



# Gas Valorisation Project Virtual Pipeline option

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 | Entreprise Tunisienne d'Activités Pétrolières



# IGU Meeting Kota Kinabalu



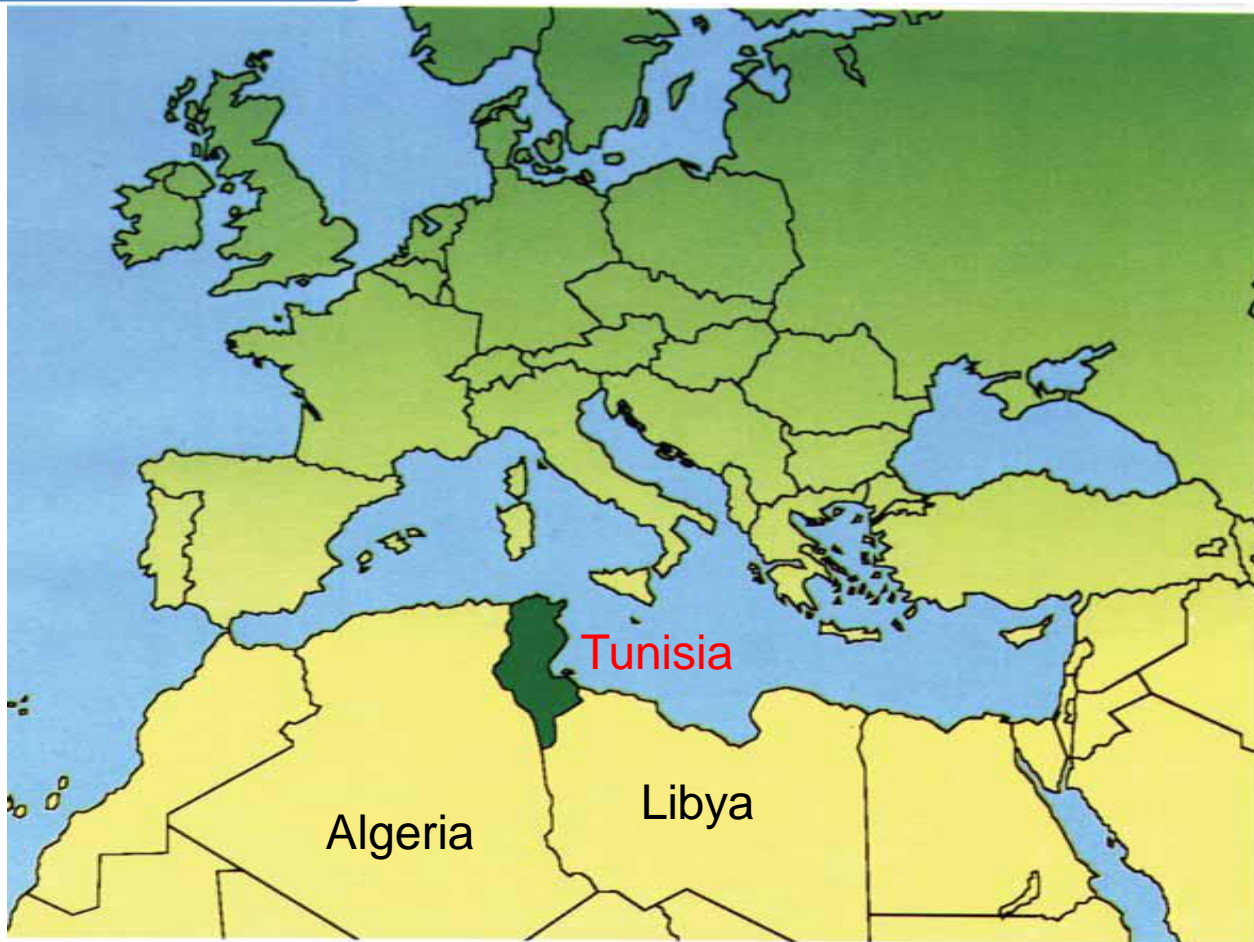
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## Topic

