

## Angola development

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Overview

Exploration assets

**Angola development**

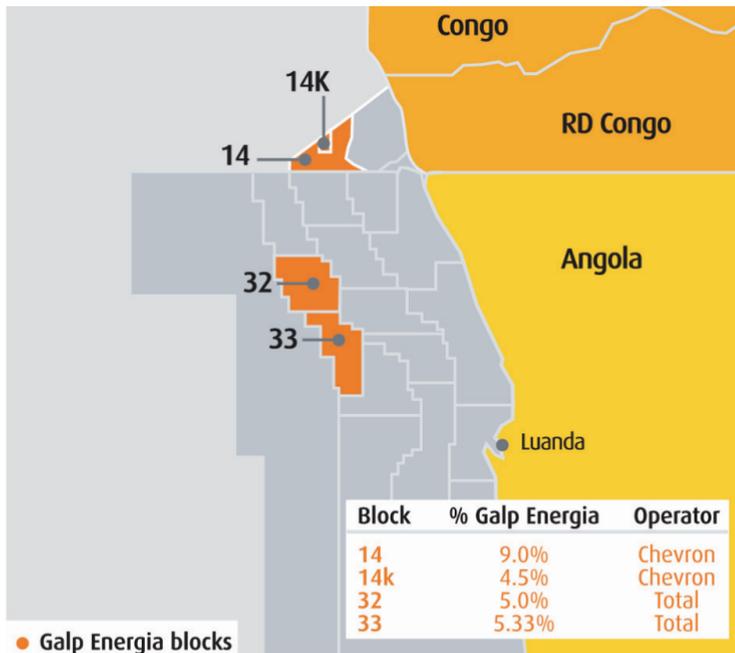
Brazil exploration assets

Pre-salt Santos basin

Final remarks

# Successful track record on Angolan projects execution

## Angolan blocks location



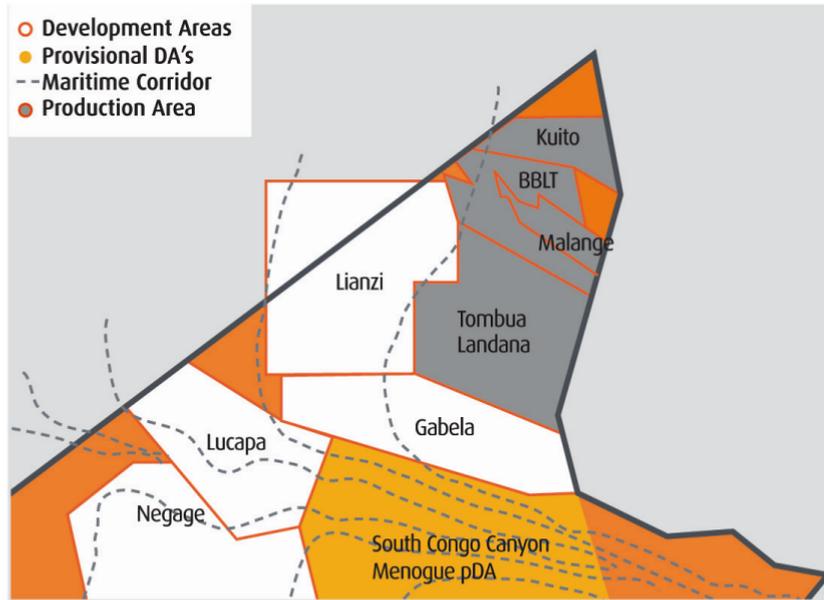
- Presence in Angola since 1982
- 12 discoveries in Block 14 and 14 discoveries in Block 32 and Block 33
- Block 14 is the only producing block
- 255 Mbbbl of total reserves<sup>1</sup> and contingent resources<sup>2</sup> at YE 2010

