

NARGAN-AMITIS
Energy Development

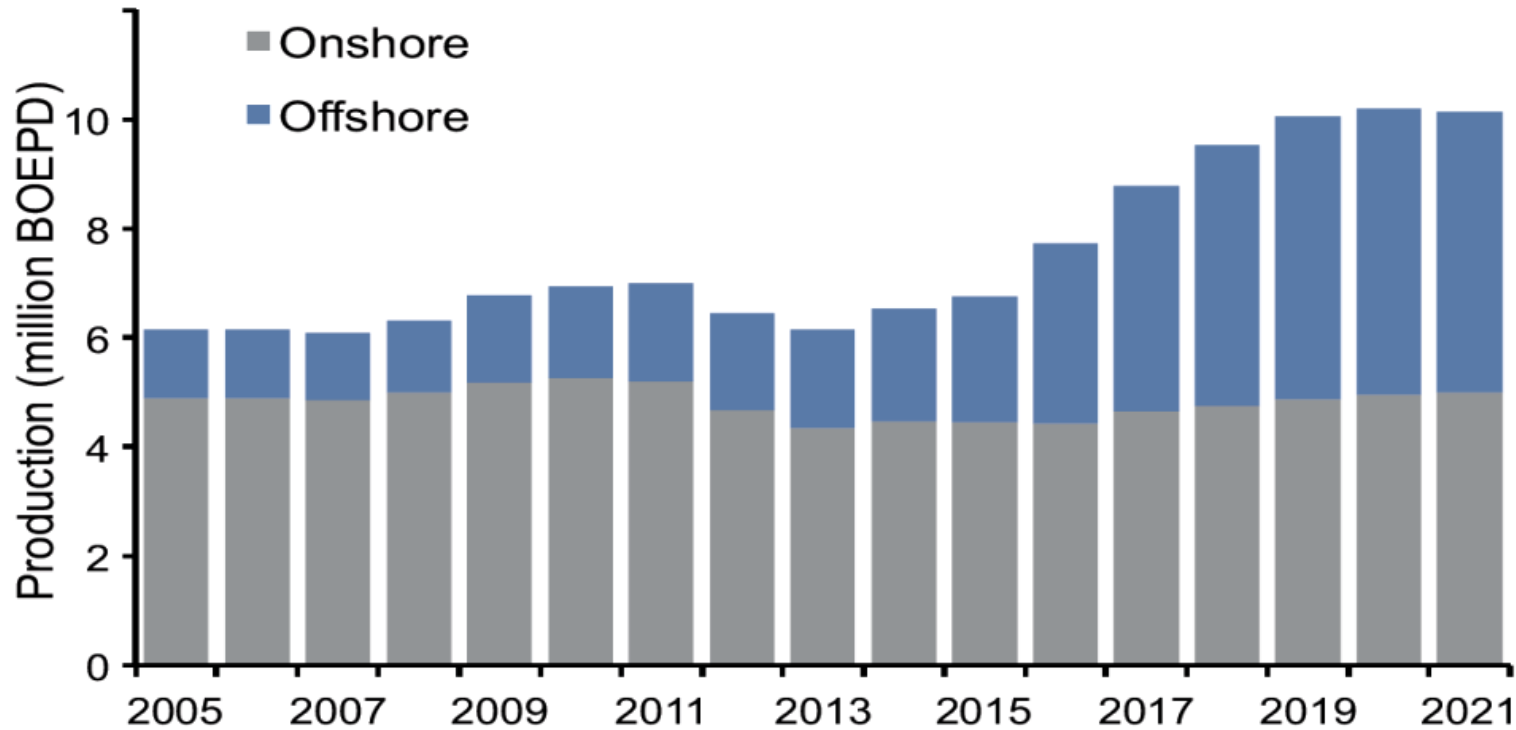
Iran E&P 2018

INSIGHT TO EOR/IOR

OPPORTUNITIES & CHALLENGES

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IRAN HYDROCARBON PRODUCTION FORECAST 2005-2021



Source: Douglas-Westwood's Iran Oil & Gas Market Forecast 2015–2019.

Increased Production,
mostly from offshore

- ⇒ How this can be achieved?
- ⇒ How much is the contribution of IOR/EOR?

