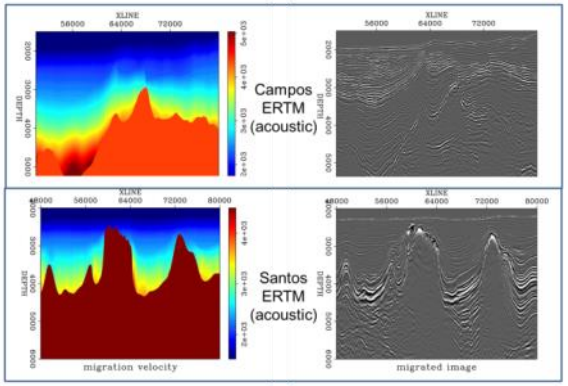
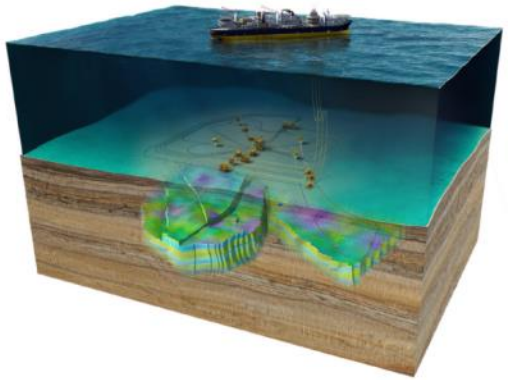
# Competitiveness of Deepwater Technology Roundtable
# The E & P Innovation Chain Of The Future

**Pedro Martínez Conesa, R&D manager**



July 2016

Rio de Janeiro

# The E&P Innovation Chain Of The Future

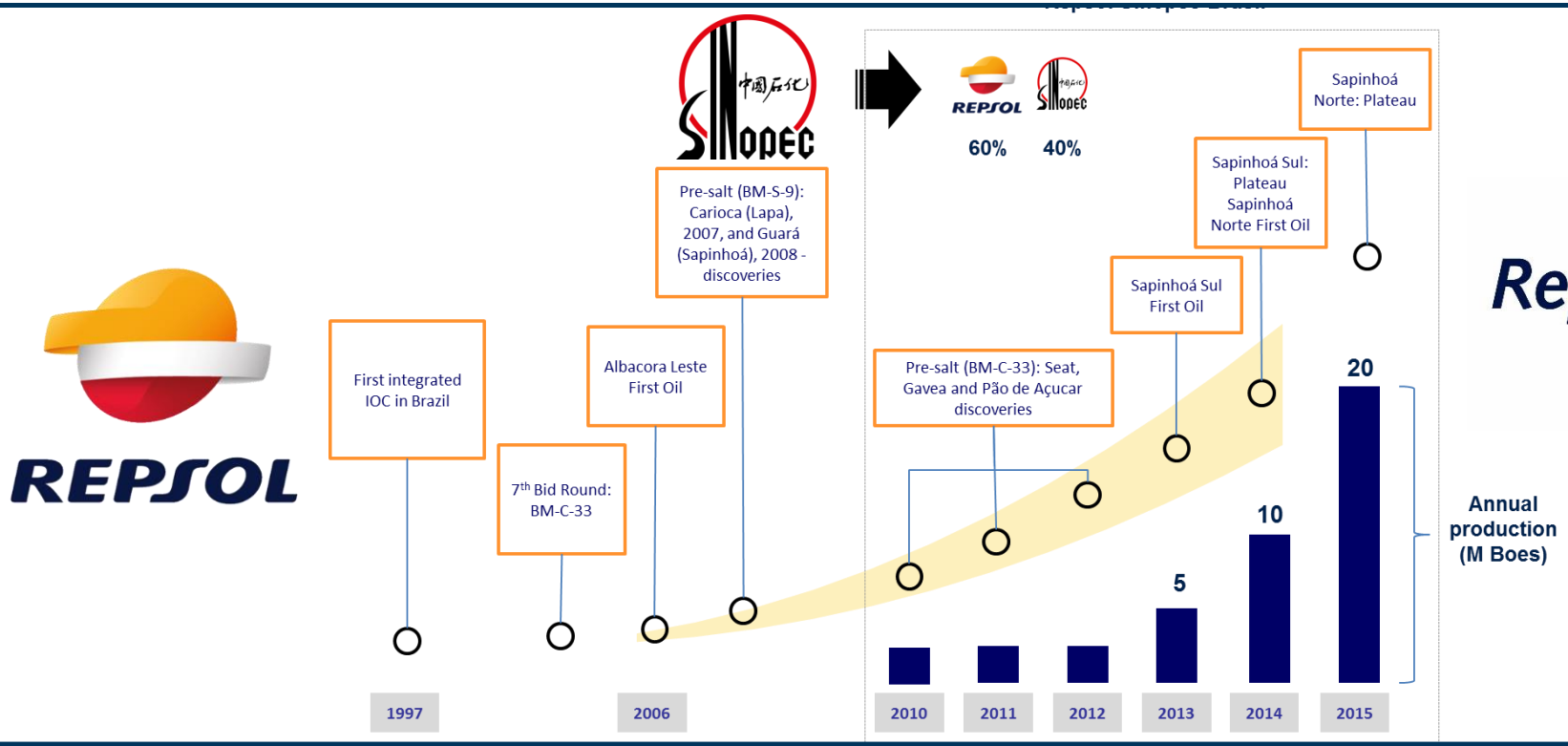
## Disruptive – Incentives, Risks, Ideas

- RSB background
- RSB R,D&I challenges
- RSB R,D&I initiatives (some of them)

# The E&P Innovation Chain Of The Future

## RSB background: first IOC in Brazil

**Repsol Sinopec Brasil is a company leader in exploration and production of hydrocarbons in Brazil.**




**Repsol Brasil, initiated its activities in Brazil in 1997, and proceeded to carry out a capital increase in December 2010, totally subscribed by Sinopec.**