- About Tunisia
- Flared Associated Gas
- Virtual Pipeline
- Case Study Story: Nestlé Factory Nigeria
- BBT Case proposal

# TUNISIA

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# ETAP



- Is a state-owned industrial and commercial company Set up on 1972 with intent to manage on behalf of the Tunisian state all hydrocarbons E&P activities
  - Exploration and Production activities
  - Crude oil trading
  - Petroleum services
  - Human resources development
- ETAP reports to a Board of Directors and it is under Control of the Ministry of Industry

# Discoveries

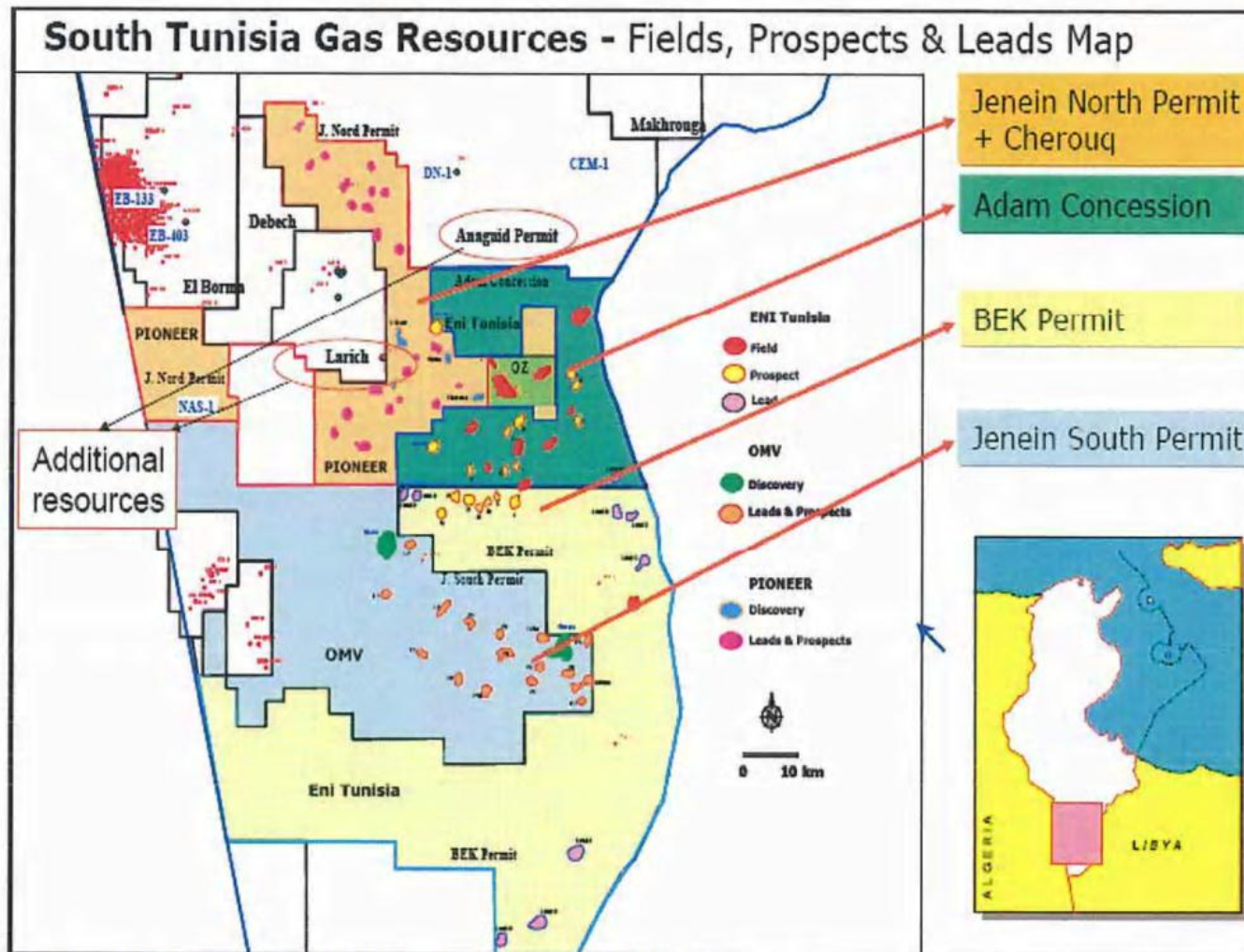


Fig. 1 – Concession and Permits in South Tunisia

# Infrastructure


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# Flared Associated Gas



The Tunisian legislation is directed to avoid the flaring of associated gases, but many flares remain for economic profitability reasons & crude oil production continuation

- Small Reserves
- Sites locations
- Lack of Infrastructure

# Actions



- Shut in the high GOR levels.
- Reduce oil production if necessary.
- Reduce gas production to free room in the gas line to associated gases.
- Implement New Projects for valorization of associated gas.
  - **Virtual pipeline**
  - Small scale DME plant (KOGAS cooperation)