CURRENT STATUS OF GAS & WATER INJECTION INTO IRANIAN OIL FIELDS (2014)

Oil Field	Gas (MMm ³ /Day)
Haftkel (Gas Inj)	0.25
Rag Sefid (Gas Inj)	0.02
Marun (Gas Inj)	15.12
Gachsaran (Gas Inj)	15.31
Bibi Hakimeh (Gas Inj)	3.78
Koupal (Gas Inj)	2.01
Karanj (Gas Inj)	5.61
Ramshir (Gas Inj)	0.13
Parsi (Gas Inj)	2.12
Pazanan (Gas Inj)	5.10
Nargesi (Gas Inj)	0.11
Darquein (Gas Inj)	6.2
IOOC fields (Water Inj)	295.9

- ⇒ Except one field, water/gas have been injected mostly for pressure maintenance
- ⇒ Less than required volume is injected
- ⇒ Incomplete subsurface understanding
- ⇒ Not a clear EOR ambition and strategy

PROPOSED STRATEGY FOR INCREASING OIL RECOVERY

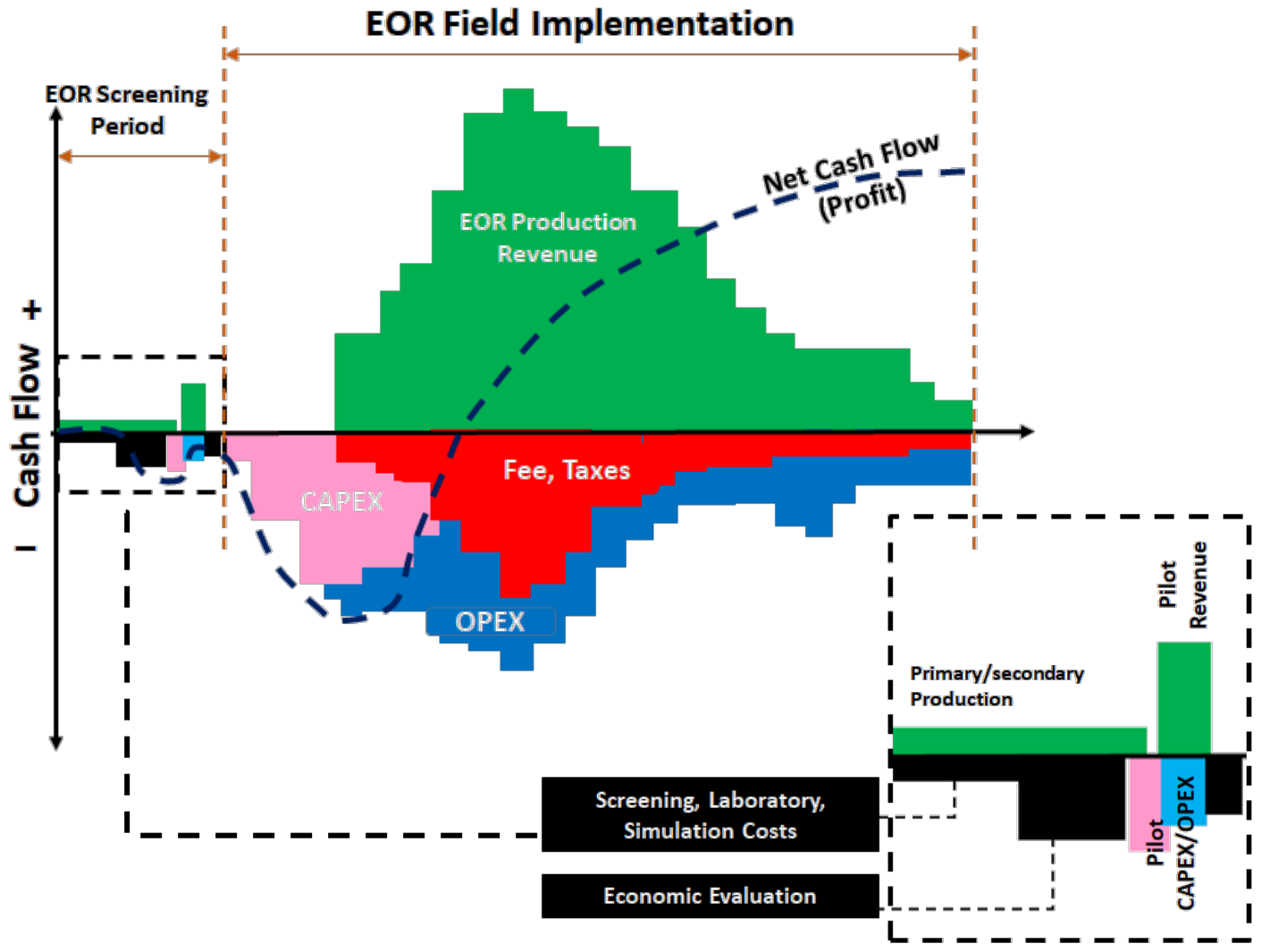
Low Risk- Low CAPEX and Fast Response Increased Oil Recovery Methods Well and Process

