



Petrobras' Gas Utilization Optimization Program (POAG-2015)

Denis Krambeck Dinelli

Petrobras' Domestic E&P Gas Production Planning



2nd WOC1/PGCA Meeting

Rio de Janeiro, Brazil

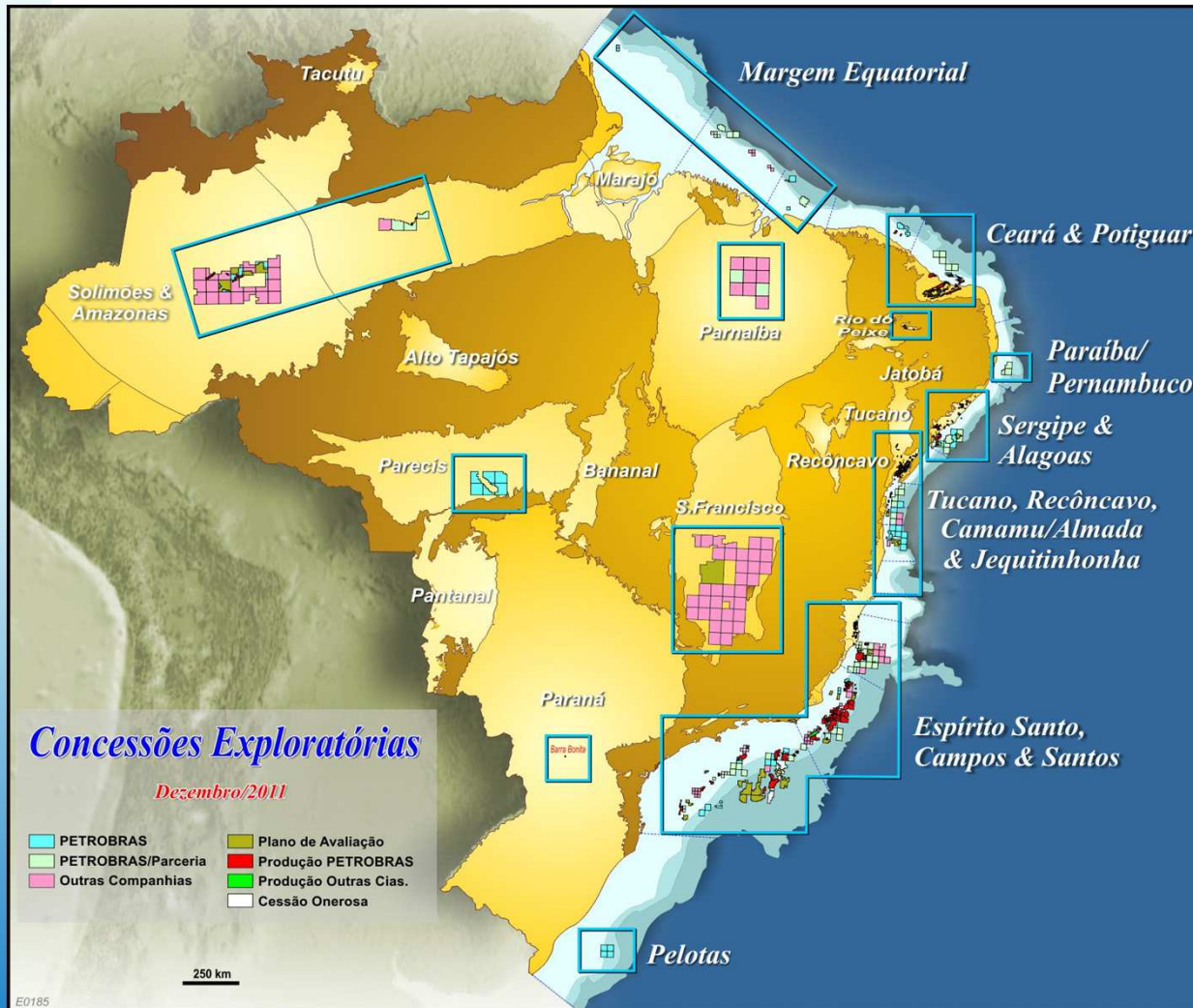
18-21 February 2013

Summary

- 1. INTRODUCTION: PETROBRAS' E&P HIGHLIGHTS**
- 2. GAS FLARING: PROBLEM DIAGNOSIS**
- 3. POAG 2015 – GAS UTILIZATION OPTIMIZATION PROGRAM**
- 4. RESULTS**
- 5. NEXT STEPS**
- 6. CONCLUSIONS**

1. INTRODUCTION: PETROBRAS' E&P HIGHLIGHTS

Petrobras' E&P Highlights (2011)



PROVEN RESERVES (31/12/2011)

- SPE
 - 15.7 billion boe
 - 395 bcm natural gas
 - R/P 19.5 years
 - Reposition index 153%
- SEC
 - 12.2 billion boe
 - 293 bcm natural gas
 - R/P 15.2 years
 - Reposition index 115%

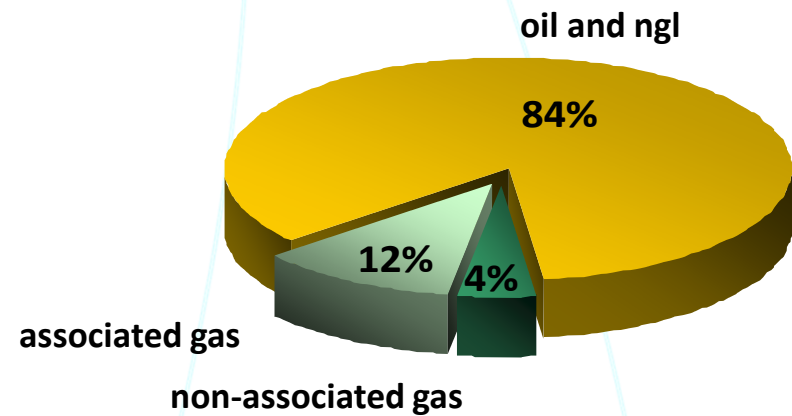
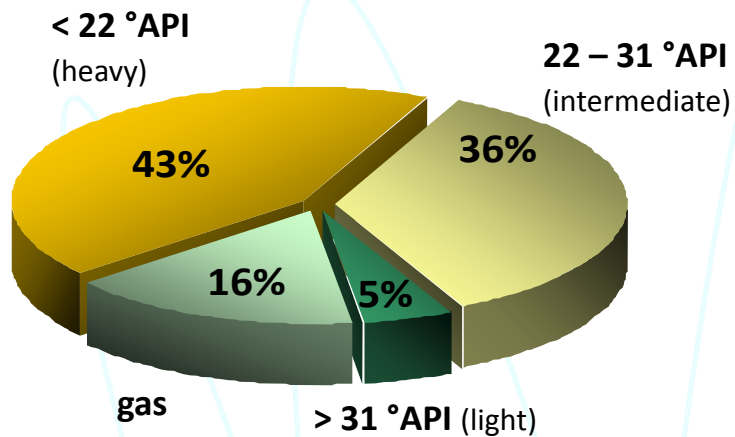
PRODUCTION (2011)

- 2.376 Mboepd
- 2.022 Mbpd oil
- 64 Mm³/day natural gas

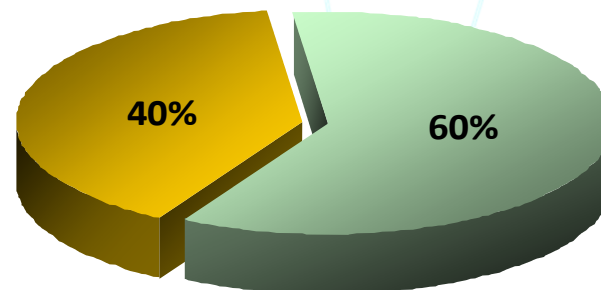
Proven Reserves (2011)

Proven reserves 31/12/2011 (SPE)

(15.7 billion boe)

