



# ***East Mediterranean Natural Gas Production Cost***



***Presentation to "I.E.N.E."***

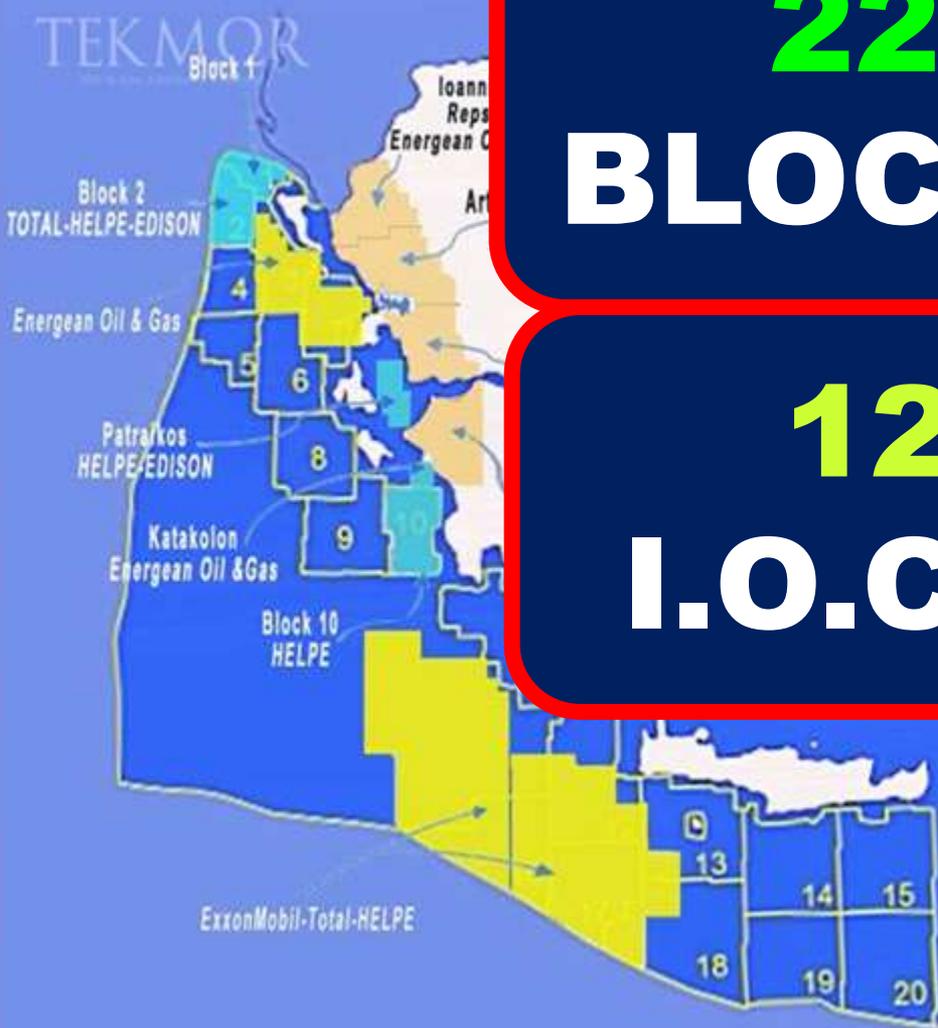
***October 30<sup>th</sup> 2018***

***Dr. Elias KONOFAGOS, Executive Vice President***

# The Big Picture of Exploration & Production Investments in Cyprus & Greece, Oct. 2018

**22**  
**BLOCKS**

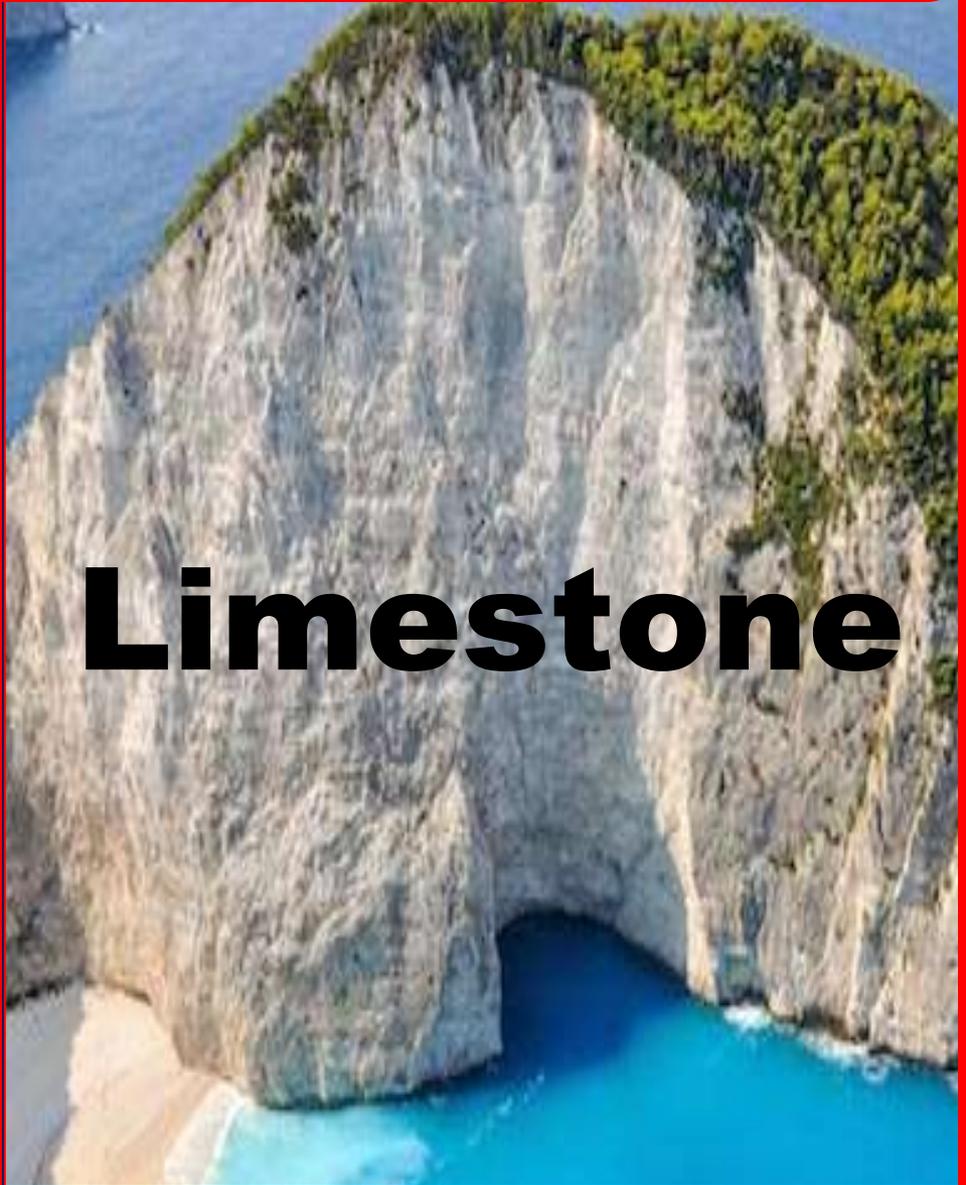
**12**  
**I.O.C.'s**



# The East Mediterranean Main Type of Reservoirs



**Sandstone**



**Limestone**

- Sandstone Reservoirs &
- Limestone Reservoirs

NOT TO SCALE



**LIMESTONE  
RES. TARGETS**

**SANDSTONE RES.  
TARGETS**

# Comparison of Gas Field Sizes



FIELDS:	SIZE	RESERVES
<b>LEVIATHAN</b> Sandstone	340 km <sup>2</sup>	20 Tcf
<b>ZOHR</b> Limestone	100 km <sup>2</sup>	30 Tcf

