Reservoir Management

Introduction

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Curriculum vitae

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- Research interests:
  - Coal geology
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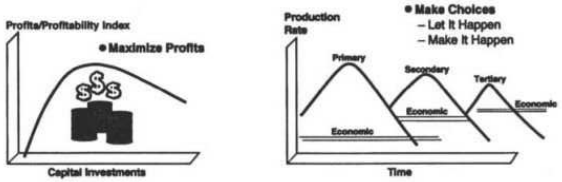
Introduction

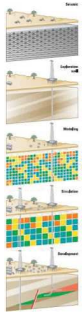
- Reservoir management definition
- Reservoir management process
- Case studies

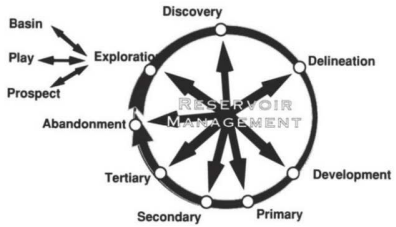
Mostly summarized from:
Satter and Thakur, 1994: Integrated Petroleum Reservoir Management

What is reservoir management



Reservoir life process





Reservoir management philosophies

1. When should reservoir management start?
2. What, how, and when to collect data?
3. What kinds of questions should be asked if we want to ensure the right answer in the process of reservoir management?
   - What does the answer mean?
   - Does the answer fit all the facts; why or why not?
   - Are there other possible interpretations of the data?
   - Were the assumptions reasonable?
   - Are the data reliable?
   - Are additional data necessary?
   - Has there been an adequate geological study?
   - Has the reservoir been adequately defined?

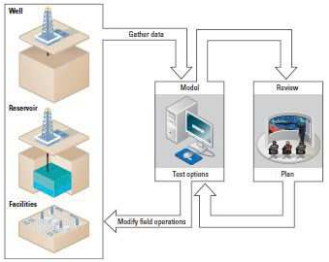
What is reservoir management

- The judicious use of various means available to a businessman in order to maximize his benefits (profits) from a reservoir
- The utilization of available resources (i.e., human, technological and financial) to maximize profits/profitability index from a reservoir by optimizing recovery while minimizing capital investments and operating expenses
- Making certain choices: Let it happen or make it happen !!
- The basic purpose of reservoir management is to control operations to obtain the maximum possible economic recovery from a reservoir based on facts, information, and knowledge.

Schedule

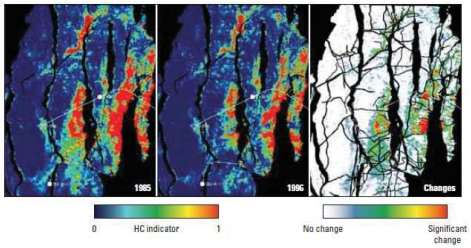
- Introduction (20/2)
- Group presentation (27/2)
- Unconventional (CBM) Reservoir Management (6/3)
- Unconventional (CBM) Reservoir Management (13/3)
- Unconventional (Shale gas) Reservoir Management (20/3)
- Unconventional (Oil shale) Reservoir Management (31/3)
- Unconventional (Methane hydrate) Reservoir Management (2/4)

Reservoir management

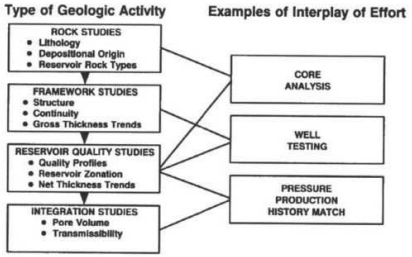


"After careful consideration of all 437 charts, graphs, and metrics,
I've decided to throw up my hands, hit the liquor store,
and get snockered. Who's with me?!"

Time-lapse monitoring



Geological, Reservoir and Engineering Activities



Three principal of engineering system

- Creation and operation of wells
- Surface processing of the fluids
- Fluids and their behavior within the reservoir

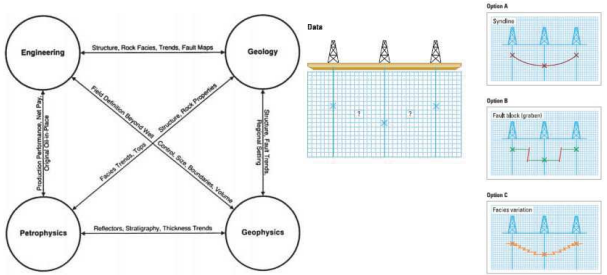
We could do well in studying the fluids and their interaction with rock (i.e., reservoir engineering), but if the proper well and/or surface system design is not considered, then recovery of oil and/or gas will not be optimized

Reservoir management = reservoir engineering?