- ⇒ Near-wellbore management | removal of near-wellbore damage
- ⇒ Prevention of organic and inorganic solid deposition in the near-wellbore/completion/pipeline
- ⇒ Well integrity
- ⇒ Smart completion
- ⇒ Production system debottlenecking (i.e. MMO)

High Risk- High CAPEX and Late Response Enhanced Oil Recovery Methods Integrated Surface and Subsurface

- ⇒ Empowering current water/gas injection projects (i.e. increased capacity, and facility design and construction)
- ⇒ EOR project implementation | changing reservoir rock and fluid properties

EOR PROJECTS ARE CHALLENGING



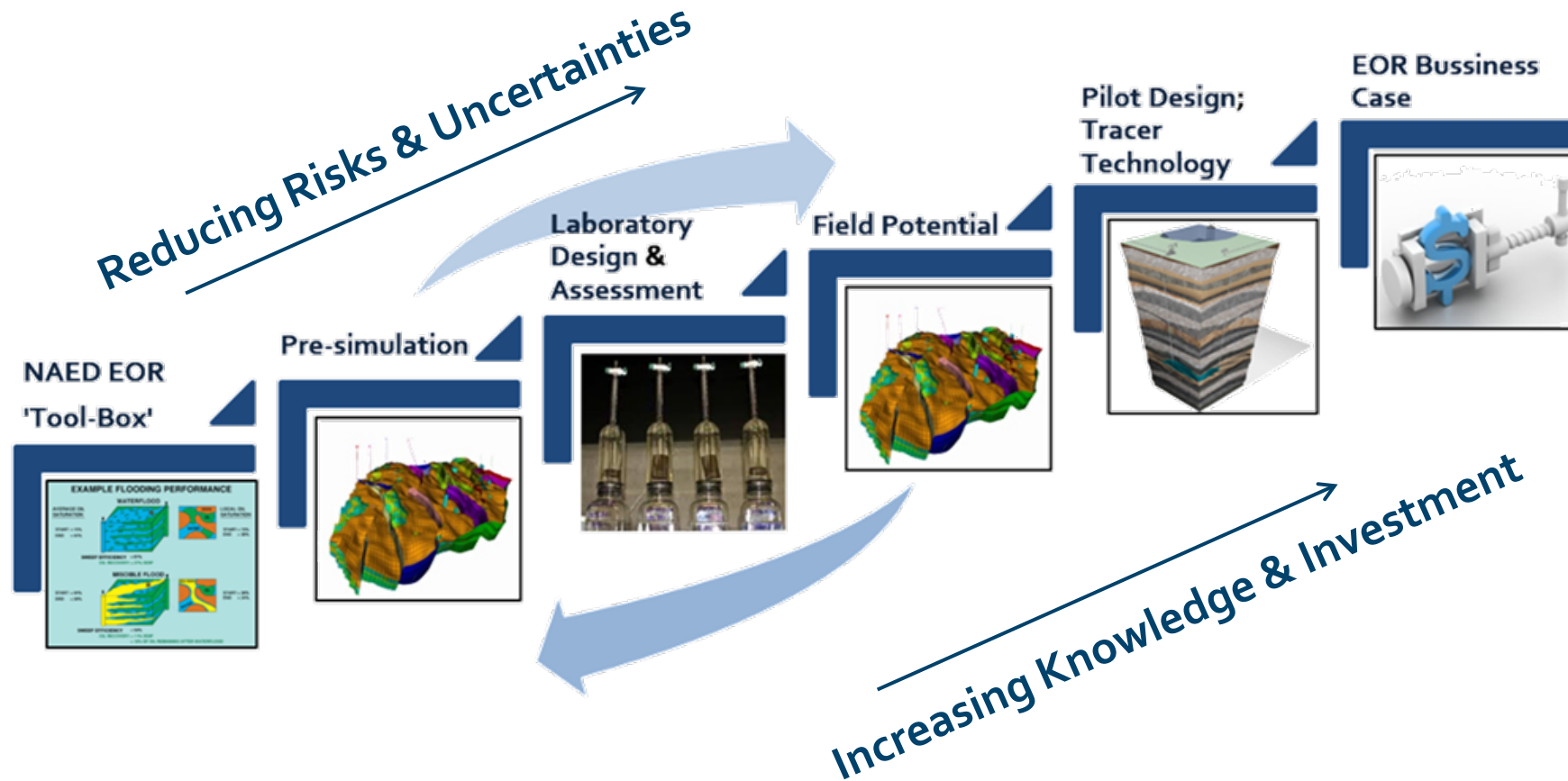
⇒ Time-line of EOR projects before positive net cash flow may take up to 10 years (early investment).