Mediterranean

**Cyprus EEZ**

**Egypt EEZ**

**Zohr**

**Leviathan**

**Israel EEZ**



# Presentation to “IENE” October 2018

## Offshore Technical Production Costs & Natural Gas Fields Commerciality





# Technical Production Cost Natural Gas

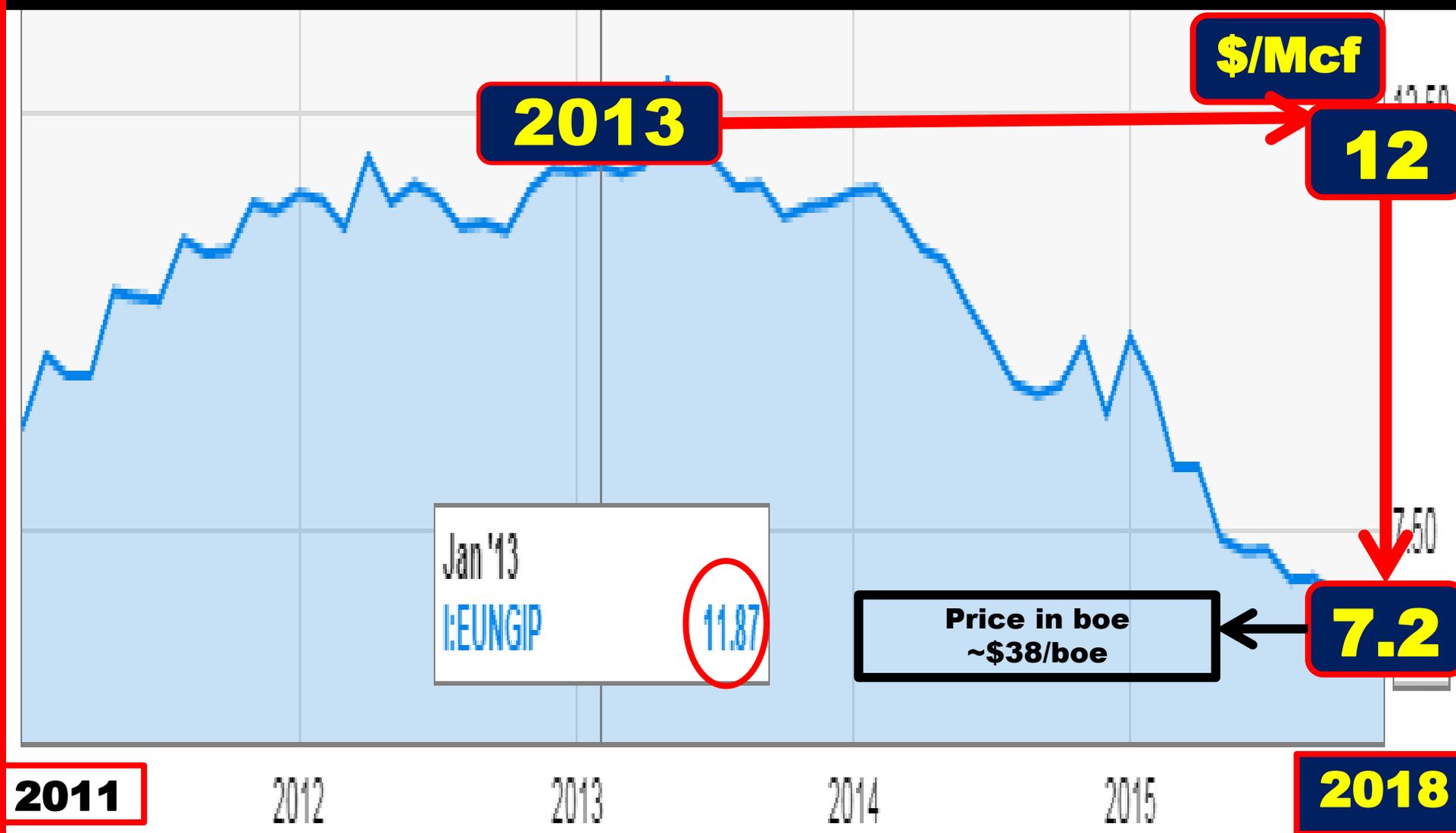
$$\text{T.P.C.} = \frac{\text{Total Cost (Expl. + Dev/ment + Op/ting)}}{\text{Total Recoverable Reserves}}$$

- Expressed in **\$/Mcft or \$/boe**
- Includes **Financing Costs**

(Calculated Before **Royalties, Taxes & Profit**)

■ **Yearly Total Gas Field Operating Cost**  
Estimated between **6% to 9%** of Development  
Cost (Production Period of 20 to 30 Years) .

