Reducing Gas Flaring : Total E&P Experience in Africa

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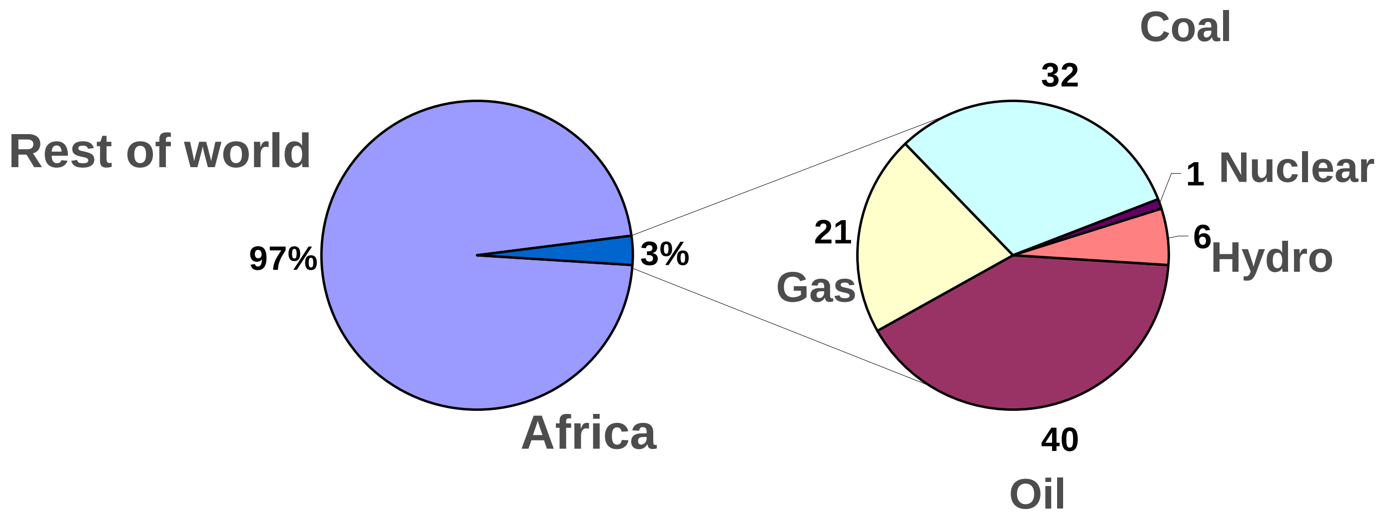
TOTAL

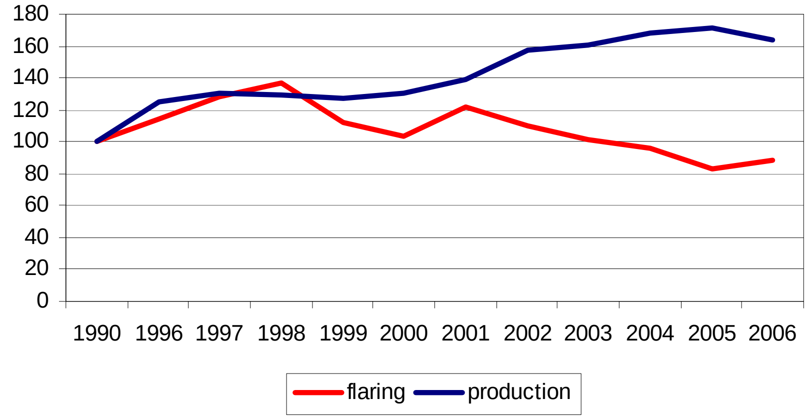
Primary energy consumption : The global picture



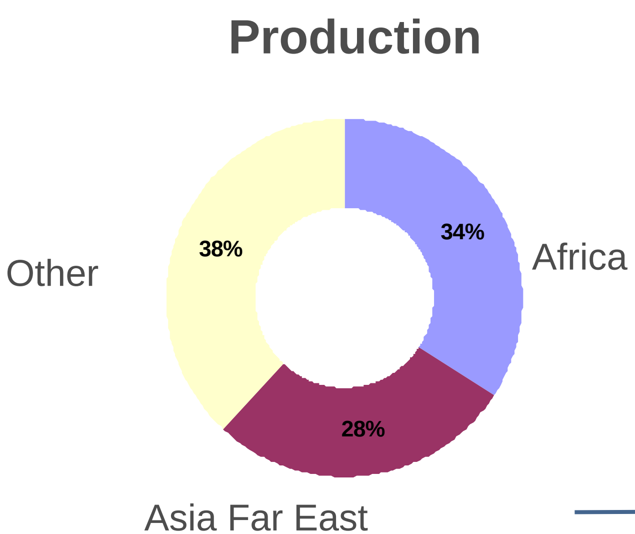
- 2006 World primary energy consumption : 10.9 Btoe
- 2006 Africa primary energy consumption : 324 Mtoe
- 2006 Africa gas consumption : 76 bcm
- Annual Gas flared worldwide : 150 bcm
- Annual Gas flared in Africa : 40 bcm