<sup>1</sup> Net entitlement 2P reserves

<sup>2</sup> Working interest 3C contingent resources

# Block 14 and 14K provide solid foundation for Galp Energia's presence in Angola

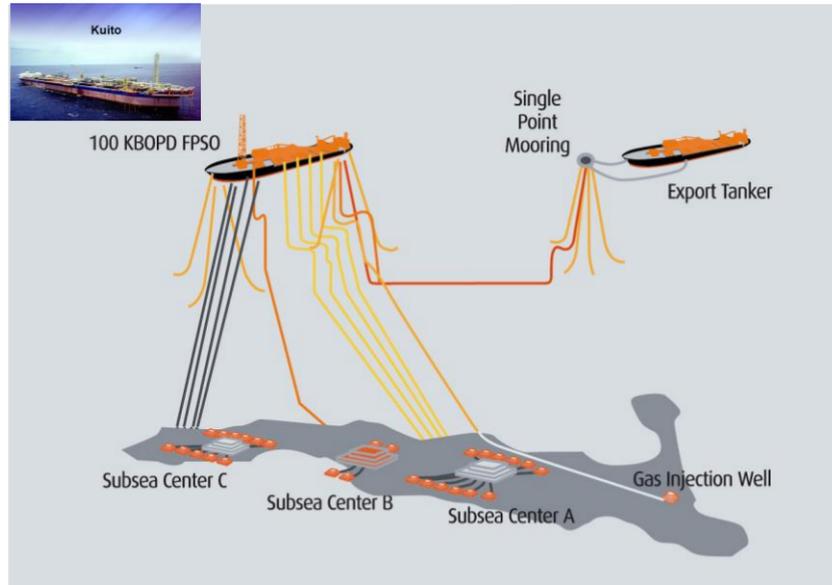
## Blocks 14 and 14K areas



- Almost the total area of Blocks 14 and 14K was retained following the expiry of exploration period
- Three fields already under production: Kuito, BBLT and Tômbua-Lândana
- Five areas still to be developed: Malange, Gabela, Lucapa, Negage and Lianzi
- Menongue is a provisional development area

# Kuito's FPSO was the first deepwater project in Angola

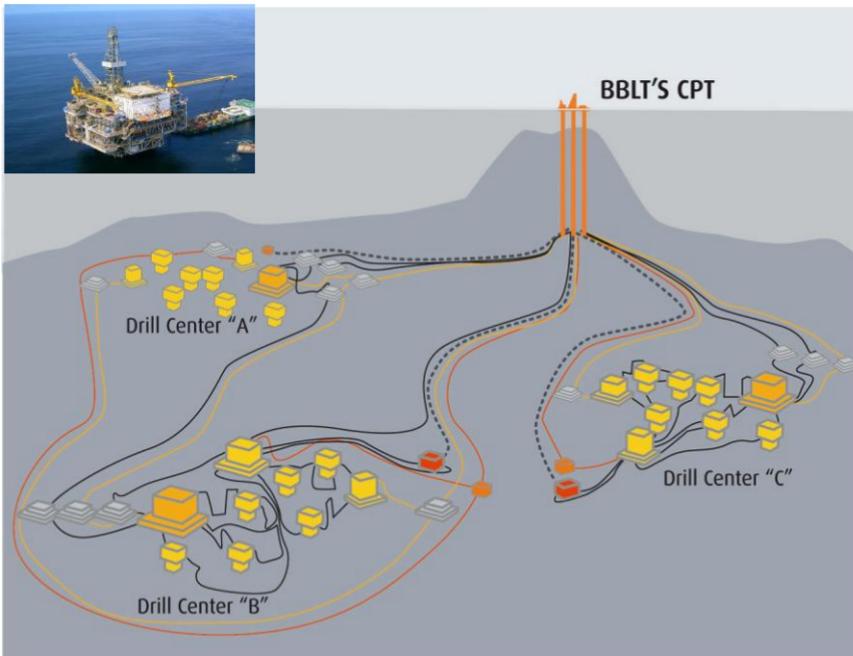
## Kuito's development



- Very successful fast track deepwater project with first discovery in 1997 and first oil in 1999
- Development consists of one FPSO, three subsea centers, 22 producers, six water injection and one gas injection wells
- Project acceleration achieved via staged development
- Upgrades successfully performed with vessel on-station