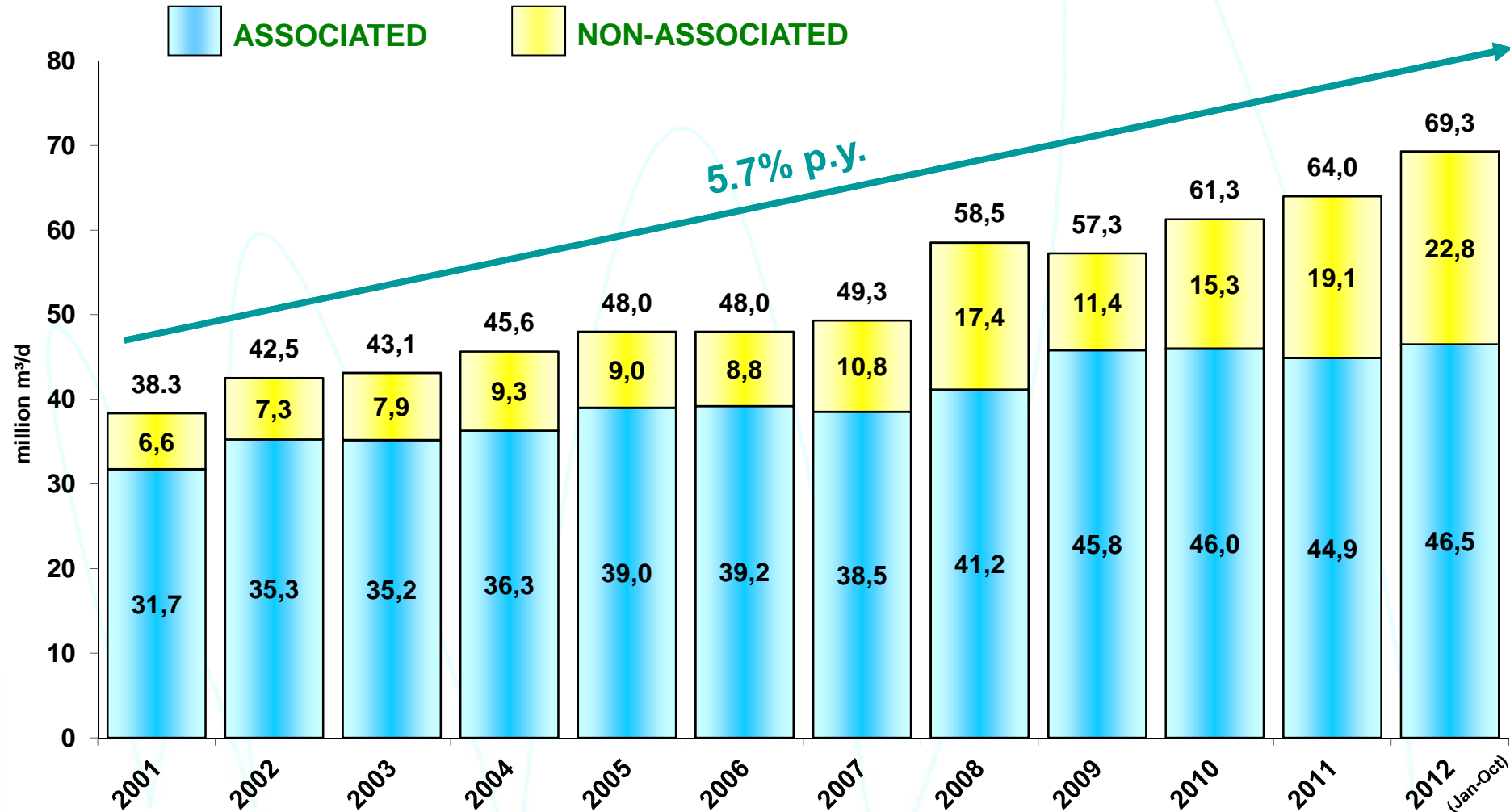


proven reserves undeveloped

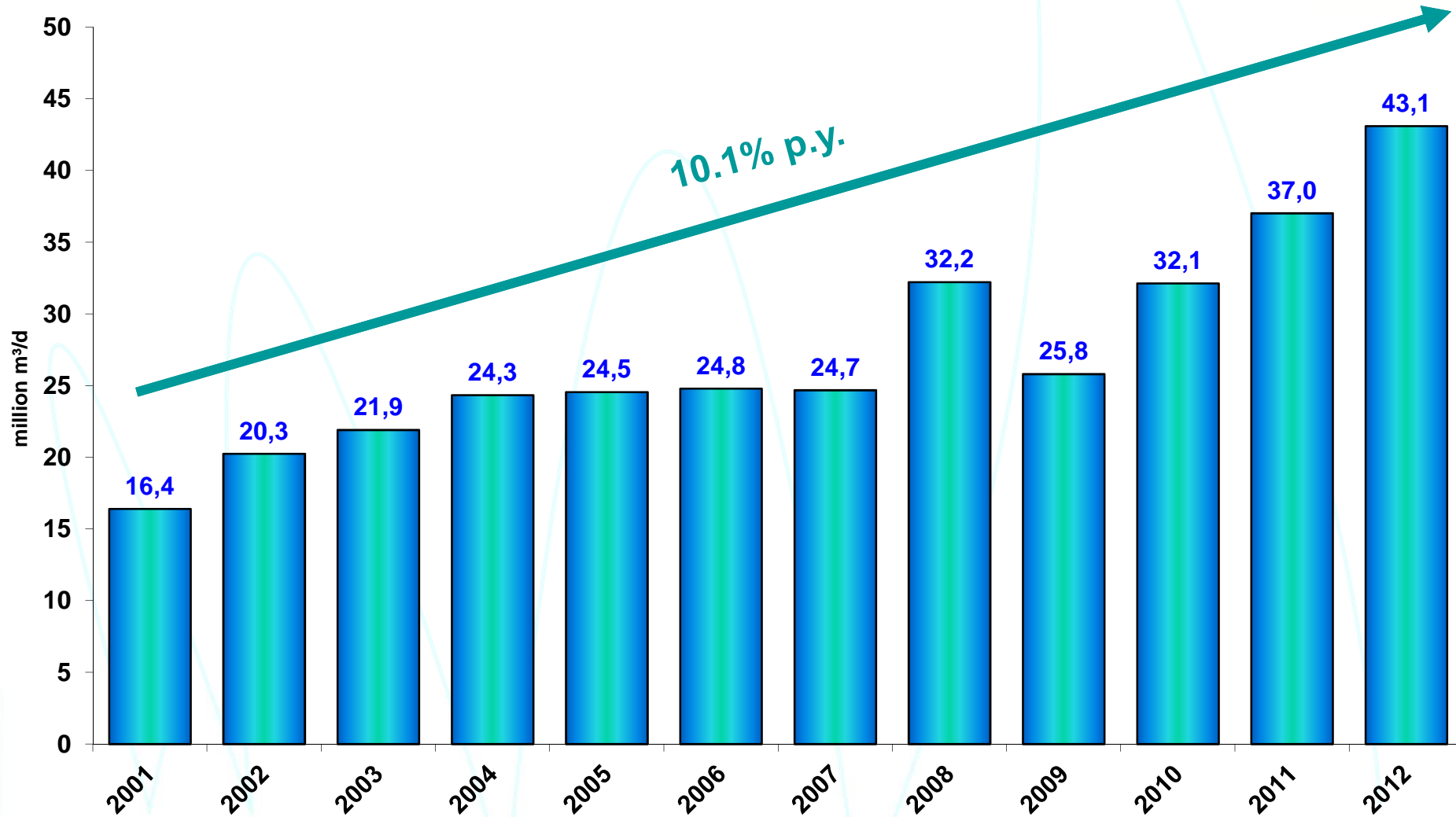


proven reserves developed

Natural Gas Production

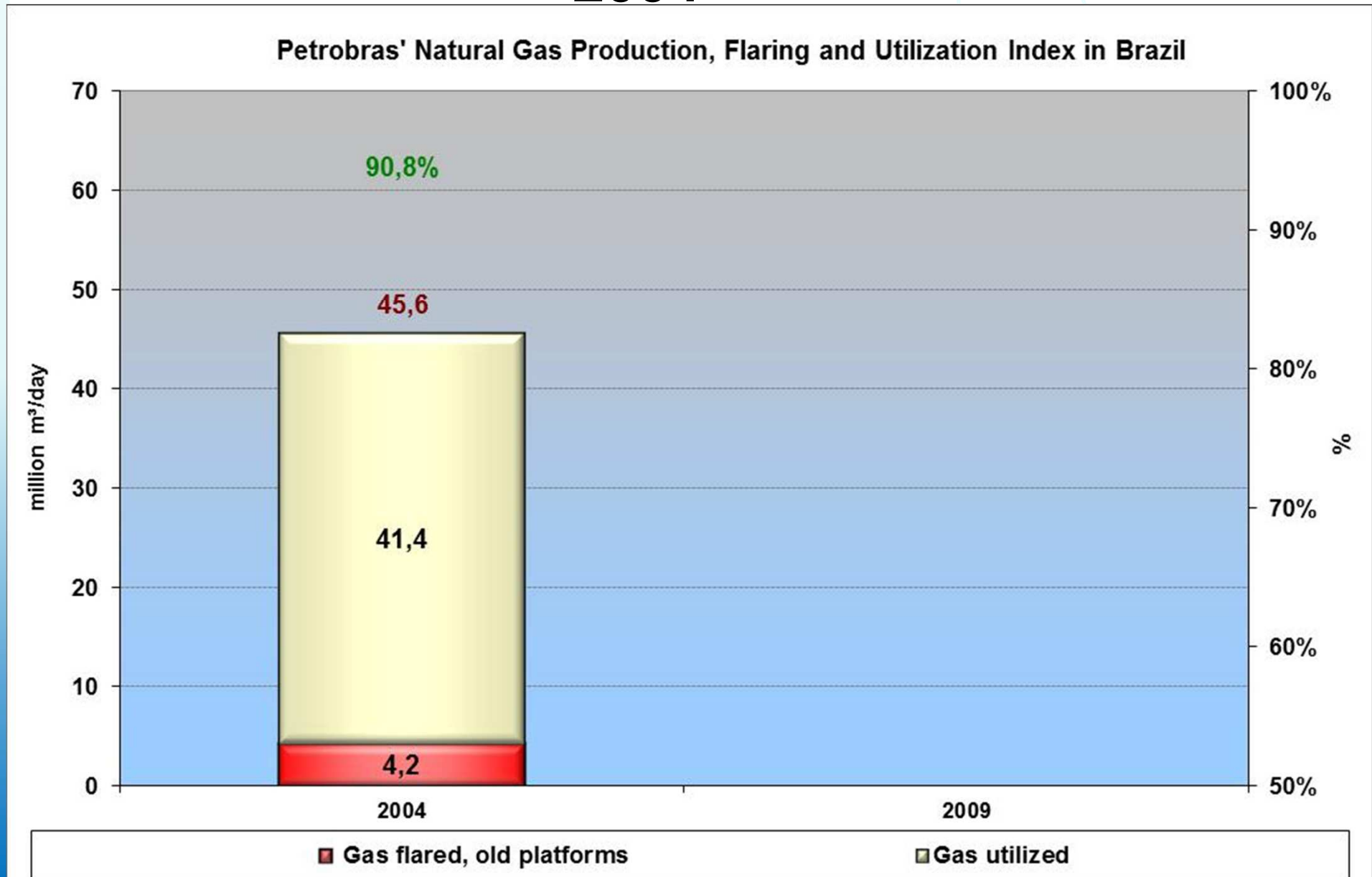


Domestic E&P Supply

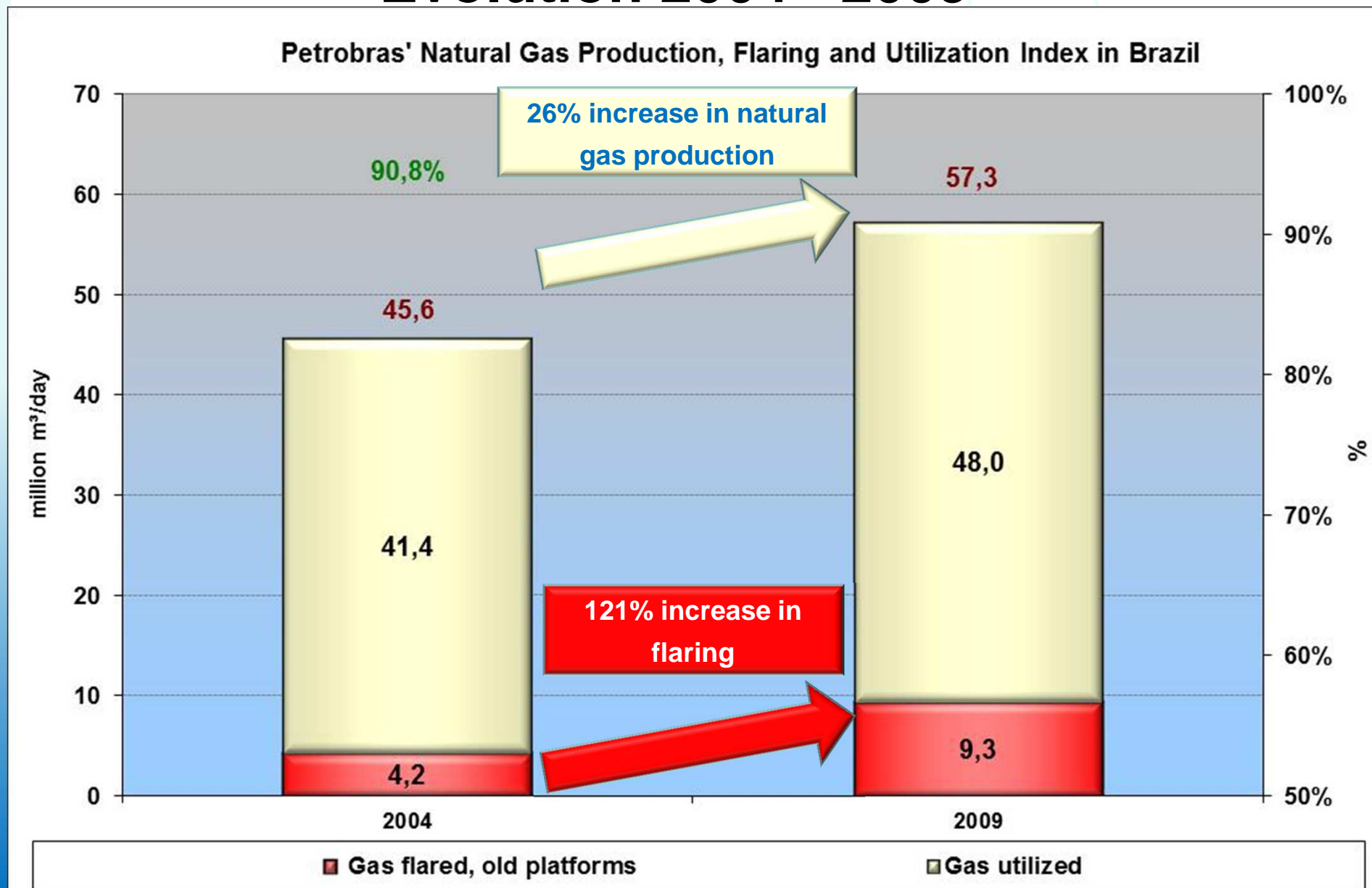


