

THE LEBANESE NATURAL GAS POTENTIAL

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Sep 20th, 2017

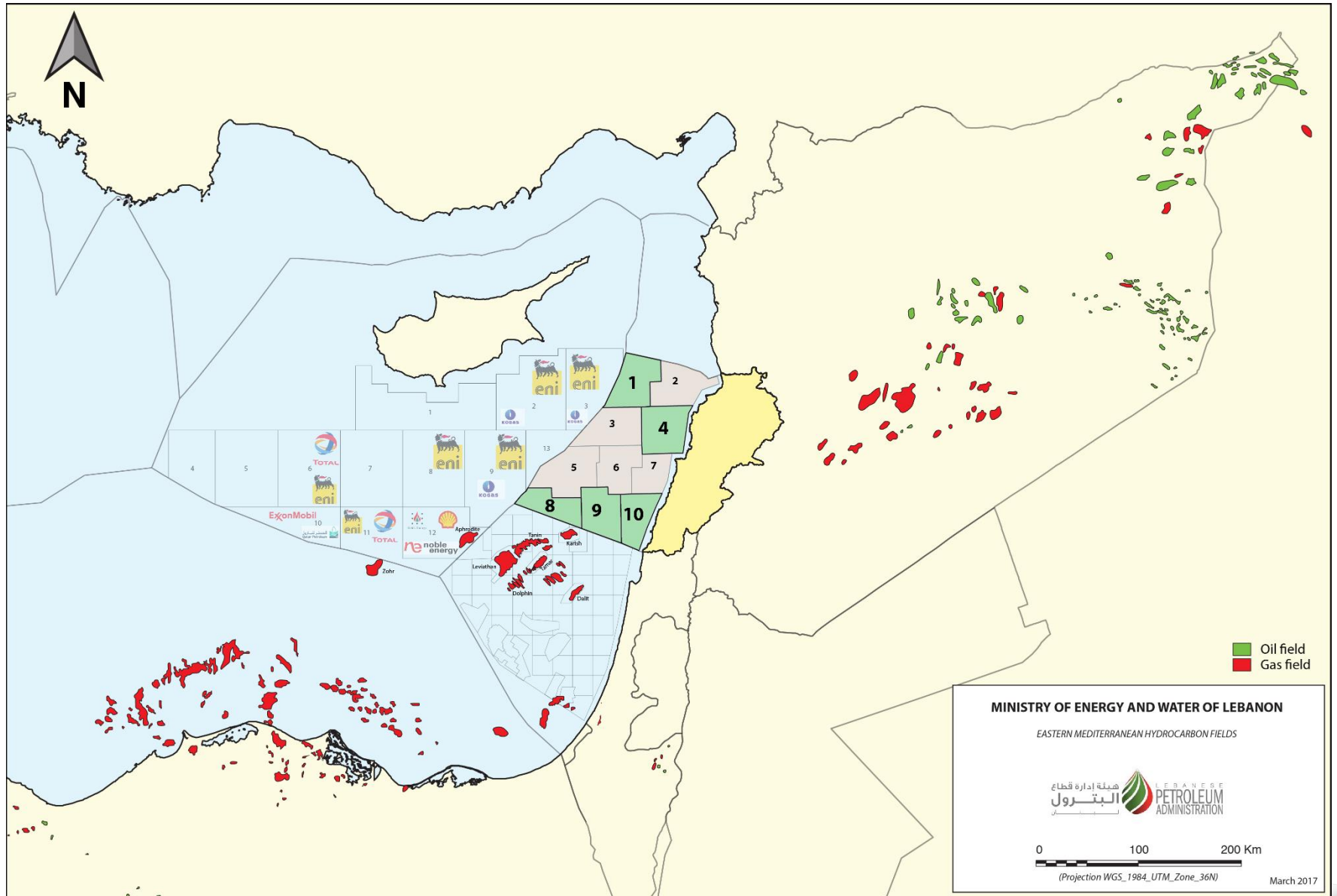


OUTLINE

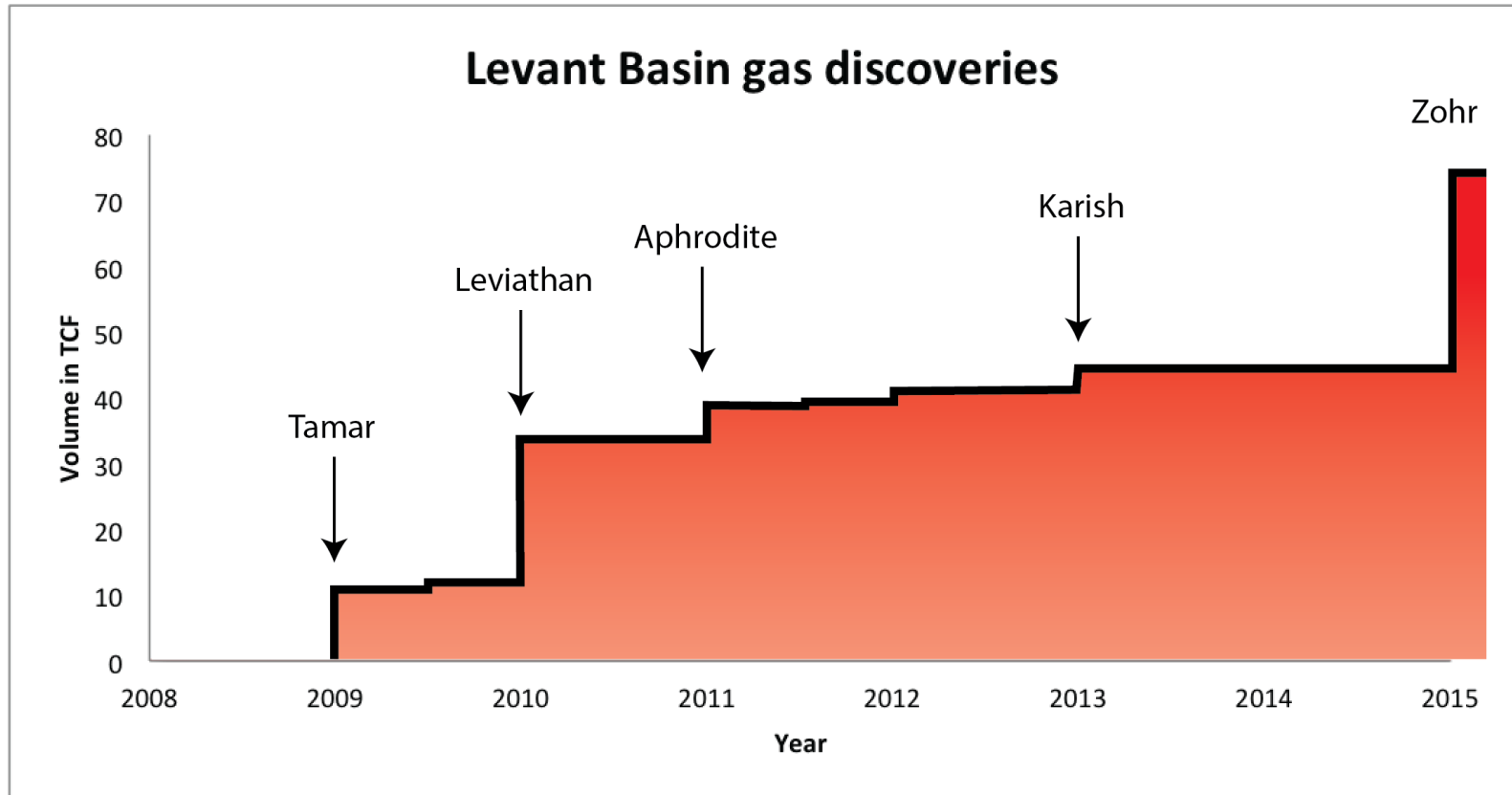
- 🌍 The regional status
- 🌍 Available data
- 🌍 Studies performed and collaboration
- 🌍 Petroleum systems offshore Lebanon
 - Concept
 - Prospects
 - Volumes
- 🌍 Markets
 - Local
 - Regional