  - Create new industries (small scale ciment plant)



# Virtual Pipeline



## Principe

# Virtual Pipeline



## CNG Compression



## Trucking



## Decentralized use



# Virtual Pipeline

## Compression

- Compressor
- Motor
- Inlet gas dryer
- Gas blow-down tank,
- Gas-recovery system
- 3-bank buffer system
- Priority panel
- Process gas cooler
- Oil cooler and heater
- Control panel (with PLC, HMI)
- Instrumentation
- Fire detector and gas leak detection
- Pressure relief valves
- Product filtration,



# Virtual Pipeline



## Trucking Trailers

- 1 x 4,000 scm;
- 1 x 7,000 scm



## Decentralized use

- Decompression Unit;
- Heater;
- Gas Storage



# Virtual Pipeline/Case Story

## Nestlé Nigeria

# Virtual Pipeline/Case Story



Customer:	Nestle Nigeria Plc./Food-industry
Electricity supply:	captive power solution; local grid not reliable
Fuel options:	Diesel @ ~1\$/liter next access to NG ~ 55km huge bureaucratic hurdles for pipeline
CNG supplier:	Green Fuels Ltd. provides CNG incl. logistics (trucks)

# Virtual Pipeline/Case Story



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2 x J320

2 x 1.06 MWe

CNG

commissioned Aug' 11



# Virtual Pipeline/Case Story



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CNG supply:

2 trailer on-site

1 x 4,000 scm; 1 x 7,000 scm



Consumption:

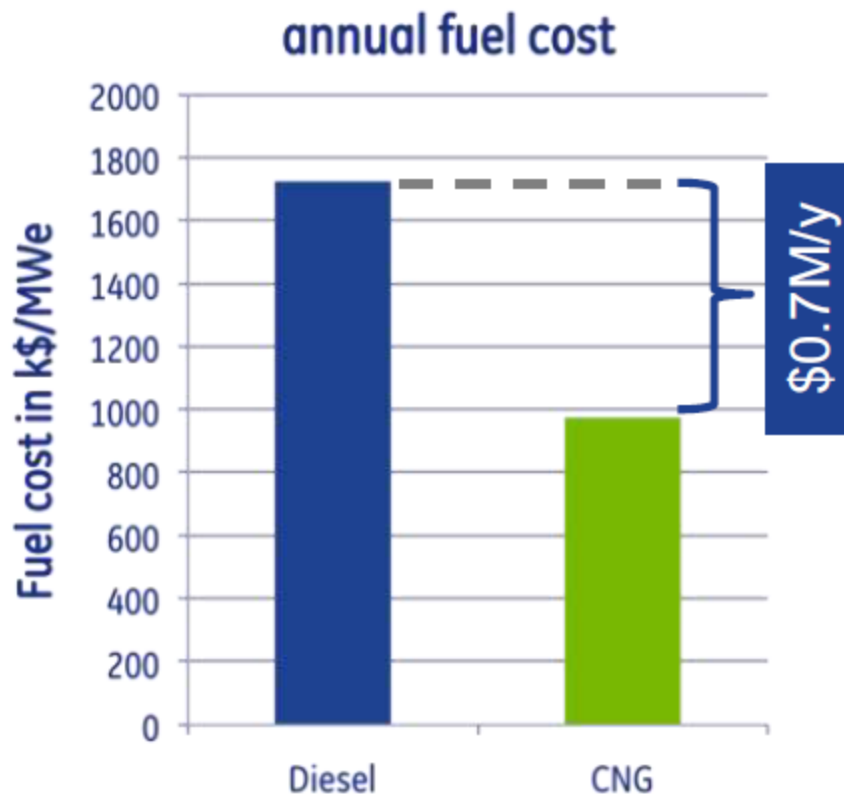
7,000 scm ~ 24 hours @ 70% load

experience:

2 years flawless operation



# Virtual Pipeline/Case Story



## Example CNG Lagos/NIG

- CNG can save up to 40% of fuel cost
- Lower emissions (NOx, particles ...)
- Lower CO<sub>2</sub> footprint

➤ Approx \$0.7Mio/y savings by CNG vs Diesel per MWe and year

# Virtual Pipeline



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## South Tunisia Bir Ben Tartar Project

# Introduction: South Tunisian Case



- Bir Ben Tartar “BBT” Concession is under development since year 2010
- 15 wells have been drilled with plans to drill an average of 6 Wells/Year
- Associated Gas rate is being produced and present rate is between 100 000 and 150 000 Nm<sup>3</sup>/day
- This important amount should be valorized in order to take advantage from this lost energy.
- A prefeasibility study has been carried out to define different valorization scenarios.

# Present conditions and perspectives

- Gas reserves doesn't justify the construction of a pipeline infrastructure.
- The concession is not far from Tataouine urban area (110 km), the solution has to consider this proximity.
- STEG (The National Electricity & Gas supplier) gas network will reach Tataouine governorate in 2 years approx.
- Power Generation onsite and injection through nearby HV lines still in the limits of profitability.

# Present conditions and perspectives

- The Virtual Pipeline option seems to satisfy all previous conditions as gas will be produced for free during the next 7-10 years.
- The solution consists on the transportation using trucks of CNG towards locations where it will be used in different possible ways.