2. GAS FLARING: PROBLEM DIAGNOSIS

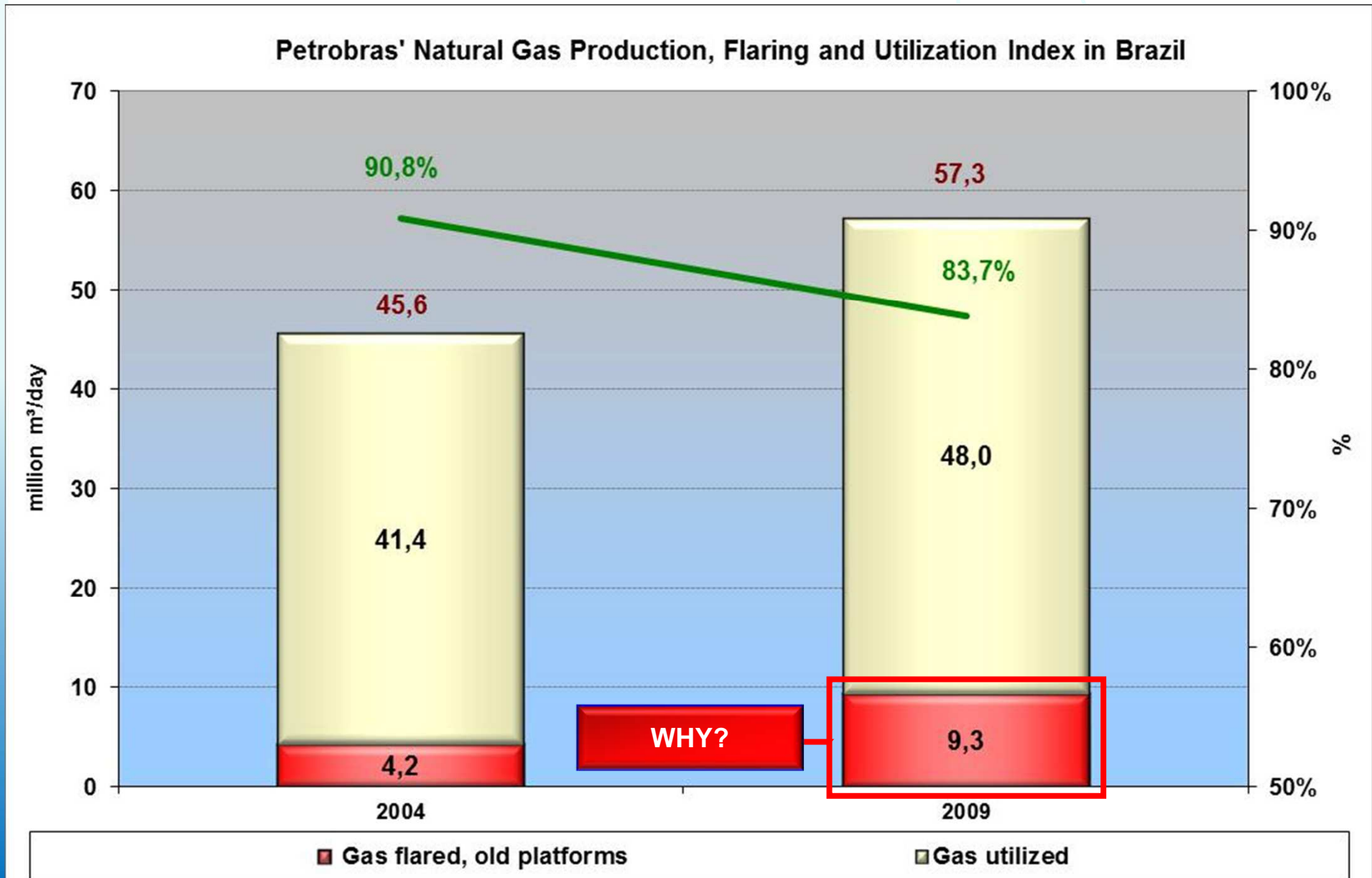
Production, Flaring and Utilization Index: 2004



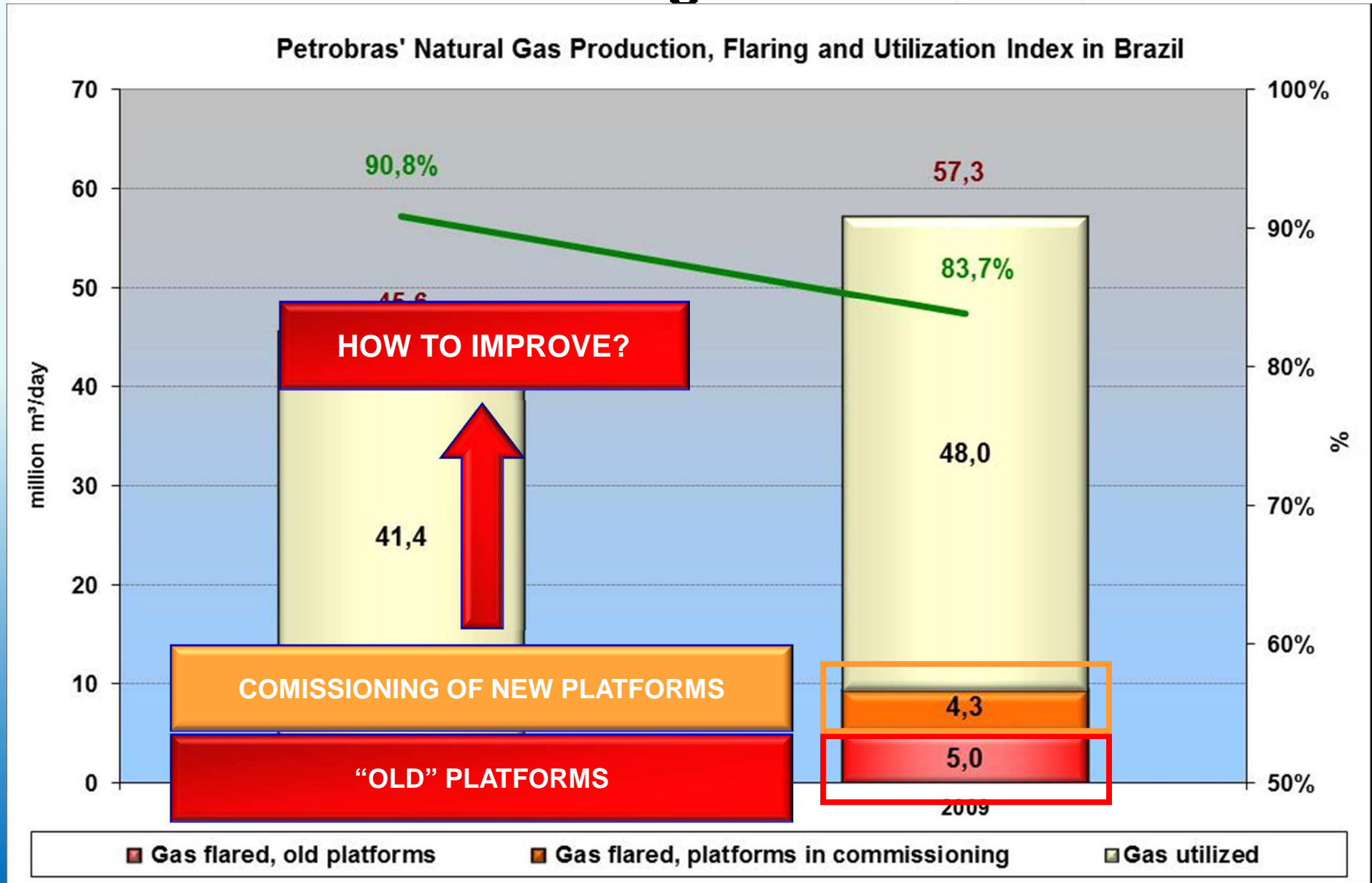
Production, Flaring and Utilization Index: Evolution 2004 - 2009



