

# Economic Comparison Between Oil and LNG for Decision Making to Evaluate Which Product to Develop from a Deepwater West Africa

**Presented by  
L.T. England, Jr.**

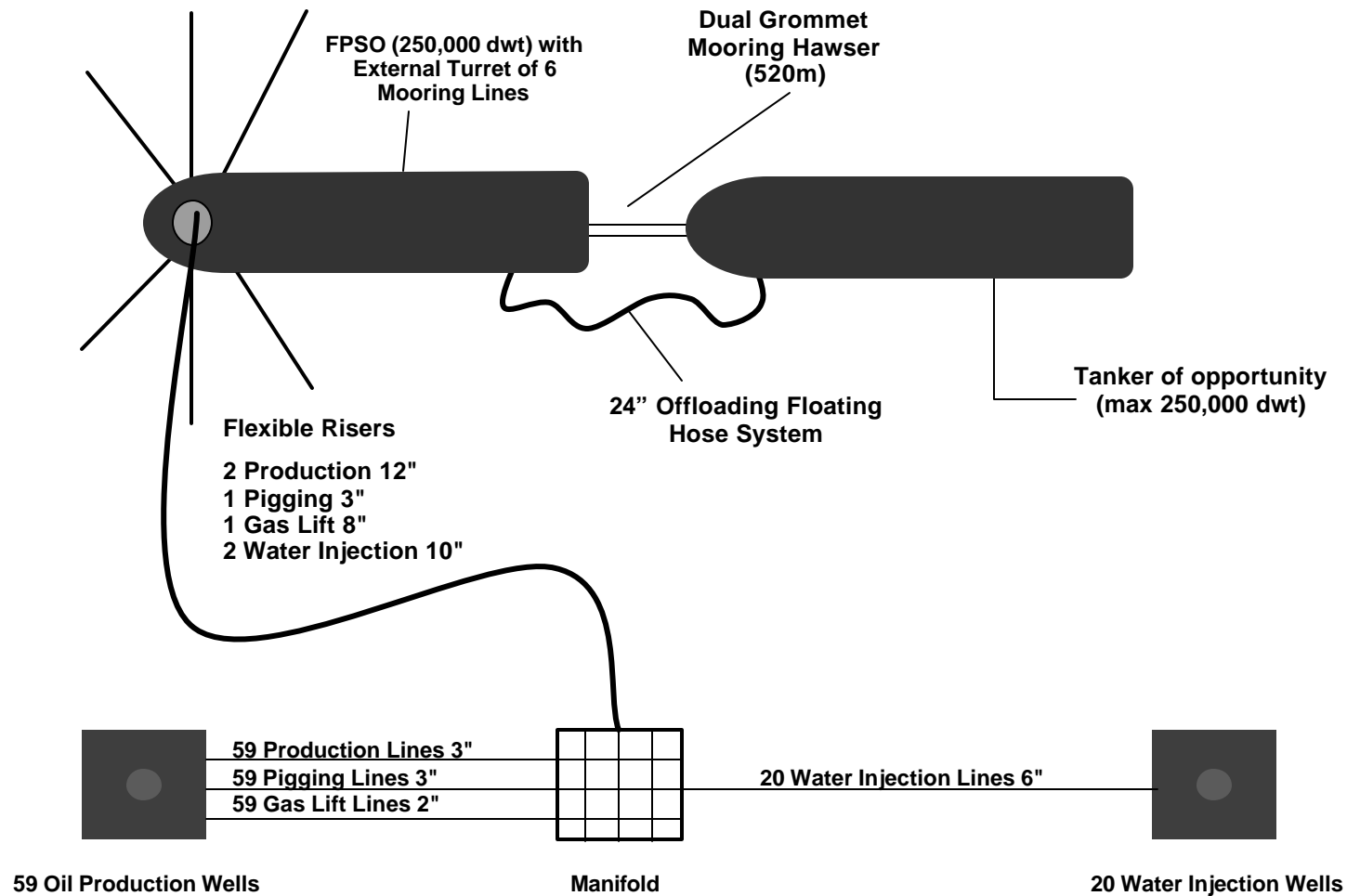
# Case 1 - Assumptions

<b>Water depth:</b>	<b>1,000 meters</b>
<b>Service Life:</b>	<b>15.3 Years</b>
<b>Oil Reservoir:</b>	<b>750 MMBBL</b>
<b>Vessel:</b>	<b>250,000 DWT Converted Tanker</b>
<b>Storage:</b>	<b>1,750,000 BBLs</b>
<b>Maximum Offloading Parcel:</b>	<b>1,250,000 BBLs</b>
<b>Production:</b>	<b>250,000 BBL/Day (Single Train)</b>
<b>Offloading Rate:</b>	<b>60,000 BBLs/Hr</b>

## **Risers**

<b>12" Oil Production:</b>	<b>2 Lines</b>
<b>3" Pigging Line:</b>	<b>1 Line</b>
<b>8" Gas Lift:</b>	<b>1 Line</b>
<b>10" Water Injection:</b>	<b>2 Lines</b>

