



G L O B A L F O R U M



**On Flaring and Venting Reduction  
and Natural Gas Utilisation**

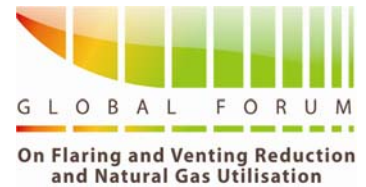
# An Onshore Solution for Elimination of Routine Flaring in Angola

Frank Christiano  
Cabinda Gas Plant  
Project Engineer  
Chevron Global Upstream & Gas





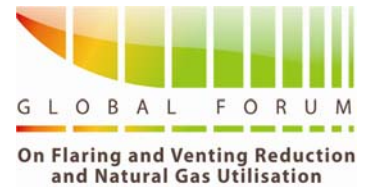
# Agenda



- Background Information
- Associated Gas Management
- Onshore Option Development
- Cabinda Gas Plant Overview
- Vapor Recovery System
- Cabinda Gas Plant Challenges
- Project Impacts
- Acknowledgements



# Chevron in Angola



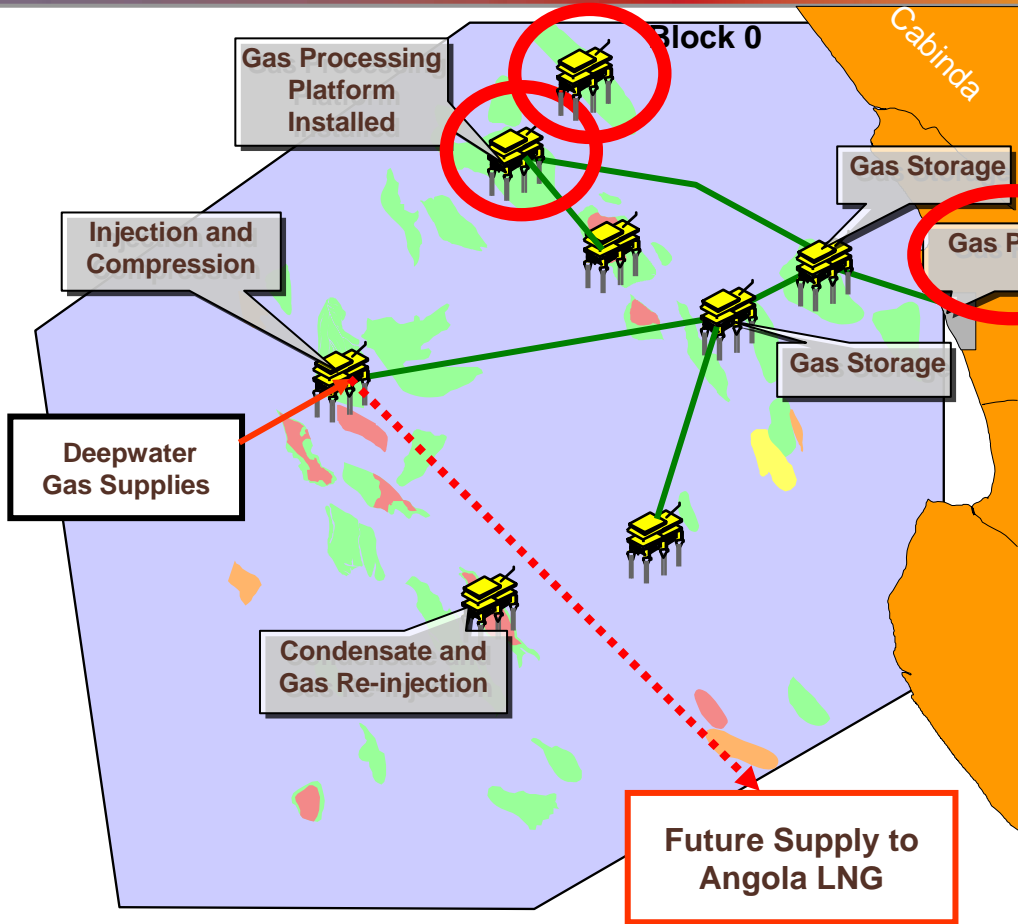
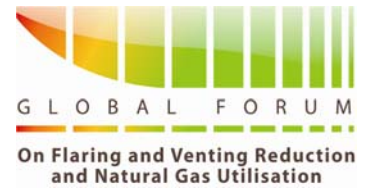
- 50+ years in Angola
- Chevron operates in Angola as Cabinda Gulf Oil Company (**CABGOC**)
- CABGOC operates the Block 0 and Block 14 offshore concessions on behalf of:

<b>Block 0:</b>	<b>Block 14</b>
<ul style="list-style-type: none"><li>• Sonangol E.P.</li><li>• CABGOC</li><li>• Total</li><li>• Eni</li></ul>	<ul style="list-style-type: none"><li>• Sonangol P&amp;P</li><li>• CABGOC</li><li>• Total</li><li>• Eni</li><li>• GALP</li></ul>