Production, Flaring and Utilization Index Evolution 2004 - 2009



Production, Flaring and Utilization Index 2009 Diagnosis



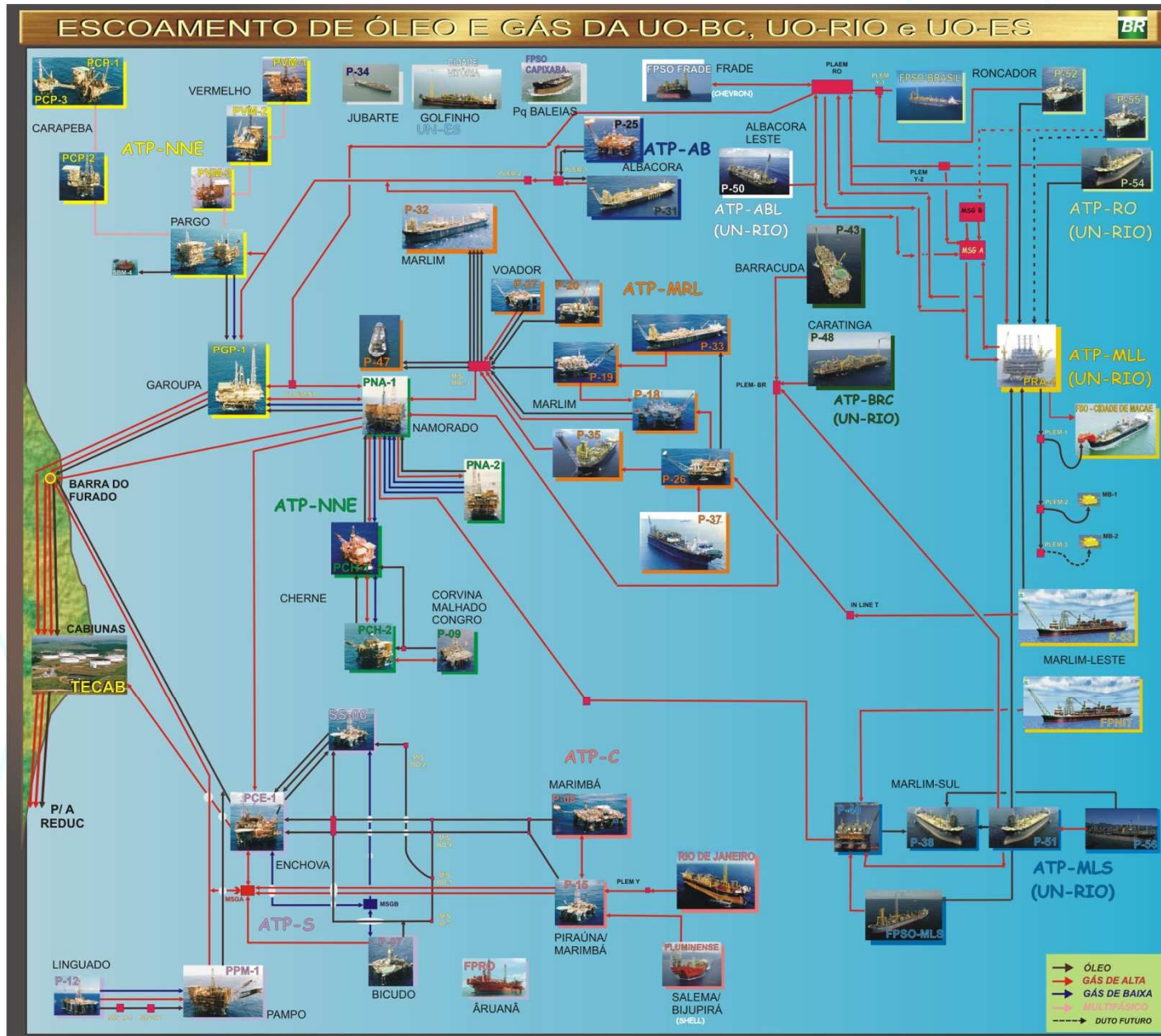
Gas Utilization Optimization Program: The Beginning

- A multi-disciplinary study group was formed to:
 - study the causes;
 - make a diagnosis;
 - propose an Action Plan for flaring reduction.
- Case studies were classified into three groups:

1	Facilities already under construction that could be modified without major changes in their startup time
2	Facilities already under construction in which modifications could strongly impact their startup time
3	Operating facilities with high flaring rates and low gas utilization ratio

- Focus should be on Campos Basin.

Campos Basin Infrastructure



3. POAG 2015 – GAS UTILIZATION OPTIMIZATION PROGRAM

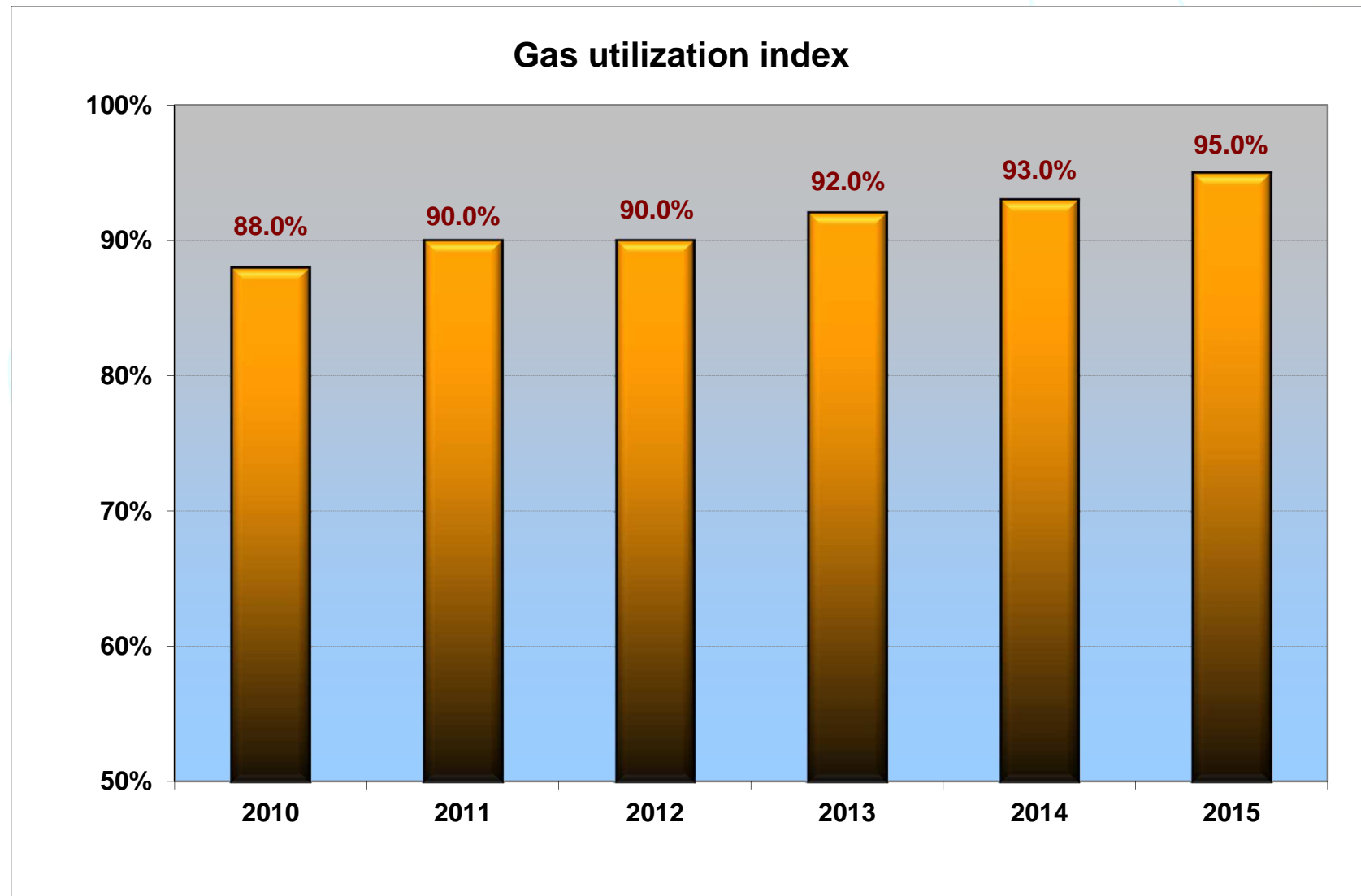
POAG 2015: Gas Utilization Optimization Program



- Program planned during 2009, based on the Action Plan developed by the multi-disciplinary Study Group;
- Approval and patronage of E&P's Executive Managers:
 - E&P Corporate
 - E&P Engineering
 - E&P S-SE
- Implemented from January 2010;
- Basic contents:
 - Directives for the approval of new production facilities;
 - Retrofits and actions to reduce gas flaring in operating platforms;
 - Flare monitoring on a weekly basis;
 - Monitoring of facilities under design or construction on a monthly basis;
 - Gas flaring reduction goals from 2010 to 2015.