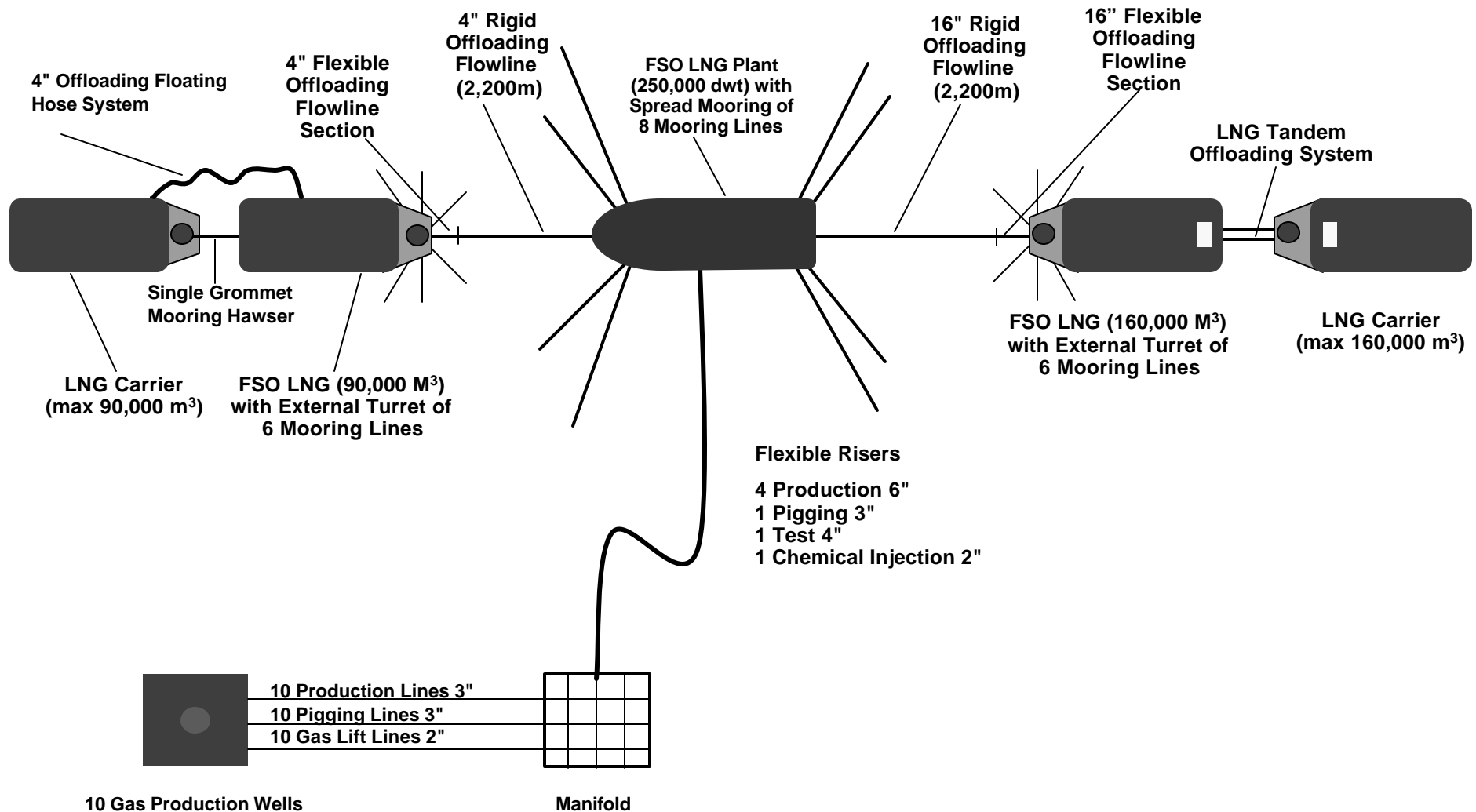
# Case 1 – Oil Production



# Case 2 - Assumptions

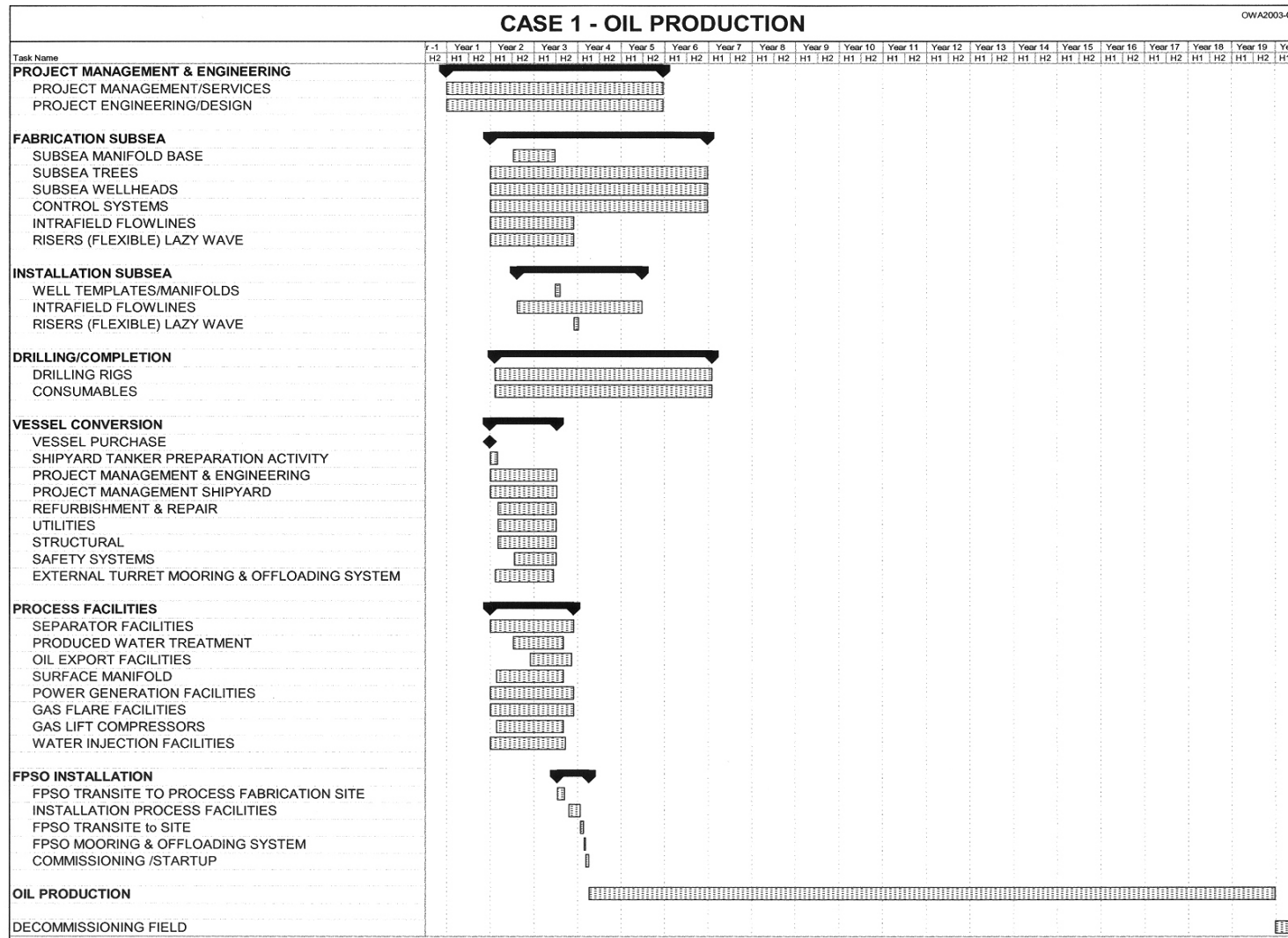
<b>Water depth:</b>	<b>1,000 meters</b>
<b>Service Life:</b>	<b>25 Years</b>
<b>Gas Reservoir:</b>	<b>6 Trillion Cubic Feet (TCF)</b>
<b>Vessel:</b>	<b>250,000 DWT Converted Tanker</b>
<b>Storage:</b>	<b>160,000 M<sup>3</sup> LNG &amp; 90,000 M<sup>3</sup> LPG</b>
<b>Maximum Offloading Parcel:</b>	<b>135,000 M<sup>3</sup> LNG &amp; 70,000 M<sup>3</sup> LPG</b>
<b>Gas Production to FPSO LNG/LPG Plant:</b>	<b>530 MMCF/Day</b>
<b>LNG Production:</b>	<b>483 MMSCF/Day</b>
<b>LPG/Condensate Production:</b>	<b>3,200 BBL/Day</b>
<b>Offloading Rates</b>	
<b>Methane:</b>	<b>8,500 M<sup>3</sup>/Hr</b>
<b>LPG/Condensate:</b>	<b>133 M<sup>3</sup>/Hr</b>
<b>Risers</b>	
<b>6" Gas Production:</b>	<b>2 Lines</b>
<b>3" Pigging Line:</b>	<b>1 Line</b>
<b>4" Gas Lift:</b>	<b>1 Line</b>
<b>2" Chemical Injection:</b>	<b>2 Lines</b>