REGIONAL ACTIVITY



REGIONAL EXPLORATION

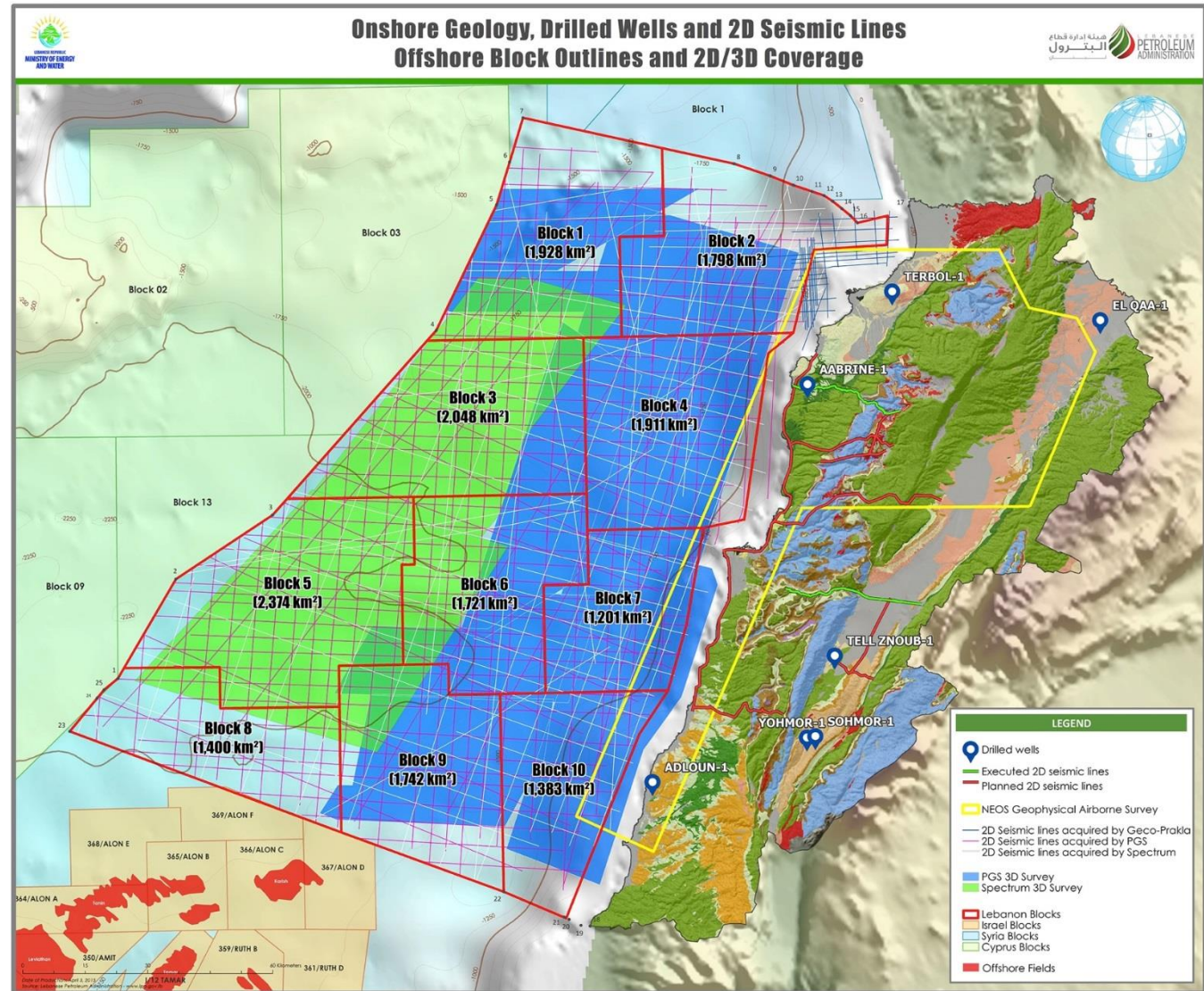


- 🔥 Zohr was a paradigm shift in the exploration cycle
- 🔥 Carbonate reservoirs are as important as sand reservoirs