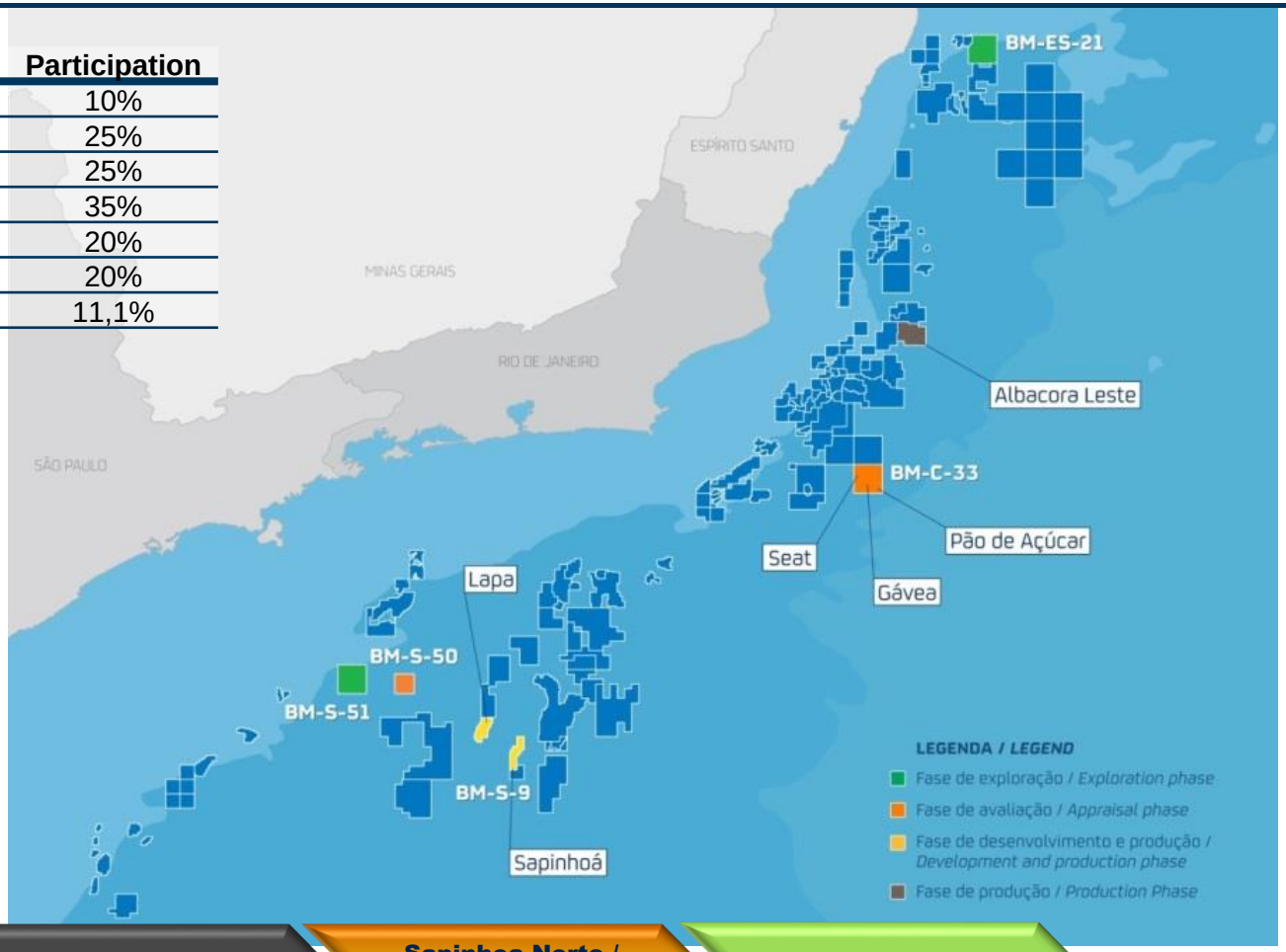
**Strategic position in areas with a higher potential of presalt region and exploratory activities in Santos Basin.**

# The E&P Innovation Chain Of The Future

## RSB background: major player in presalt basin

**Current approximate production ca. 80.000 boe/d (3rd producer in the country). Strategic positioning in presalt higher potential areas.**

| Area | Phase | Operator | Participation |
|---|---|---|---|
| Albacora Leste | Production | Petrobras | 10% |
| Sapinhoá | Development | Petrobras | 25% |
| Lapa | Development | Petrobras | 25% |
| BM-C-33 | Appraisal | Statoil | 35% |
| BM-S-50 | Appraisal | Petrobras | 20% |
| BM-S-51 | Exploration | Petrobras | 20% |
| BM-ES-21 | Exploration | Petrobras | 11,1% |