# Case 2 – Gas Production



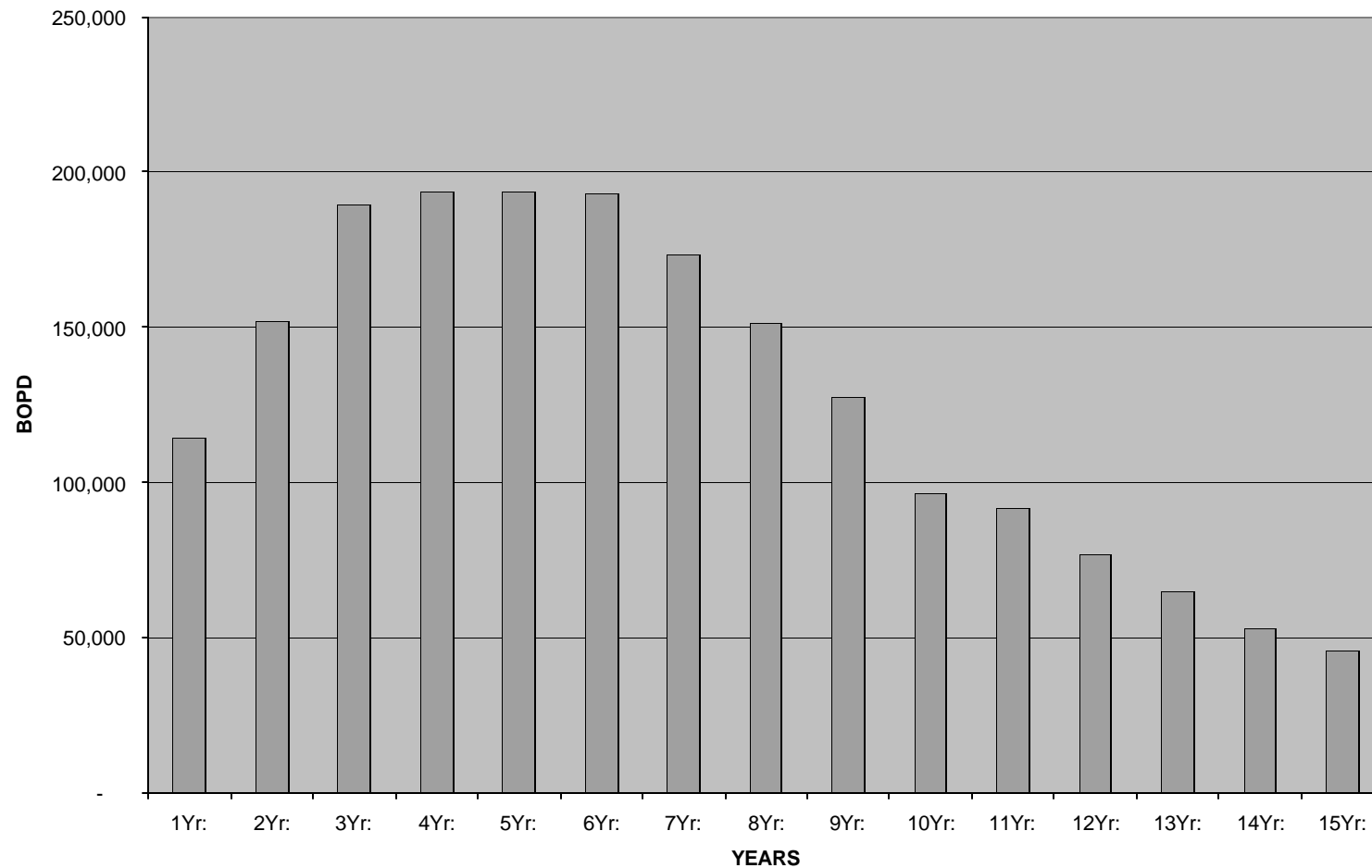
# Case 1 – Oil Production

## Field Life Schedule



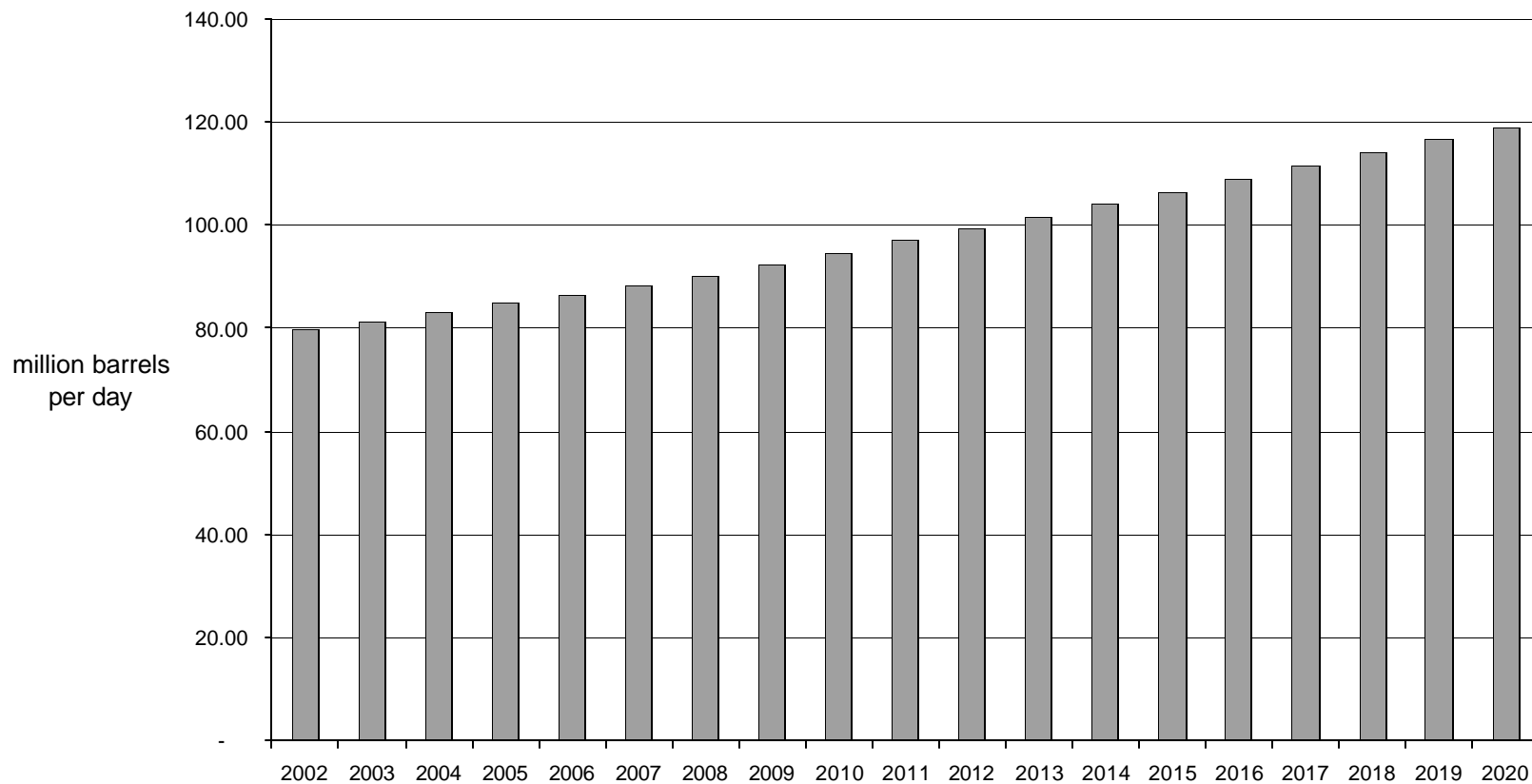
# Case 1 – Oil Production – West Africa

## 250,000 BOPD Over 15 Years



# Worldwide Demand for Liquid Oil Products

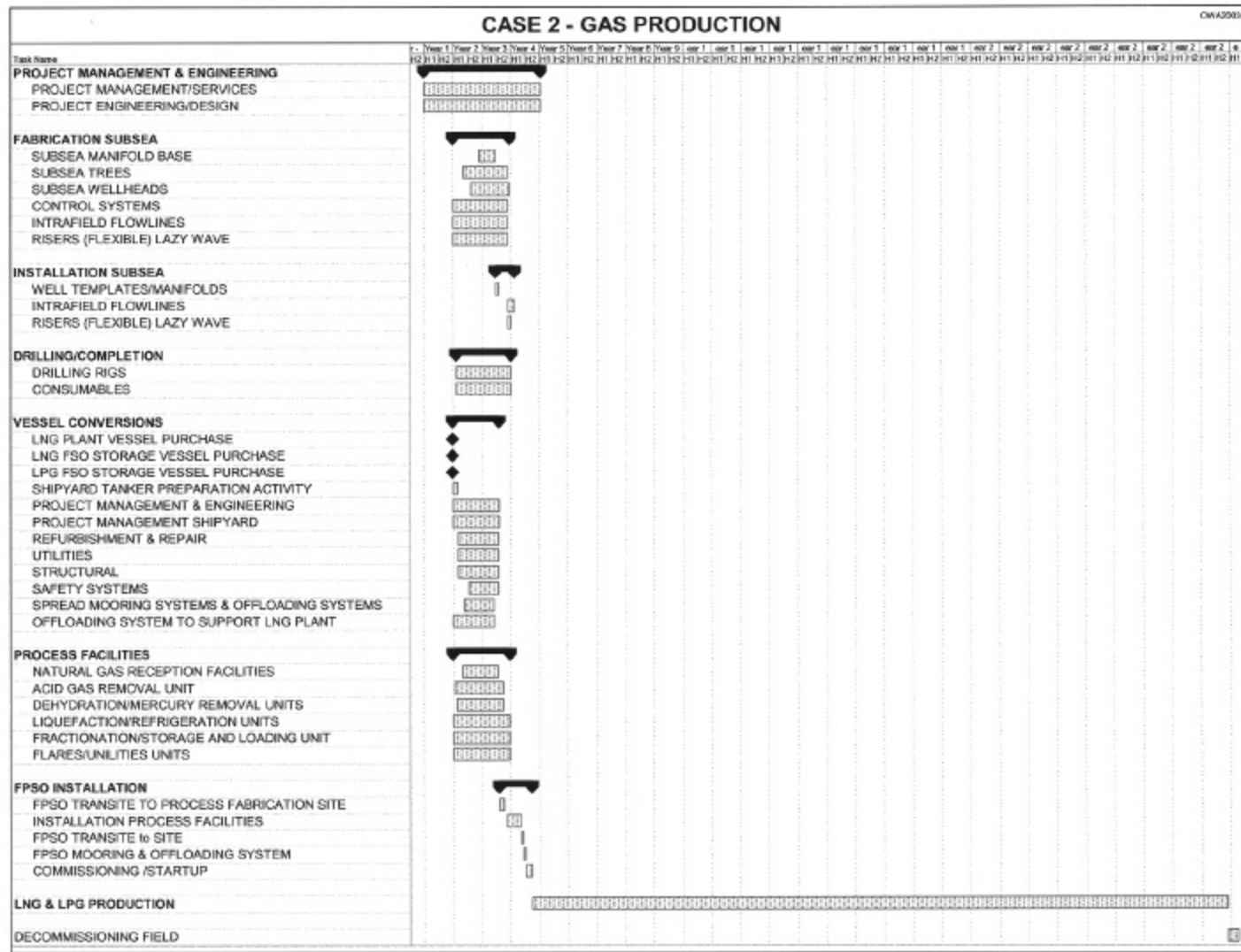
**Worldwide Demand for Liquid Oil Products is Expected to Increase  
2.30% Annually Until 2020**





