



# Application of UNFC

A Case Study: Matured Reservoir in Kuwait

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Webinar on Application of UNFC to Petroleum Total Resource Management: Status and Outlook, 29 July 2020



## ■ Motivation

The novelty of this study is the first known application of the UNFC approach to a petroleum reservoir of the Middle East.

- Kuwait Oil Company recently participating in UNFC forums.
- A pilot study was undertaken to understand the applicability of UNFC classification for classifying hydrocarbon reserves and resources in NOC environment.
- For pilot purposes, conventional matured reservoir with sufficient production history has been selected. In addition, enhanced learning experience from Mexico Pilot study provided very useful tools.
- In this study, an attempt has been made to capture all aspects of resource classification including subcategories of UNFC system to classify the areas and projects in a pilot reservoir.

# Methodology

Geologic, development, economic, & socio-environmental factors were evaluated



UNEP

## ■ In-place estimates:

- Reservoir is penetrated by significant number of wells
- Reservoir boundaries and properties are well defined.
- Reservoir has an observed oil-water contact seen in multiple wells
- Static geologic model fully understood
- In-place volumes were estimated to be 90% certainty

## ■ Recoverable Reserve estimates:

- Significant production performance history is available.
- Performance & analytical methods used to estimate producing recoveries
- Matured development plan
- Pilot planned for EOR application
- Ranges of estimate for G1, G2, & G3

## ■ Development plans:

- All projects are in advance stage of execution
- Development drilling is continuously undertaken
- Infill drilling undergoing for sustained production and maintain decline
- Pressure maintenance project bringing good results

## ■ Economics:

- All the opportunities identified are economically attractive using internal economic model and benchmarking
- Techno-Economic analysis performed on EOR projects

## ■ Socio-environmental factors:

- Impact of operations in immediate field area and regionally were evaluated
- Desert Location, no population.

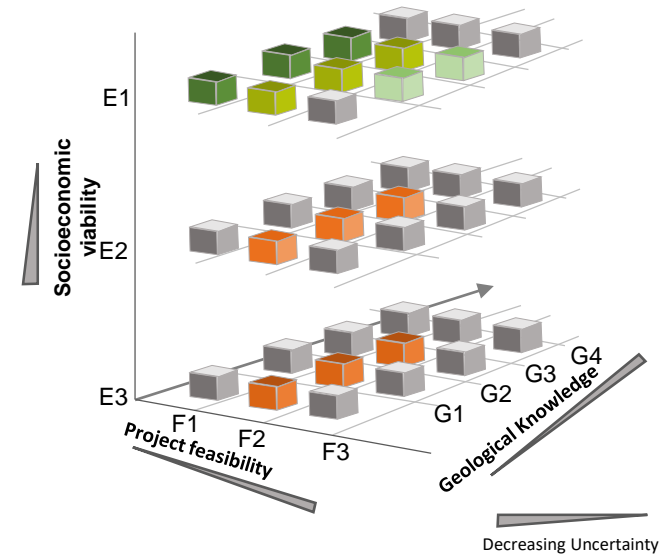
# Results

Example for UNFC estimated oil recovery of mature oil reservoir in Kuwait



## ■ Categorization of Reserves

Discovered	Reserves		On Production	211
			Approved for Development	15
			Justified for Development	121
	Contingent Resources		Development Pending	0
			Development On Hold	0
			Development Unclassified	291
			Development Not Viable	3
Unrecoverable		Discovered Unrecoverable	389	
Undiscovered	Prospective Resources		Prospect	0
			Lead	0
			Play	0
	Unrecoverable		Undiscovered Unrecoverable	0
Special Cases			Defined but Not Classified in PRMS	0
			Less Common Mappings	0
TOTAL (MMSTB)				1,030



	G1	G1+G2	G1+C2+G3	Remark
E1.1, F1.1	121	183	211	Commercial, On Production
E1.1, F1.2	13	15	15	Commercial, Approved for Development
E1.1, F1.3	-	100	121	Commercial, Justified for Development
<b>Total E1,F1</b>	<b>134</b>	<b>298</b>	<b>347</b>	
E2.1, F2.2	44	88	291	Potentially Commercial, Unclassified Development (EOR Projects)
<b>Total E2,F2</b>	<b>44</b>	<b>88</b>	<b>291</b>	
E3.3, F2.3	1	2	3	Non-Commercial, Development Not Viable (Sub-Marginal, Uneconomic projects)
<b>Total E3,F2</b>	<b>1</b>	<b>2</b>	<b>3</b>	
<b>Total</b>	<b>179</b>	<b>388</b>	<b>641</b>	
	<b>G4.1</b>	<b>G4.1+G4.2</b>	<b>G4.1+G4.2+G4.3</b>	
E, F	-	-	-	Prospective Undiscovered

\* In-place and recoverable volumes are indicative numbers and do not represent any true value due to confidentiality of such data

UNFC 3-D categories representation of estimated oil recovery for mature oil reservoir in Kuwait



## Conclusion and Observation

From Pilot study, following has been observed:

- ✓ UNFC methodology can be applied to Oil industry with visualization of status.
  - ✓ UNFC and PRMS are project based, KOC follow opportunity based projects.
  - ✓ Mapping of UNFC provides a level of granularity regarding project maturity considering all aspects of requirements (HSE, Environmental impact, etc.).
  - ✓ Pilots results shows more understanding of commerciality of future projects and progression.
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- UNFC can be applied to Oil field projects to identify all aspects especially impact on environment, socio-economic requirements.
  - KOC plans for offshore drilling which would require more data from different aspects and UNFC model can help in understanding.
  - Continuous collaborative use of UNFC will benefit Oil industry toward understanding applicability for other resources (solar energy, geothermal, unconventional, etc.)

# Thank you

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