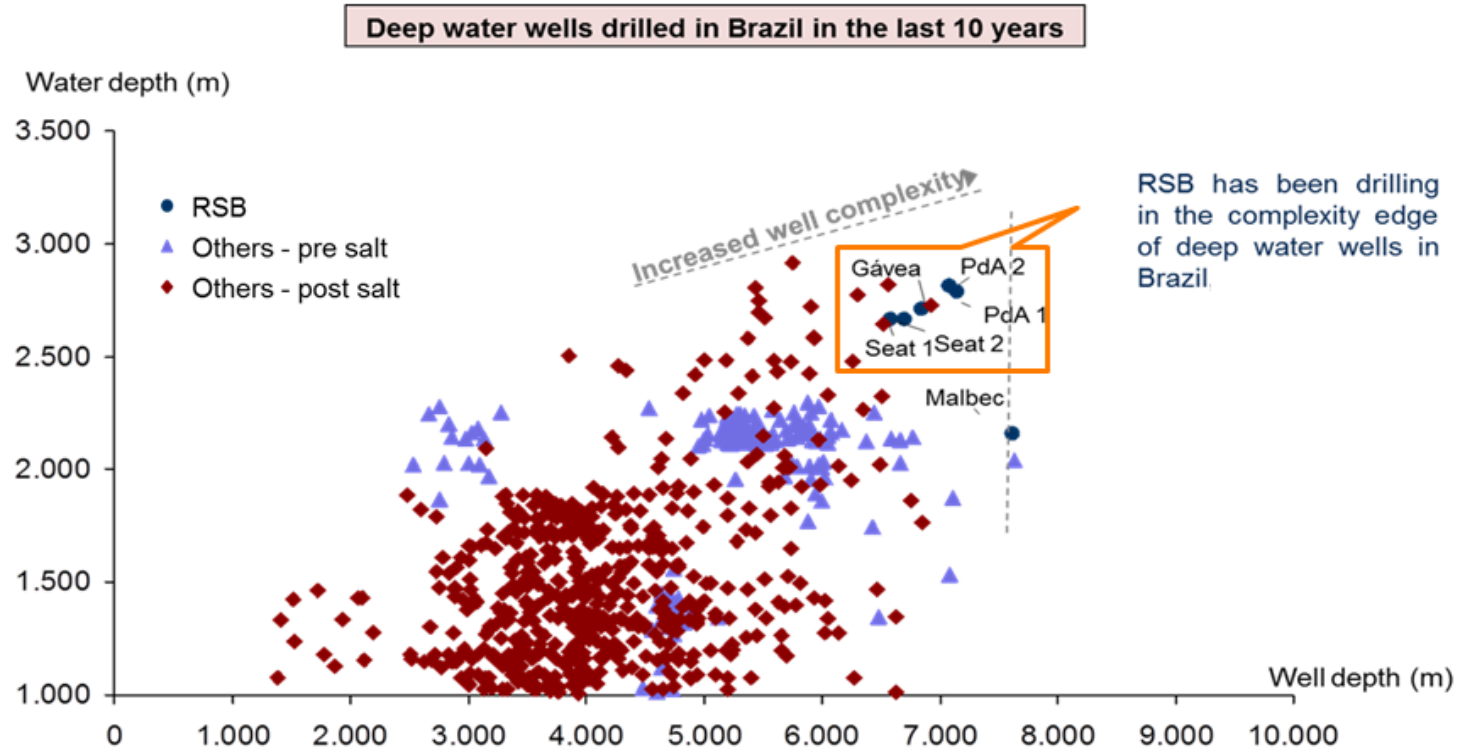




**Albacora Leste / Sapinhoa Piloto** → **Sapinhoa Norte / Lapa / BM-C-33 / BM-S-50 - Sagitario** → **BM-S-51 Lebre**

# The E&P Innovation Chain Of The Future

## RSB background: hands-on experience facing major presalt challenges

**Wells drilled in BM-C-33 with RSB as operator are amongst the more complex drilled to date in ultra deepwater.**




RSB has been drilling in the complexity edge of deep water wells in Brazil.

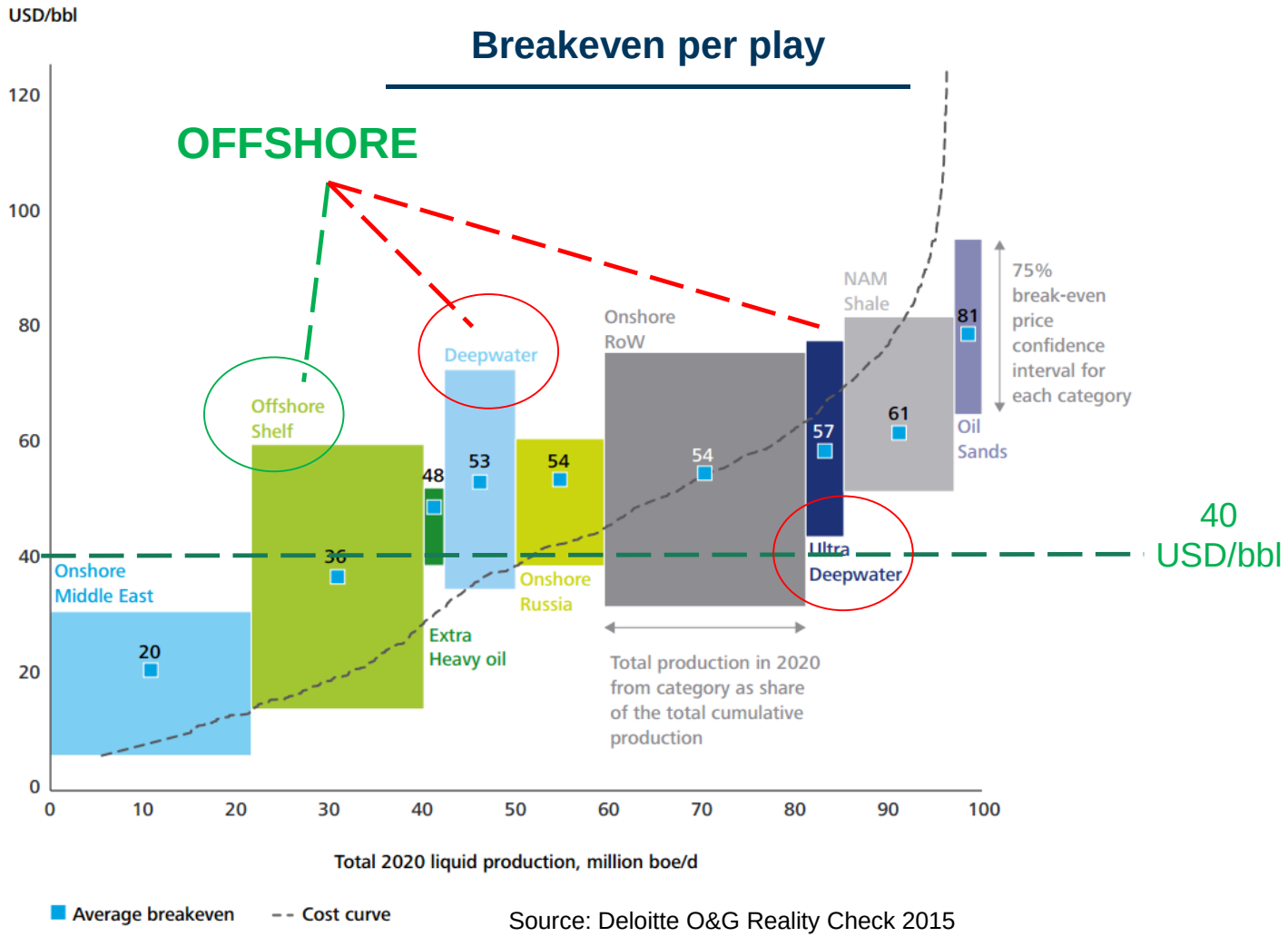
**Wells drilled have 2.800 metres of water column and are located 200 km away from the shore. Flow assurance issues (fluid: condensate gas, highly paraffinic and with risks of hydrate formation).**

**Besides needing to drill the salt layer, rock in the reservoir is of extreme hardness and non conventional (silicified carbonate with volcanic intrusions).**

# The E&P Innovation Chain Of The Future

## R&D strategic goal: offshore deepwater competitive at 40 $/bbl

**R&D goal: develop next generation of technologies associated to development, operation and decommissioning of offshore oil basins.**