⇒ **Risks** associated with EOR projects have to be identified/managed.

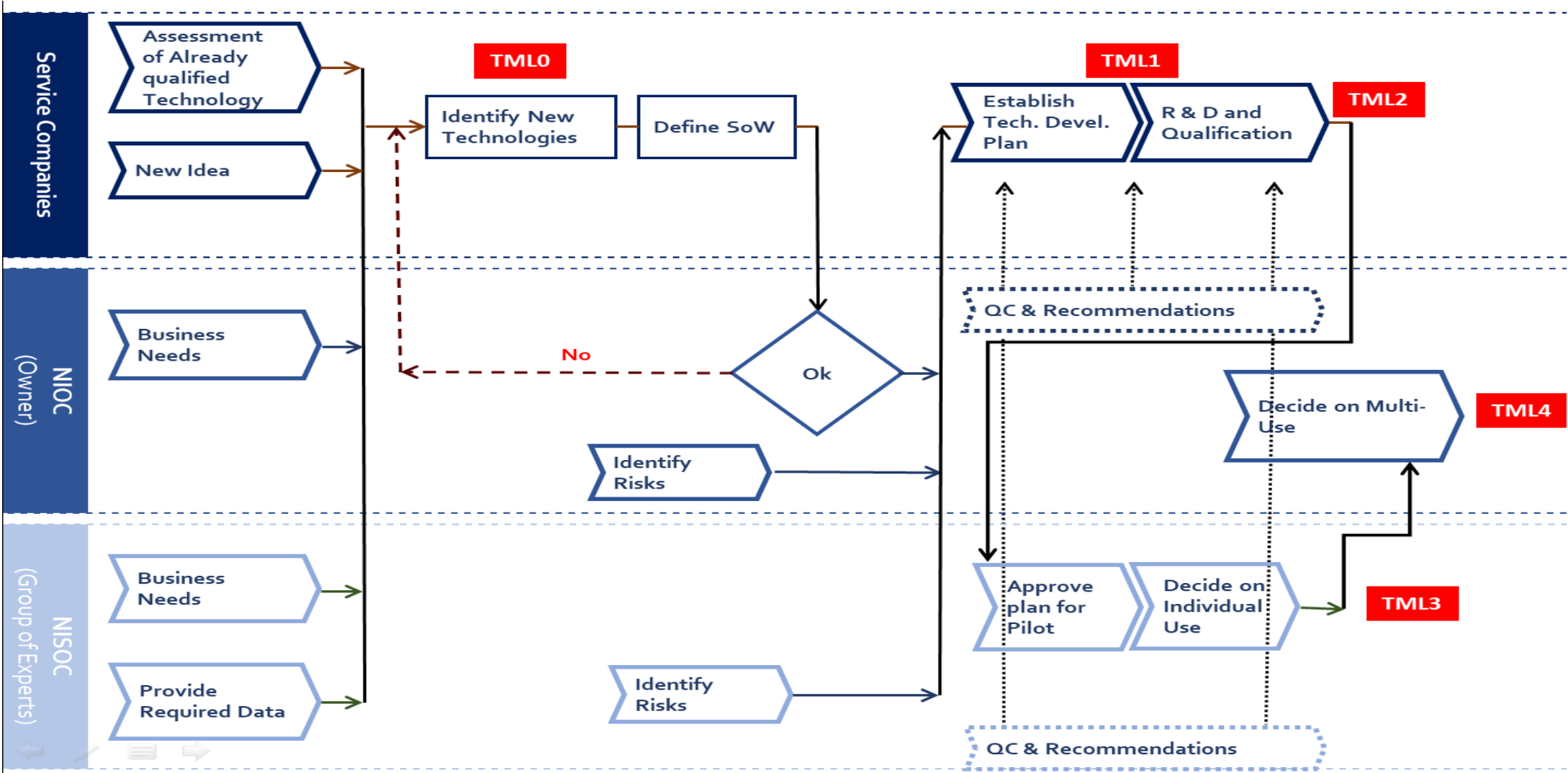
– If one fails, no additional recovery can be obtained

⇒ Each activity has to take place in a well synchronized manner for incremental oil to be realized at the surface.