# Excellence in execution in BBLT

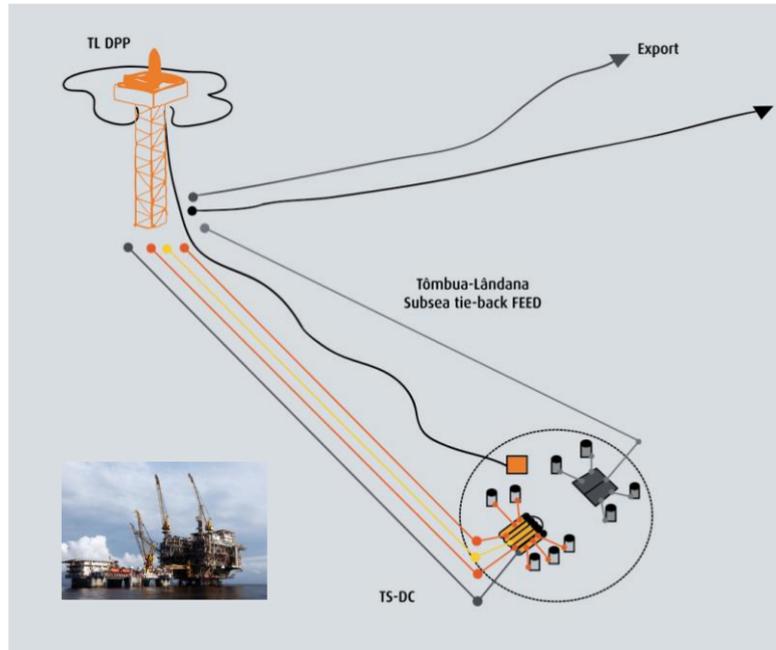
## BBLT's Compliant Piled Tower



- Awarded "Project of the Year" by the Offshore Energy Association in 2005
- Development consists of one Compliant Piled Tower (CPT), three subsea centers, 30 producers and 18 water injection wells
- Two stage execution: First BB (CPT, process, import and export facilities); Second LT (subsea centers and tiebacks)
- Hub concept, available to incorporate further tie-backs

# Replicating proven concept on Tômbua-Lândana

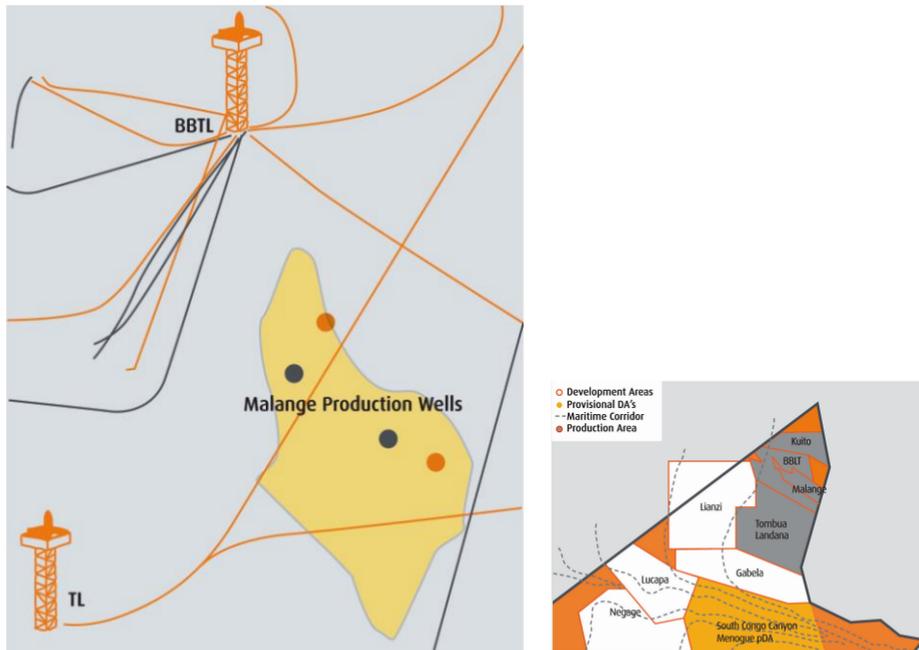
## Tômbua-Lândana's CPT



- Weight and cost optimization via Tender Assisted Drilling rig
- One of the tallest fixed structure executed in the world
- Development to date consists of one CPT, one subsea centers, 11 producers and three water injection wells
- Two stage execution: 1<sup>st</sup> TL (CPT, process, import and export facilities); 2<sup>nd</sup> TS (subsea centers and tie-back)
- Hub concept, available to incorporate further tie-backs