Source: Deloitte O&G Reality Check 2015

# The E&P Innovation Chain Of The Future

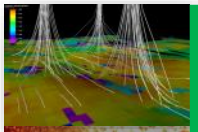
## Challenges of our strategic plan

Repsol Sinopec Brasil

## RSB R&D CHALLENGES

KEY TECHNOLOGY AREAS

**Well Technology**



**Offshore Operations**

**Materials and Corrosion**

**Fluid-Rock Characterisation**

**Enhanced Oil Recovery**

**Subsurface Illumination**

- INCREASE RATE OF PERFORATION (ROP)
- REDUCE NON PRODUCING TIME
- PLUG & ABANDONMENT
- INTEGRITY MONITORING
- INCREASE WATER DEPTH
- NEW FIELD DEVELOPMENT STRATEGIES
- INCREASE STEP OUTS
- WHILE DRILLING CHARACTERISATION
- INCREASE RESERVOIR PRODUCTIVITY
- INCREASE RECOVERY
- IMPROVE ILLUMINATION OF COMPLEX RESERVOIRS

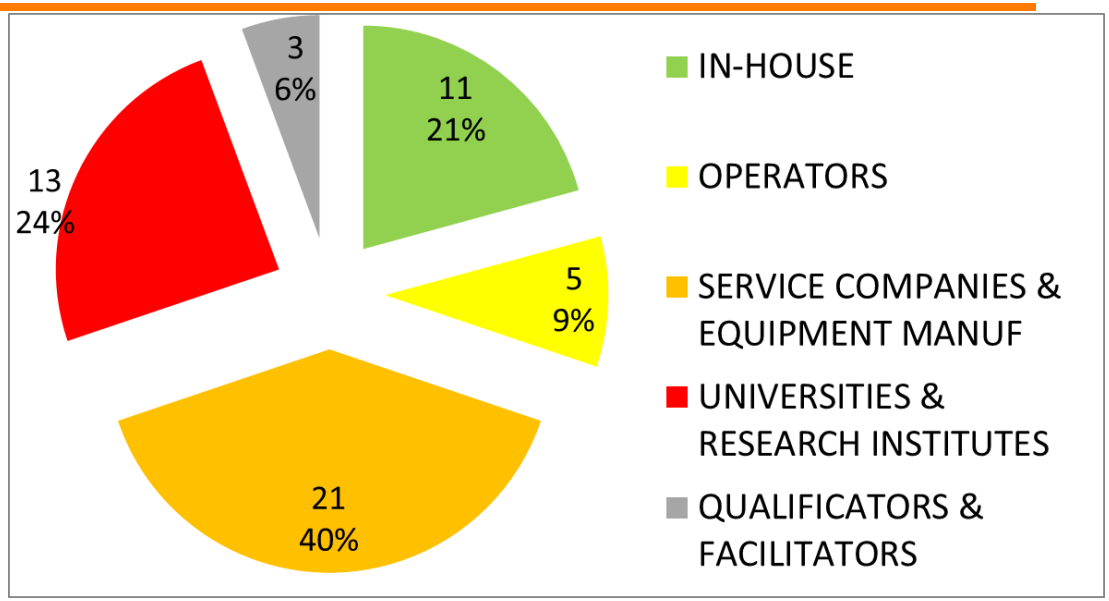
# The E&P Innovation Chain Of The Future

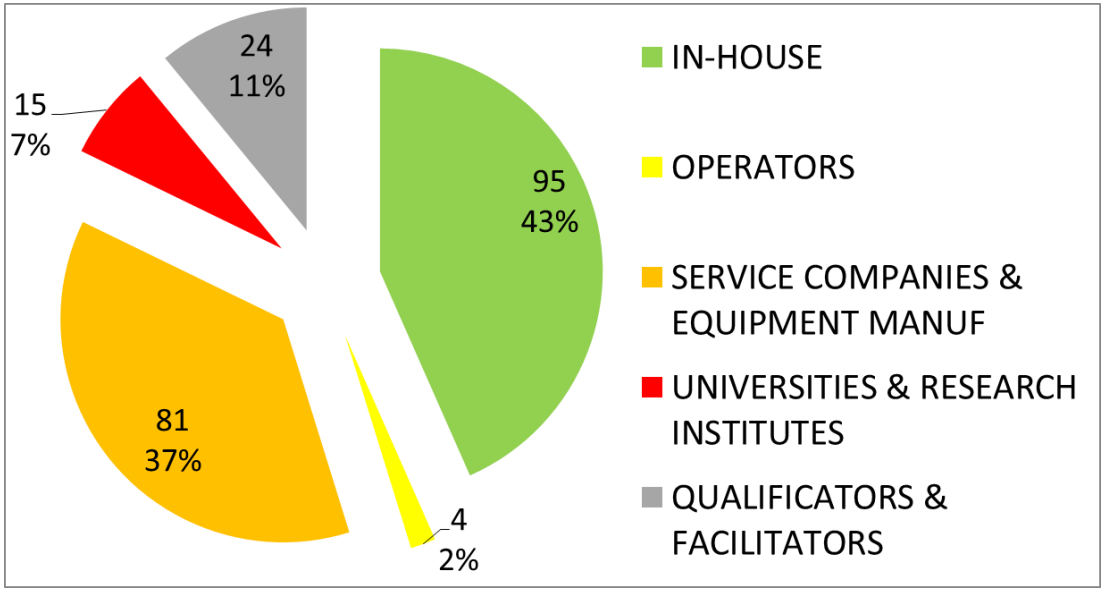
## R&D Portfolio defined with collaboration of partners

53 technical meetings during the months of March and April in 2015

- **In-house**
- **Operators**
- **Service companies and equipment manufacturers**
- **Small & Medium sized technology companies**
- **Universities and Research Institutes**
- **Qualificators and facilitators**