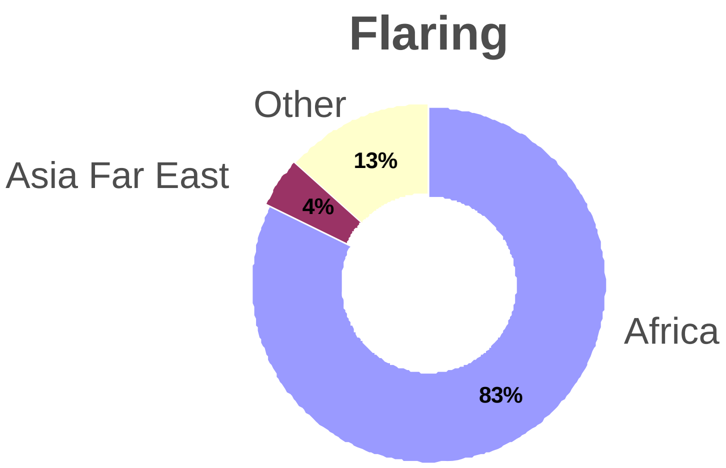
based on IEA & GGFR reports

Flaring within Total E&P operations



Base 100 : 1990 figures





- ***Since 2000, decrease in flaring despite increase in production***
- ***More than 80% of flaring occurs in Africa***

Strong historical presence of TOTAL in Africa

1932

1950 - 1961

1962 - 1994

1995 - 2006

- **The origins**
  - 1932 : 1st exploration in Gabon
  - 1946 : 1st exploration in Cameroon
  - 1950 : Discoveries in Egypt
- **Expansion of conventional production**
  - 1952 : 1st Petrofina concession in Angola
  - 1955 : 1st discovery in Angola (Benfica) and in Cameroon (Logbaba)
  - 1956 : Discoveries of Hassi Messaoud, Hassi R'Mel and Edjeleh (Algeria)
  - 1956 : 1st discovery in Gabon
  - 1958-1961 : Discoveries of Zarzaïtine and Gassi Touil (Algeria)
- **Offshore expansion**
  - 1962 : Discovery of Anguille (Gabon), first drilling and Obagi discovery (Nigeria)
  - 1968 : Emeraude discovery (Congo)
  - 1971 : Discovery of Grondin (Gabon) and Ashtart (Tunisia)
  - 1975 : Al Jurf discovery (Libya)
  - 1982 : Pacassa discovery (Angola)
  - 1985 : Rabi Kounga discovery (Gabon)
- **Deep and Ultra-deep offshore acceleration :**
  - 1995 : Moho discovery (Congo) and Mabruk (Libya) start-up
  - 1996-2002 : 15 discoveries on Block 17 (Angola)
  - 1996 : El Sharara start-up (Libya)
  - 1999 : TFT start-up (Algeria)
  - 2000 : Akpo discovery (Nigeria)
  - 2001 : Girassol start-up (Angola)
  - 2003 : Amenam (Nigeria), Jasmim (Angola) and Al-Jurf (Libya) start-ups
  - 2003-2005 : 5 discoveries on Block 32 (Angola)
  - 2004-2005 : OPL 222 discoveries (Nigeria -Usan)
  - 2005 : Akpo and Moho Bilondo launched
  - 2005-2006 : start-up NLNG trains 4 & 5
  - 2006 : 3rd discovery on MTPS (Congo)
  - 2006 : NC191/NC186 (Libya) first discoveries
  - 2006 : Entered into OML 112/117 and Brass LNG (Nigeria)
  - 2006 : Mobi M2 (Congo) discovery
  - 2006 : Dissoni discovery, Bomana and appraisals intake (Cameroon)
  - 2006 : Block 32 & 17 discoveries and appraisals
  - 2006 : BBLT and Dalia start-up (Angola)
  - 2007 : Rosa start-up (Angola)