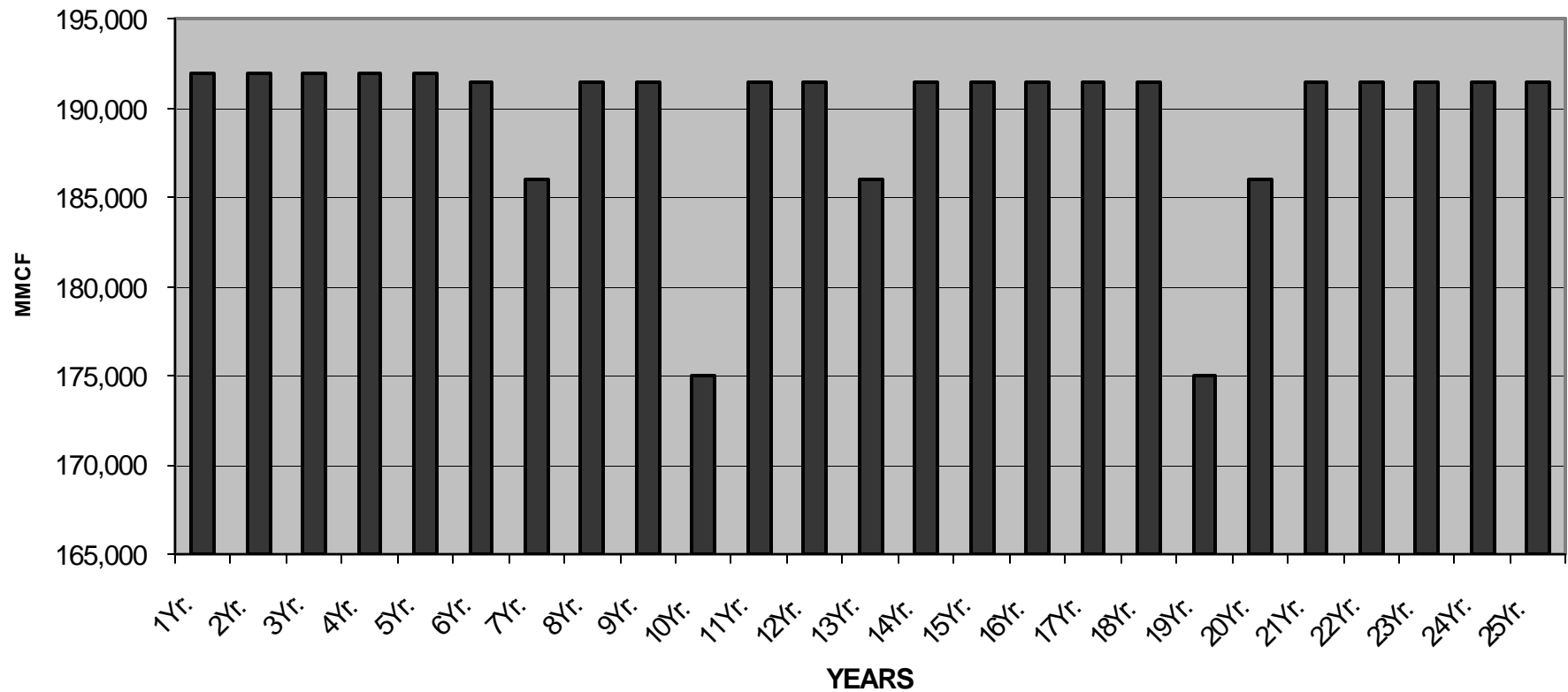
# Case 2 – Gas Production

## Field Life Schedule



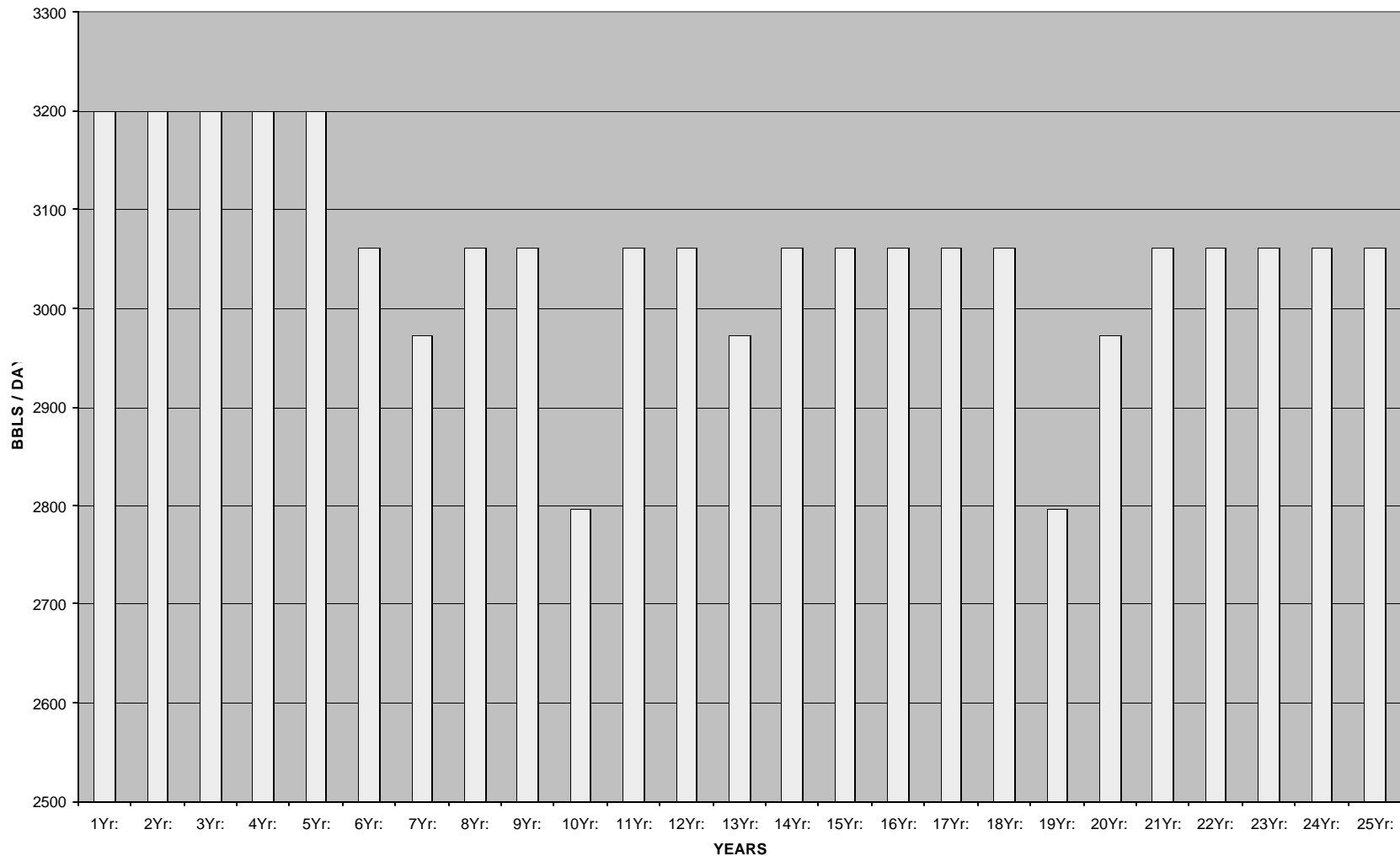
# Case 2 – LNG Production – West Africa

## 200,000 MMCF/Day Over 25 Years