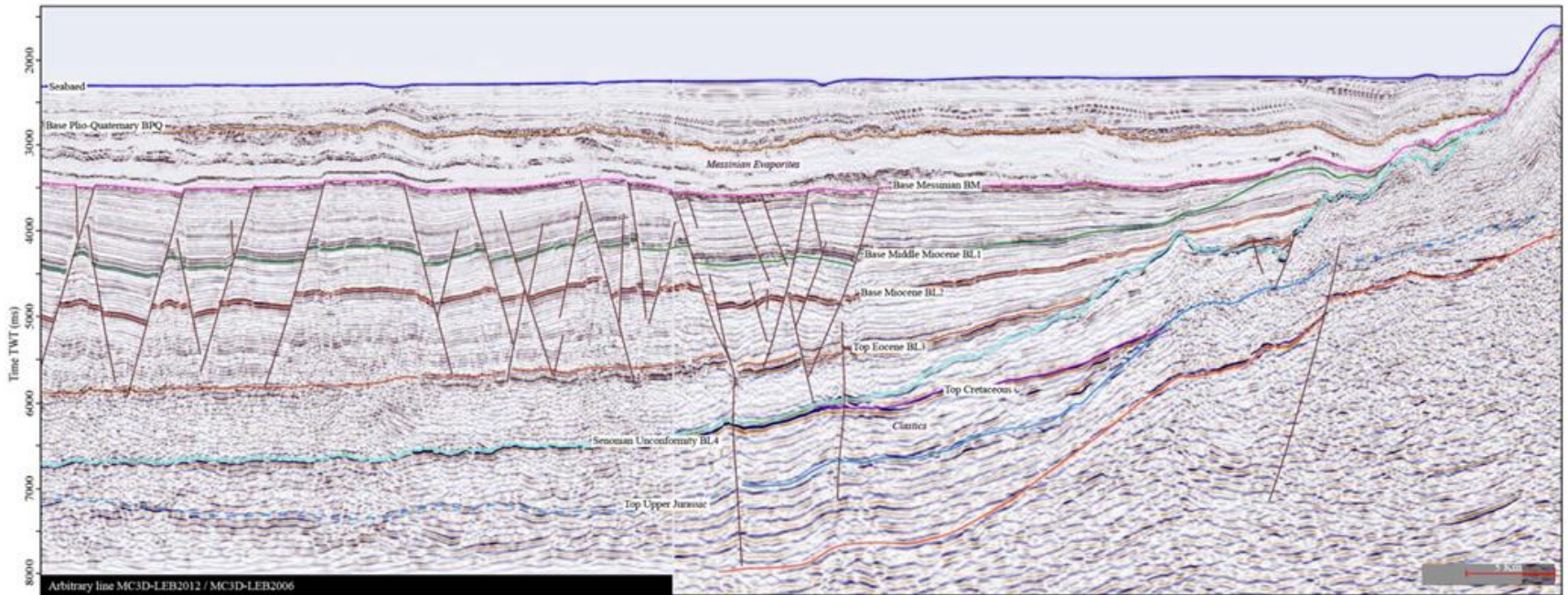


AVAILABLE MULTICLIENT DATA

- Spectrum 2D lines (5172 km)
- PGS 2D lines (5000 km)
- GeckoPrakla 2D lines (508 km)
- PGS 3D seismic data (9700 km²)
- Spectrum 3D seismic data (5360 km²)
- NEOS airborne geophysical (6000 km²)
- Onshore 2D lines (100 km)



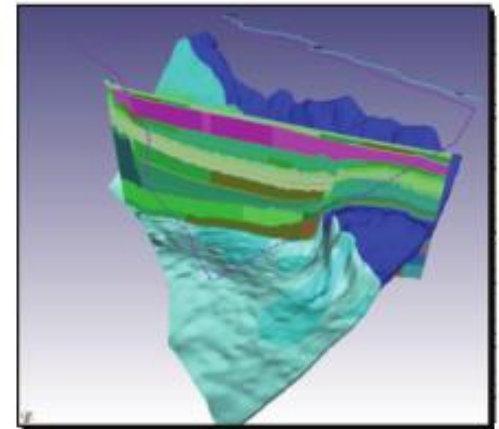
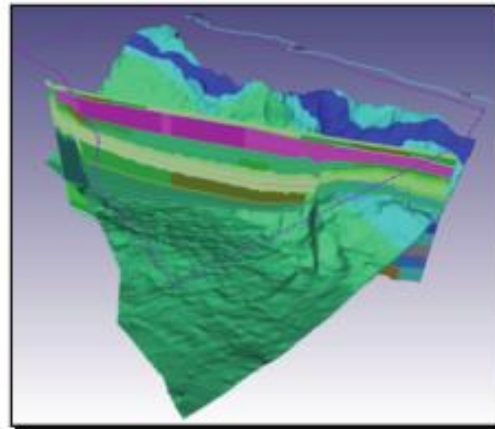
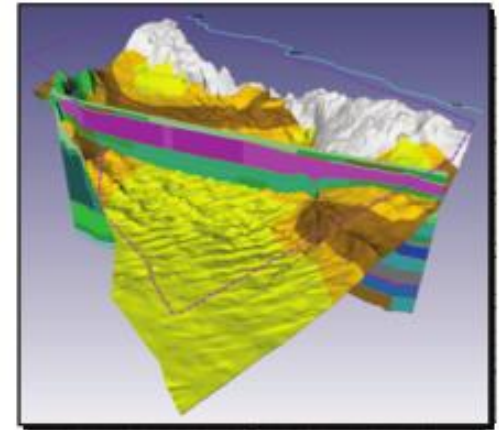
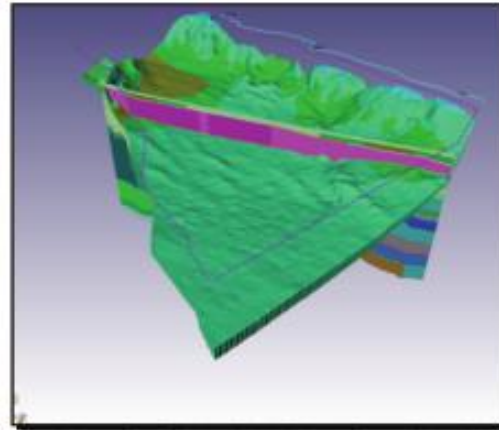
STUDIES PERFORMED



- Interpretation of the 2D and 3D seismic data 2012 – to present
- Mapping petroleum system elements
- Locating structures capable of holding petroleum -> prospects