# E.U. Mean Import Natural Gas price 2011 - 2016



# EastMed Natural Gas

# Technical Production Costs

# Examples

Tamar SW

Water Depth  
1.700 m

Tamar

- Discovery 2009,
- First Production 2013

TAMAR Processing Platform

150km

- Banks Consortium Financing, by HSBC & Barclay's etc

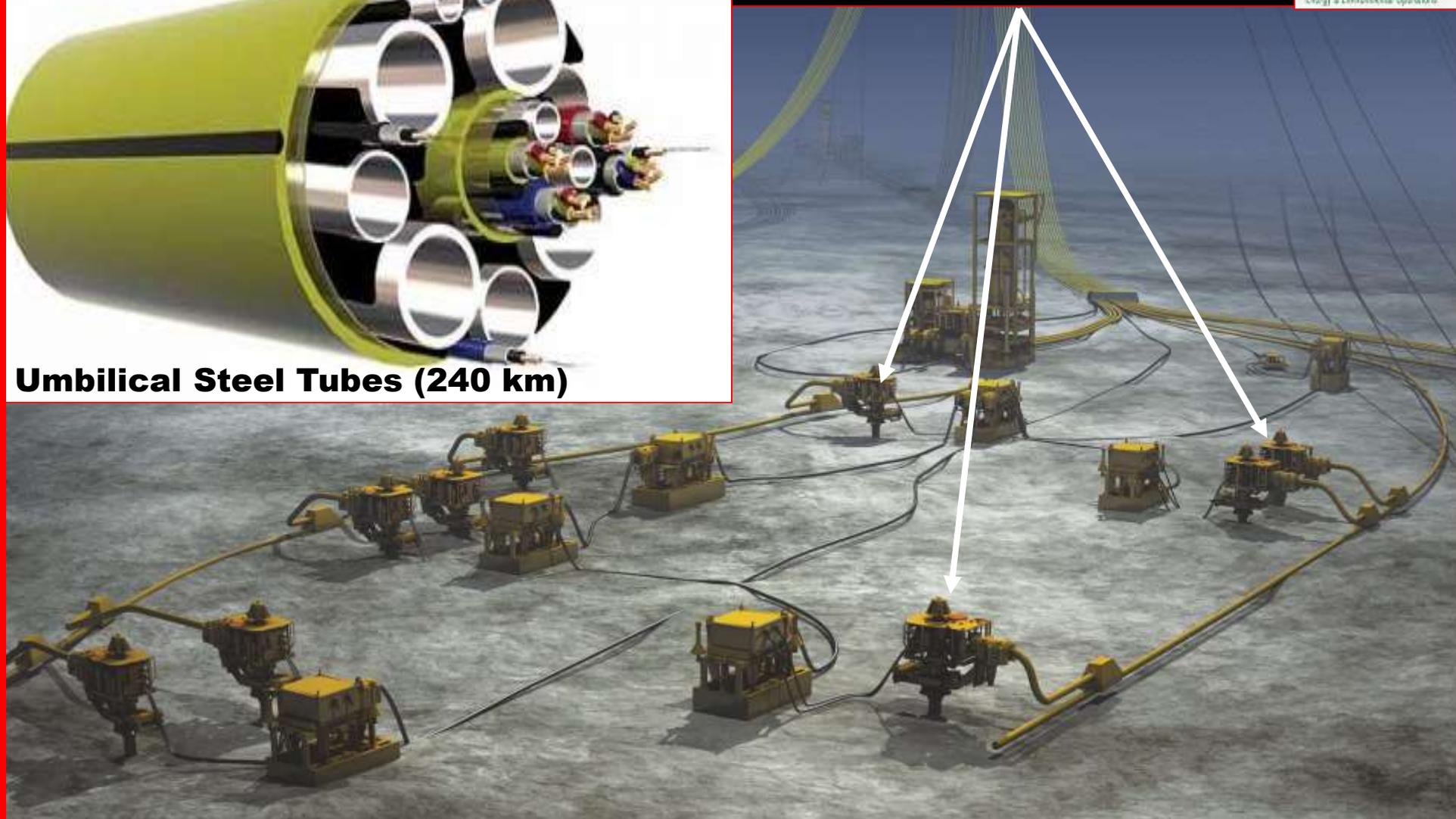
Mari-B Platform

## Flexible Pipes



**Umbilical Steel Tubes (240 km)**

## Subsea Well Heads



**Key Point: Unmanned Remote Production Management from Platform**  
**Tamar Field: Subsea Well Heads Offshore Development Scheme**

Tamar SW

Tamar

- Exploration= ~\$1 B
- Total Development= \$5 B
- 20 Years Production: 8,4 Tcf
- Annual Production= ~420 Bcft
- Operating Cost= ~\$600 MM/Year

Tamar Platform

Mari-B Platform

Tamar SW

Tamar

Subsea Wells  
Water Depth 1.678m

**~\$2,1/Mcft**

**or**

**~\$13/boe**

**Israel Contractual Price:  
\$5,8/Mcft**

**Project IRR=~20%**

**Dr. Elias KONOFAGOS**

150 km Pilelines &  
Umbilical Cables

Tamar Platform

Mari-B Platform

**SEPTEMBER 2017**



# “Zohr” Gas Field, Full Subsea Development



**Dr. Elias KONOFAGOS**

**500.000 boe/day**

# Development Scheme of "Zohr" Gas Field

**Zohr**

Wd = 1500 m

**Accelerated Start Up:**

- 6 wells
- 26" line
- 1 DEG line + 1 service line
- existing control platform upgrading
- 1 umbilical
- new onshore plant

**Ramp-Up to plateau:**

- 14 wells
- additional 2x26" lines
- 1 DEG line + 1 service line
- 2 umbilicals
- new control platform
- new onshore plant

**Plateau Extension:**

- 5wells
- additional 3x26" lines
- 1 umbilical
- onshore compressors

**Total 600km Subsea Steel Tubes Umbilical Providing Electrical & Hydraulic Connections with Well Heads**

3 x 26" x 215 km pipeline

2 x 26" x 215 km pipeline

26" x 215 km pipeline

4 x 150 km umbilical

Barboni

New control pltf (WD ~ 100 m)

Darfeel

Nouras

- - - - - New Umbilical (Accel. S/U)
- - - - - New Umbilical (FF)
- - - - - New Umbilical (FF)
- - - - - New GAS Pipeline (Accelerated start up)
- - - - - New GAS Pipeline (Ramp up to plateau)
- - - - - New GAS Pipeline (plateau extension)
- - - - - Existing Gas Pipeline
- - - - - SOW Field

