

Natural Resources GP

Unconventional Oil and Gas:
Can the US model be applied in
North Africa?

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Contents

Introduction

The US model: What Led to the Boom?

- **Technology**
- **Environmental Issues**
- **Legal Framework**
- **Proppants**

The North African situation

- **Developments**
- **Legislation**
- **Challenges**

A proposal by Natural Resources GP

- **Best Practices**
- **Technology transfer**
- **Institutions**

Introduction

- **Unconventionals responsible for increase in estimated U.S. oil and natural gas reserves**
- **A very significant hydrocarbon production from shale in the US -- for gas now over 30%**
- **Speculation about what countries will follow and at what pace**
- **EIA/ARI: top 3 SG technically recoverable reserves: US 1,161 tcf, China 1,115, Argentina 802**
- **Algeria, Libya, Tunisia, Morocco, Mauritania, W. Sahara 557 tcf**

The US model: What Led to the Boom?

- **Government policy, private entrepreneurship [starting fm a Greek-American!], technology innovations, private land and mineral rights ownership, high natural gas prices in the 2000s, + other factors**
- **...also remember: shale basin topography mostly favorable; most SG plays [except Penn.] in areas w/ low population densities and history of conventional oil & gas devt**

The US model- Technology

Significant US lead - service companies

From TOGS '12 to today:

- **Pad drilling ['Octopus']:** Rather than drill single horizontal well at a site, now several wells from same pad: target shale play more effectively, save time, conserve money, esp. where there are multiple layers of shale over a single site
- **UniStim fracturing fluid:** less fresh water by enabling using up to 100% produced or flowback water
- **Waterless fracking:** LPG, CO₂, butane-rich mix
- **Chemical [usually acid] injected into formation, cleaning up area around well bore → more oil and gas can flow**

The US model- Environmental Issues

In August '13

- **Water: 'rivers fracturing fluids leak → deaths of aquatic species' [USGS]; groundwater → aquifer; effect of additives**
- **Air: 'no indications of public health emergency or threat' [W.Virginia]**
- **Seismicity: '>100 earthquakes in < 1 year' [Ohio]**
- **Land use, traffic, dust/noise: hiatus on new fracking projects [W.Wisconsin Aug '13]**

The US model- Legal Framework

Remember: private land and minerals ownership!

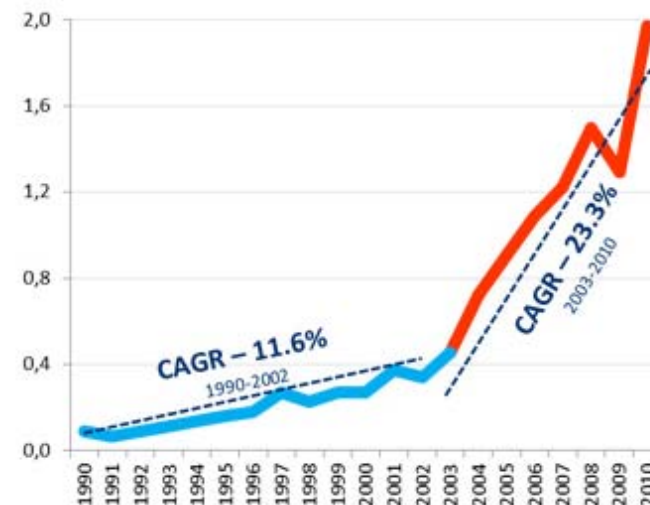
In Aug-Sept '13

- **Centralized state control vs county and local governments**
- **Local opposition stronger in states where oil & gas production is not prominent**
- **Part-time residents oppose w/ full-time landowners**
- **...but US frac sand supplier partnering w/ farmer cooperative to develop sand-unloading sites alongside group of grain elevators near Bakken; also looking at Colorado, Oklahoma**
- **Hydraulic fracturing environmental legislation: Federal, states [Wisconsin, Calif,...]**
- **Illinois HF Tax Act**
- **...but much heavier deductions from royalty checks sent to landowners [Penn.]**

The US model- Proppants

- Frac sands [FS] & ceramic, resin-coated or not to increase pack conductivity
- N.American market ~ 35m s.tons today → >45m s.tons in 2017...
- Jumbo Bin, new breed of bulk transport system: galvanised steel, 375-400 cf, to carry 'flowable' bulk cargoes incl. seeds, wood pellets, golf balls and, the company hopes, kaolin and frac sand

...out of which ceramic



The N. African situation—Developments...