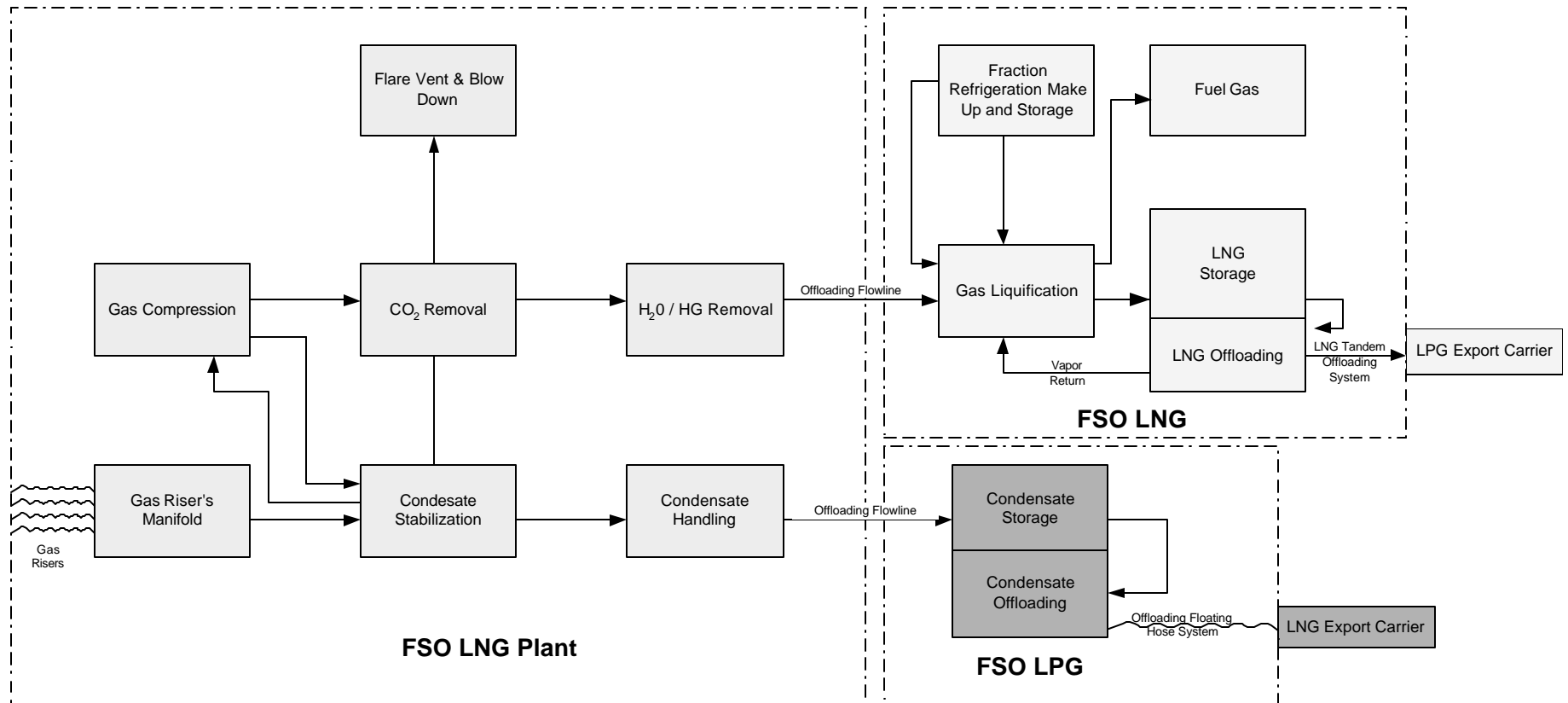


# Case 2 – Condensate Production – West Africa

## 3,200 BBLS/Day Over 25 Years



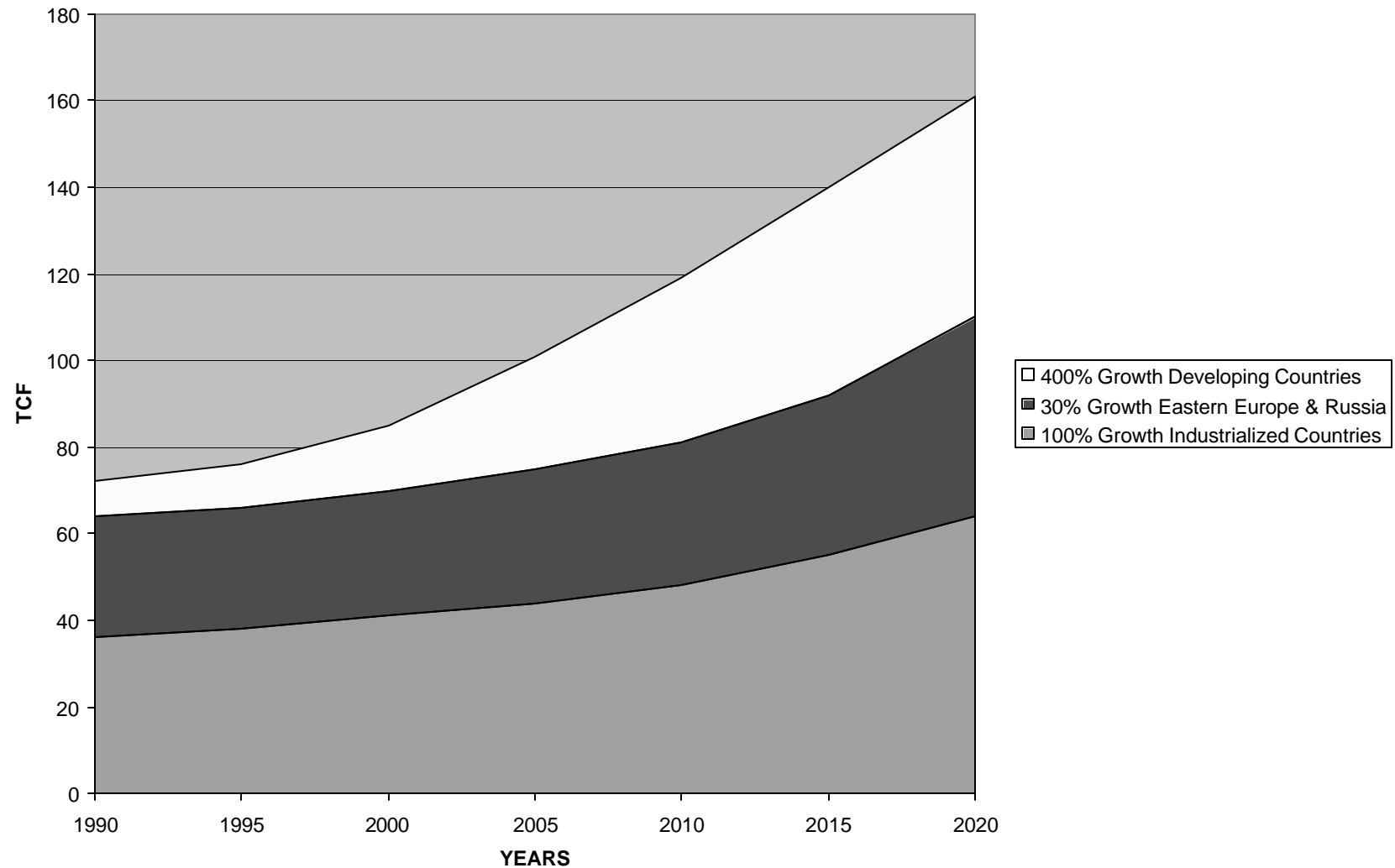
# LNG & Condensate Production Flow Diagram