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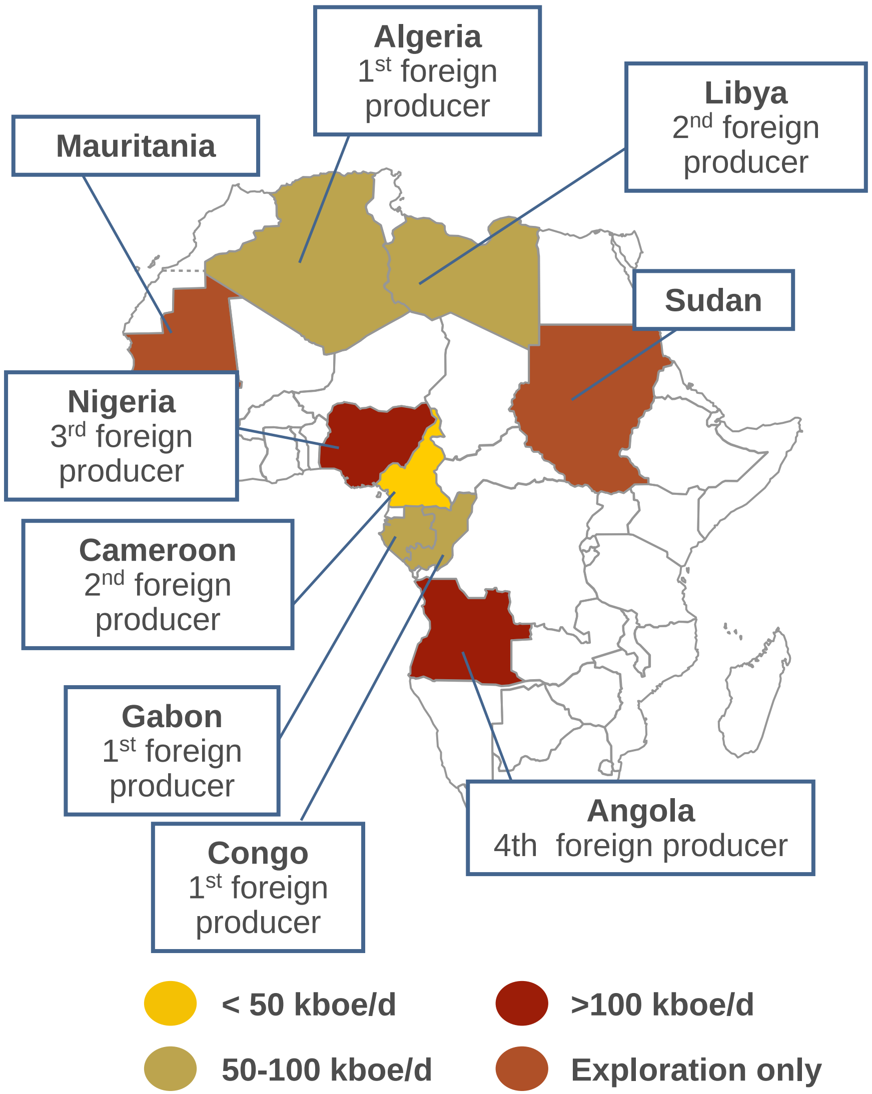
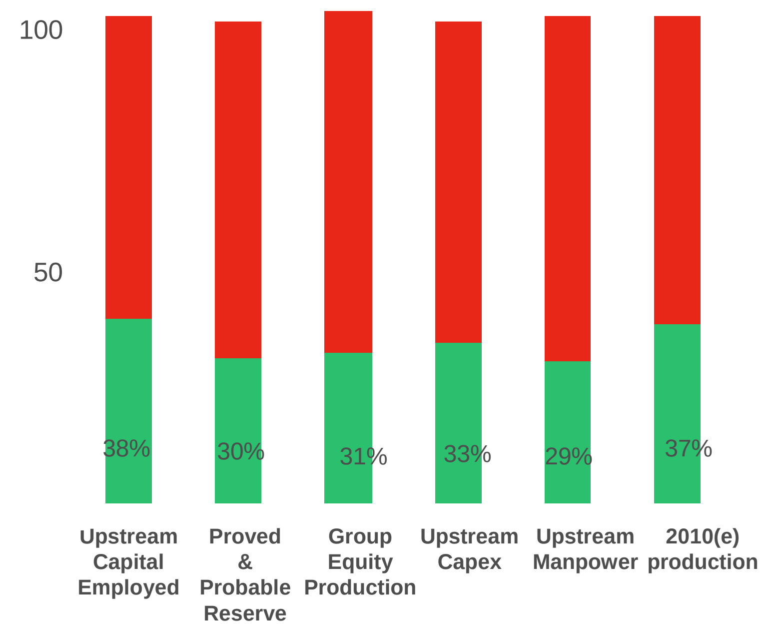
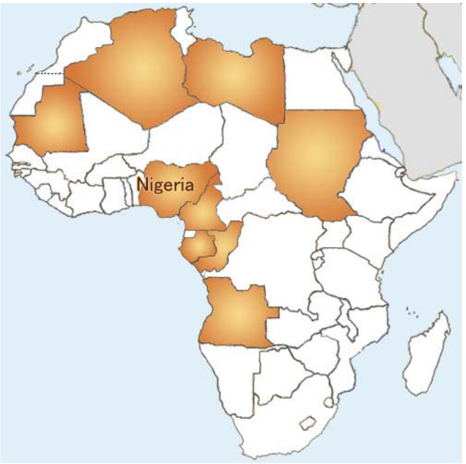
Africa : largest production region for Total