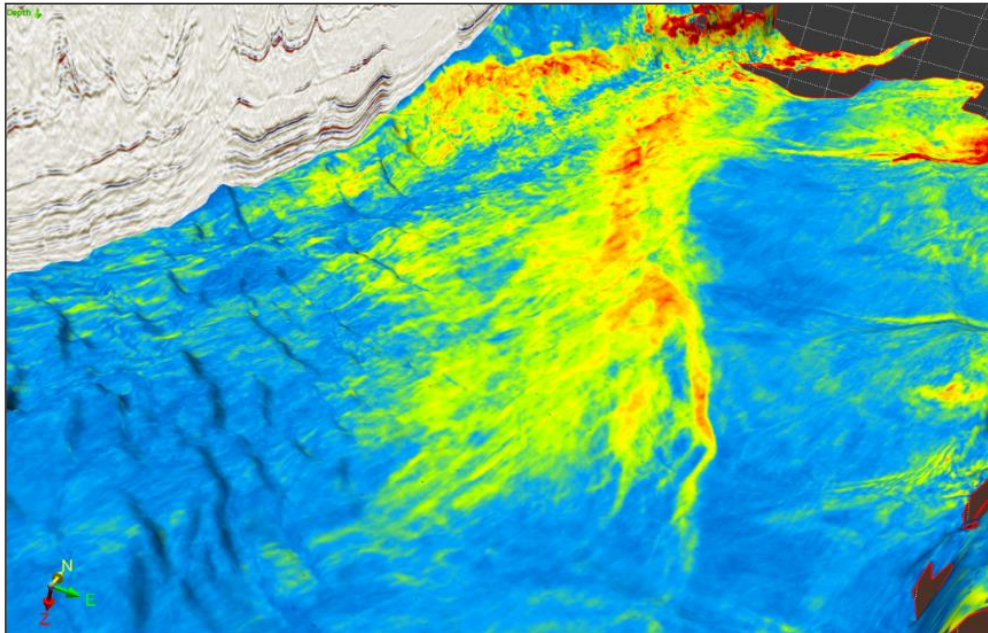
STUDIES PERFORMED

- 3D basin modelling 2012 with BeicipFranlab
- Quantify amount of hydrocarbon expelled and trapped
- Locate important areas in the basin for exploration



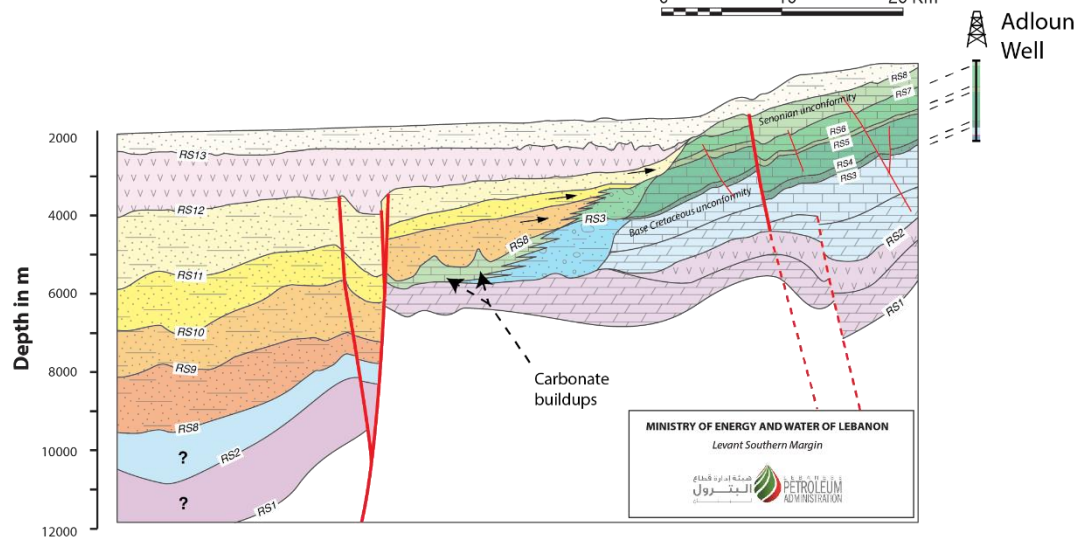
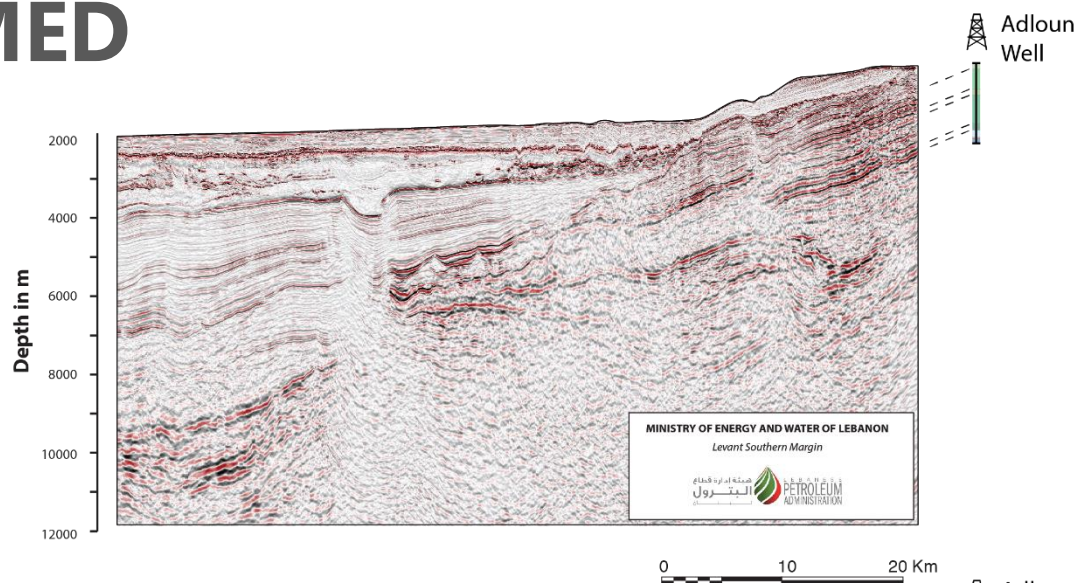
STUDIES PERFORMED