POAG 2015 - Initial Goals



POAG 2015: Strategic Directives

RAISE GAS UTILIZATION TO INTERNATIONAL BENCHMARK LEVELS

GROUP 1

**SECURE A
MINIMUM
UTILIZATION
RATIO OF 97% IN
NEW
PRODUCTION
FACILITIES**

GROUP 2

**SECURE A
MINIMUM
UTILIZATION
RATIO OF 95% IN
NEW
PRODUCTION
FACILITIES**

GROUP 3

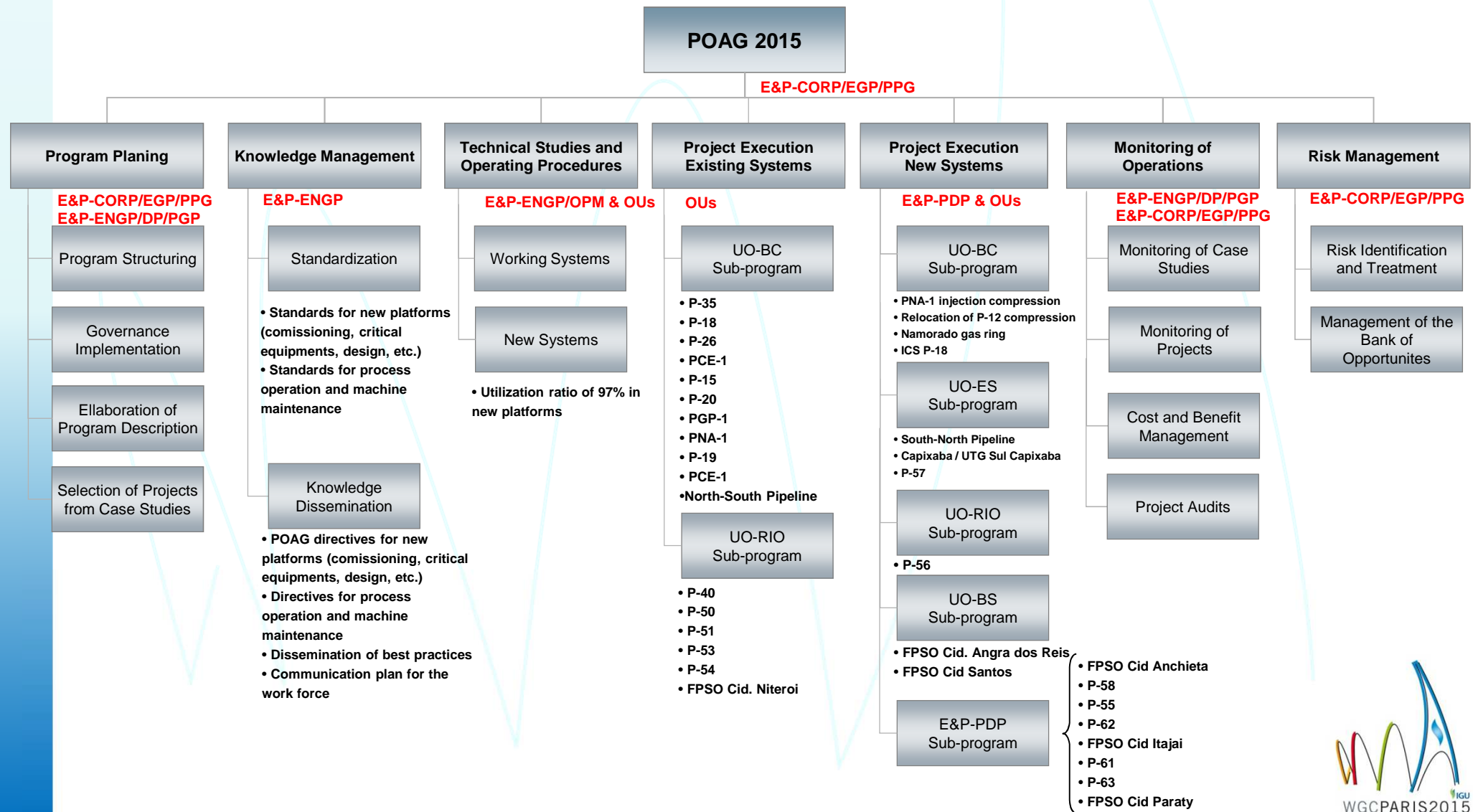
**SECURE A
MINIMUM
UTILIZATION
RATIO OF 95% IN
PRODUCTION
FACILITIES THAT
FLARE MORE
THAN 80,000 m³/d**

AT STARTUP NEW PLATFORMS MUST ABIDE TO THE STRATEGIC DIRECTIVES SET FOR GAS UTILIZATION AND EXPORTATION

GAS UTILIZATION AND OIL PRODUCTION CANNOT BE AFFECTED BY DEMAND FLUCTUATIONS

**NEW PROJECTS SHOULD NOT REDUCE THE UTILIZATION RATIO OF OPERATING FACILITIES
(e.g. platforms, collection stations)**

POAG 2015: Analytical Structure of the Program



POAG 2015 Governance Model

Objectives: Assure transparency and periodicity in the distribution of information concerning the evolution of the program; support decision makers of all levels with real time monitoring of the physical progress achieved in the projects, in a structured and organized manner.

Strategic Vision I

Biannual



Resp: Director

Strategic Vision II

Bimonthly



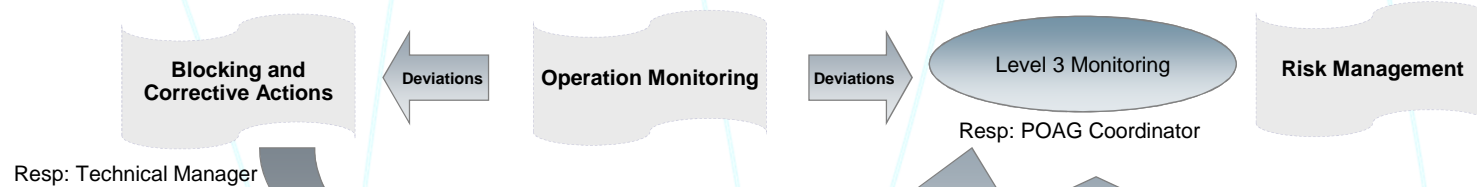
Resp: Executive Manager I



Resp: Executive Manager II

Program Vision

Monthly



Project and Case Study Vision

Monthly



Resp: Sub-Program Coordinators

POAG 2015: Implementation Monitoring

- Structured monitoring of the projects development was essential;
- Web-based tool used on the monthly meetings:
 - Baseline vs. Projected completion date for each project;
 - Projects' activities and chronogram;
 - Projected impact on the initial goals;
 - Updated Action Plan, with root cause analysis for deviations;

SUBPROGRAMA	PROJETO	PENDÊNCIAS	FUNÇÕES							
			Coord...	CPM	Eng.	ENGP	Exp	PCM	SMS	
UO-BS - Novos Sistemas	Atividades Complementares (POAG UO-BS)									
	Sist. Comp. Esc. Cid. Angra dos Reis	EF	Amarelo							
UO-BS - Sistemas Implantados	Sist. Comp. Esc. Unid. Afretada (FPSO Cid Santo...)	E	Vermelho							
UO-RIO - Novos Sistemas	Sist. Comp. Esc. Unid. Próprias (P-55)	E	Verde							
	Sist. Comp. Esc. Unid. Próprias (P-56)	E	Verde							
UO-RIO - Sistemas Implantados	Redução de Queima da P-50	EF	Amarelo			Verde		Verde		
	Redução de Queima da P-51	EF	Verde							
	Redução de Queima da P-52	E	Amarelo							
	Redução de Queima da P-53	E	Verde							

Legenda

- No prazo
- Atraso sem impacto na data
- Atraso com impacto na data
- Marco sem tendência
- Total de marcos em edição
- Total de marcos finalizados
- Total de marcos em edição e finalizados

Visualizar: EVTE Submarcos Histórico Acessos Função Tendência Anterior Anexos Info PRODEP Painel Executivo

ID	MARCO	Planejada EVTE	Planejada Implant...	Prevista/Alcançada	Tendência ATUAL
2 Fase de Seleção (Projeto Conceitual)					
2.6	Aprovação do EVTE Conceitual (Portão 2)	AGO/07	AGO/07		Concluído
3 Fase de Definição (Projeto Básico)					
3.5	Aprovação do EVTE Básico (Portão 3)	AGO/08	NOV/08		Concluído
3.5.1	Conclusão do projeto para fabricação do ICS		FEV/08	FEV/08	Concluído
3.5.2	Conclusão do projeto detalhado das obras de adequação da P-18		MAI/08	JUL/08	Concluído
4 Fase de Execução / Implantação					
4.4	Conclusão do Recebimento dos Materiais e Equipamentos	OUT/10	OUT/10	NOV/10	Concluído
4.4.1	Testes do Conjunto Principal / Teste de Resistência		JUL/10	JUN/10	Concluído
4.4.2	Liberação do Equipamento na Fábrica.		AGO/10	JUL/10	Concluído
4.4.3	Transporte para o Brasil e Desembaraço Alandegário		OUT/10	NOV/10	Concluído
4.4.4	Recebimento de Materiais para Sistema de Captura de Condensado (Cooling Loop Trap)		OUT/10	NOV/10	Concluído