Total number of ideas identified: 219

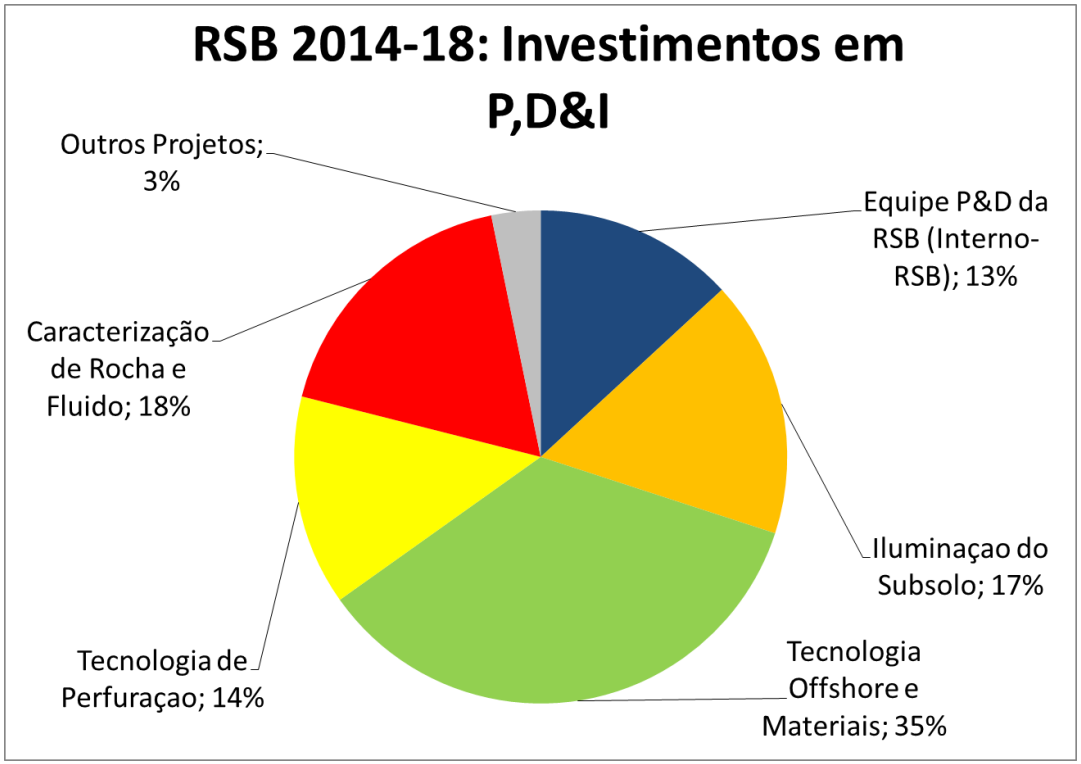


# The E&P Innovation Chain Of The Future

## RSB R&D investment plan 2014-18

**R$~200 million investment in R&D during period 2014-18.**
**85% of resources invested in Brazilian universities and/or companies**




- **Internal resources**
  - Creation of local research hub, in collaboration with shareholders research centres.
- **Subsurface Illumination**
  - Goal: improve illumination of complex reservoirs and reduce drilling costs
- **Rock and Fluid Characterisation + EOR**
  - Goal: development of monitoring tools for flow assurance and design of new strategies for enhanced oil recovery.
- **Offshore Technology and Materials**
  - Monitoring of integrity and oil spills detection, new technologies for deepwater and long tiebacks.
- **Drilling Technology**
  - New technologies for hard rock drilling and cementing.

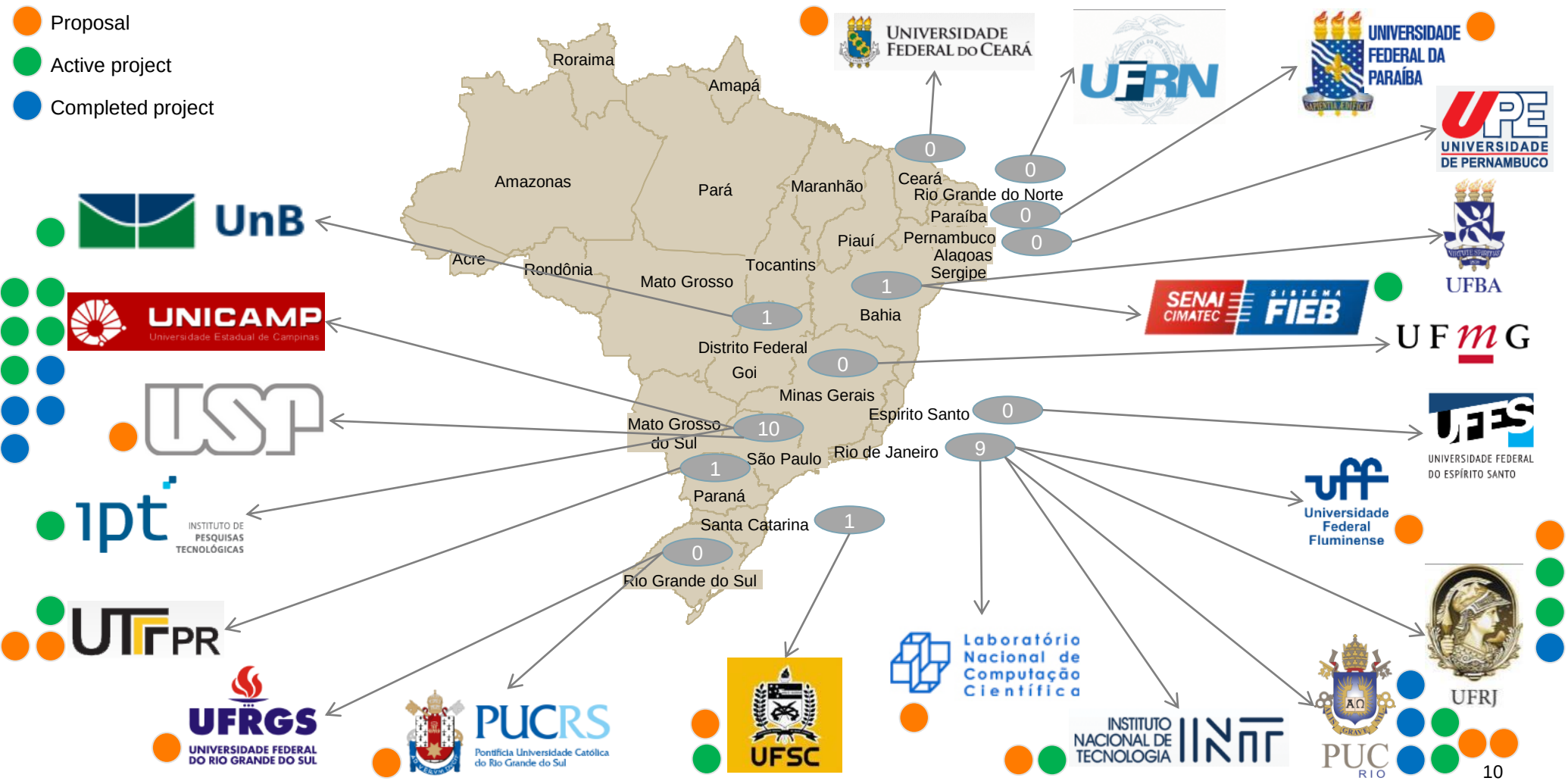
**Execution model in partnership with other oil companies and our shareholder research centres.**