N. Africa becomes an attractive area for exploring SG

- **Algeria:** ENI drilled 1st test well; Statoil & Repsol undertook geological & reservoir characterization studies
- **Egypt:** N. Africa's 2nd largest fracker -- tight gas, W. Desert, Halliburton biggest pumper; Egypt General Petroleum Company also seeking to develop SG
- **Libya:** National Oil Company examining options for exploring its unconventional oil & gas resources, incl. internally evaluating → bringing in experienced int'l cos; Talisman talks w/ Polish Oil & Gas Co for Sirte Basin unconventional resources exploration

...The N. African situation—Developments

- ***Morocco:*** > 30 IOC's signed up for exploration; plans to collect seismic data → drilling of a SG exploration well at Zag w/ San Leon Energy [Ireland] & Longreach Oil and Gas [Canada]; green light to 5 int'l cos to drill reserve estimation drivers; plans 1st pilot plant for electricity production fm oil shale
- ***Tunisia:*** Shell talks w/ Minister Lamin Chakharim on exploration of gas in Kairuan, Sousse, El Jem, Safakis, beg '13; Ghadames Basin: Cygam, Chinook; Winstar w/ state-owned ETAP to drilling deep, test well (Sabria 12) in 2013; Pelagian Basin: African Hydrocarbons and Shell announced \$150 mi exploration to target conventional reservoirs and SG/SO potential

The N. African situation—Legislation...

Hydrocarbon codes, exploration & production-sharing agreements, taxation/royalties & incentives, environmental legislation

- ***Algeria:* Feb '13 Hydrocarbons Code revision offering new incentives eg taxes on project's profitability, not turnover; tax breaks; foreign operators' access to pipelines owned/operated by Sonatrach; encourages activity related to small unconventional resources/deposits or in under-explored areas; 51:49 remains.**
- ***Morocco:* ONHYM to develop a specific code for oil shale; resistance of insurance companies over foreign workers**

...The N. African situation—Legislation

- ***Libya:*** ‘to modify 1955 Petroleum Law & regulations to adopt and to allow for SG exploration and exploitation at attractive contractual & fiscal terms’
- ***Egypt:*** working on terms/conditions of SG fields operation ‘because the current conditions do not encourage investors to explore unconventional resources’
- ***Tunisia:*** working on Hydrocarbons Code reforms; SG/SO?

The N. African situation-Challenges

- **Absence of good data**
- **Water scarcity, protection & management, impact on supplies**
- **Technology: need for strong oil-services sector**
- **Infrastructure/Logistics: many more rigs than conventional activity [are there enough available?]; onerous import regime could impede shipping-in necessary extra equipment; promising SG resources often lie far from trunk pipelines**
- **Political and civil situation**
- **→Higher extraction cost**
- **Marketing**

The proposal by Natural Resources GP...

Technology - best practices

- **Learn from the applicable part of the US experience**
- **Road infrastructure**
- **Drilling intensity - large # of rigs simultaneously working a concentrated area**
- **Underground injection wells for waste water disposal**
- **Waterless fracking**
- **R&D: Simply transfer fm DOE tight gas & coalbed methane programs; the Seismic Technology Program; the Drilling, Completion, and Stimulation Program. Also NRC & National Energy Technology Laboratory**

...The proposal by Natural Resources GP

Legal, fiscal and institutional...

- **Again, learn from the applicable part of the US experience**
- **Fiscal policies, such as tax credits, offered firms some incentives to drill SG**
- **If unable to lease land & mineral rights across large areas early, at a low price, then incentivize neighbors**
- **Cooperation between different agencies**
- **Regional and international cooperation to mitigate tensions caused fm increasing demand & dwindling water supply and secure water resources for future generations...FAO Water Scarcity Initiative in the Near East and North Africa (NENA) region**
- **S. Africa reviewing its water regulations to guard against damage fm SG exploration/extraction; SG extraction a 'controlled activity' needing water license only issued once effect on ground water taken into account**

Conclusions

‘All of the above’ plus:

- **Develop national expertise**
- **Adequate training:** thorough technology transfer, following API best practices and standards (600 for the Oil and Gas Industry, 112 for fracking) proper oversight, and taking no short cuts
- **Policy coordination possibly under a common umbrella – Natural Resources GP will be glad to participate**

Thank you

- and see you again at 'The South-Eastern European Conference on Shale Oil and Gas', in Athens, 2014

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