- Advanced geophysical characterisation studies
- Locate reservoirs of oil and gas
- Reduce uncertainties
- Point to likely drilling targets



STUDIES PERFORMED

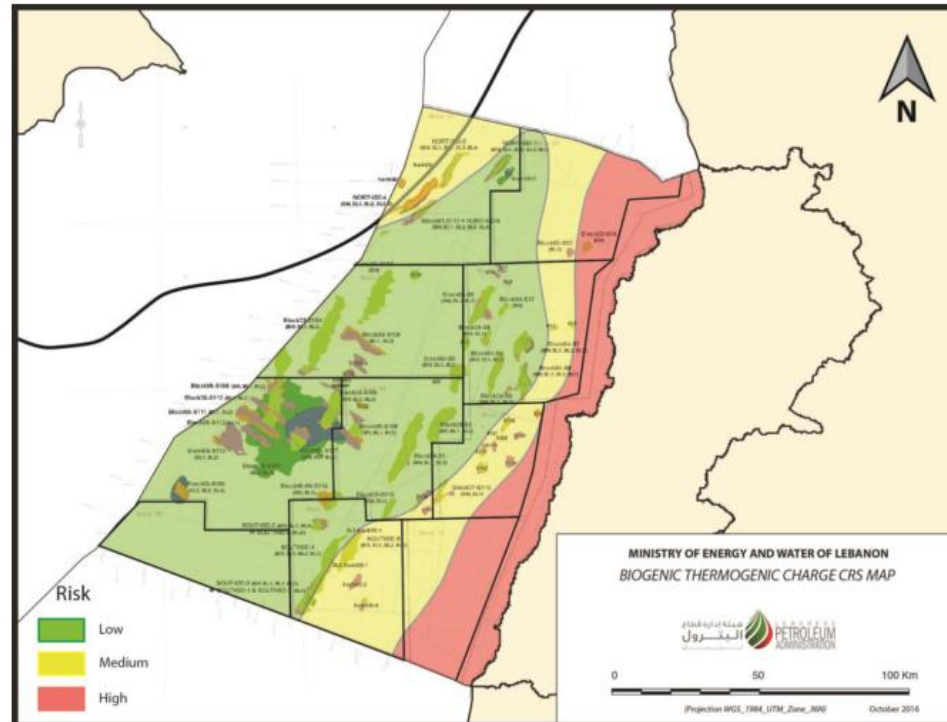
- Analysis of the carbonate potential offshore Lebanon following the Zohr discovery
- Assessment of likely discoveries in carbonate reservoirs
- Recent discovery in Onisiforos 1 tcf



Pliocene	Turonian/Senonian	Triassic	Salt
Messinian	Cenomanian	Shaly sand	Fault
Upper Miocene	Albian	Talus	Unconformity
Lower Miocene	Aptian	Limestone	Onlap
Oligocene	Neocomian	Dolomite	
Eocene	Jurassic/Upper Trias	Clastics	

STUDIES PERFORMED

- Play Fairway Analysis to rank blocks and areas of exploration
- Ranking from most prospective to least prospective
- Calculate volumes in potential prospects



ACADEMIC PROJECTS

Memorandum of understanding (MOU):

- University of Aberdeen (UK): 2 PhD projects proposed

University Collaboration

- Imperial College
- UPMC Paris VI
- RWTH Aachen
- Lebanese University
- NDU Louaize
- NTNU



PhD projects

- Hawie, 2014: stratigraphy of the Levant Basin
- Ghalayini, 2015: Structures and traps in the Levant Basin
- Bou Daher, 2015: Source rocks characterisation offshore and onshore
- Inati, 2017: Crustal structure of the Levant Basin

