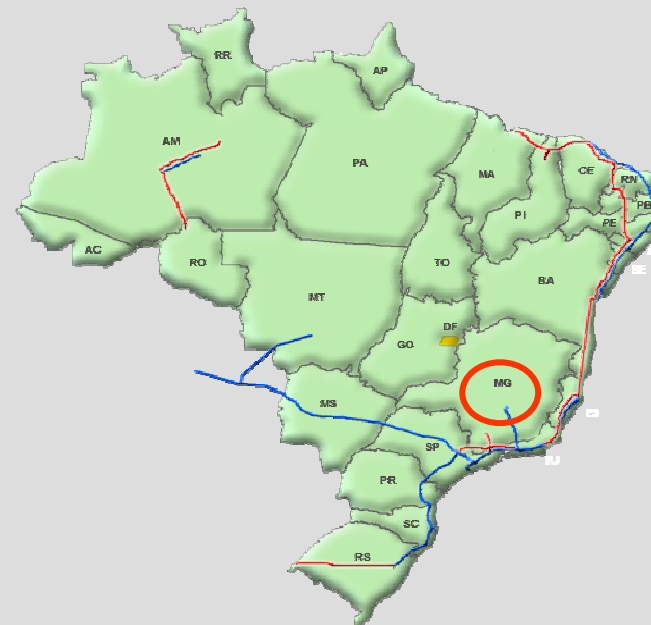
- ◆ State of Amazonas
- ◆ 5,000 m³/day
- ◆ 400 km
- ◆ NG Filling Station
- ◆ trucks on boats

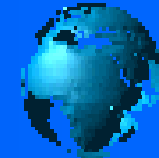




4 The On-going Projects in Brazil (cont.)

- ◆ **State of Minas Gerais**
 - ◆ **48,000 m³/day**
 - ◆ **90 km (average)**
 - ◆ **Industrial Customers and NG Filling Stations**

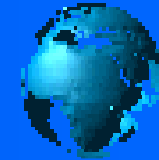




4 The On-going Projects in Brazil (cont.)

- ◆ State of São Paulo
 - ◆ 100,000 m³/day
 - ◆ 80 km (average)
 - ◆ Industrial Customers and NG Filling Stations





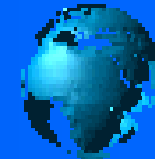
4 The On-going Projects in Brazil (cont.)

4.2 The LNG Project - GEMINI

◆ LNG Plant



◆ Tank Storage Capacity => 4,500 m³

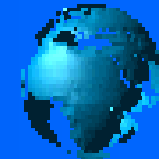


4 The On-going Projects in Brazil (cont.)

4.2 The LNG Project - GEMINI

◆ Distribution Center



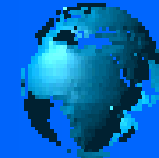


4 The On-going Projects in Brazil (cont.)

4.2 The LNG Project - GEMINI

◆ Logistics



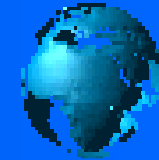


4 The On-going Projects in Brazil (cont.)

4.2 The LNG Project - GEMINI

◆ Customer Service

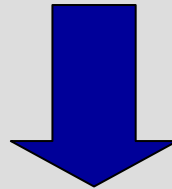




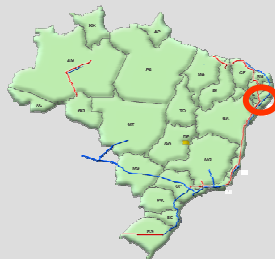
4 The On-going Projects in Brazil (cont.)

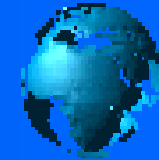
4.3 New Special CNG Projects

- ◆ **lack of redundancy of Brazilian pipeline network;**
- ◆ **need to provide maintenance or assess integrity of pipeline without interrupting supply of NG to some specific markets;**



- ◆ **supply CNG to those markets during interruption of pipeline delivery;**
- ◆ **State of Sergipe**





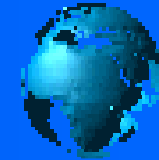
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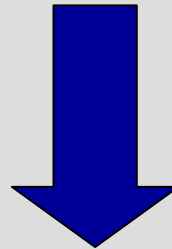
5 Conclusions



5

Conclusions

- ◆ **physical and economic aspects were addressed;**
- ◆ **two different business approaches;**
- ◆ **existing projects - expansion of borders of natural gas supply;**
- ◆ **one on-going LNG project in Brazil – GEMINI;**

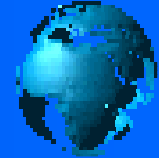


- ◆ **it has been feasible to use CNG and LNG to develop new markets in Brazil, especially because of the present characteristics of pipeline network.**



PETROBRAS

"CHALLENGE IS OUR ENERGY"



THANK YOU

DANK U

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