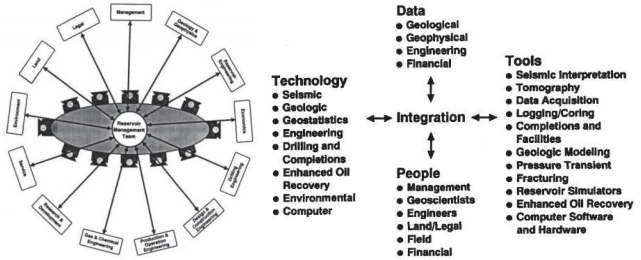
- Stage 1 (Before 1970)
  - reservoir engineering was considered the most important technical item in the management of reservoirs
- Stage 2 (Period 1970s and 1980s)
  - Synergism between geology and reservoir engineering became very popular and proved to be quite beneficial
- Stage 3 (Current situation)
  - Reservoir management is not synonymous with reservoir engineering and/or reservoir geology.
  - Success requires multidisciplinary, integrated team efforts.
  - The players are everybody who has anything to do with the reservoir

Reservoir Management Process

Interaction of Different Disciplines



Reservoir Management

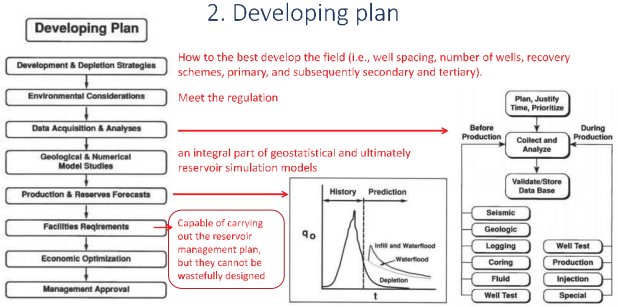


4. Monitoring

Data acquisition and management

- oil, water and gas production,
- gas and water injection,
- static and flowing bottom hole pressures,
- production and injection tests,
- injection and production profiles.

2. Developing plan



1. Setting Goal

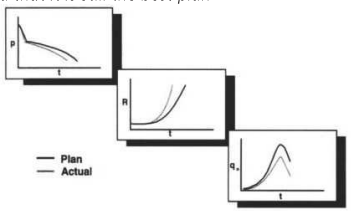
A. Reservoir characteristics
   - ✓geology, rock and fluid properties, fluid flow and recovery mechanisms, drilling and well completions, and past production performance

B. Total environment
   - ✓Corporate-goal, financial strength, culture, and attitude.
   - ✓Economic-business climate, oil/gas price, inflation, capital, and personnel availability.
   - ✓Social-conservation, safety, and environmental regulations.

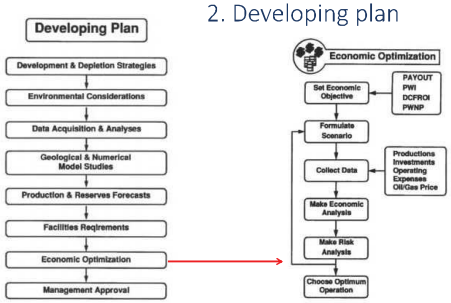
C. Available technology

5. Evaluation

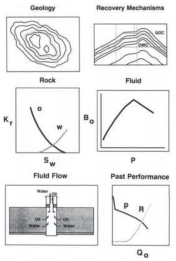
The plan must be reviewed periodically to ensure that it is being followed, that it is working, and that it is still the best plan



2. Developing plan



1. A. Reservoir knowledge



6. Revising

when the reservoir performance does not conform to the management plan or when conditions change

1. is it working ?
2. what needs to be done to make it work ?
3. what would work better ?
4. etc

3. Implementation

Start with a plan of action, involving all functions.

- Flexible plan.
- Management support.
- Commitment of field personnel.
- Periodic review meetings

Reasons for failure:

- Lack of overall knowledge of the project on the part of all team members,
- Failure to interact and coordinate the various functional groups, and
- Delay in initiating the management process.

1. C. Technology

Geophysics	Geology	Production Engineering	Reservoir Engineering
2D Seismic	Core Description	Economics	Portfolio Management
3D Seismic	Thin Sections	Data Acquisition & Management	Log Analysis
Cross-Hole Tomography	Microscopes	Well Stimulation	Transient Well Tests
Vertical Seismic Profile	Image Analysis	Pipeflow Simulation	Conventional Core Analysis
Multicomponent Seismic	X-Ray	Wellbore Simulation	CT Scan, NMR Fluid Analysis
Shear Wave Logging	Stable Isotope Analysis	Nodal Analysis	Decline Curve Analysis
	Depositional Models		Material Balance
	Diagenetic Models		Waterflood
	Maps, Cross-Sections		Streamtube Models
	Remote Sensing		Reservoir Simulation
			Geostatistics
			EOR Screening
			EOR Technology
			Expert Systems
			Neural Networks

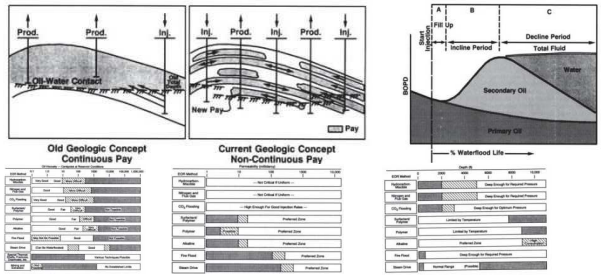
End

Reasons for Failure of Reservoir Management Programs

- Unintegrated System
- Starting Too Late
- Lack of Maintenance

Reservoir management approach

Case studies



Case studies: Group presentation

- Enhanced oil/gas recovery : steam flooding, water/gas injection, chemical flooding, etc
- Geological model re-interpretation→ reservoir modelling
- Surface facilities