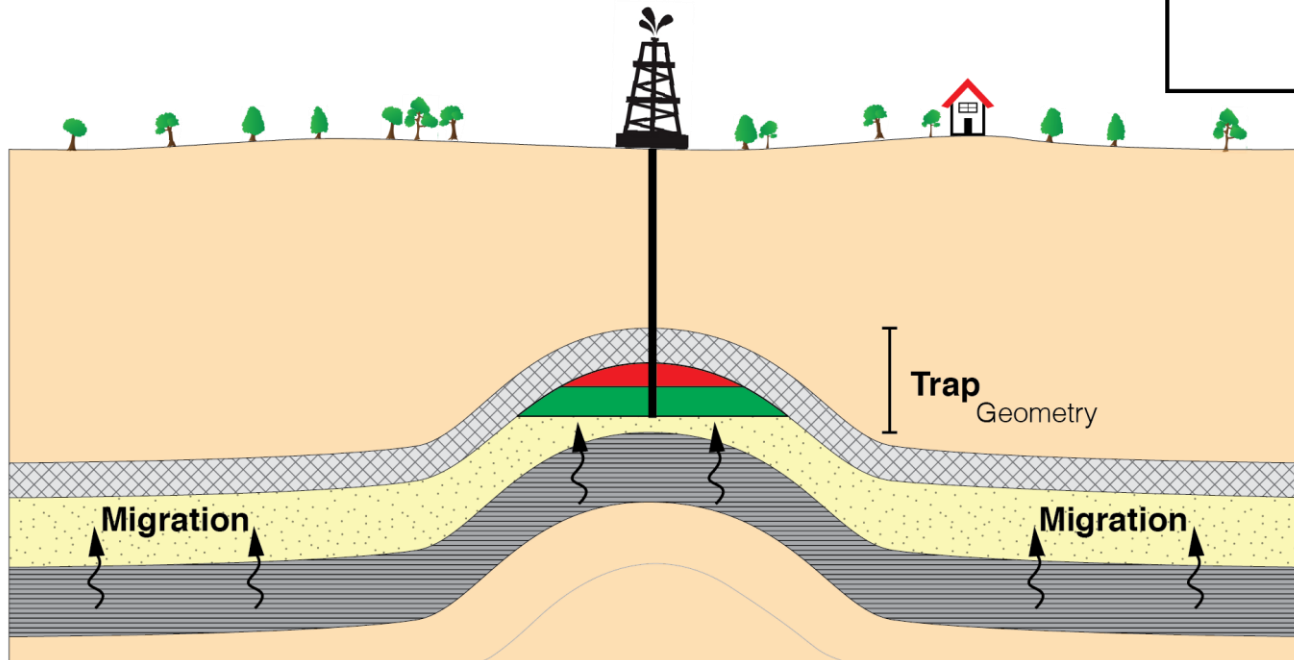


PETROLEUM SYSTEM OFFSHORE LEBANON

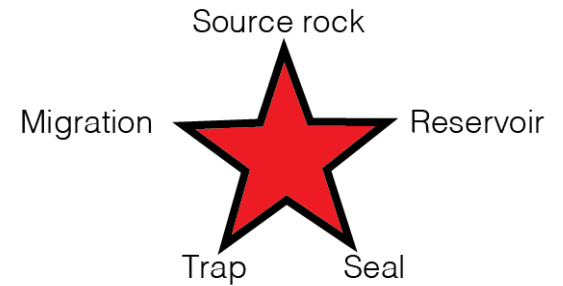


THE CONCEPT OF PETROLEUM SYSTEM

The Conventional Petroleum System



The 5 elements of a petroleum system

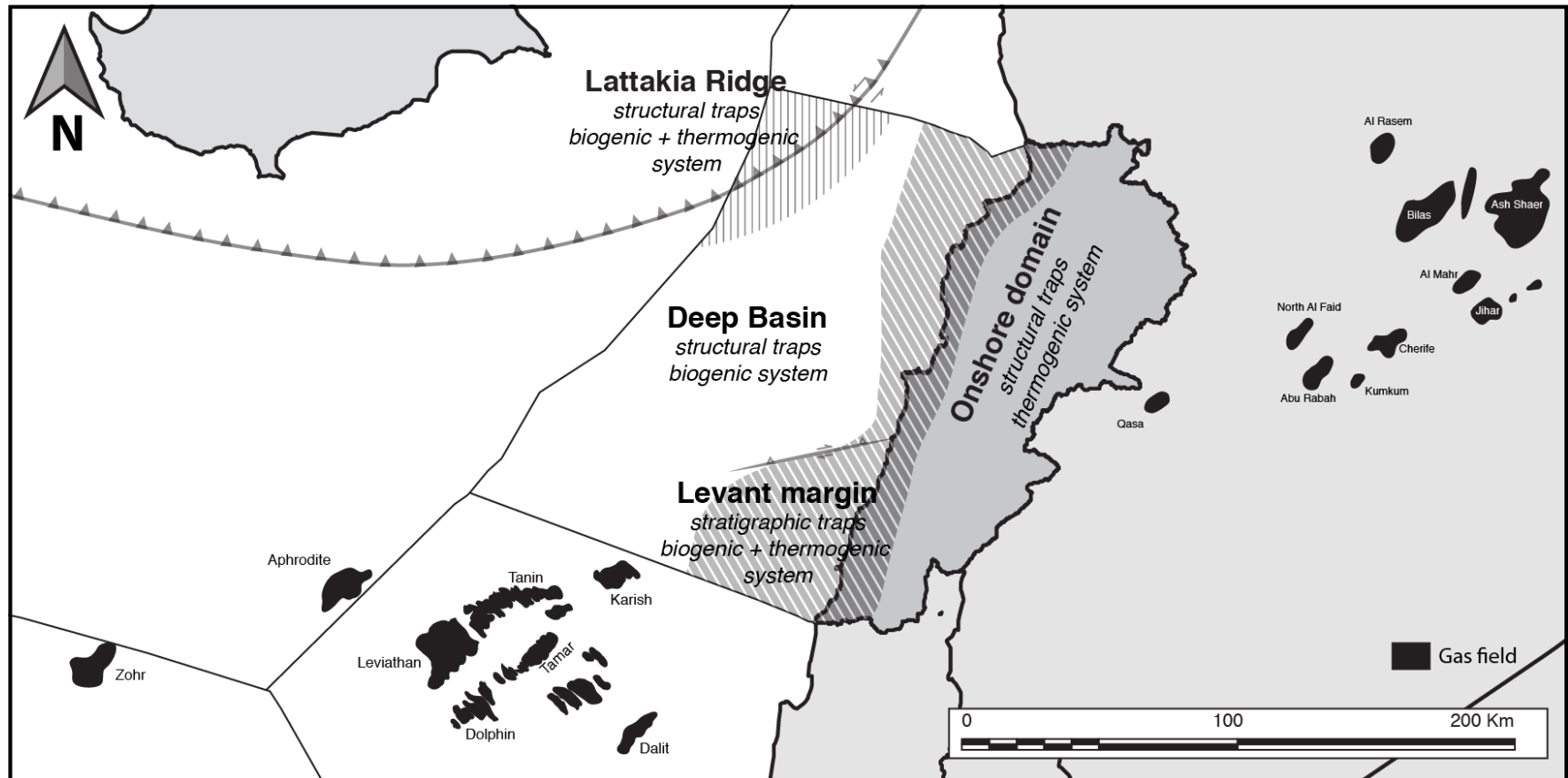


- Seal** Impermeable rock
- Reservoir** Permeable rock
- Source Rock** Source of oil/gas