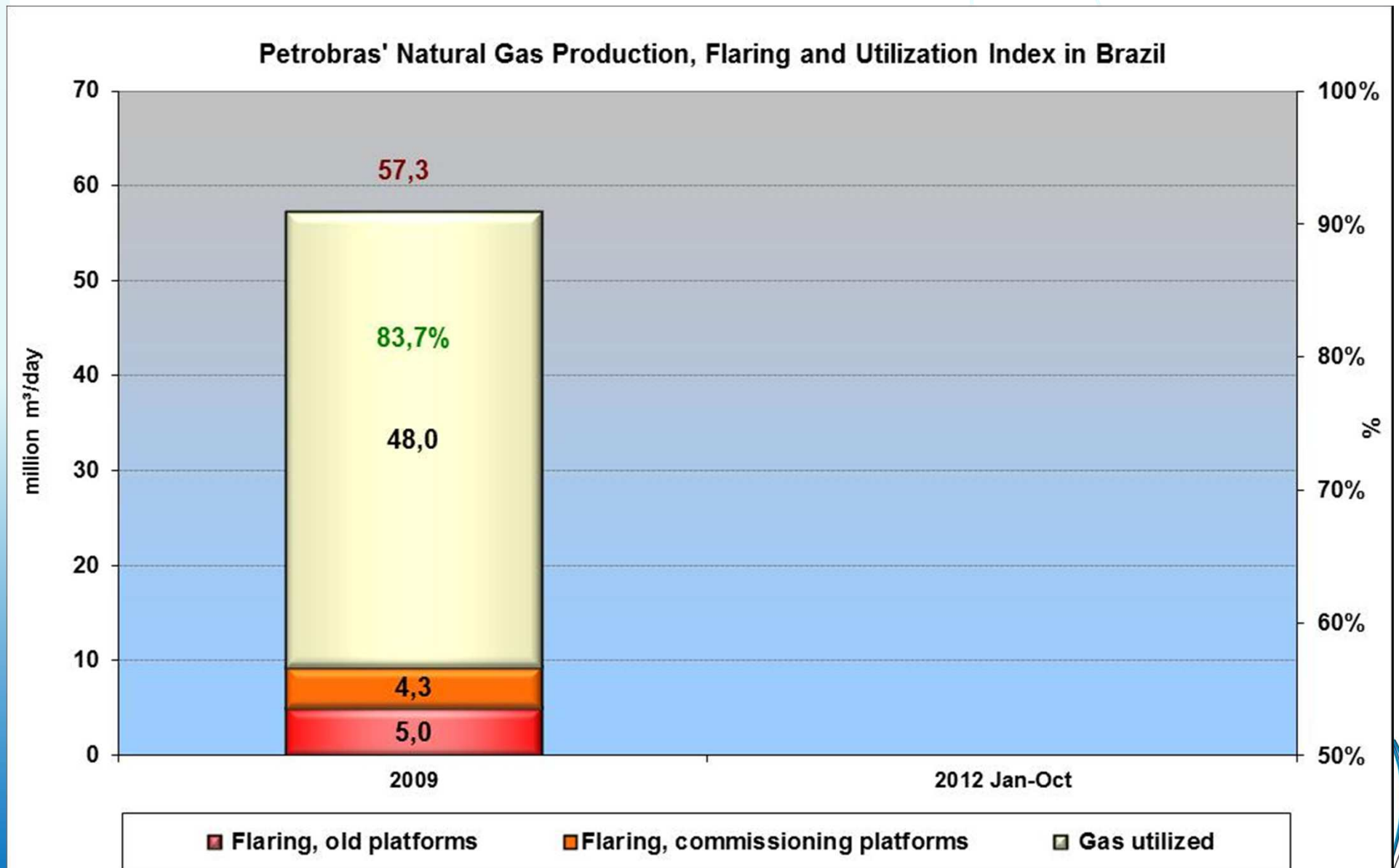
POAG 2015: Results Monitoring

- Weekly reports of the flared volumes and the projections for the month and year for the High Management, summarizing the biggest deviations from the goals:
- Corrective actions monitoring;
- Critical factor for the success: the discipline in keeping the Program governance running as proposed was vital to communicate the importance of POAG to all involved workforce.

It is for real!

