

WORKSHOP Geração Termoelétrica a Gás Natural
Painel 2 – Tecnologias

ENGIE no Brasil,
do transporte ao estocagem de Gas



Brasilia, 03 de Outubro de 2019

ENGIE no Brasil

ENGIE no Brasil | Números Chave

Desde
1996
presente no país

Mais de
2750
Colaboradores

Mais de
1000
Clientes

Faturamento de
9,3
Bilhões de reais
em 2018

Aquisição de
3 empresas
em 2018 de eficiência energética,
gerenciamento de energia
e iluminação pública

10.211 MW*
em operação em
61 usinas (Maior produtor
independente privado de
geração de energia elétrica
no Brasil)

90%
em fontes
limpas e renováveis

Aquisição da
TAG
em 2019, detentora da **mais extensa**
malha de transporte de gás natural
do País

2300
Instalações em
geração solar
distribuída

Mais de
200
Contratos
de O&M

*A capacidade instalada é referente apenas às participações da Companhia nas usinas em operação, incluindo Jirau.

Presente em todo o Brasil

-  Hidrelétrica
-  Termelétrica
-  Eólica
-  Solar
-  Biomassa
-  Transmissão de Energia
-  Gasoduto
-  HVAC
-  Energia Descentralizada
-  Mercado Livre de Energia
-  Soluções Integradas
-  Em construção



Estratégia – áreas de desenvolvimento promissoras para o Brasil:

- ◆ Crescimento em energias renováveis
- ◆ Energia fotovoltaica para empresas
- ◆ Soluções de eficiência energética
- ◆ Transmissão de energia
- ◆ Cadeia do gás
- ◆ Propostas de soluções envolvendo CAPEX

TAG - Transportadora Associada de Gás

R\$ 35,1 bilhões por 100% da TAG

58,5% ENGIE – 31,5% CDPQ – 10% Petrobras

Financiamento Non-recourse (lastreado nos GTAs existentes):
14 BBRL com 3 Bancos Locais e 2.45 BUSD com 7 Internacionais

Infraestrutura de gasodutos com 4.500 km

Capacidade total contratada de cerca de 70 milhões m³/dia

11 instalações de compressão de gás

14 pontos de recebimento de gás, incluindo 02 terminais de GNL

90 pontos de entrega

Estocagem de Gas

Storengy: a leader in Gas Storage in Europe

21 Underground storage facilities in Europe

UNITED KINGDOM

Stublach

GERMANY

Harsefeld
Uelsen
Lesum
Peckensen


FRANCE

Gournay-sur-Aronde
Saint-Clair-sur-Epte
Saint-Illiers-la-Ville
Beynes
Soing-en-Sologne
Céré-la-Ronde
Chémery
Etrez
Tersanne
Hauterives
Manosque*