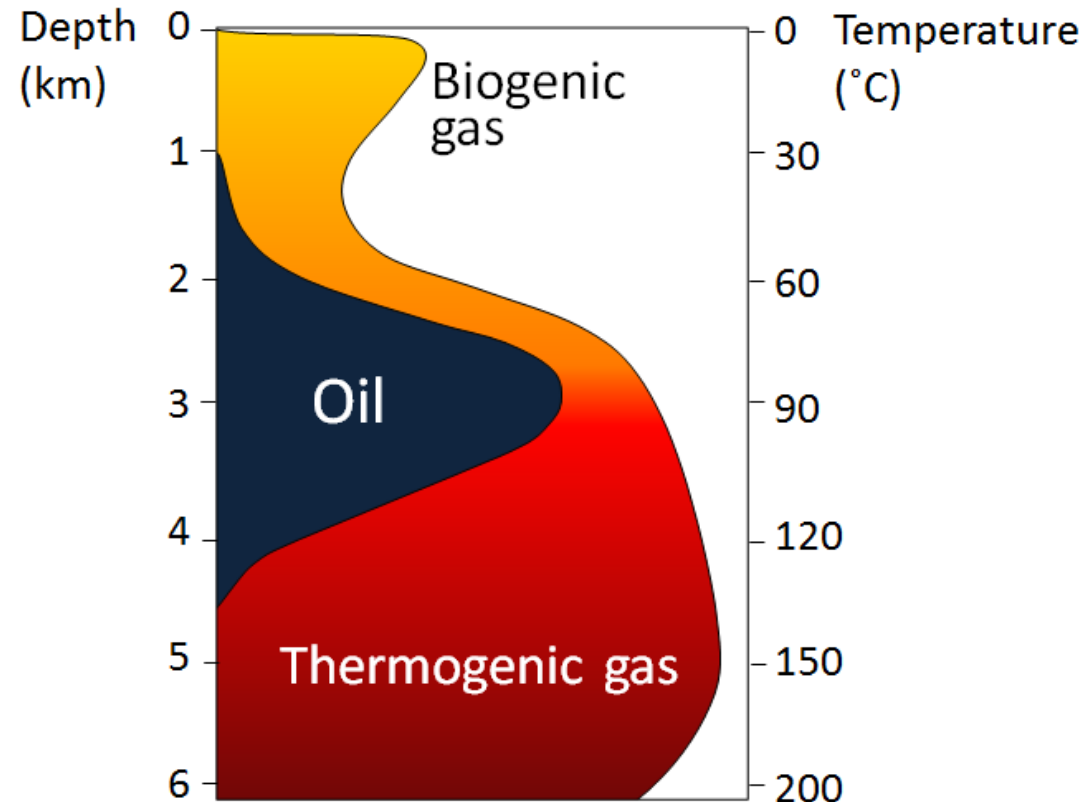
THE PETROLEUM SYSTEMS OF LEBANON

- 4 petroleum systems identified
- Consist mainly of gas in the deep Basin
- Liquid oil expected onshore and along the margin



OIL VS GAS IN LEBANON

- Oil is generated at specific depth, in temperature between 60 and 120 C
- Gas is generated at temperature >120 C
- Gas is also biogenic, produced by bacteria who degrade the rocks





MARKETS



ENERGY DEMAND IN LEBANON

Existing Deir Ammar CCGT (upgraded to 460 MW)
Deir Ammar II (538 MW) NG/HFO under construction - 2018

IPPs (1500 MW) NG

Zouk II (194 MW) NG/HFO

Jieh II (94 MW) NG/HFO

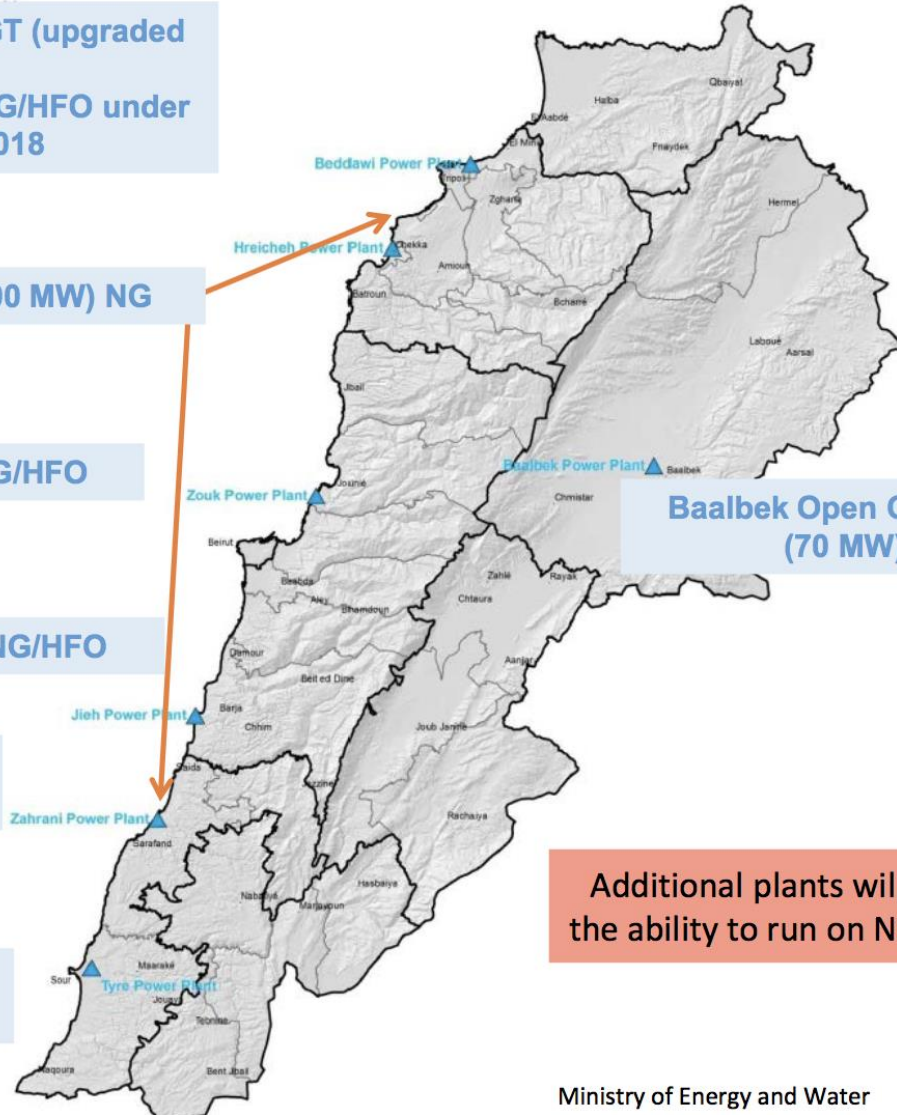
Existing Zahrani CCGT (upgraded to 460 MW)

Tyre Open Cycle PP (70 MW)