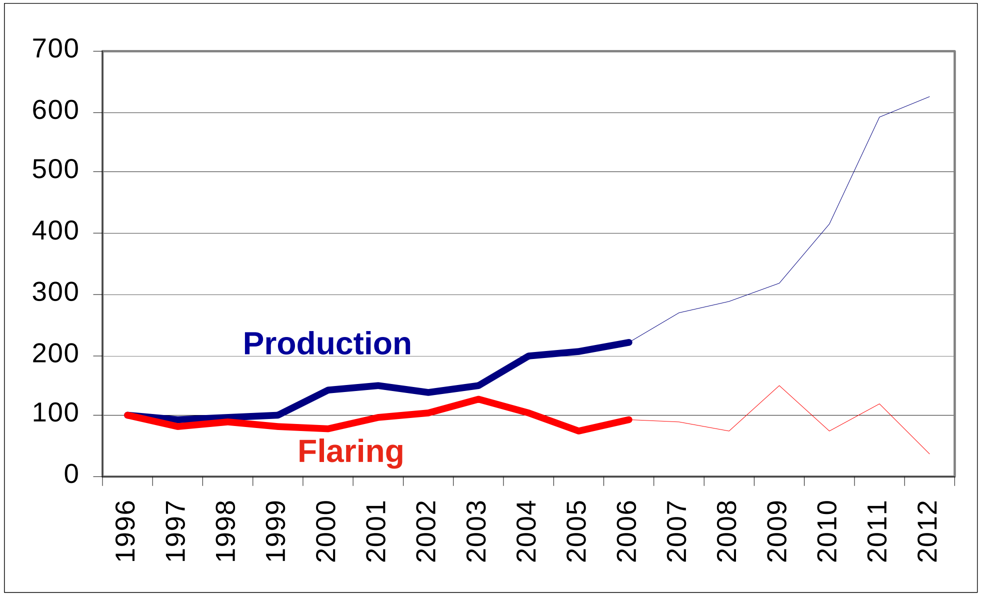




based on 2006 production reports

Total in Nigeria : Gas flaring evolution



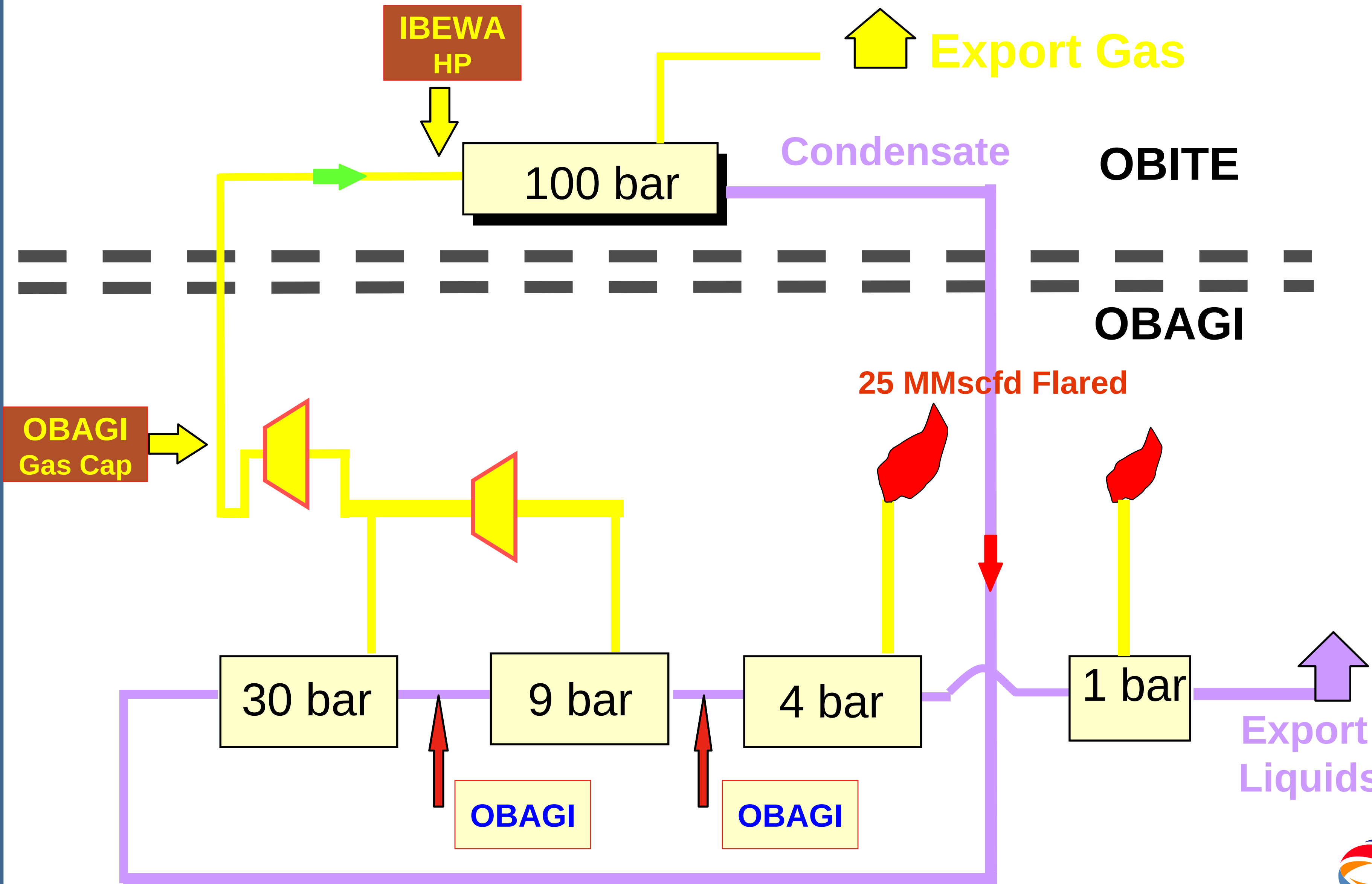


Base 100 : 1996 figures

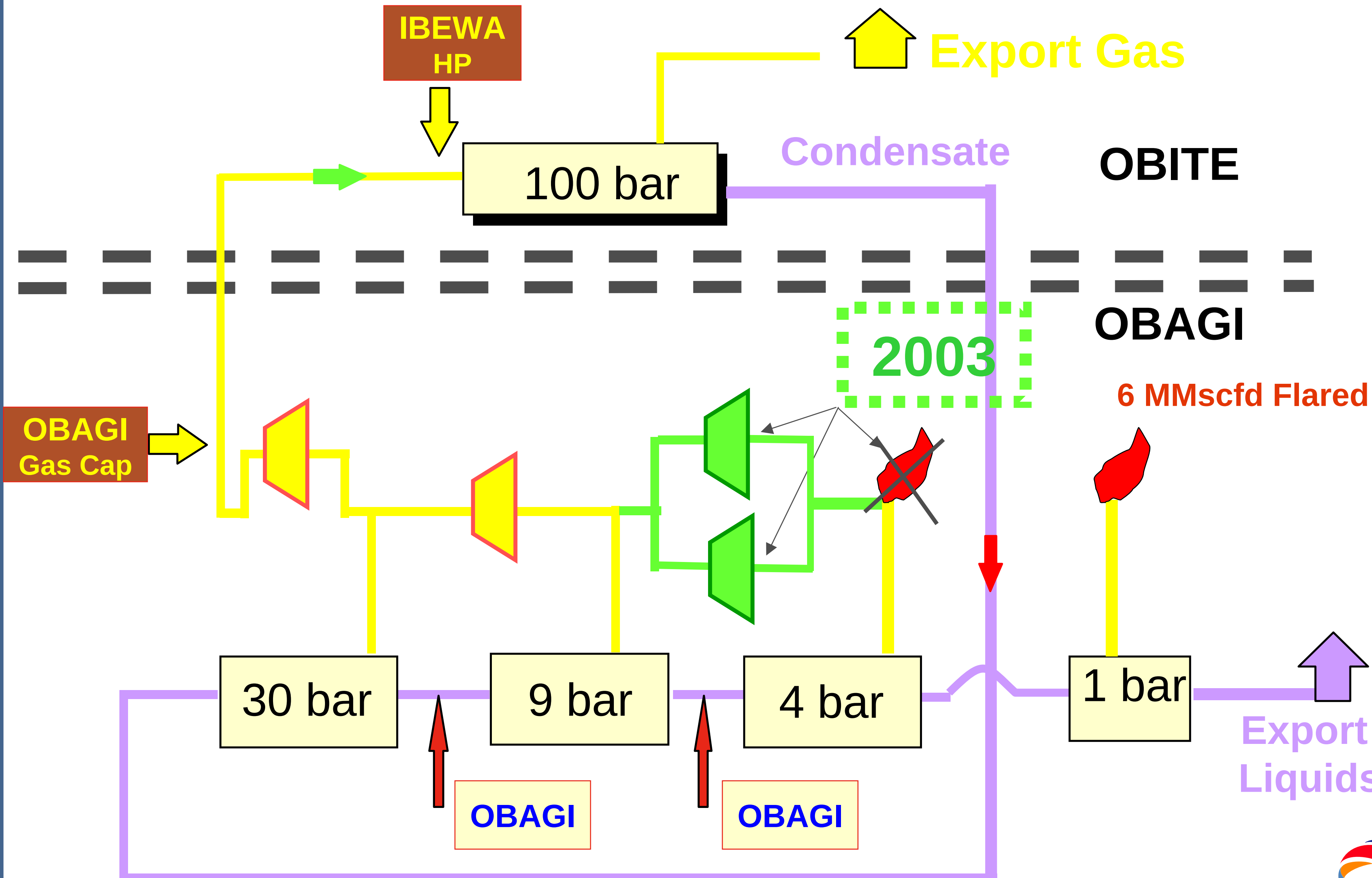
- **Production operations from onshore and conventional offshore fields.**
- **Deep offshore to be put on stream in 2008, <u>without continuous flaring</u>.**
- **LNG plant in operations since 1999.**

- **All associated gas from onshore fields exported (LNG plant and domestic market) as from 2010.**
- **Almost all associated gas from conventional offshore either re-injected or exported to LNG plant as from 2010.**
- **No continuous flaring on new developments.**