New Onshore Plant  
4+4 trains of 350 MMSCFD each

El Gamil Plant

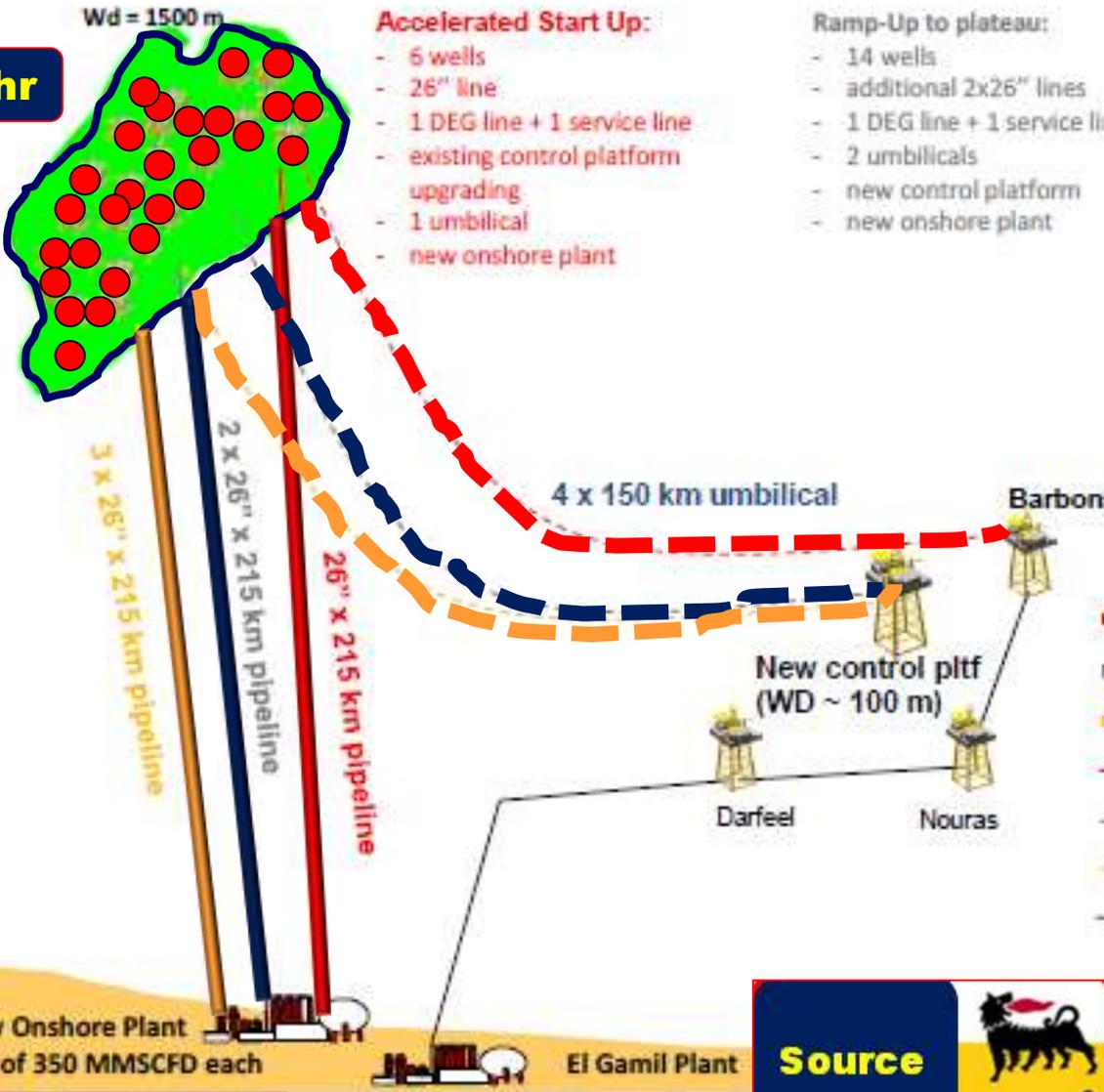
**Source**



**Dr. Elias Konofagos**

# Development Scheme of "Zohr" Gas Field

**Zohr**



**Accelerated Start Up:**

- 6 wells
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- 2 umbilicals
- new control platform
- new onshore plant

## ECONOMICS

- **Exploration = ~\$1 Billion**
- **Prod. Wells = ~\$2 Billion**
- **Development = ~\$11 Billion**
- **Operating Cost = ~\$1,1 B/Year**
- **Yearly Prod. = ~900 Bcf**
- **30 Years Prod. = 26Tcf**