# Malange development leveraging on existing infrastructure

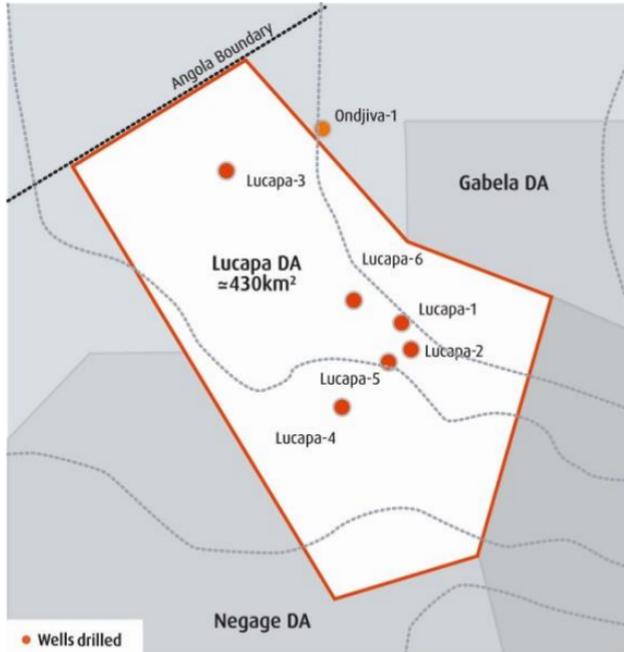
## Malange tie-back alternatives



- Malange discovery in 2007 with appraisal programme completed in 2010
- Two drilled wells justified submitting conceptual development plan to concessionaire
- First Pinda development in Block 14 with light oil (40° API)
- Engineering studies underway to mature tie-back development alternative
- Aiming for project acceleration (contractual first oil date in 2016)

# Lucapa progressing towards first oil

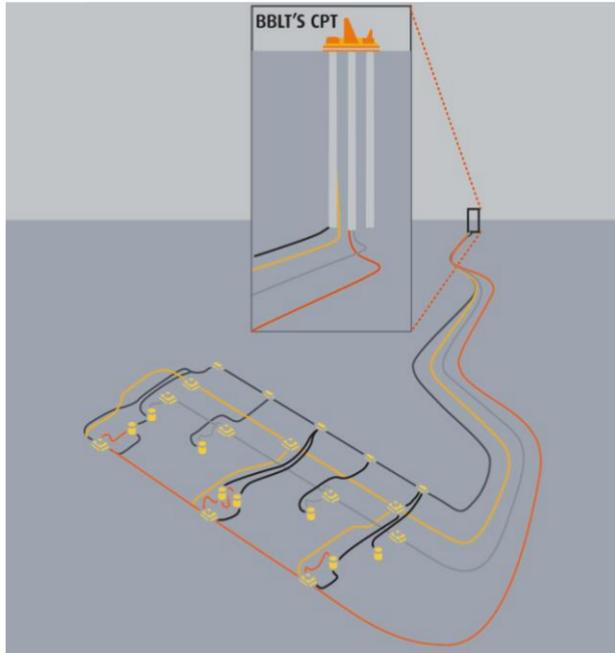
## Lucapa's development area



- Lucapa discovery in 2007 with appraisal programme complete in 2010 with Lucapa-6
- Six exploration and appraisal wells drilled justified submitting conceptual development plan to concessionaire
- Engineering studies ongoing to select optimal development alternative
- Contractual first oil expected for 2016