# Project opportunities: Close gas endpoints

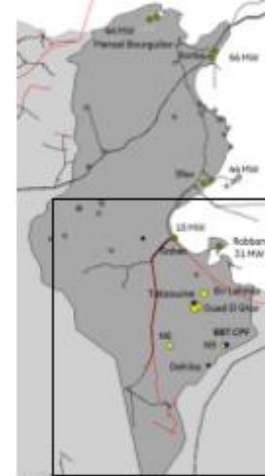
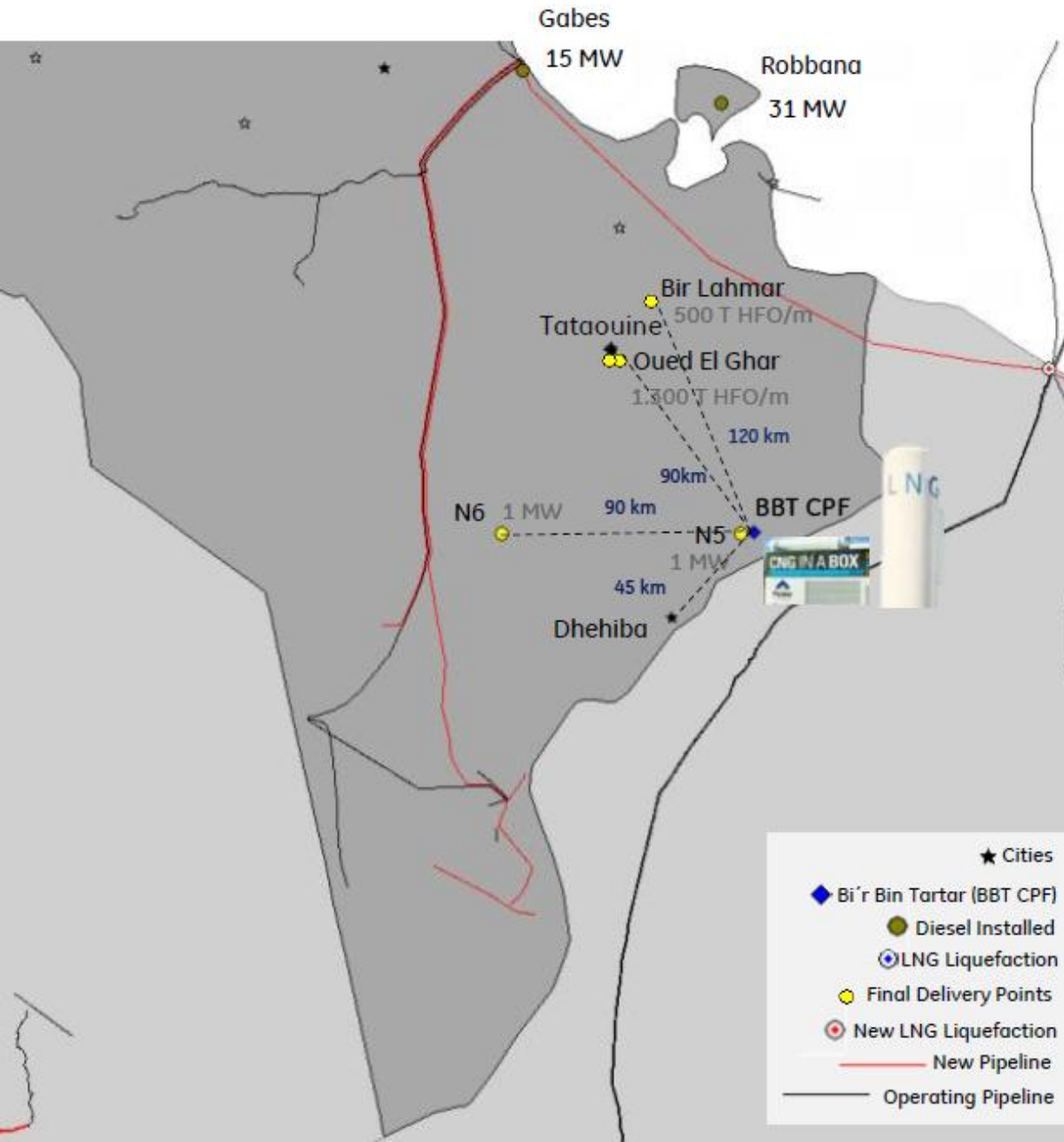
- Two Gypsum plants in Oued El Ghar, 15 km east Tataouine (80 km from BBT) consuming respectively 800 T/month and 500 T/month of Heavy Fuel. With eventual cogeneration approach and Fuel substitution.
- One Brick Factory in Bir Lahmar, 20 km North Tataouine (120 km from BBT) consuming 500 T/month of Heavy Fuel with eventual cogeneration approach for Power

# Project opportunities: Close gas endpoints



- Two points, Dhehiba and Oum Souiche (50 km from BBT) where a minimum of 1 MWe on each to be generated and injected in STEG medium voltage local grid.
- One Future (June 2014) Sodium & Potassium plant under construction situated @ Oum Khielet, 50 km from BBT with a forecasted monthly HF consumption of 400 T.