# LNG Tandem Offloading System



# Natural Gas World Demand



# Case Studies – CAPEX Evaluations

- **Project Engineering/Design**
- **Project Management/Services**
- **Drilling Rigs**
- **Drilling Rigs Consumables**
- **Subsea Manifold Base**
- **Subsea Weldheads**
- **Subsea Trees**
- **Control Systems**
- **Flowlines from Satellite/Cluster**
- **Risers**
- **Installation**
- **Survey**

# Case Studies – CAPEX Evaluations

## Oil

- **FPSO**

### Process

- Separator Facilities
- Produced Water Treatment
- Oil Export Facilities
- Surface Manifold
- Power Generation Facilities
- Gas Flare Facilities
- Gas Lift Compressors

### Installation

- FPSO

## Gas

- **LNG Plant Vessel & FPSO**

### Process

- Natural Gas Reception Facilities
- Acid Gas Removal Unit
- Dehydration/Mercury Removal Unit
- Liquefaction/Refrigeration Units:
  - Located on LNG FSO for this project
- Fraction/Storage and Loading Unit:
  - Located on LNG FSO for this project
- Flares/Utilities Units

### Installation

- LNG Plant Vessel
- LNG FSO
- LPG FSO



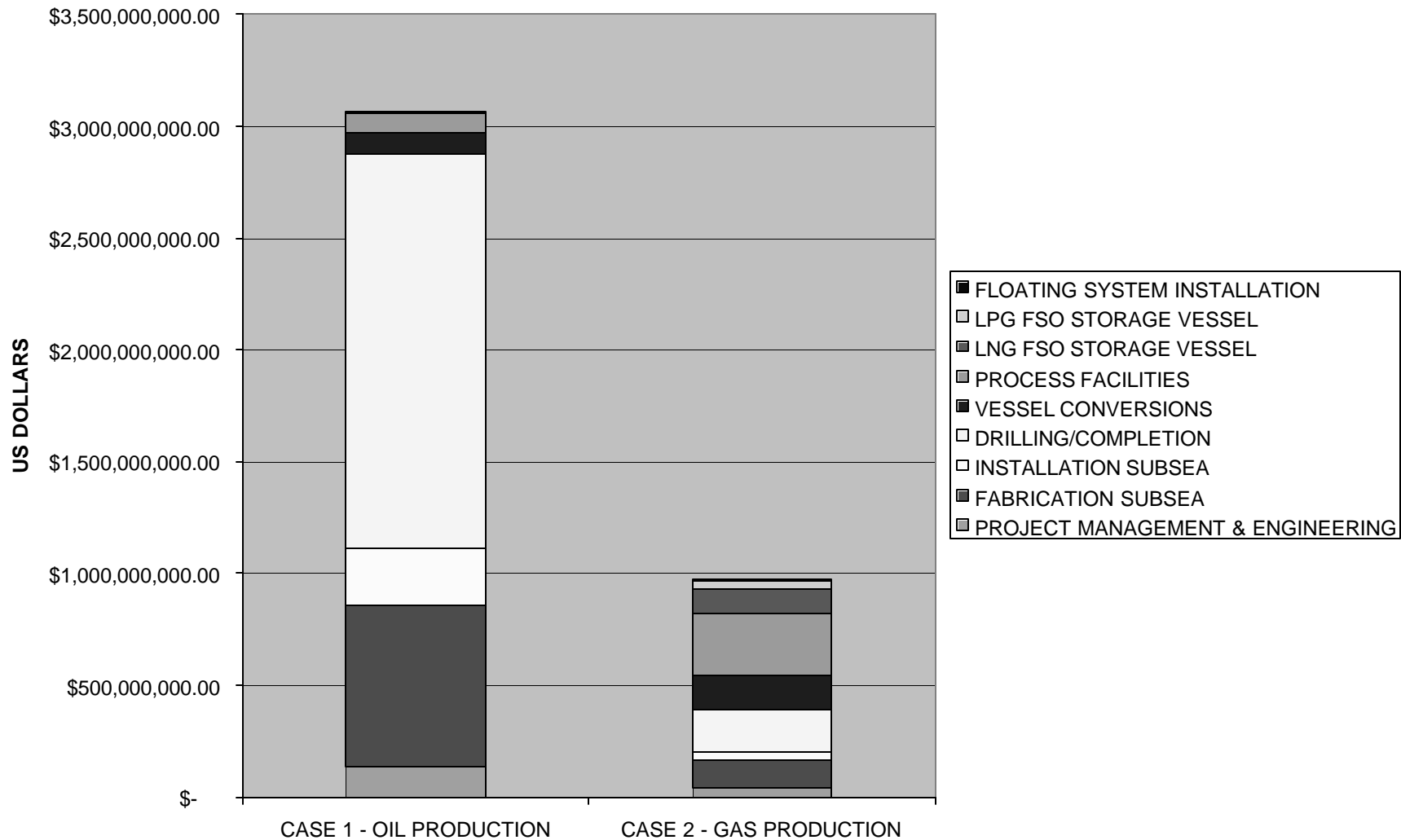
# Case Studies – OPEX Evaluations

- **Vessel(s)**
- **Vessel(s) 5 Year Underwater Cleaning and Inspection**
- **Process Facilities**
- **Subsea Well Equipment Operation**
- **Subsea Well Equipment Replacement Cost (Every 10 Years)**
- **Subsea Well Workover**
- **Template/Manifold Inspection & Maintenance**
- **Flowline/Pipeline Inspection & Maintenance**
- **Production Risers Inspection & Maintenance**
- **Production System Mooring Inspection & Maintenance**
- **Tanker Export System Inspection & Maintenance**
- **Shore Base**
- **Helicopter, Supply Boat & Mooring Tug(s)**
- **Quarters/Catering**
- **Insurance**
- **Field Decommissioning**