EOR SCREENING IN A STEP-BY-STEP APPROACH; REDUCING COMPLEXITY & RISK



CORPORATE TECHNOLOGY DEVELOPMENT AND IMPLEMENTATION PORTFOLIO



EOR/IOR CONGRESS COMMITTEE

Goals:

- ⇒ Identify EOR/IOR projects implementation challenges in Iran
- ⇒ Define the pre-requirements for EOR/IOR projects
- ⇒ Help NIOC to define a clear ambition and road-map for increasing oil recovery

Timeline:

- ⇒ One year until the EOR Congress 2019

WE HAVE HAD TWO WORKGROUPS:

- ⇒ January 24, 2018 | 29 attendees from 16 Companies
- ⇒ February 26, 2018 | 23 attendees from 18 Companies

Attendees are from:

- ⇒ NIOC, NISOC, IOOC, ICOFC, NIOCEXP, POGC, PPARS, IOEC, EOR Research Center, NAED, GHADIREP, MAPSA, PEDC, PERSIA, TEC, KPE, KEPS, WSI, GPT, REA

IDENTIFIED EOR/IOR CHALLENGES CATEGORIES

1 Strategic Management

2 Legal & Contracts

3 Financing & Financial Aspects

4 Project Management

5 Technical Aspects

1 Strategic Management

- ⇒ Lack of appreciate **production policy, EOR road-map** as well as **increasing oil recovery ambition**
- ⇒ Not a clear strategy in NIOC for **technology development based on Iranian fields' requirements** and assuring of using local content
- ⇒ **Local companies capabilities** for field implementation of EOR/IOR and using international potentials and experiences
- ⇒ **Lack of risk analysis** procedure for EOR projects and ambiguities on risk takers and responsible persons
- ⇒ Project conception methodology and **improving tendering procedures** in state organizations
- ⇒ Investigation and evaluation of **EOR/IOR infrastructures**
- ⇒ **Development of Human Resource** and defining research oriented projects based on Iranian fields' requirements
- ⇒ **Inappropriate use of engineering and consultancy** services by NIOC in EOR/IOR projects

2 Legal & Contracts

⇒ EOR/IOR projects' **business models & contracts** (Study, Pilot, Full Field)

3 Financing & Financial Aspects

⇒ **Financing methods** (Pilot, Full Field)

⇒ **High CAPEX** and technical complications of upgrading and improving topside and surface facilities

4 Project Management

- ⇒ Piloting; Scopes and Success Criteria, Approaches and Necessities
- ⇒ EOR Full Field Implementation

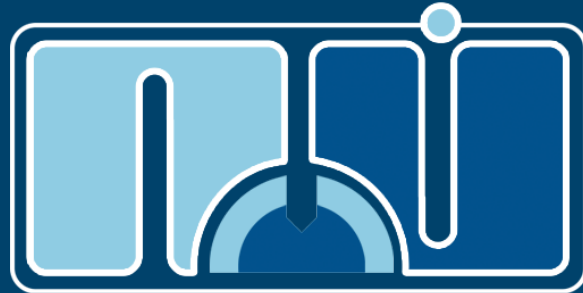
5 Technical Aspects

- ⇒ Incomplete **subsurface understanding**
- ⇒ **Integration of MDP preparation and EOR/IOR** studies from field development commencement and updating studies in field life cycle
- ⇒ Investigation of **low risk and fast response methods** (Well Based Methods and Surface Facilities Upgrading)
- ⇒ Laboratorial **experiments and study phases** of IOR/EOR implementation
- ⇒ Investigation of **environmental effects**

HIGHLIGHTS

- ⇒ Low risk, low CAPEX and fast response increased recovery methods to be considered in parallel to risky, expensive and time consuming EOR projects

- ⇒ Challenges of Implementation of EOR projects in Iran
 - ⇒ Incomplete subsurface understanding | Poor reservoir monitoring and surveillance
 - ⇒ Not optimized well locations
 - ⇒ High cost of building EOR facilities or redevelopment of existing brownfields
 - ⇒ High cost of EOR fluids
 - ⇒ Concern over EOR economy
 - ⇒ Technology needs
 - ⇒ Limited technical and managerial expertise
 - ⇒ Not a clear ambition and strategy



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