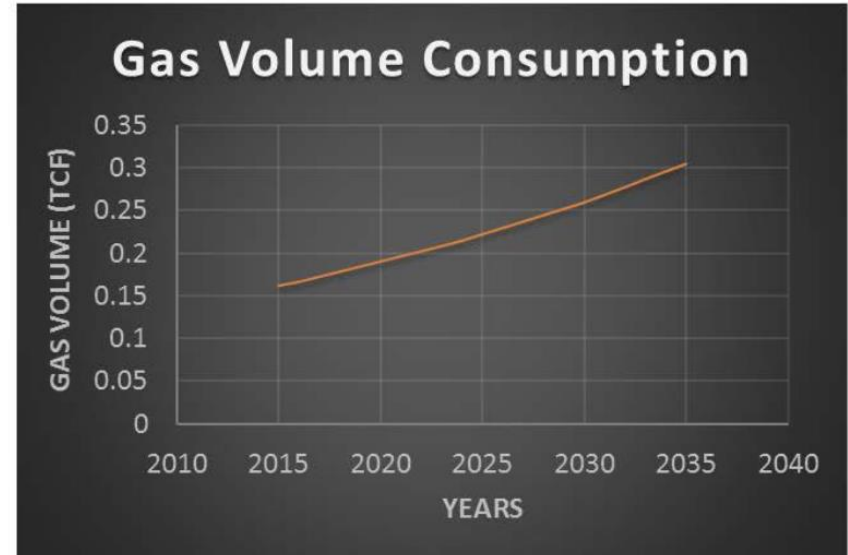
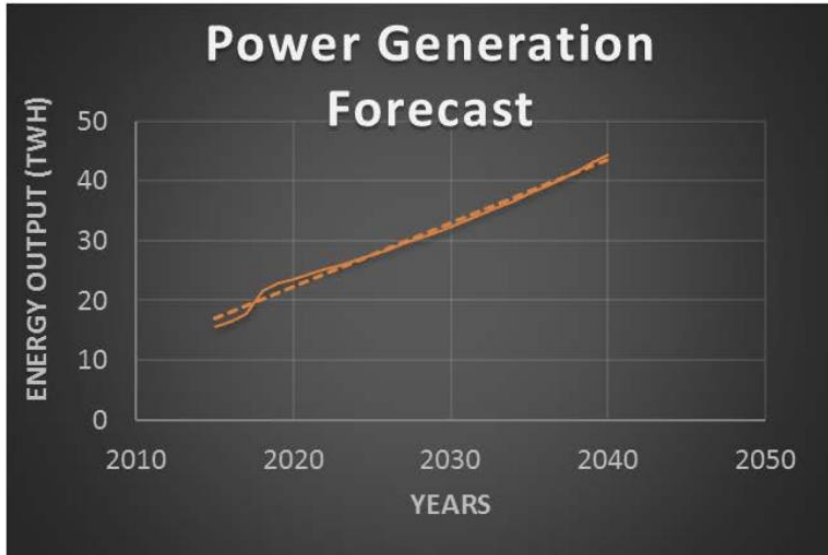
Baalbek Open Cycle PP (70 MW)

Additional plants will all have the ability to run on Natural Gas

98% of the production capacity resides on the coastline



ENERGY DEMAND IN LEBANON



Electricity Demand App. 32 TWh in 2030

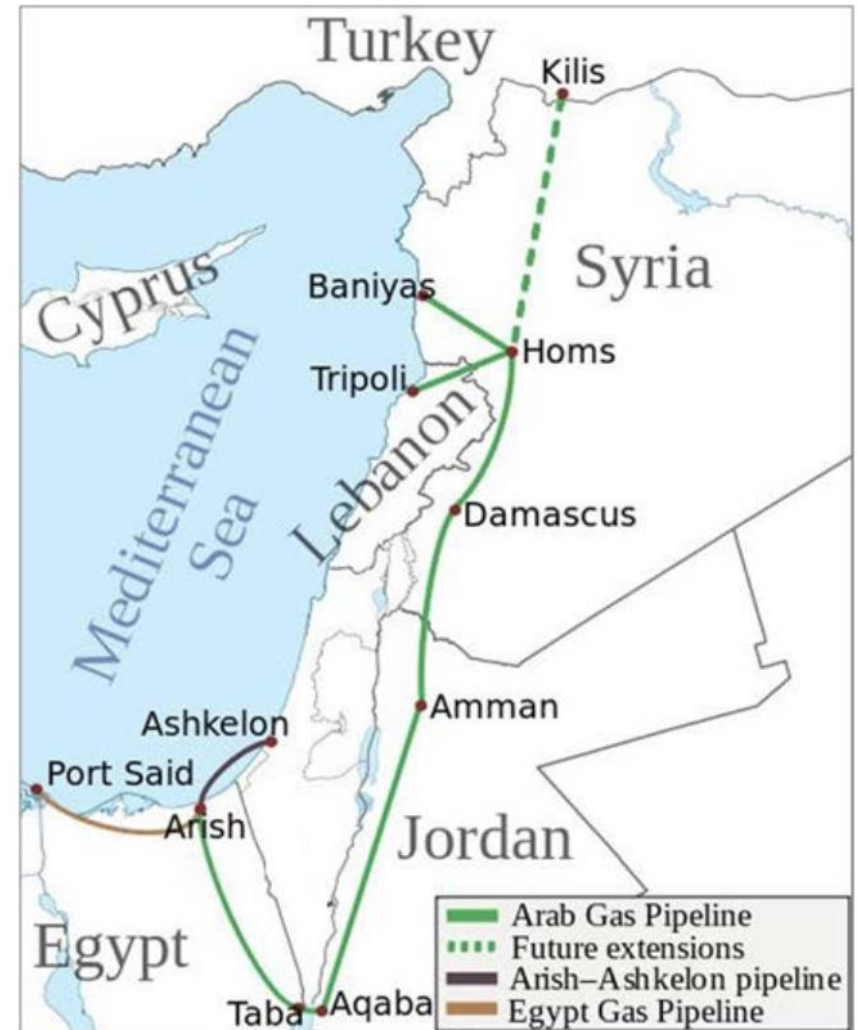


Volume of Gas Needed App. 0.26 TCF per year in 2030



REGIONAL MARKETS

- Lebanon holds friendly relations with Syria, Turkey, Cyprus, Egypt, Jordan and the EU.
- Lebanese Natural Gas can easily reach Syria, Jordan and Egypt through the Arab Gas Pipeline.
- Turkey can be reached by an extension of the Arab Gas Pipeline or through a short offshore shallow water pipeline.
- The EU markets can be reached through Turkey.
- Lebanon can tie-in to any regional collaboration passing through Cyprus.



CONCLUSIONS

- Available data and studies performed at the LPA indicated the presence of large quantities of natural gas offshore Lebanon
- Natural gas can be used in the Lebanese local market
- Export options to neighbouring countries and the EU are also likely





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