# Lianzi overcoming challenges via technology development

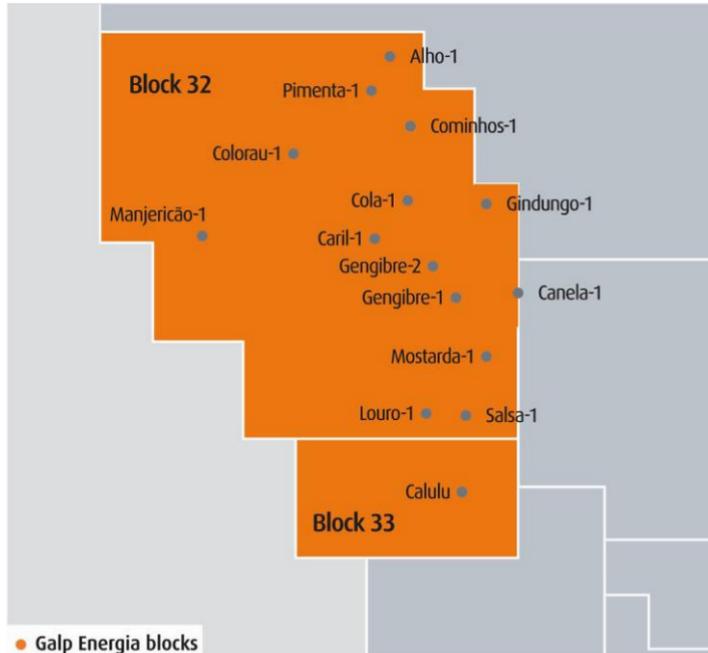
## Lianzi development



- First unitized development between Angola and Republic of the Congo
- Long tie-back to BBLT, 42 km away
- Technology qualification: direct electrical heating, subsea sampling and subsea multiphase metering
- Engineering optimization studies underway to BBLT tie-back development alternative

# Translating exploration success into development projects

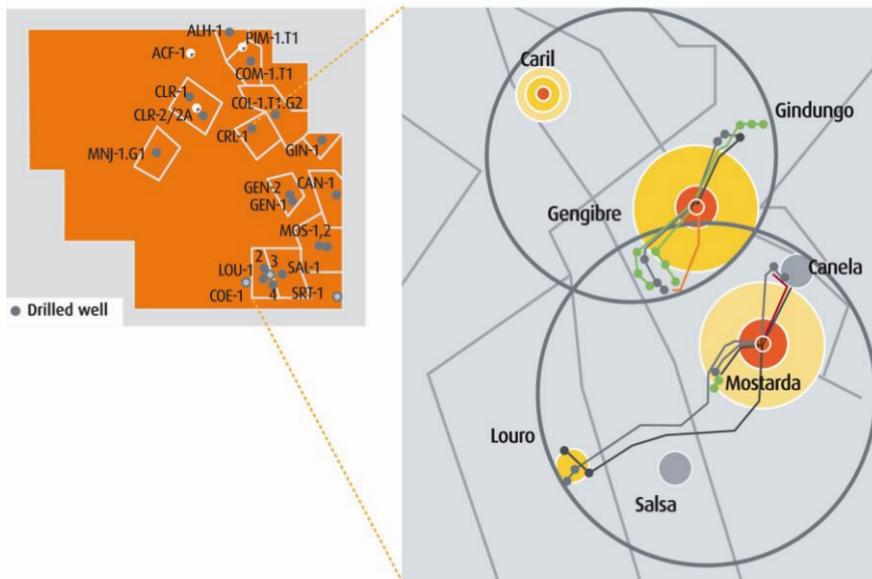
## Block 32 and 33 areas



- 13 discoveries and 12 development areas submitted to concessionaire
- Total surface area of 1,113 km<sup>2</sup>
- One concept at pre-development stage: Block 32 Kaombo
- Block 33 proceeding with evaluation programme