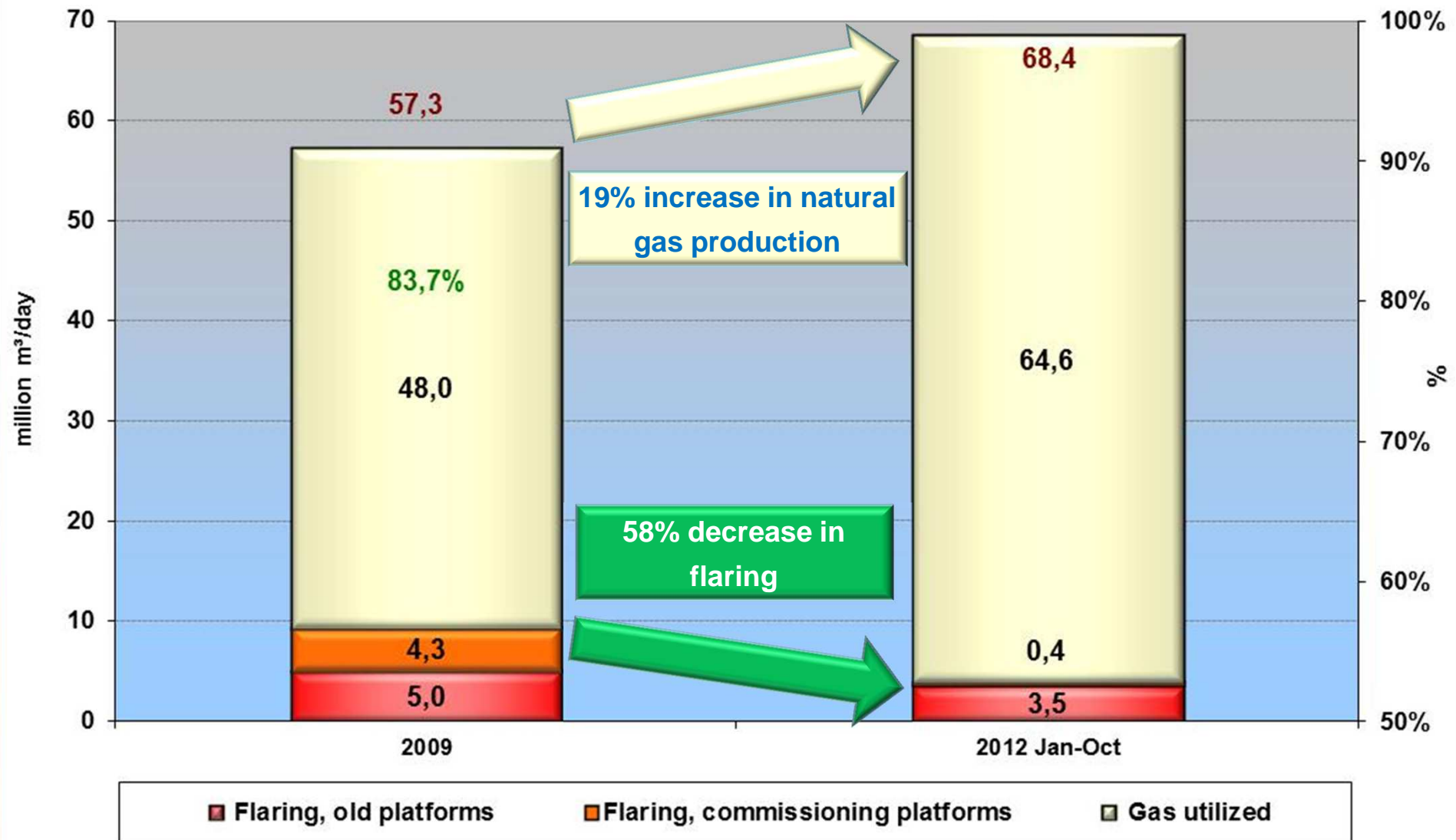
4. RESULTS

POAG 2015: Production, Flaring and Utilization Index Results 2009-2012

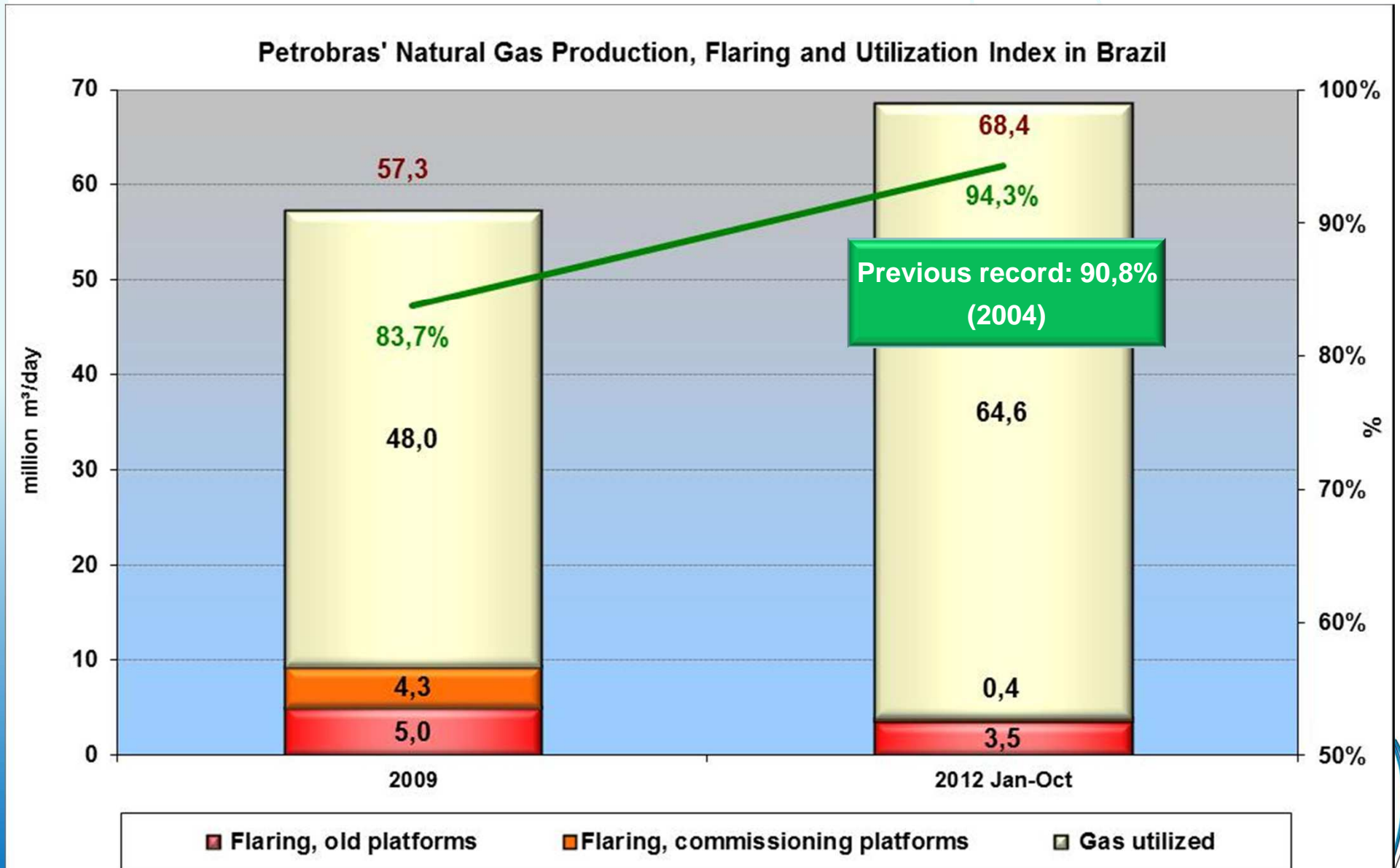


POAG 2015: Production, Flaring and Utilization Index Results 2009-2012

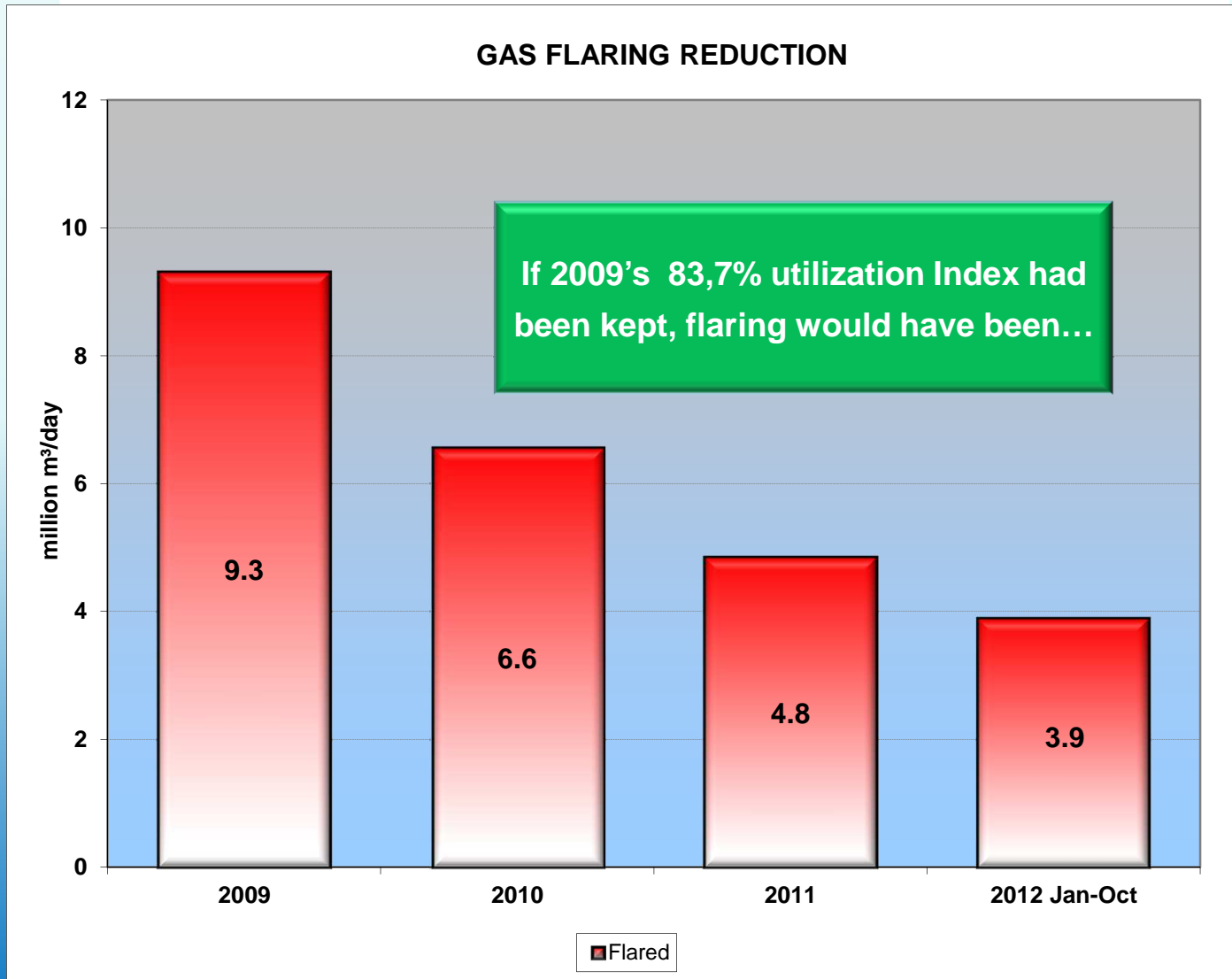
Petrobras' Natural Gas Production, Flaring and Utilization Index in Brazil



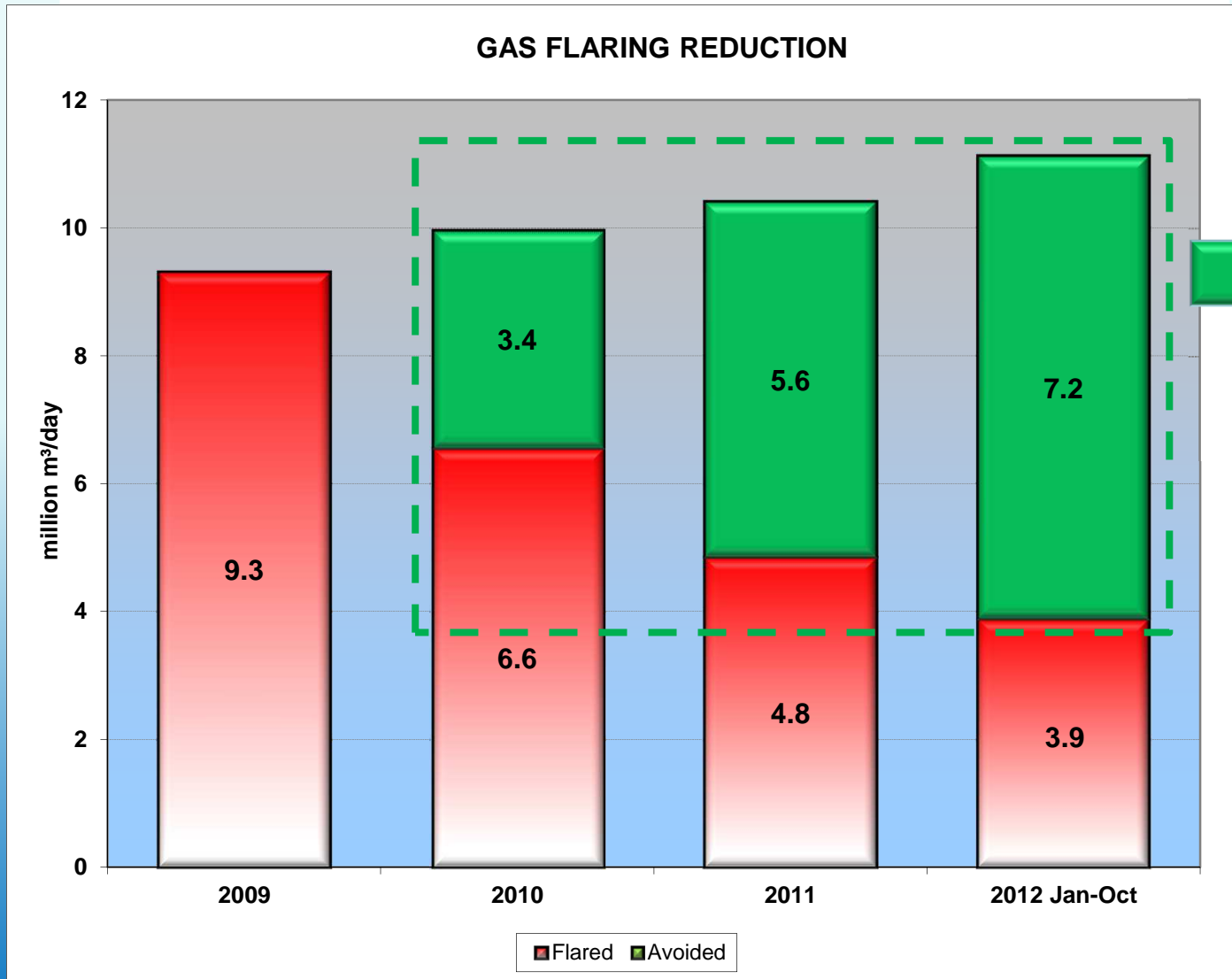
POAG 2015: Production, Flaring and Utilization Index Results 2009-2012