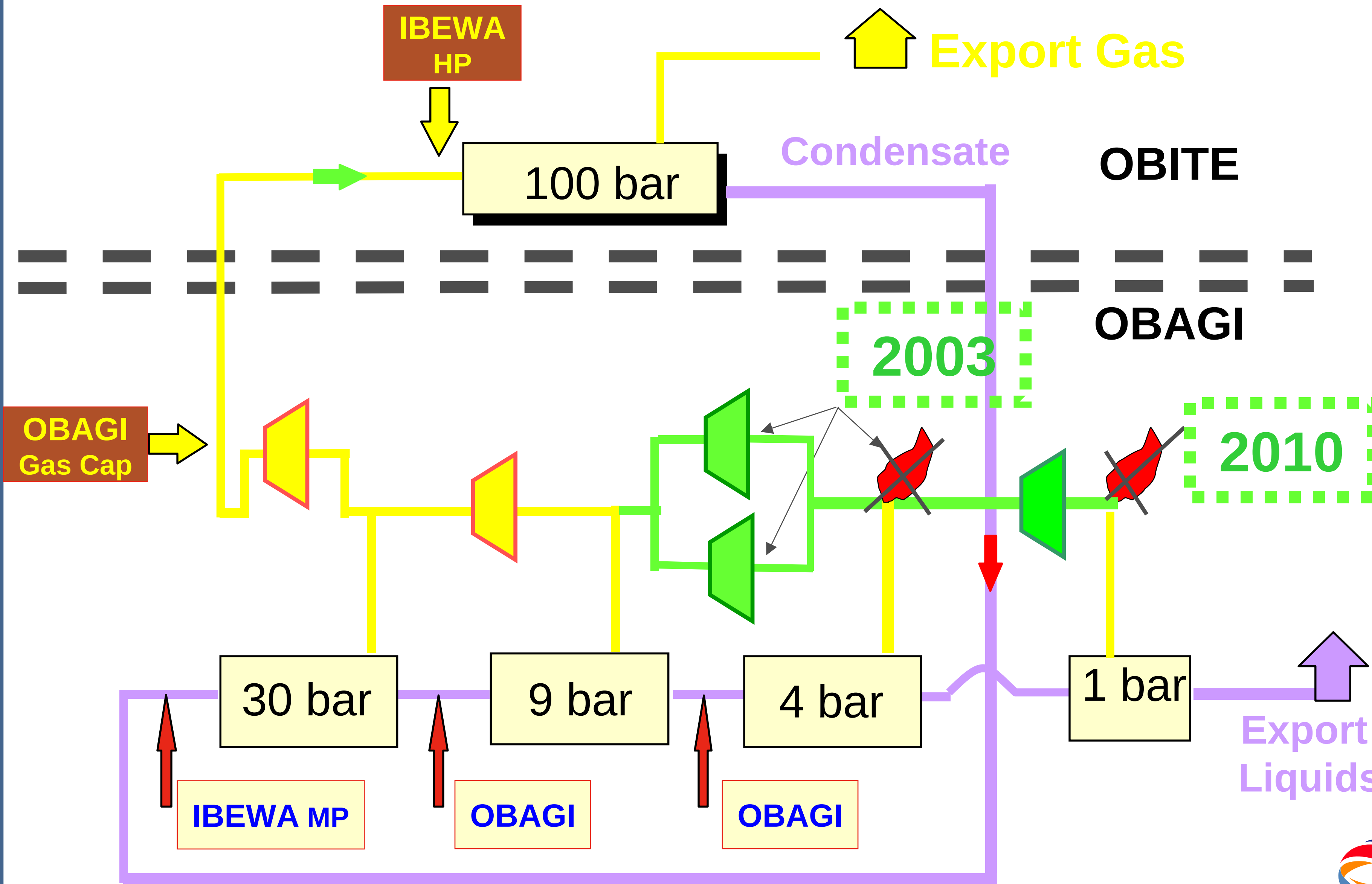
Total in Nigeria : Reducing gas flaring onshore



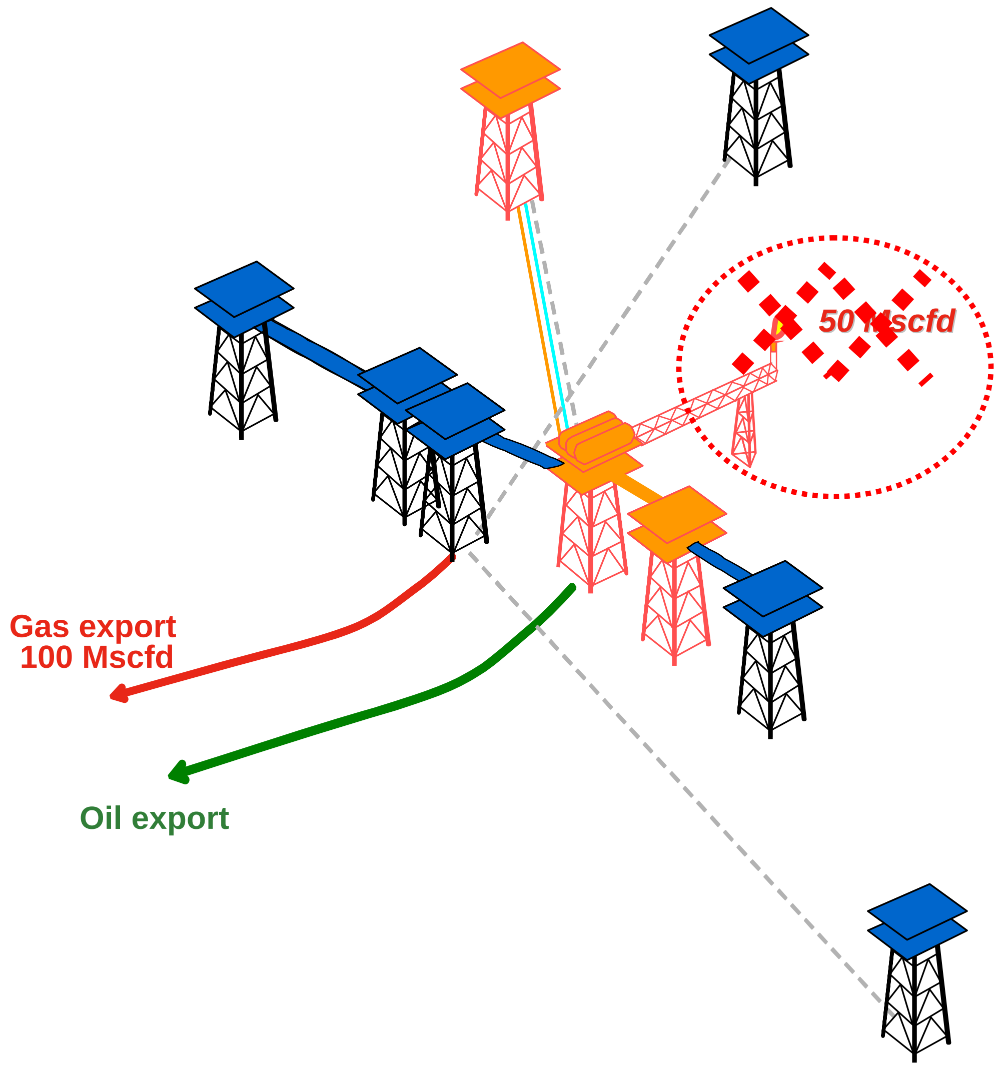
Total in Nigeria : Reducing gas flaring onshore