**We expect that these partnerships will bring additional 60% funding to our projects.**

# The E&P Innovation Chain Of The Future

## RSB network of Brazilian universities and research institutes

**21 universities and research institutes from 13 different states.**
**23 completed or active projects in 9 different universities (13 additional under evaluation).**



# The E&P Innovation Chain Of The Future

## Industry Partners: cost and risk sharing

**Partnership with other operators.**
**Execution of activities with participation of Brazilian industry.**

### Operators

Statoil
PETROBRAS
Shell
BG GROUP
Petrogal
TOTAL
SINOCHEM
Chevron
queiroz galvão

### Service and Equipment Suppliers and Qualifiers

BAKER HUGHES
vallourec
FMC
HALLIBURTON
OneSubsea
A Cameron & Schlumberger Company
Technip
Schlumberger
KONGSBERG
subsea 7
ABB
AkerSolutions
PGS
BUREAU VERITAS
Tenaris
DNV·GL
CGG
Passion for Geoscience

### Small and Medium Enterprises

gis GeoImagingSolutions
ikon Science
OILFINDER
I-DUTTO
ALIS
SOLUÇÕES EM ENGENHARIA & SISTEMAS
INGRAINBRASIL
serviços de geofísica ltda
PETREC
ESSS
ouro negro

# The E&P Innovation Chain Of The Future

## International cooperation coordinated through our shareholders

**Partnership with shareholders (SINOPEC e REPSOL) research centres located in China and Spain. More than 2.000 researchers and state-of-the-art laboratory facilities.**

中国石化石油物探技术研究院
SINOPEC GEOPHYSICAL RESEARCH INSTITUTE

中国石化石油勘探开发研究院
SINOPEC Exploration & Production Research Institute

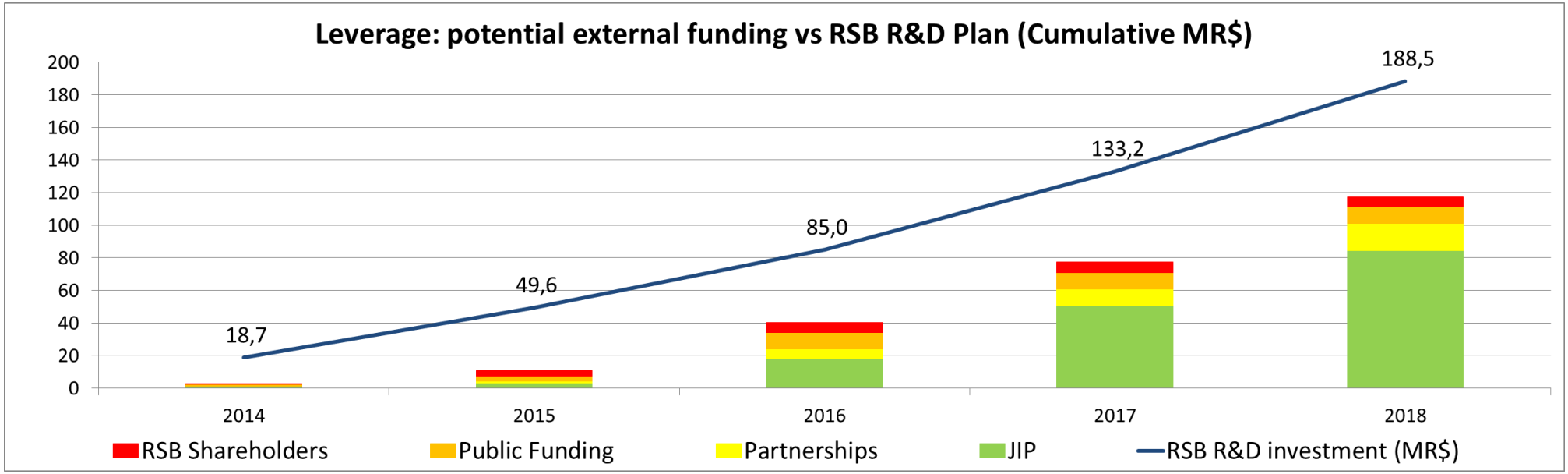

中国石化上海石油化工研究院
SINOPEC SHANGHAI RESEARCH INSTITUTE OF PETROCHEMICAL TECHNOLOGY

中国石油化工股份有限公司石油工程技术研究院
Sinopec Research Institute of Petroleum Engineering

# The E&P Innovation Chain Of The Future

## Partnership and access to public funding for innovation

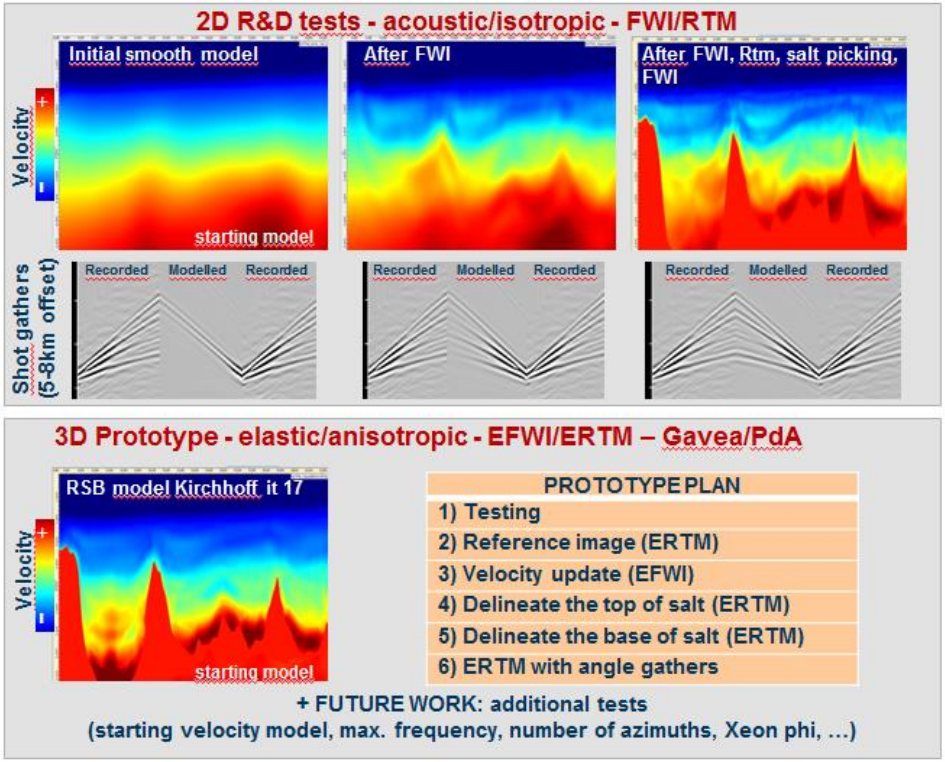
- **Cooperation is useful in pre-competitive projects (low TRL levels), but it is essential to successfully execute latest stages of technology development (high TRLs, prototyping and field demonstration)**
- **Partnerships with other Oil Operators (+40% additional resources and expertise)**
- **Public funding also available: EMBRAPII and other FINEP initiatives, BNDES, international funding initiatives (Norway-NRC, Spain-CDTI, EU-Horizon)**
- **RSB shareholders also partners in some projects that generate synergies between portfolios**