# Case Study Cost Comparison

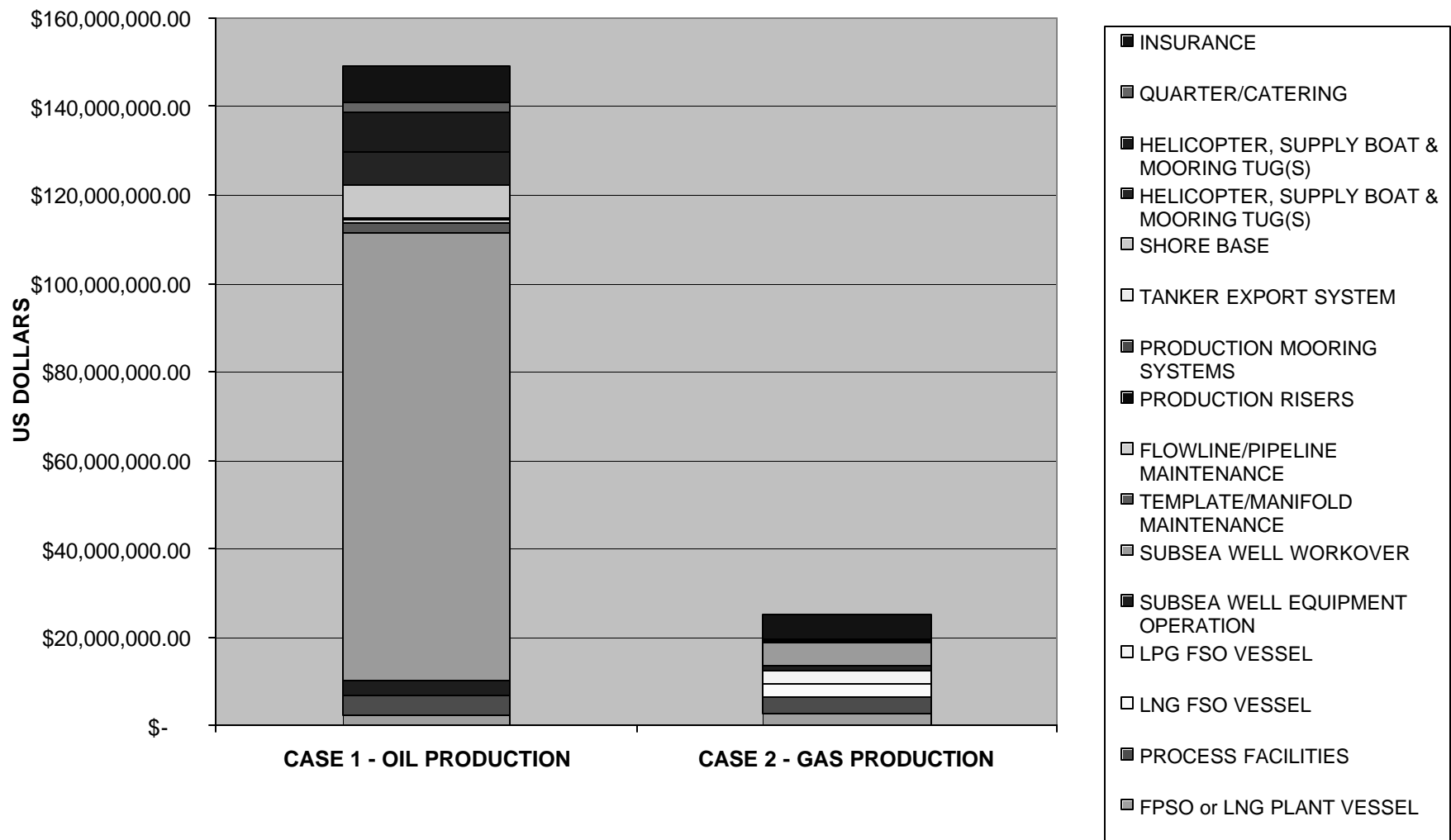
- **+/- 10% using today's prices**
- **Inflation 2% per year**
- **Case 1 Oil @ \$22.50 BBL**
- **Case 2 Natural Gas @ \$3.50 MMBTU**
- **Case 2 Condensate @ \$20.00 BBL**
- **Net Present Value @ 10.5% @ First Field Production**