■ Aquifers
■ Salt caverns
■ Depleted fields




1st
Europe's leading operator of natural gas storage facilities



12.2 Gm³
gas storage capacity



Employees

800
in France

160
in Germany

50
in the United Kingdom



4th
world's largest operator of natural gas storage facilities

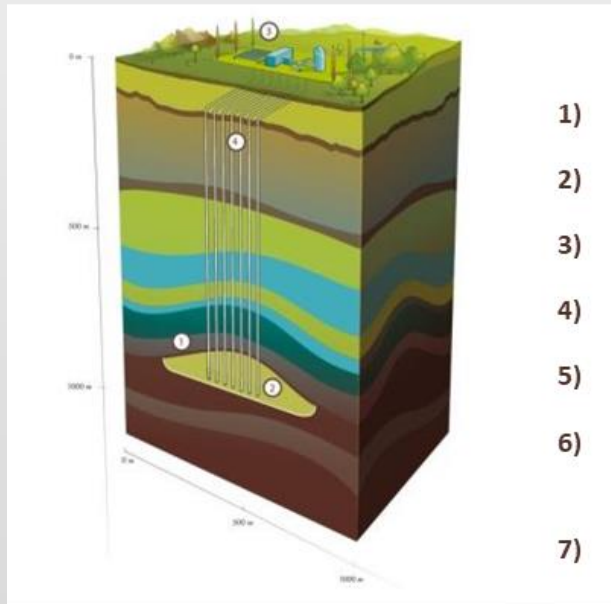


0 TF
lost time injury frequency rate

The Underground Gas Storage technologies

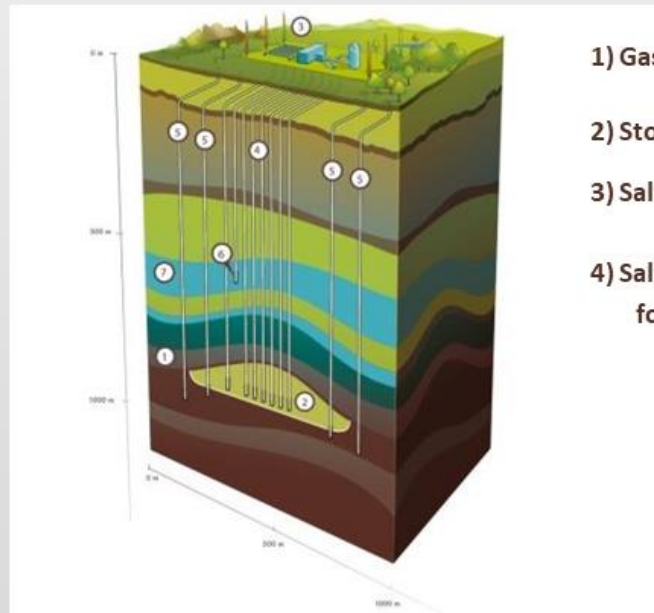
Storage in Depleted Fields

- Large working gas capacity
- Deliverability depending on rock porosity and permeability



- 1) Caprock
- 2) Reservoir
- 3) Gas station
- 4) Storage well
- 5) Observation well
- 6) Upper aquifer observation well
- 7) upper aquifer