New Onshore Plant  
4+4 trains of 350 MMSCFD each

El Gamil Plant

**Source**



# Development Scheme of "Zohr" Gas Field

Zohr

Wd = 1500 m

### Accelerated Start Up:

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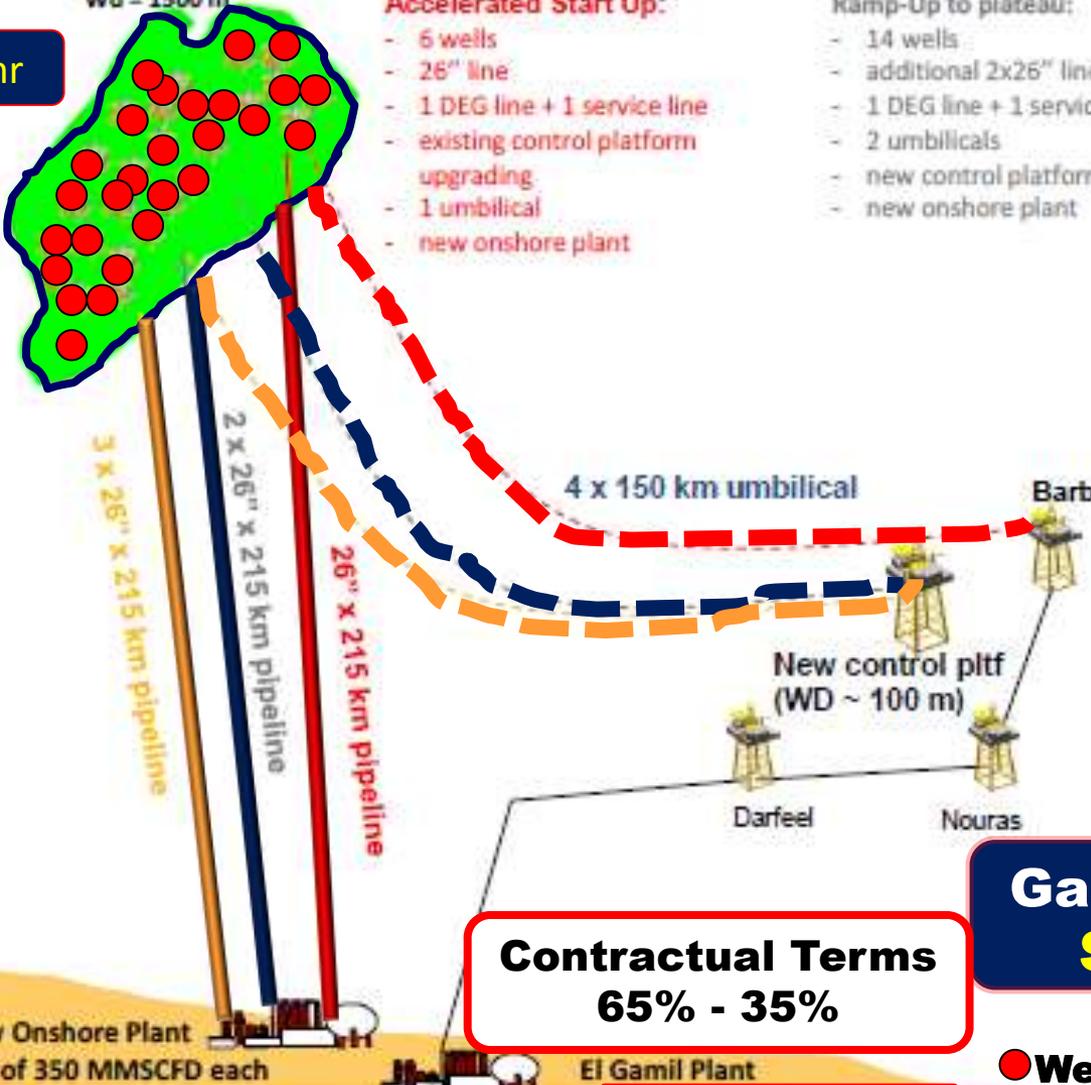
### Plateau Extension:

- 5wells
- additional 3x26" lines
- 1 umbilical
- onshore compressors

= **~\$1,8/Mcft**

or

= **~\$11/boe**



- - - - - New Umbilical (Accel. S/U)
- - - - - New Umbilical (FF)
- - - - - New Umbilical (FF)
- - - - - New GAS Pipeline (Accelerated start up)
- - - - - New GAS Pipeline (Ramp up to plateau)