# Oil & Gas Production West Africa CAPEX

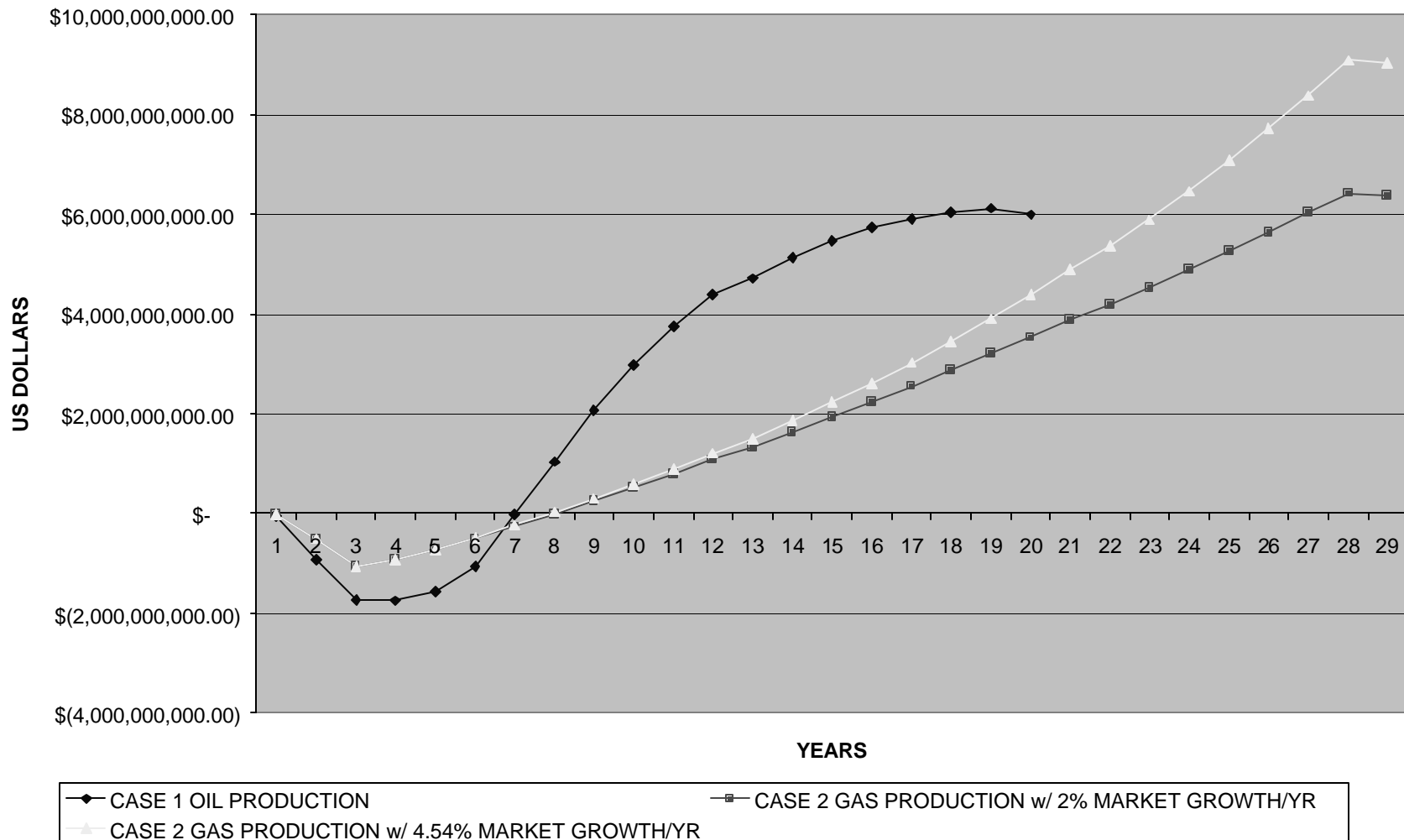


# Oil & Gas Production West Africa

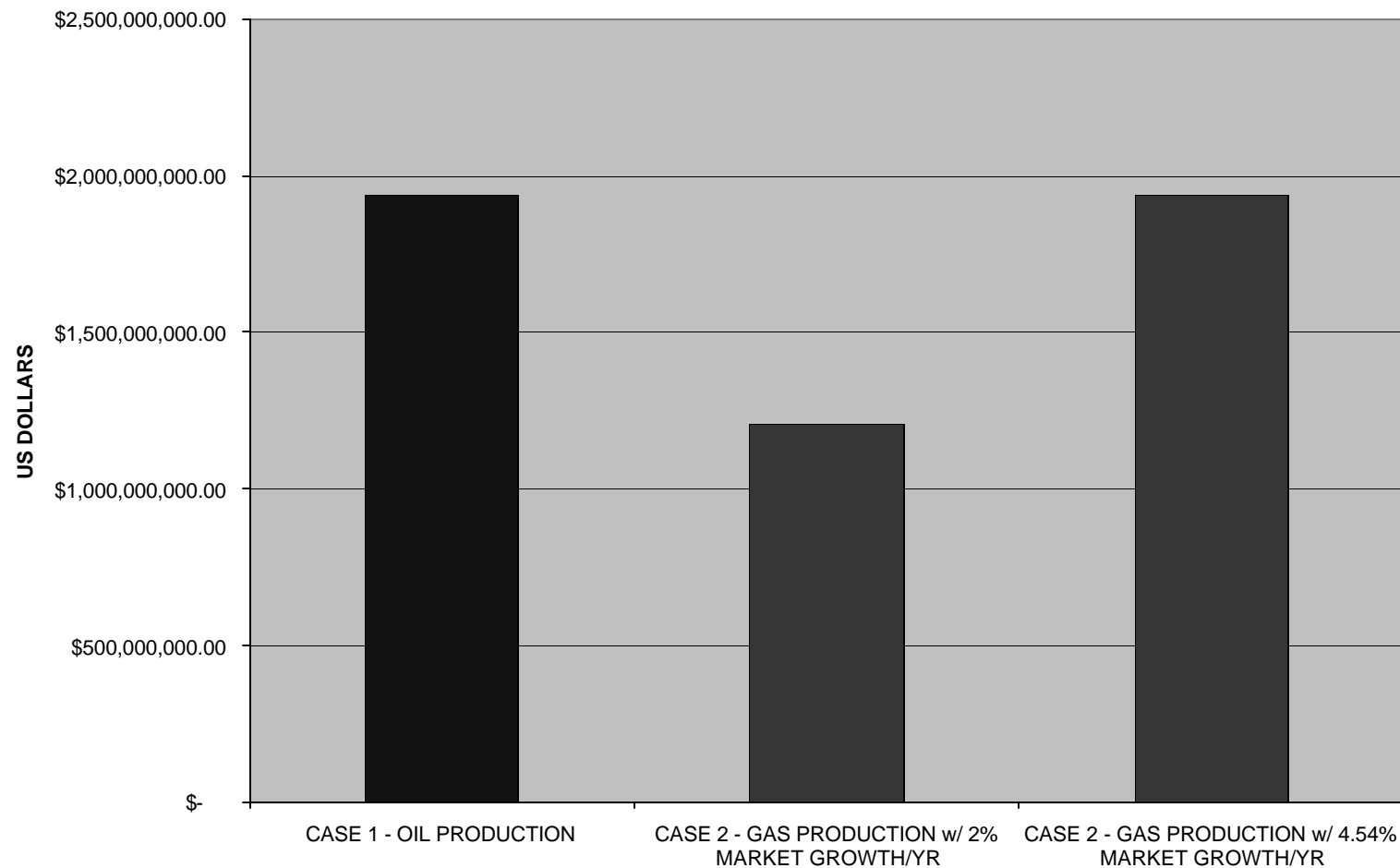
## OPEX First Year



# Oil & Gas Production Cash Flow



# Net Present Value At First Production



# Conclusion

- **Case 1 – Oil Production:**
  - Low risk and quick return on large capital investment
- **Case 2 – Gas Production:**
  - Higher risk with higher profits expected in the future with lower capital investment

**With the present anticipated gas market price forecasts, gas production is the preferred choice for this case study.**

# Oil & Gas Price Update

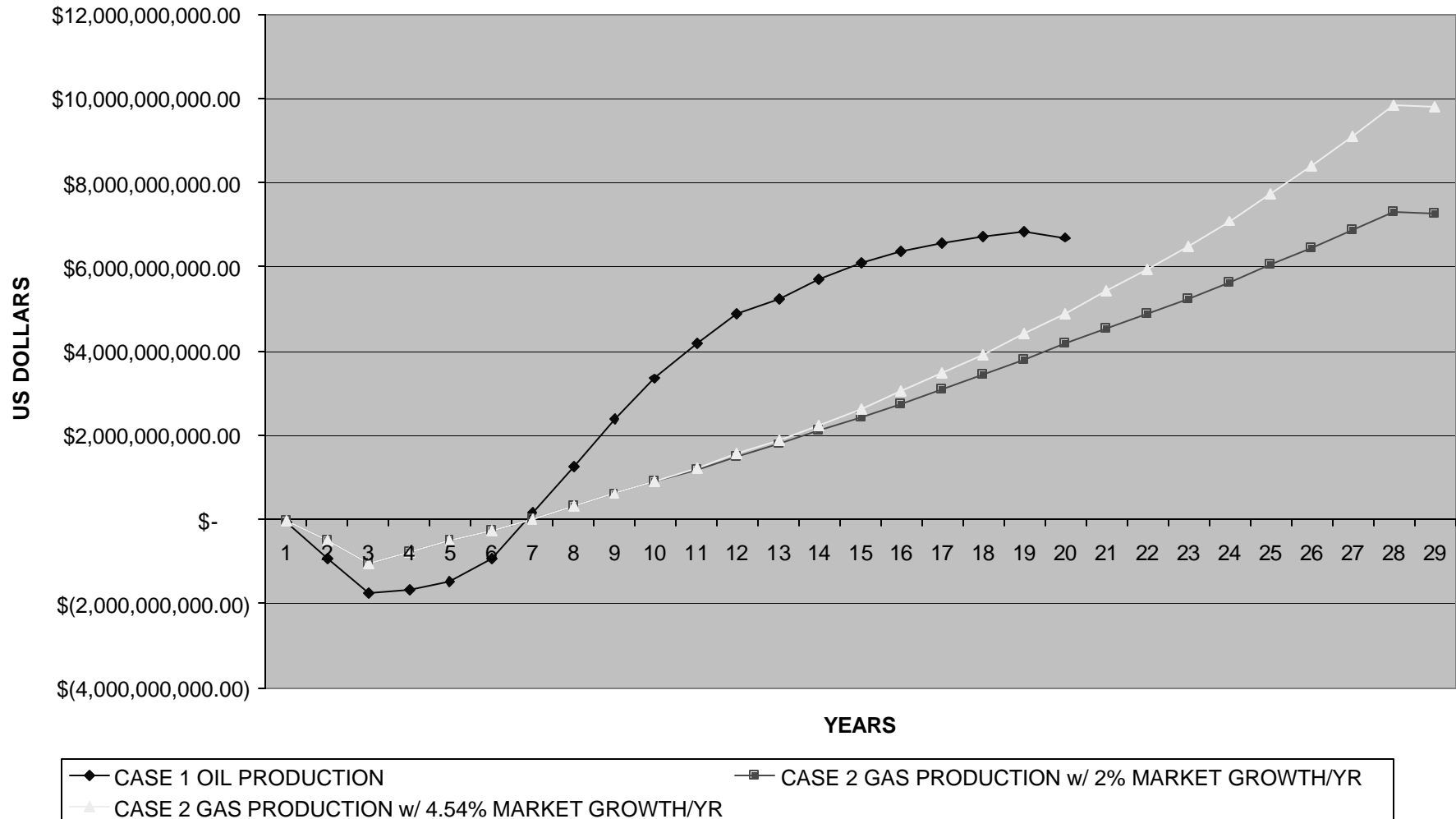
- **As of 14 Feb 2003 spot price of oil to \$36.83 bbl**
- **Overall crude futures up more than 15% in last quarter**
- **Longer term estimate prices up 4 to 7%**

## Henry Hub Spot Prices of Natural Gas

- **Jan 2002                      \$2.26/mmbtu**
- **Jan 2003                      \$5.46/mmbtu**
- **14 Feb 2003                \$5.86/mmbtu**



# OIL & GAS PRODUCTION CASH FLOW UPDATED TO 14 FEB 03 OIL & GAS PRICES



## NET PRESENT VALUE AT FIRST PRODUCT UPDATED TO 14 FEB 03 OIL & GAS PRICES