Total in Nigeria : Reducing gas flaring onshore



Total in Nigeria : Reducing gas flaring offshore



1. Ofon Phase 1 in 1995

A typical offshore development of the 90's in the Gulf of Guinea

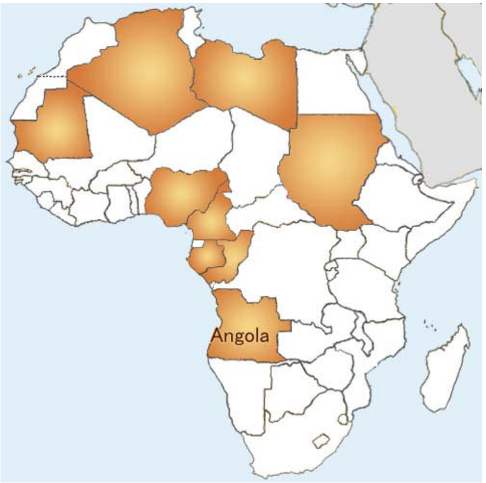
2. New context after Phase1

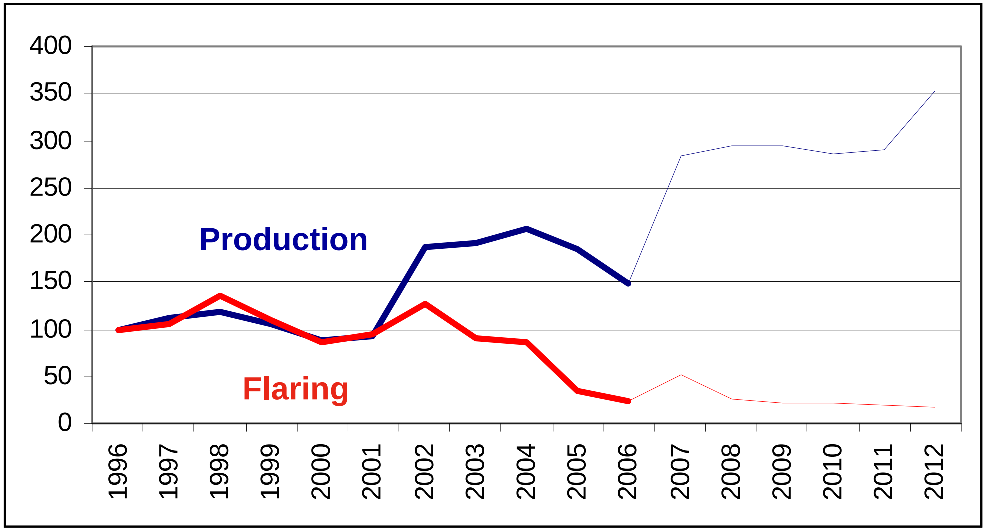
- Gas outlet : NLNG onstream
- Field redevelopment opportunity
- Growing concern on GHG emission

3. Ofon Phase 2 Project

- Expansion of the fields
- Installation of gas facilities
- No more flare
- Laying of gas export pipeline

Total in Angola : Gas flaring evolution





Base 100 : 1996 figures

- **Production operations from conventional offshore (Bloc 3) and deep offshore (bloc 17).**
- **LNG plant to be put on stream in 2012.**

- **No continuous flaring on bloc 17 fields.**
- **94% of production from bloc 17 fields.**
- **Bloc 17 associated gas :**
  - Currently re-injected
  - Supply of ALNG plant as from 2012