**Contractual Terms  
65% - 35%**

**Gas Price Paid by Egypt:  
\$4/Mcft - \$5,88/Mcft**

New Onshore Plant  
4+4 trains of 350 MMSCFD each

El Gamil Plant

● Wells

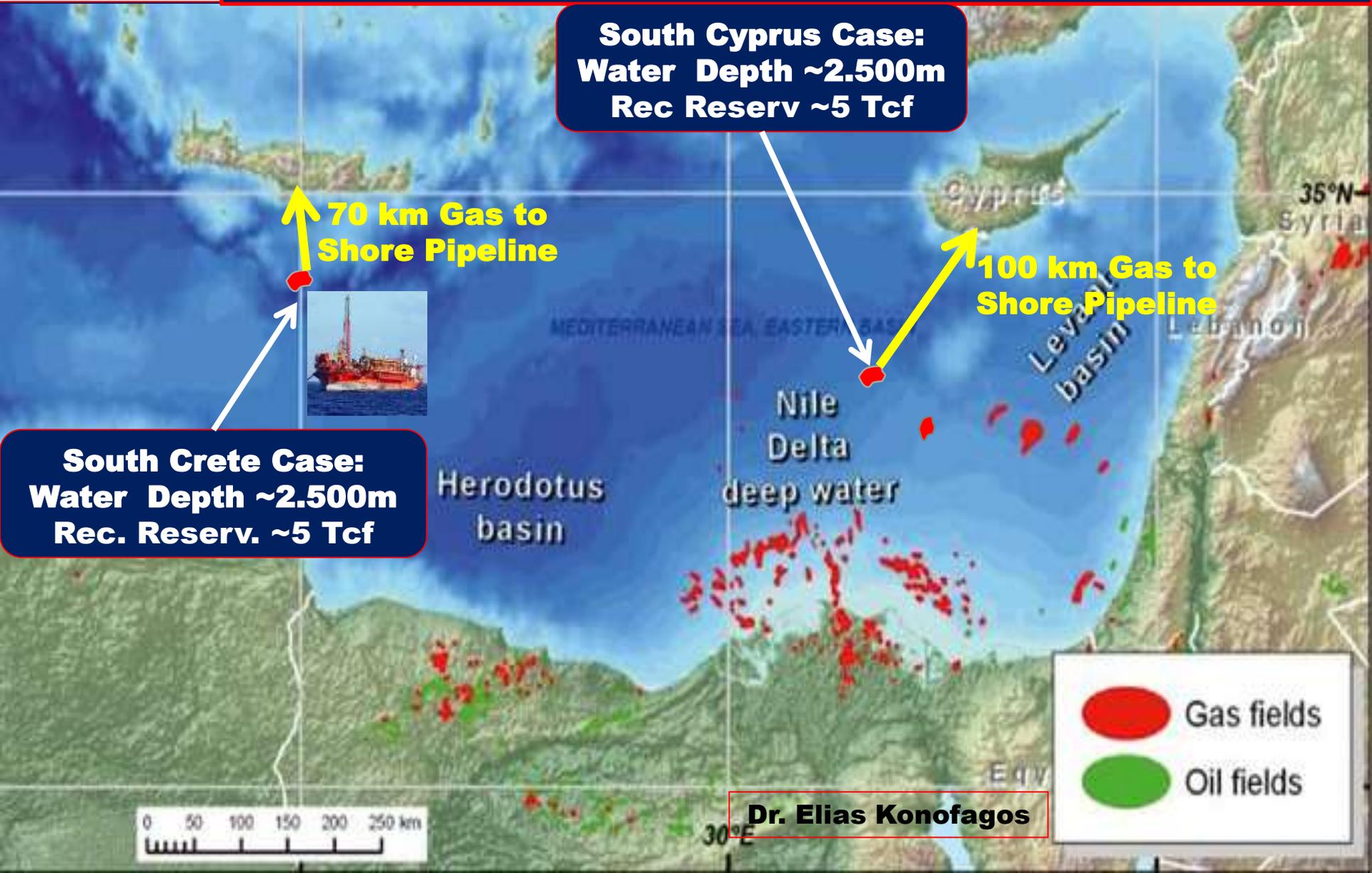


**Equivalence: \$30/bbl = \$5/Mcft**

**IRR = ~35%**

**Dr. Elias Konofagos**

# South of Cyprus or South of Crete Expected Gas Discovery Cases, Rec. Res. 2,5 Tcf



# South Cyprus or Crete Gas Field Case, Reserves 5 Tcf, Production Investments

**Floating  
Production  
Facilities**

**Subsea  
Production  
Well Heads.**

- **Exploration Cost= ~ 1 Billion**
- **Wells: Drilling Depth 3.500m**
- **Well Cost= ~\$100 Million**
- **Development= ~\$6 Billion**
- **Annual Production, 180 Bcf**
- **18 Years Production, 5,5 Tcf**
- **Operating Cost: \$600 Million/Year**