# VIRTUAL PIPELINE CNG/LNG GE Jenbacher Solution



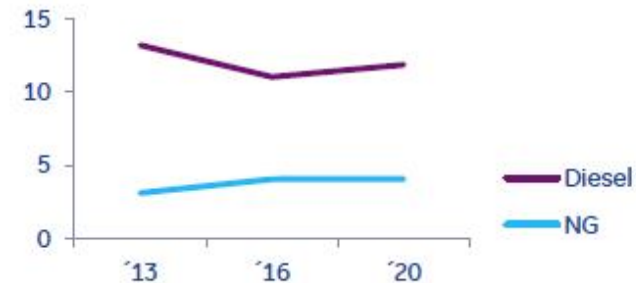
Compression of gas at BBT CPF

14 LPG trucks (ETAP)... waiting to be used

Forecast gas availability (min. 7 years)  
... 5 MMSCPD (14.000 m<sup>3</sup>/day)

One Future Plant in Beni Amir (June 2014)  
Forecasted consumption: 400 T HFO/m

Fuel Prices Northern Africa (\$US / MMBtu)



MW range: 0,3-100 MW

Pipelines: Condensate, Gas, LPG



# Compression Proposal Solution

Standardized & modular solutions



CNG In A Box™		CNG 100	.....	CNG 400
CNG production	[scfm]	208		958
potential Power generation 24/7	[MWe]	1.4		4.8

# CNG In A Box™ Performance



Model <sup>1</sup>	Min - Max HP	Suction Range (psig) <sup>2</sup>	Flow Range (scfm) <sup>2,3</sup>	GGE/Min Range
<b>CNG-100</b>	76 – 100	8 – 17	143 - 208	1.14 – 1.66
<b>CNG-125</b>	76 – 125	8 – 27	143 – 280	1.14 – 2.24
<b>CNG-150</b>	76 – 150	8 – 38	143 – 357	1.14 – 2.86
<b>CNG-200</b>	76 – 200	8 – 53	143 - 465	1.14 – 3.72
<b>CNG-250</b>	202 – 250	8 – 15	384 – 516	3.07 – 4.13
<b>CNG-400</b>	202 - 400	8 – 39	384 – 958	3.07 – 7.66

<sup>1</sup>Standard CNG models are listed here; larger and smaller power options available upon request

<sup>2</sup>Flows / suction-pressures based on 4700 psig discharge (no significant change at other outputs);  
100-200HP models can go to 4psig suction pressure; 250/400HP can go to 0psig

<sup>3</sup>Flows / powers based at 1800rpm (60hz) with SG of 0.65 and K-Value of 1.24 (@ STP)

# Trucking Proposal Solution



Based on 7,000 scm / Truck

- Ouel El Ghar :
  - 1st Gypsum plant 800 t HFO: 3-4 trucks /day
  - 2 nd Gypsum plant 500 t HFO => 2 trucks /day
- Bir Lahmar :
  - 1st Brick factory = 500 t HFO => 2 trucks /day
- Oum Khielet :
  - Future Sodum & Potassium plant = 400 t HFO => 2 trucks/days
- Dhehiba and Bir Mhira :
  - 1 MWe electrical power generation each => 1 truck/ days each site.

Total 12 trucks per days

# Budget Proposal



6 sites (4 for Industrial process + 2 for electrical power generation; respectively 2200 tons HFO/month + 2 \* 1 MWe)

- 5 modified units CNG 400 with a budget price of € 4 MM exw .
- Opex / year (maintenance ~3%) per unit (excluding driving cost) € 22.500
- Trucking cost : ~ € 10/MWH (~ € 3/MMBTU)
- Gas engines, 1 Mwe : € 1.2 MM exw per unit

# Way Forward



Taking into consideration this interesting CNG option, the following actions should be done:

- Assess closely the different industries and their needs vs Impact of the CNG project.
- Study technical feasibility and evaluate the related investment for a BBT centralized CNG project
- Prepare the execution schedule and go ahead with the project once it is proven profitable.

# Thank you for your attention