- Operated production of approximately 550,000 bbls/day
- Workforce of approximately 3,000
- Full spectrum of operations:
  - Operated and non-operated interests
  - Offshore and onshore operations
  - Shallow and deepwater exploration, development and production
  - Angola LNG
  - Oil, gas, condensate and LPGs



# Associated Gas Management

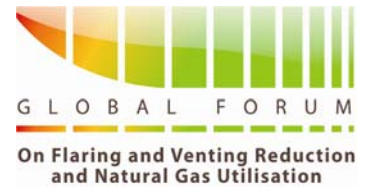


- ✓ Routine Flare Elimination
- ✓ Gas to Angola LNG
- ✓ Create Value

CABGOC Operated Blocks Associated Gas Infrastructure



# Gas Management Project



- Flare and Relief Modifications (FARM) Project

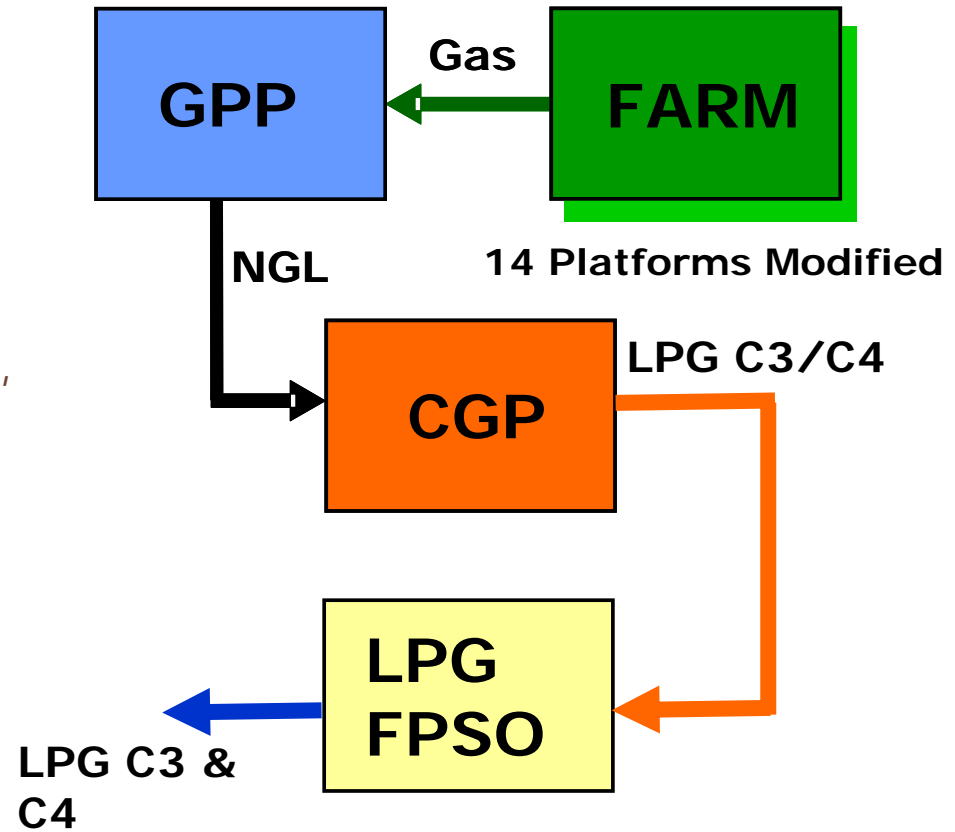
- Upgrades and modifies the flare gas and relief systems on 14 offshore facilities

- Gas Processing Platform (GPP)

- Provides additional compression, sweetening, and dehydration. Captures Natural Gas Liquids (NGL's, C5+).

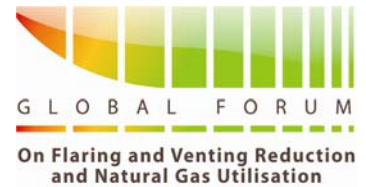
- Cabinda Gas Plant (CGP)

- Processes Offshore NGL's and Terminal gas, produces LPG for export through LPG FPSO





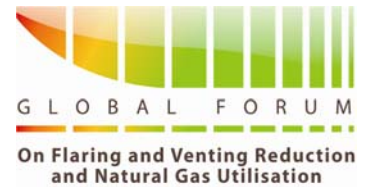
# Onshore Option Development



- **2003: Value Engineering identified opportunity for a single onshore Gas Plant instead of:**
  - Large Gas Plant on offshore platform
  - Small Gas Plant onshore, no export
  
- **Alternatives reviewed:**
  - Dedicated NGL pipeline to onshore
  - Keep propane offshore, maximize butane in crude
  - Offshore (Inject NGL in Field A)
  - Offshore (Inject NGL in Field B)
  - Onshore Gas Processing