# South Cyprus or South Crete Gas Field Case, Reserves 5 Tcf, Technical Production Cost

**Floating  
Production  
Facilities**

**Subsea Production  
Well Heads.**

= **~\$4,5/Mcft**

**or**

= **~\$27/boe**

**Natural Gas Contract  
Price: \$5/Mcft (~\$30/boe)**

**Contractual Terms  
40%-60% Sharing**

**Project IRR= ~0%**

# South Cyprus or South Crete Gas Field Case, Reserves 5 Tcf, Technical Production Cost

**Floating  
Production  
Facilities**

**Subsea Production  
Well Heads.**

= **~\$4,5/Mcft**

**or**

= **~\$27/boe**

**Natural Gas Contract  
Price: \$7/Mcft (~\$30/boe)**

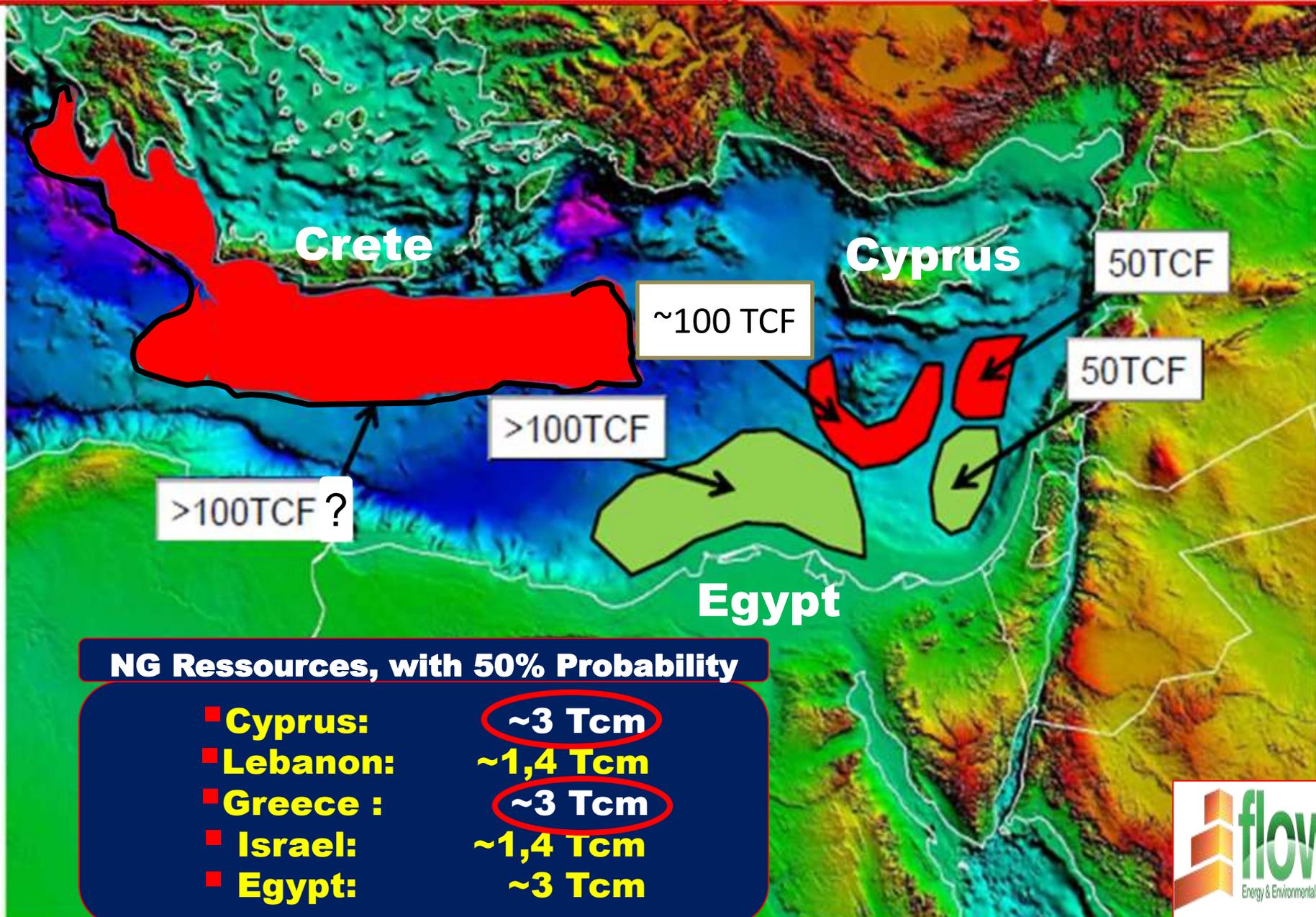
**Contractual Terms  
40%-60% Sharing**

**Project IRR= ~12%**

**Expected Limestone Biogenic Gas Reservoirs**

**Expected Sandstone Gas Reservoirs**

Source: Spectrum  
Dr. Elias Konofagos



**NG Ressources, with 50% Probability**

- **Cyprus:** ~3 Tcm
- **Lebanon:** ~1,4 Tcm
- **Greece :** ~3 Tcm
- **Israel:** ~1,4 Tcm
- **Egypt:** ~3 Tcm



# Future Natural Gas Discoveries & Stand Alone Commerciality Challenges

Water Depths >2.500m

- Reservoirs of Sufficient Size
- High Natural Gas Pay Zones (>10Tcf)
- High Wells Production Rate, ~35MMcf/day
- Contactual Commercial Terms Compatible with the Risks Involved



Energy & Environmental Operations

**DR. ELIAS KONOFAGOS**  
**EXECUTIVE V.P.**

**THANK YOU**

**Presentation to I.E.N.E.**

**Athens, October 30<sup>th</sup> 2018**



