

Reservoir Revitalization: Key Questions to Address*

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Search and Discovery Article #70202 (2015)**

Posted December 14, 2015

*Adapted from oral presentation given at AAPG Geoscience Technology Workshop, “Revitalizing Reservoirs-Rocky Mountains, Mid-Continent, Canada, International Focus, Golden, Colorado, August 11-12, 2015

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Abstract

This presentation presents a framework for further analysis and discussion of the best approaches for revitalizing reservoirs. With the recent surge in new techniques and technology, as well as new plays put into production, a tremendous opportunity exists in both U.S. and international reservoirs to apply lessons learned to existing reservoirs in order to economically increase production and recoverable reserves.

Identifying Good Candidates

The first step is to identify good candidates for reservoir revitalization. Not only is it necessary to have recoverable reserves, doing so must be economic. Now that the price of new technologies has begun to normalize, revitalization projects that may not have been considered viable or economic can now make sense.

- Mature Fields
- Shale plays with steep decline rates in the laterals

Refracturing

- Understimulated potential between layers
- Horizontals drilled but not completed

Bringing together teams: Geology, engineering, petrophysics and geophysics matter. While it is common to use multi-disciplinary teams for exploratory efforts, revitalization of mature fields has often been left to reservoir engineers. In order to make the most of a reservoir, it is important to pull in the entire team, and also to see which new technologies can be adapted for use in reservoir optimization.

Question 1: What do we do about reservoirs that have lost their drive? How can geologists and geophysicists contribute?

- Mature fields: types of flooding to restore pressure
- CO2 floods
- Waterfloods: how/why geology matters
- Shale Plays
- Do they decline because they have lost their drive?
- Precisely why do shale reservoirs decline?
- What do we know about fractures, proppants, interference?

Question 2: What are the best ways to recover oil within an old field?

- Infill drilling: where and why do we drill?
- Depositional environment / understanding the geology
- Geochemistry: what can it tell us?
- Geomechanics: Drive / migration pathways
- Structure: Faults / fracture networks
- Horizontal drilling: where? when?
- Examples of horizontal drilling in a “conventional” play
- What are some of the key hazards?
- Water?
- Heterogeneity?
- Formation damage?
- Drive / low pressure?
- Synchronous information gathering

What do I need? When does it help?

- Smart Drilling / Geosteering
- Mudlogging?
- XRF?
- XRT?
- Logging while drilling; what is the state of the art right now?

Question 3: I've drilled but not completed a horizontal well. I wanted to get a better price on my completion. Is that all I need to think about?

- Completing horizontals
- Geological vs. Geometrical fracs
- Selecting proppants
- Developing a reservoir model using logs, geochemistry, geology

Question 4: What is the information I need to revitalize a reservoir? How do I develop workflows and put together teams?

- Solutions on a shoestring budget
- Larger fields / moderate budgets
- "If we could have it all" budgets / workflows

The background image shows an industrial oil field under a cloudy sky. In the center, a pumpjack is visible. To the left, there is a large stack of hay bales covered with a grey tarp. To the right, there is a large white cylindrical water tank and another structure partially covered with a blue tarp. The foreground is a gravel area with a wire fence.

Reservoir Revitalization: Key Questions to Address

Susan Smith Nash, Ph.D.

AAPG



SEANBURY INVESTMENTS, L.L.C.
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CLEVELAND COUNTY, OK

THIS UNIT STARTS
AUTOMATICALLY

**Won't get
fooled
again**

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(405) 364-1950

SMITH # 1

SECTION 21-9N-3W

CLEVELAND COUNTY, OK.

I have a big problem, Graham.
Check out the new pumping unit.

Looks good!





SEANBURY INVESTMENTS, L.L.C.
SECTION 91-104-30
CLEVELAND COUNTY, OK

THIS UNIT STARTS
AUTOMATICALLY

Yes. It looks good.

But, it is horrible.
It is not working!

What happened?



I got fooled again! I thought I got a great deal on a refurbished pumping unit, and it was a great deal. But it was too small, and it is not able to pump off all the water.

How did you decide on that pumping unit and not another?