# The E&P Innovation Chain Of The Future

## Subsurface Illumination: research programme SPEED

**Development of prototype and optimisation of high performance computing usage. HPC research facility that needed private and public funding for its construction.**





Yemoja HPC. Cimatec, Salvador, Bahia.
~410 TFlops (860 Nodes CPU);

**Project in partnership between a technology based company (GIS) and a research institute (SENAI-CIMATEC).**

**Public funding through EMBRAPII-FINEP.**

# The E&P Innovation Chain Of The Future

## Oil spill detection from dynamic production systems

### Development of oil spill detection system for floating applications
### International cooperation with industrial partner Indra (Spain)

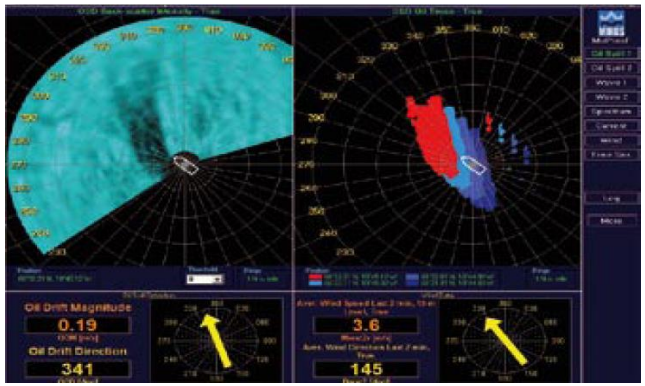
**HEADS** is an Hydrocarbon Early Automatic Detection System, based on the combination of **two** different **sensors** (**radar** and **IR** camera) that are assisted by **meteorological sensors** and managed by **smart algorithms.**

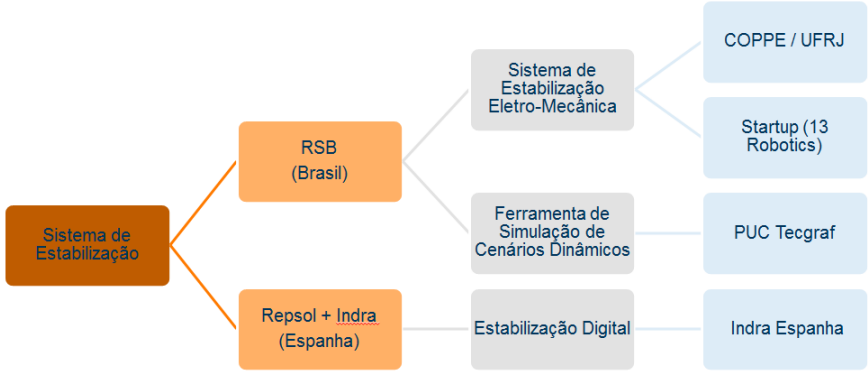
- Currently, the System has to be **installed on fixed sites**: fixed platforms or onshore.

**HARDWARE**

- Radar (from R&D)
- IR Camera (from R&D)
- Interconnection boxes (from R&D)
- Wind sensor + AIS
- Connections
- Compact frame
- Marine computer
- Unstabilization platform for tests

The objective of this project is to **adapt HEADS** to enable the **detection** of spills **from mobile sites** (e.g: mobile platforms or FPSO)



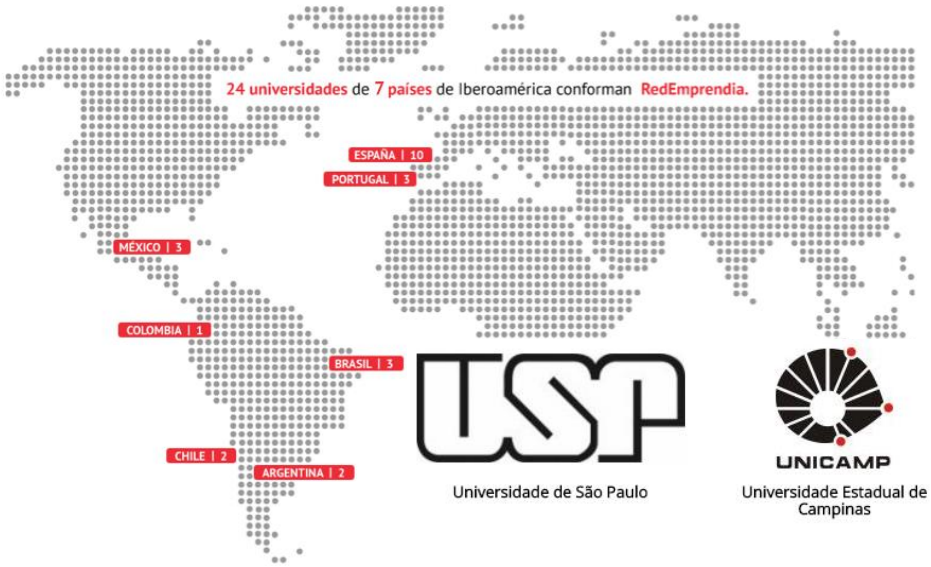

**Project in partnership with REPSOL R&D and INDRA Spain. Two universities and one start-up company executing activities in Brazil.**