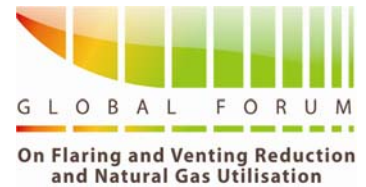
# Summary of Main Alternatives



Offshore	Onshore
Lower Capital Expense	Higher Capital Expense
Disposal of Natural Gas Liquids	Sale of Natural Gas Liquids
Fixed Local product volumes (extra volume flared)	Adjustable Local product volumes (extra volume exported)
No flexibility for future developments	Utilize infrastructure for future developments



# Cabinda Gas Plant Overview



## Scope:

- Inlet Separators for recovery of NGL's from Offshore Crude Pipeline
- Vapor recovery from Terminal tanks and equipment
- LPG Recovery Plant designed for inlet gas flow rate of 25 MMSCFD (708,000 m<sup>3</sup>/day)
- LPG export to LPG FPSO via 6" pipeline
- 13.2 MW Power Generation Plant
- Flare modifications to existing process facilities

## Design Cases:

- Normal & Design Rates
- Low RVP
- No Offshore NGL

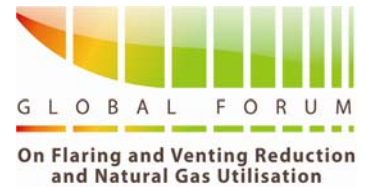


**CGP will eliminate routine onshore flaring, process NGLs collected offshore, and export LPG**





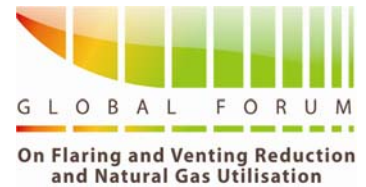
# Vapor Recovery System



- One of the more challenging aspects of this project was designing for the capture and first stage compression of gas streams:
  - From multiple sources and varying quality
  - That are NGLs rich; and
  - Very low pressure
- Vapor Recovery Technologies Considered
  - Dry Screw Compressors
  - Turbo Compressors (Ejectors)
  - Wet Screw Compressors




# Vapor Recovery System



- The selected Vapor Recovery System has several unique design elements:
  - Rotary screw compressors – best solution for wet gas and the required 3 to 115 psig (0.21 to 7.93 barg) pressure differential.
  - Systems for handling condensate dropout and potential slugs of liquids from the field
  - Six compressor trains provide flexibility for a wide volume range, and redundancy to minimize downtime
  - System designed to operate as one integrated unit, which responds automatically to changes in volume



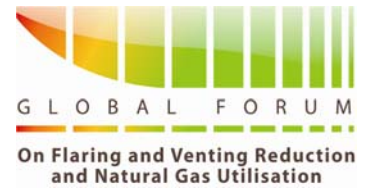
# Vapor Recovery System

  
GLOBAL FORUM  
On Flaring and Venting Reduction  
and Natural Gas Utilisation





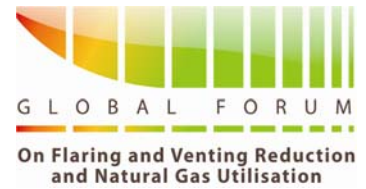
# Vapor Recovery System



One of 3 Vapor Recovery Units that will capture 25 MMscfd of associated gas for the Cabinda Gas Plant project



# Cabinda Gas Plant Location





# Vapor Recovery System Installation



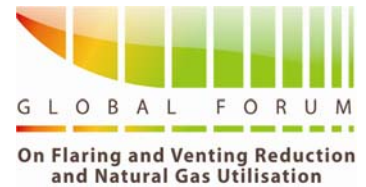


# LPG FPSO





# Project Challenges

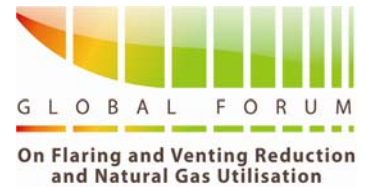


- Change of existing operation and integration of facilities
- Brownfield Construction in operating plant
- New Flare system required
- Alternative Paths for Gas
  - Produce Products
  - Store Feedstocks
  - Flare (last resort)
- Challenging contractor environment
- Infrastructure improvement





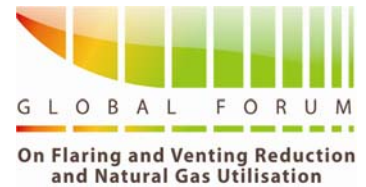
# Project Impact



- **Project Environmental Impact** - removal of 25 MMSCFD (708,000 m<sup>3</sup>/day) has the same greenhouse gas effect as:
  - Removing 812,000 cars from the road
  - Planting 1.1 million acres (4,450 square kilometers) of trees – an area larger than the state of Rhode Island or the country of Switzerland
- **Angolan Content:**
  - Welding school created in Cabinda
  - Over 400 Angolan workers from Cabinda employed by EPC contractor and subcontractors



# Acknowledgements



## –Block 0 Associates:

- Sonangol E&P
- CABGOC (Operator)
- Total
- ENI

–Bob King and CABGOC Gas Management program

–Larry Wesselink and Cabinda Gas Plant Project team

–Larry Richards and Hybon Engineering Company



# Thank you