# Kaombo with split hub concept

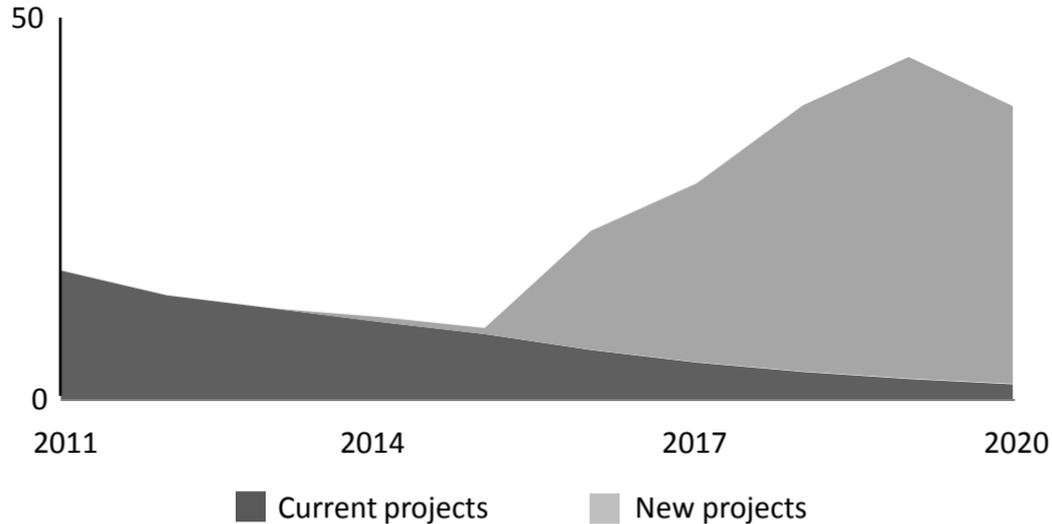
## Block 32 development hubs



- Kaombo “Split Hub” concept approved
- Engineering optimization studies ongoing to mature “Split Hub” concept
- Two FPSO supporting six development areas with an aggregated capacity of c.200 kbopd
- First oil date staged per FPSO expected by 2016 and 2017

# Angola WI production of c.35 kbopd in 2020

## Angola WI production (kbopd)



Working interest production CAGR 2010-20 of 7%

# Acronyms

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|                  |  |                   |  |
|------------------|--|-------------------|--|
| #                | Number   | HR                | Human Resources                            |
| \$               | United States dollar                               | IOC               | International Oil Company                  |
| %                | Percentage   | IPO               | Initial Public Offering                    |
| 2D               | Two dimensional seismic                            | Kboepd            | Thousand barrels of oil equivalent per day |
| 3D               | Three dimensional seismic                          | Kbopd             | Thousand barrels of oil per day            |
| ANP              | Brazilian agency for oil, natural gas and biofuels | Km                | Kilometre                                  |
| API gravity      | American Petroleum Institute gravity               | Km <sup>2</sup>   | Square kilometre                           |
| BB               | Benguela and Belize                                | LLI               | Long Lead Item                             |
| BBLT             | Benguela, Belize, Lobito, and Tomboco              | LNG               | Liquified Natural Gas                      |
| Bcm              | Billion cubic metres                               | LT                | Lobito Tomboco                             |
| Bln              | Billion  | M <sup>3</sup> /d | Million cubic metre per day                |
| Boe              | Barrel of oil equivalent                           | Mln               | Million                                    |
| c.               | Circa  | MW                | MegaWatt                                   |
| CAGR             | Compound Annual Growth Rate                        | NG                | Natural Gas                                |
| CSEM             | Control Source of Electromagnetic Method           | NOC               | National Oil Company                       |
| CO <sub>2</sub>  | Carbone Dioxide                                    | p.p.              | Percentage point                           |
| CPT              | Compliant Piled Tower                              | R&M               | Refining & Marketing                       |
| E&P              | Exploration & Production                           | RCA               | Replacement Cost adjusted                  |
| EPC              | Engineering, Procurement and Construction          | TL                | Tômbua-Lândana                             |
| EWT              | Extended Well Test                                 | Ton               | Tonne                                      |
| FLNG             | Floating Liquified Natural Gas                     | TS                | Tômbua South                               |
| FPSO             | Floating Production Storage Offloading             | UOTE              | Oil Transhipment Unit                      |
| G&P              | Gas & Power  | WAG               | Water-alterning-gas                        |
| GWh              | GigaWatt hour                                      | WAT               | Wax appearance temperature                 |
| H <sub>2</sub> S | Hydrogen sulfide                                   | WI                | Working interest                           |
| HC               | Hydrocarbon  | YE                | Year End                                   |

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