**Existing technology for fixed platforms that needs to be adapted to floating production systems.**

# The E&P Innovation Chain Of The Future

## Look for disruptive ideas: scouting for growth

Universities




- **Universia**
  - Network with 24 Universities located in 7 Iberoamerican Countries (4 in Brazil)
  - **RedEmprendia Solutions is part of Universia**
    - 7 Universities participated (Brazil-1, Spain-1, Portugal-2, Chile-1, Mexico-1, Colombia-1)
    - Launched the first Call in cooperation with Repsol (2015)

Universidade de São Paulo

Universidade Estadual de Campinas

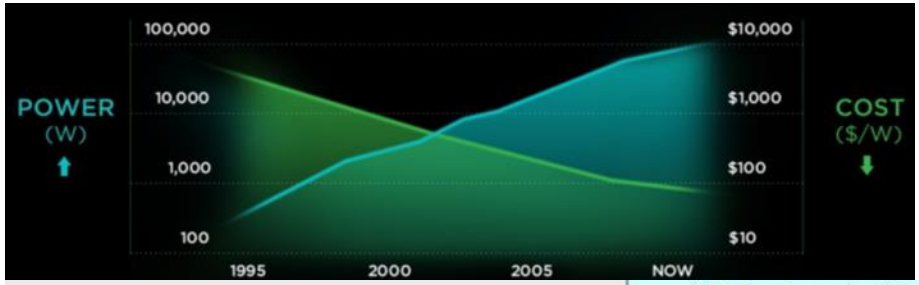
Universidade Federal de Minas Gerais

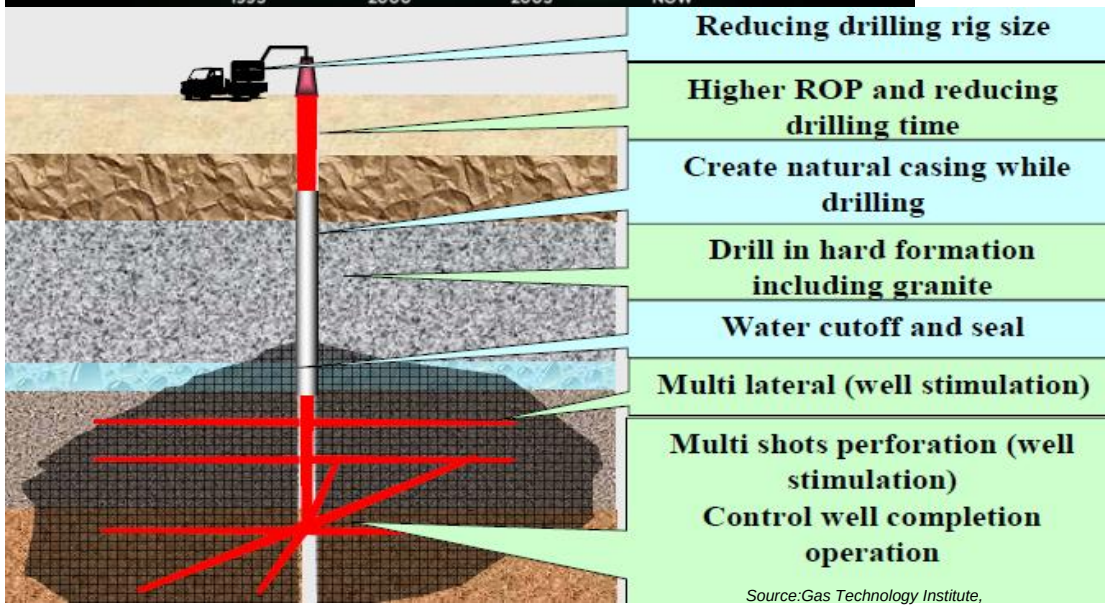
Universidade Federal Rio Grande do Sul

- **Why an Open Innovation Programme?**
  - Specific programme focused on encouraging Academia to propose disruptive solutions to Industry Challenges
  - Enabling technologies (Breakthroughs, High Risk, High Reward) at a Proof of Concept stage
  - Aiming to bring innovation opportunities from other industry sectors (out of the box), capturing talent from university departments that are not amongst our typical network (non O&G departments)
  - Focus on developing entrepreneurship, aligned with our Corporate Social Responsibility Objectives

# The E&P Innovation Chain Of The Future

## Laser drilling: disruptive innovation that needs collaboration



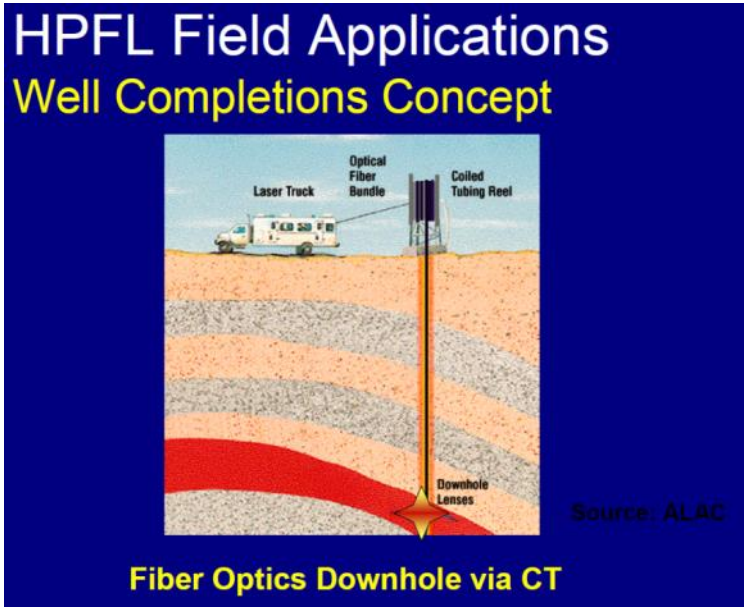




*Source:Gas Technology Institute, Phoenix, AZ,* February, 2004

### Laser Enhanced Drilling (PDC+Laser)

A test hole drilled 12' deep in dolomite rock

A prototype of laser and PDC-hybrid bits. (Zediker et al., 2012)




- **Drilling over ~10 times faster than conventional drilling.**
- **Lasers can be used in various ways for destroying rock but two of them have become attractive for deep drilling:**
  - ✓ Rock weakening with further application of mechanical tools
  - ✓ Direct rock destruction via ablation (spalling, fusing or vaporizing).

**THANK YOU!**
**OBRIGADO!**
**谢谢！**
**GRACIAS!**

Repsol Sinopec Brasil