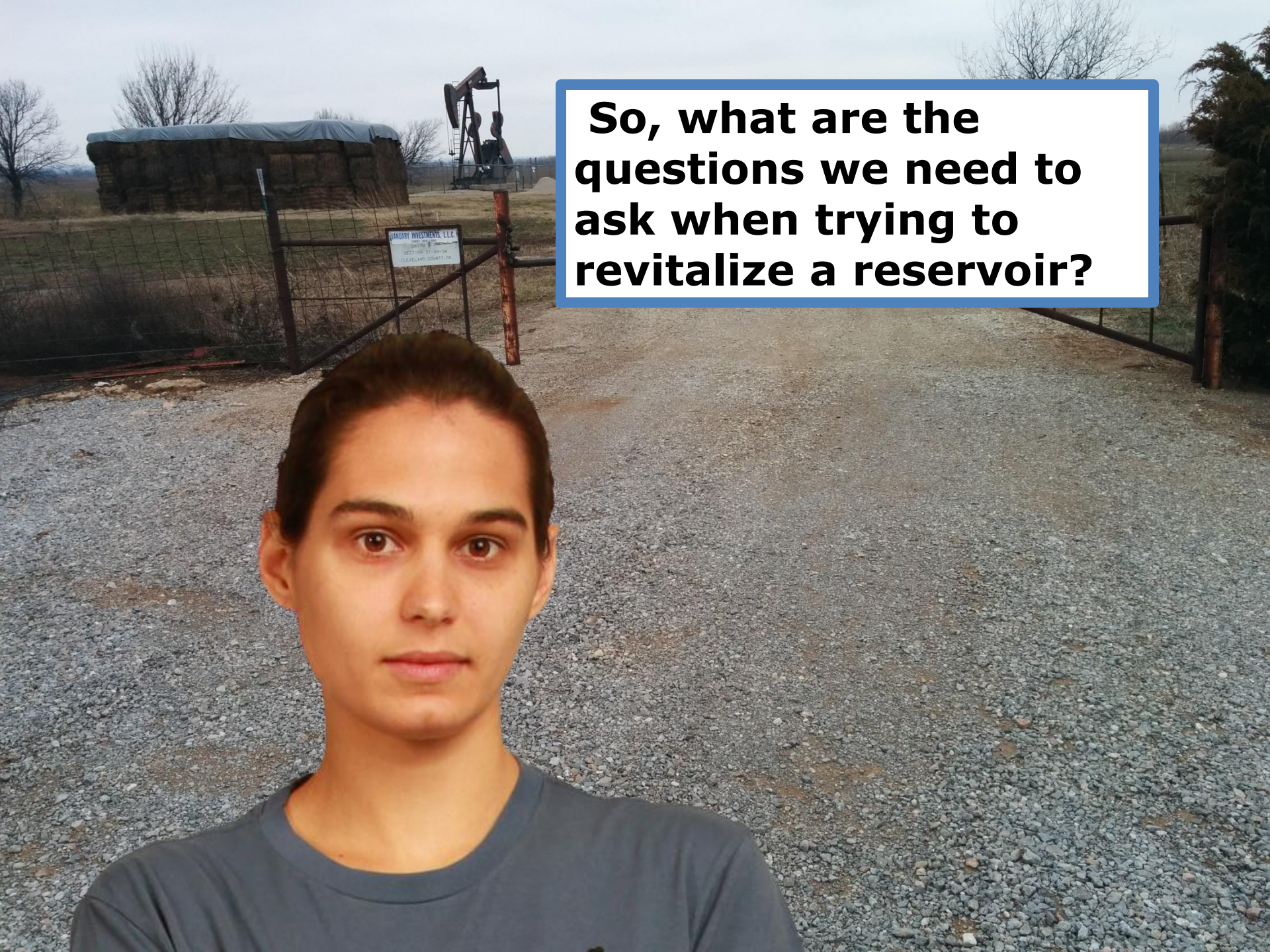


It was being auctioned and I got it for a great price. And, supposedly it could handle the volume of water -- but it cannot. Plus, it is on a timer, and it freezes up and does not start pumping when it is supposed to. Can you help me understand more about pumping units in mature fields?

I would love to! There is really a lot to selecting the right size pumping unit. It is all about producing, and I am always eager to share my experience.



So, what are the questions we need to ask when trying to revitalize a reservoir?



We are eager to learn!



Identifying Good Candidates

- Mature Fields
- Shale plays with steep decline rates in the laterals
- Refracturing
- Understimulated potential between laterals
- Horizontals: drilled but not completed

Question 1

- *What do we do about reservoirs that have lost their drive?*
- *How can geologists and geophysicists contribute?*
- *Engineers?*

Floods to Restore Reservoir Drive

- CO2 floods
 - Where economically viable?
 - What are the pros and cons?
- Waterfloods:
 - how / why geology matters

Shale Plays

- Do they decline because they have lost their drive?
- What we do we know about
 - fractures,
 - proppants,
 - interference?
- If they have lost pressure / drive, what are the implications?

Question 2

- *What are the best ways to recover oil within an old field?*

Infill Drilling

Where and why do we drill?

- Depositional environment / understanding the geology
- Geochemistry: what can it tell us?
- Geomechanics: Drive / migration pathways
- Structure: Faults / fracture networks

Synchronous Information

- What do I need?
- When does it help?

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- What do I need?
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Examples

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- Mudlogging?
- XRF?
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- Logging While Drilling:
 - what is the state of the art right now?

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Question 3

- *I've drilled but not completed a horizontal well. I wanted to get a better price on my completion.*
- *Is that all I need to think about?*

Completing horizontals

- Geological vs. Geometrical fracs
- Selecting proppants
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Question 4

- *What is the information I need to revitalize a reservoir?*
- *How do I develop workflows and put together teams?*

Team Realities

- Solutions on a shoestring budget
- Larger fields / moderate budgets
- "If we could have it all" budgets / workflows

Implementation

- Artificial lift
- Infrastructure (gas processing, reinjection)
- Water issues
 - Injection
 - New concerns about injection
 - Disposal and other dilemmas

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