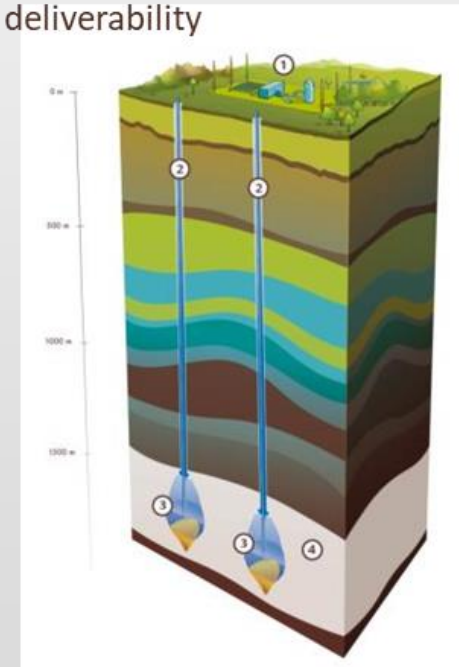
Storage in Natural Aquifers



- 1) Gas plant
- 2) Storage well
- 3) Salt cavern
- 4) Salt dome/layer formation

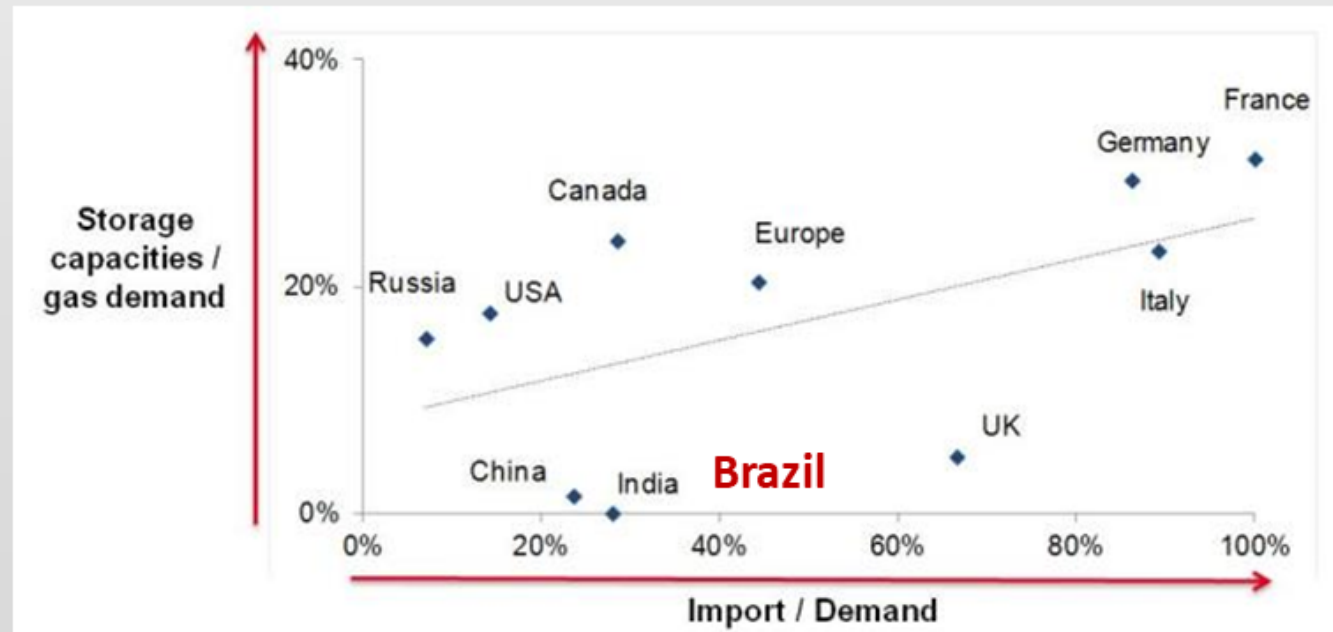
Storage in Salt Caverns

- Smaller working gas capacity
- High deliverability



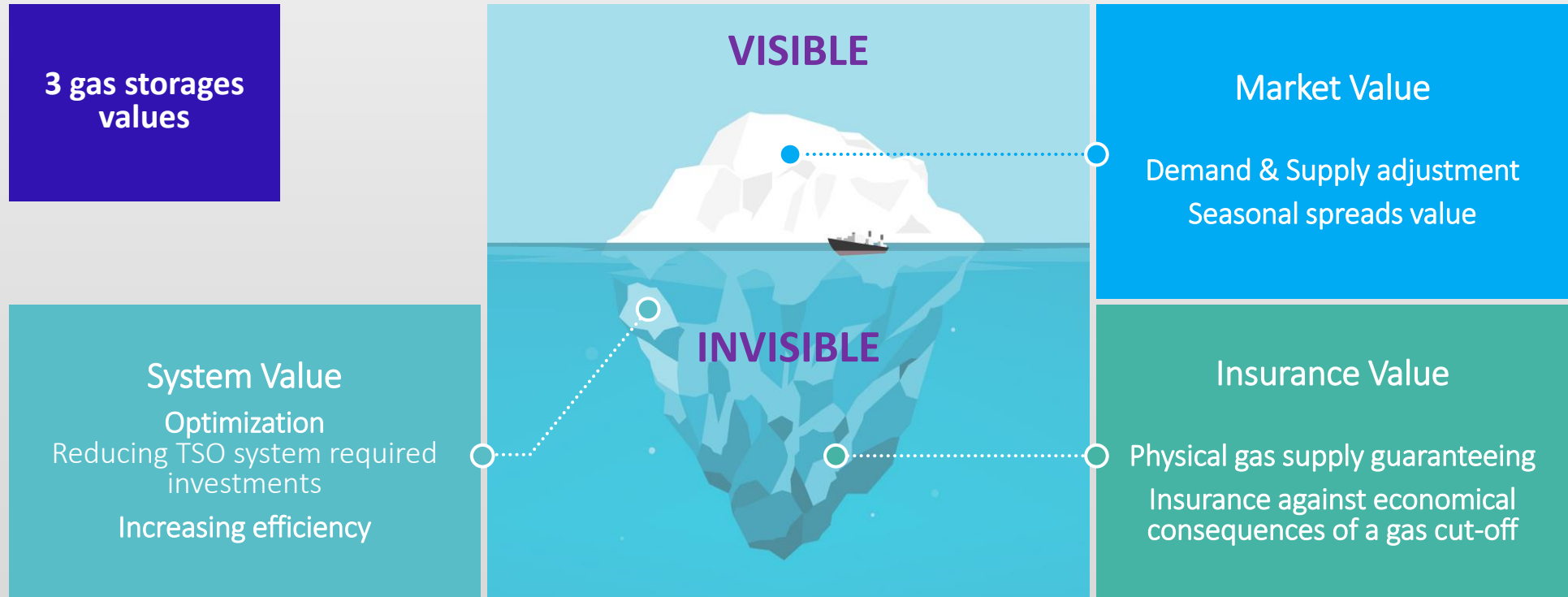
Underground Gas Storage... everywhere

- **All the major gas consuming countries have UGS:**
 - whether they are importers or exporter...