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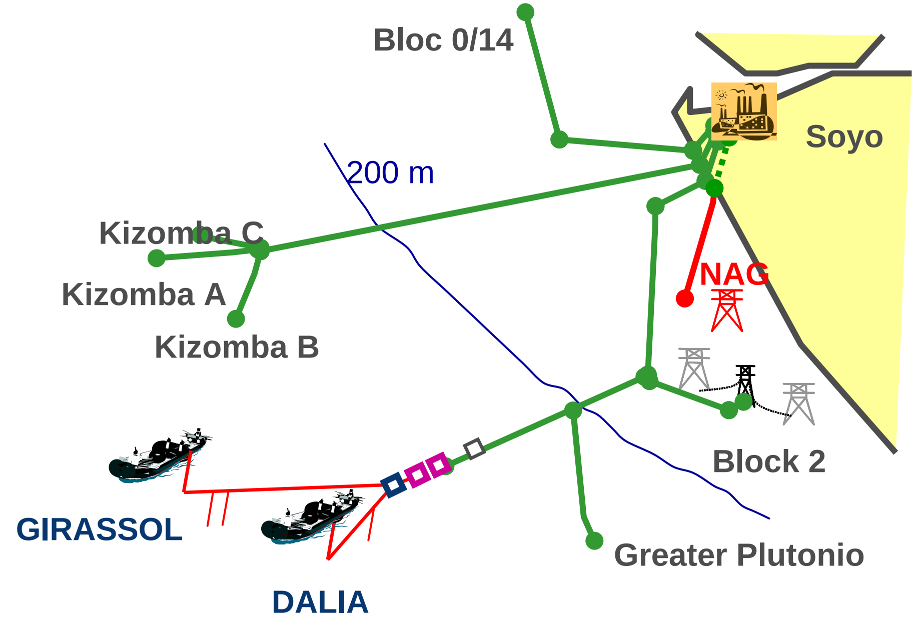
Angola LNG mindset
from a gas flaring concern to a gas valorization scheme

- **Common Goal : ensure sustainable oil developments & address gas flaring concerns through a gas valorization scheme**
- **Strong Commitment & Alignment of all Stakeholders : partnership Sonangol - Oil companies**
- **Pooling of gas resources**
- **Legal & Commercial Framework suiting the project characteristics**
- **Strong partners to overcome commercial and technical challenges**
- **Start-up : 2012**

Arranging a stable gas supply of 1Bcfd



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Gas Flaring in other African countries

- **Libya : Gas re-injection project under development, no more continuous flaring as from 2011.**

- **Cameroon :**
  - Mature production, scattered infrastructures (19 flares, 17 satellites).
  - Associated gas used as supply for Malabo LNG plant (under study).

- **Gabon, Congo :**
  - Mature production, scattered infrastructures, far from LNG plants.
  - Gas re-injection implemented on Nkossa (Congo), under study for other assets.
  - Supply (limited) domestic market

The path to gas flaring reduction

- **E&P installations are large, complex and costly**
  - Re engineering or modifications are difficult

    ➔ First Priority : Design new development with no flaring

    Total company rule since 2000

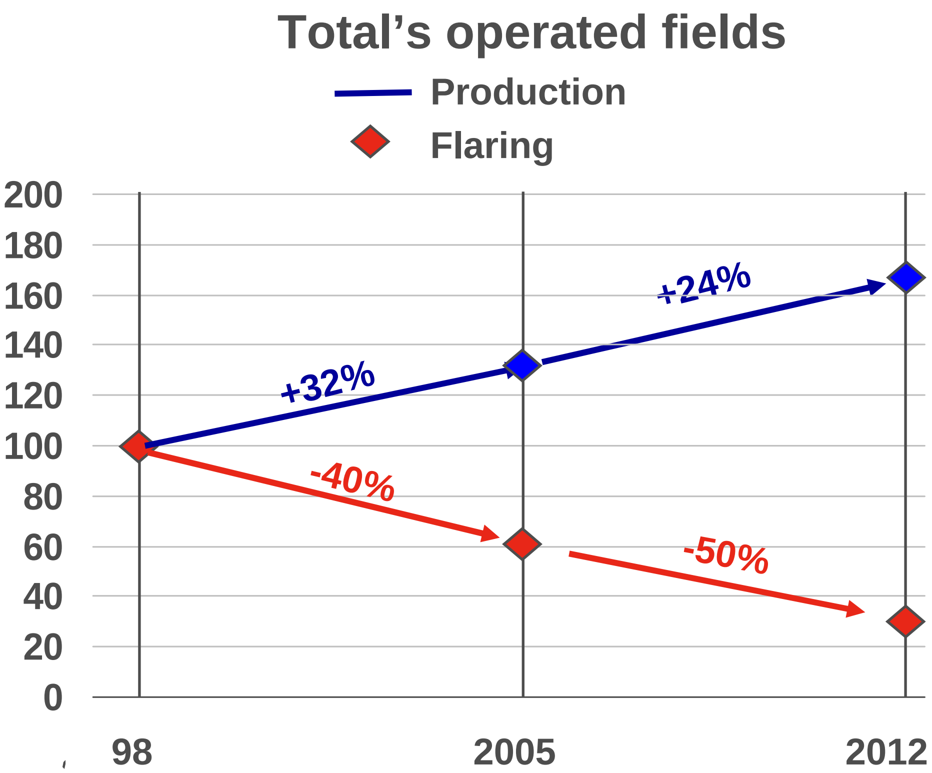
- **Our real issue now is to reduce flaring on existing fields**
  - Existing gas markets / outlets are favorable conditions

    Examples : North Sea (no more flare), Nigeria (Ofon ph2)
  - More difficult and lengthy when new gas outlet has to be created

    Examples : Angola (ALNG), Cameroon..

Efforts are rewarding :

Total operated flaring will continue to decrease despite rising operated production



- **No flaring on new development**
- **Flaring Reduction on existing fields**
  - Acute Monitoring of flaring
  - Dedicated team
  - Elaboration of Technical & Business solution
- **Issues discussed with Partners and Governments**

Total target : -50% 2005-2012

Beyond 2012 : Efforts are to be maintained and amplified if we want to keep reducing flaring

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