POAG 2015: Flaring and G.H.G. Avoided 2010-2012



POAG 2015: Flaring and G.H.G. Avoided 2010-2012



**Gas Flaring avoided:
5,9 billion m³**

**G.H.G emissions avoided:
16 million tons CO₂**

**3 million passenger cars
(15% Brazilian fleet)**

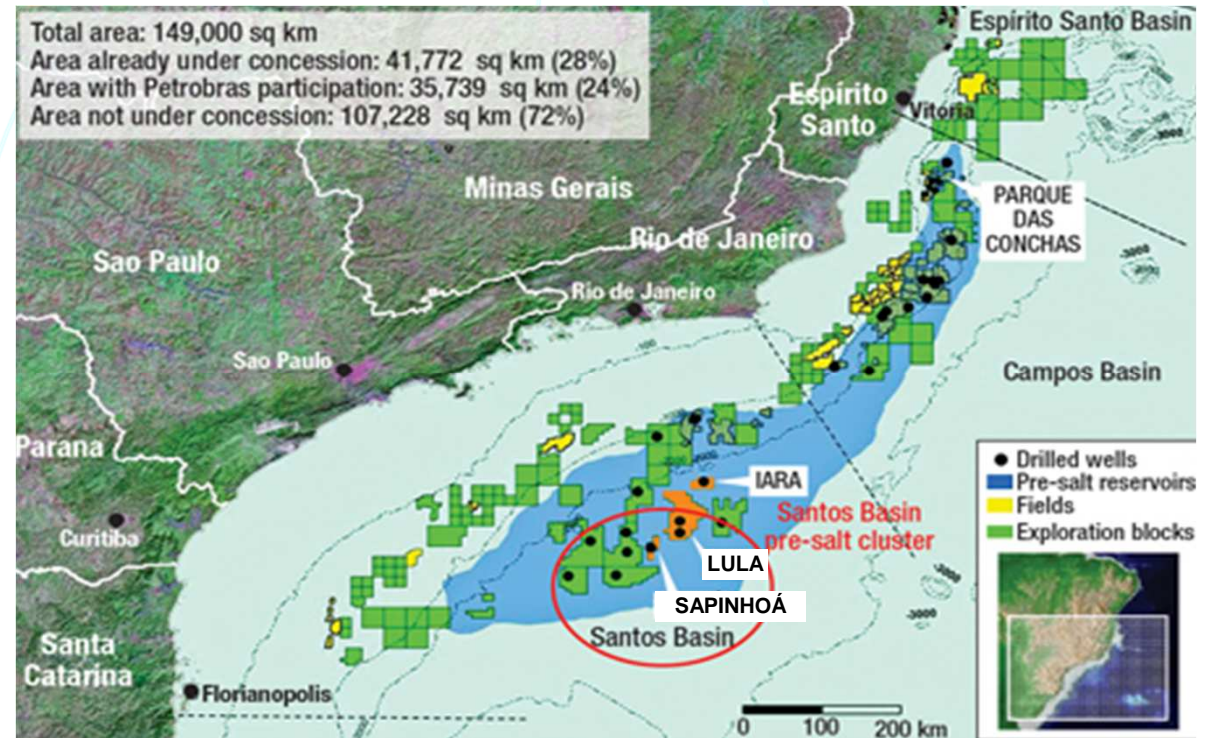
•References:

- Global Gas Flaring Reduction partners make progress, UNIDO, June 2012
- Estudo de Baixo Carbono para o Brasil, World Bank, 2010

5. NEXT STEPS

The Brazilian Pre-Salt

- The Pre-Salt in Brazil was the result of efforts to find new exploratory horizons in the Brazilian sedimentary basins;
- Total area of 149,000 km², comprising the Santos and Campos sedimentary basins;
- The Pre-Salt reservoirs are, as is characteristic of carbonate reservoirs, heterogeneous, with highly variable petrophysical properties;
- Basically associated gas, in a gas-oil ratio between 200 and 300 m³/m³.



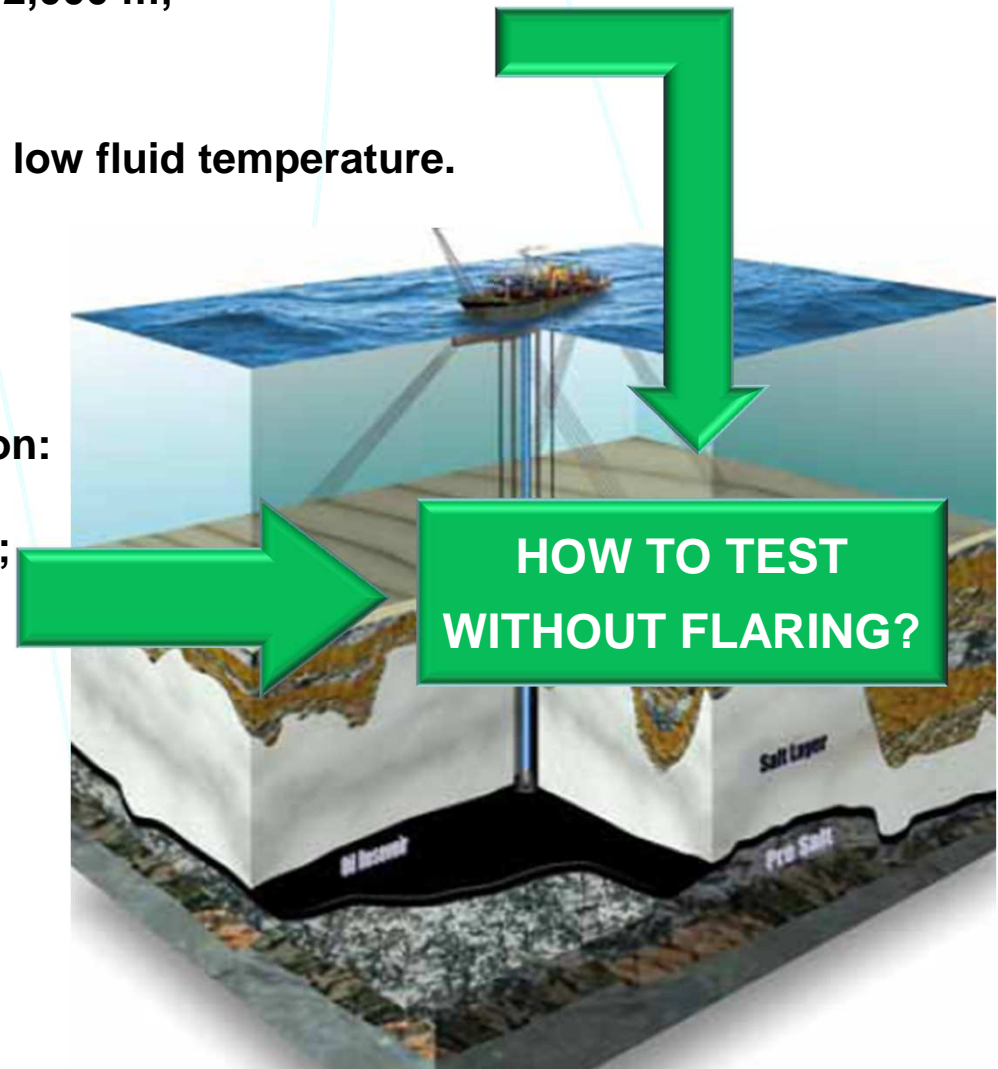
The Brazilian Pre-Salt

Challenges:

- reservoirs depths between 5,000 and 6,000 m below the sea level;
- extensive salt layer, with thickness up to 2,000 m;
- high contents of CO₂ ;
- H₂S in high concentrations;
- flow assurance in ultra-deep waters, with low fluid temperature.

Extended Well Tests (EWT) – 6 to 12 months

- reducing technical and geological risks;
- powerful tool for reservoir characterization:
 - ✓ Checking Damage mechanisms and reservoir hydraulic communications;
 - ✓ Sampling rocks and fluids;
 - ✓ Flow assurance;
 - ✓ Economic potential.



Modular Offshore Gas-to-Liquids (GTL)

- Technological solution for transporting and monetizing associated and stranded gas reserves during EWT phase;
- The compact reactors applied in GTL process represent a breakthrough in GTL technology, because of their small footprint, lower weight, modular design and high efficiency per unit of reactor volume which meet the requirements for offshore applications.

Gas-to-Flare



Gas-to-Liquid



Petrobras' FGTL R&D 2006-2012

~ US\$ 90 MM



Human Resources: ~ US\$ 15 MM
(200.000 h)



Infra-structure + OPEX + others:

~ US\$ 75 MM



Petrobras' FGTL: Pilot Projects



Pilot Plant in Lubnor (Velocys)

- Operating since December/ 2011;
- Project under revision, with new startup on March/2013;
- Processing 3 to 4 th m³/d of gas, producing up to 10 bbl of synthetic oil.



Pilot Plant in Atalaia (CompactGTL)

- Operating since November/2011;
- Technology has been qualified, and enhancing the efficiency is under analysis;
- Processing 10 th m³/d of gas, producing of 20 bbl of synthetic oil.

6. CONCLUSIONS

Conclusions

- **Petrobras' Gas Utilization Optimization Program allowed a growth in our Gas Utilization from 83,7% in 2009 to 94,3% in 2012;**
- **Key factors for POAG's success were:**
 - a correct diagnosis of the causes for flaring;
 - focused Action Plan and Strategic Directives;
 - High Management sponsorship for the Program;
 - dissemination of all the initiatives to all involved workforce;
 - structured and constant monitoring of gas flaring by all management levels;
- **Petrobras is still searching for better and improved means of raising its production altogether with minimum gas flaring, through the use of modular GTL units in the EWT platforms.**

Coordination Committee 2012-2015

Merci!