 - ... the more they depend on imports, the more they store
 - The number of storages depends on the situation of the country...
 - ... but essentially on the geology.



Gas storage adds 3 key values to gas system

Storage brings many values to gas system,
but all of them are not covered by markets



Brazil has very high need of flexibility

Thermal dispatch:

- 1 during the dry seasons
- 2 during the dry years

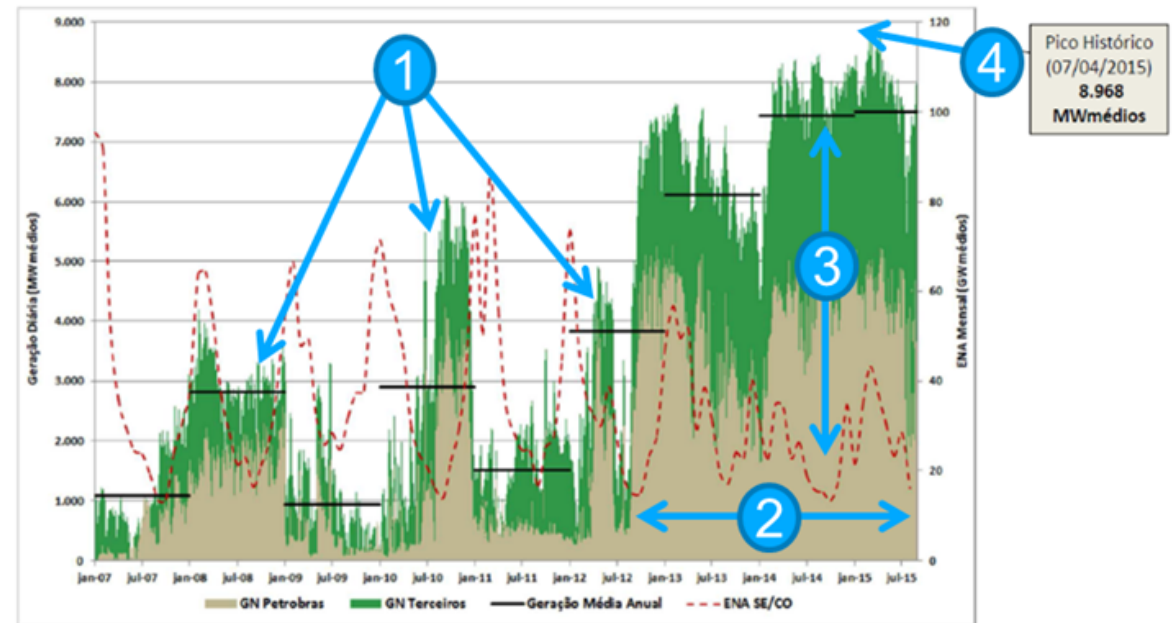
Extreme variability of the gas to power demand:

- 3 from 8 to 50 MMm³/d
i.e. +70% of the gas demand
- 4 historical generation peak

O Despacho Termelétrico é volátil, variando em função das condições hidrológicas de cada período







Histórico do Despacho Termelétrico a GN no Brasil



VOLUME DE GN PARA O SETOR TERMELÉTRICO PODE VARIAR DE 8 a 50 MMm³/d

The Sources of Flexibility of Brazilian Gas System

			Description	Degree of flexibility
	Domestic gas production	Swing to adapt to the demand	75% associated gas	LOW
	LNG imports	LNG imports program	80% take-or-pay from Bolivia	LOW
	Regas	Storage capacity of the terminals	FSRU	LIMITED
	Gas imports	Contractual dispositions (take-or-pay)		
	Gas transmission	Linepack (gas stored in the pipes)	Long distance network	LIMITED
	Gas demand	Voluntary reduction of consumption	Thermal dispatch as a back-up of hydro	LOW

How is Brazil doing today and is it sustainable?

- **Portfolio optimization** of the fully integrated **national monopoly**
 - Future role of **PETROBRAS**?
 - Creation of a **Gas Market** open to third parties?
- Construction of 3 **LNG regasification terminals** in 5 years **to import LNG when needed**
 - In average **low load factor** of the terminals
 - LNG supply - **constraints and risks** (sea conditions, geopolitics...)
 - Mid-terms needs **exposed to spot** LNG market (prices volatility...)
- Gas-fired power plants are **dispatched with 60 days of anticipation to organize LNG imports**
 - Is it responding well to the **power sector needs**?
 - Will it support gas to be the **preferred fuel** for thermal units?

New Challenges for the Gas System in Brazil

Furthermore, there is significant uncertainty for the near future:

- **Bolivian** gas production
 - **Pre Salt** gas production
- } volume and flexibility available?
- Balance of the power **intermittent sources** (wind, solar...)?
 - **Opening of the gas market?**
 - **Gas pricing?**

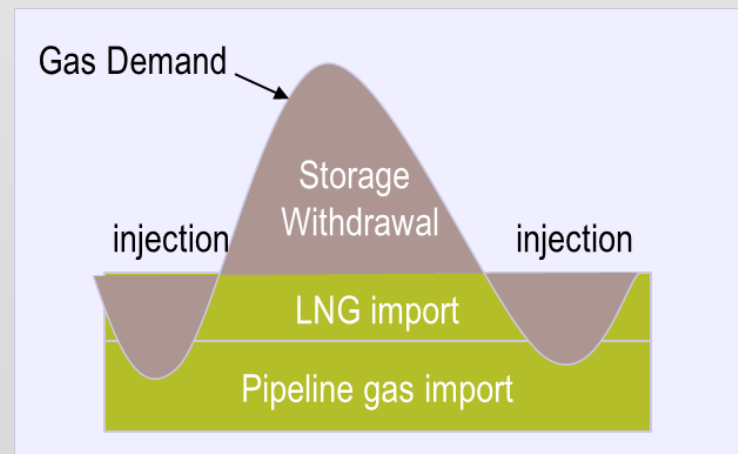
The need for gas flexibility is structural in Brazil

The answer should be structural too

What Underground Gas Storage can bring to Brazil?

Underground Gas Storage offers unique services without equivalent

- High volumes of energy stored in the country of delivery (not abroad)
- High withdrawal rates: volume rapidly available to the consumers
- High reliability: a proven technology, gas immediately available
- High operational safety: between 600 and 2,000 meters of depth



What Underground Gas Storage can bring to Brazil?



- **Guarantee and optimize gas supply** to the Thermal Power Plants
- **Optimize usage** of existing gas infrastructures (LNG terminals and transmission network)
- Facilitate the **Opening of the Market** by supporting new comers to develop a supply portfolio and contribute gas hub emerging
- Give **new options for the producers** of associated gas to monetize their production with more added value without interfering with oil production
- Offer a product to physically **balance the gas transmission network**
- Improve the **security of supply and reduce vulnerability of the country** as a whole





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