

Enhanced Oil Recovery (EOR) Beyond CO₂ “Game Changer” – 3rd/4th Generation CO₂/Chemical Flooding

PROPOSAL

A Unique Industrial Consortium Program Approach:
Participate in a Joint-Industry-Project (JIP) for a New
Platform

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Introduction/Background...

- It is well defined that CO₂/Chemical flooding next generation technology at lower cost is the “next big thing” for the petroleum industry. The U.S. DOE and ARI have developed substantial background. Industry supports these conclusions!
<http://www-static.shell.com/content/dam/shell/static/future-energy/downloads/eor/eor-brochure-2012.pdf>
http://www.adv-res.com/pdf/Game_Changer_Document.pdf
- The impetus for this drive has skyrocketed! Why? Simple!
 - 1 Decrease in oil prices have placed much more emphasis in recovering proven reserves, at lower cost. We have plenty of reserves.
 - 2 The rising costs of oil exploration make short term E&P expenditures below \$50/barrel less attractive.
 - 3 There is significant future impetus to look at less costly, GHG and investment decisions for future production.

Simply put, lowering the cost, improving the effectiveness of EOR makes good economic sense!



Environment – Advanced Developments Already Exist...

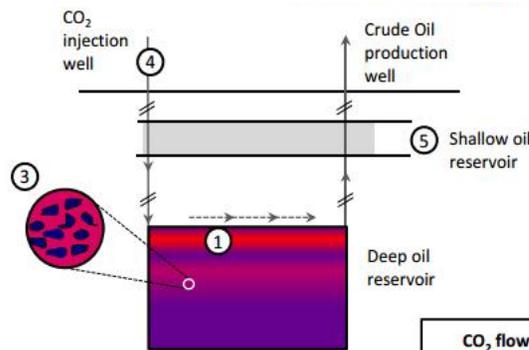
Extensive DOE/ARI U.S. investments have already been proven – next generation is required.

*The key take-away...
this is not sufficient –
it defines the
challenge – but not
the solutions!*

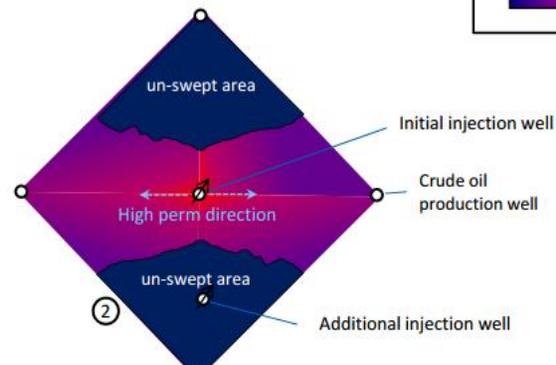


Next Generation CO₂ Enhanced Oil Recovery: Technology Areas

Cross-section of rock between injection and production well



Areal view of a five spot pattern



- ① **Improved Conformance Control.** Reduce the unproductive channeling of CO₂ through high permeability reservoir flow paths
- ② **Advanced Flood Design.** Target and produce the high oil saturation reservoir segments bypassed or poorly swept by the waterflood.
- ③ **Enhanced Mobility Ratio.** Reduce fingering, create a more uniform and effective flow front in swept areas.
- ④ **Increased volumes of efficiently-injected CO₂.** Improve sweep efficiency and reduce oil saturation toward the theoretical maximum.
- ⑤ **Near-miscible CO₂ EOR.** Apply CO₂ EOR in shallow reservoirs that are close to but not above minimum miscibility pressure (MMP).

Also required for next generation CO₂ EOR are three enabling technology that cross-cut the primary technologies:

- Robust reservoir characterization
- Enhanced fluid injectivity via near well completion
- Extensive monitoring, diagnostics and process control.

Source: http://www.netl.doe.gov/File%20Library/Research/Energy%20Analysis/Publications/Disag-Next-Gen-CO2-EOR_full_v6.pdf

Justification for TCGR's Approach... Consortium!

It is clear from the progress-to-date that the DOE/ARI and industry approach has been haphazard at best. The reason is the young, small company and dynamic approach to one-off-field demonstrations. While useful as demonstrations, they offer no consolidated, lower cost approach to the **industry challenge**.

What is justified is an industry consortium approach which shaves costs and consolidates “the best of the best”, so that a platform R&D program addresses the broadest industry development, rather than taking speculative individualized approaches. We know no single tool or “silver bullet” exists, but by combining “best practices” a huge industry EOR benefit can be derived.

**...No silver bullet – but by combining best practices
a lower cost industry EOR solution will emerge...**

TCGR Program, Commitment, Timing & Deliverables...

TCGR is proposing a multi-year program, based on an industrial consortium that will be membership driven, to address the challenges of reduced cost EOR technologies for oil recovery. It is envisaged this will involve a unique combination of petroleum, specialty chemical, field services and CO₂/GHG infrastructure investors.

We are proposing to begin this program and consortium in the next three (3) months. One of the first deliverables will be a **CONSORTIUM ROADMAP** - a study which places all participants on the same page, as to the well documented issues and challenges. This will be followed by a consortium membership meeting to discuss the roadmap findings and define next steps.

TCGR has extensive experience in handling industrial consortiums of different types.



TCGR Program, Commitment to Industrial Consortium...

This commitment, will require an initial two (2) year investment, at \$38,000/year. Deliverables will be membership driven – but first involve the committed **CONSORTIUM ROADMAP**.



TCGR has a proven track record, reputation and 30+ years of experience and can provide unique R&D and industry tools to make this a success!

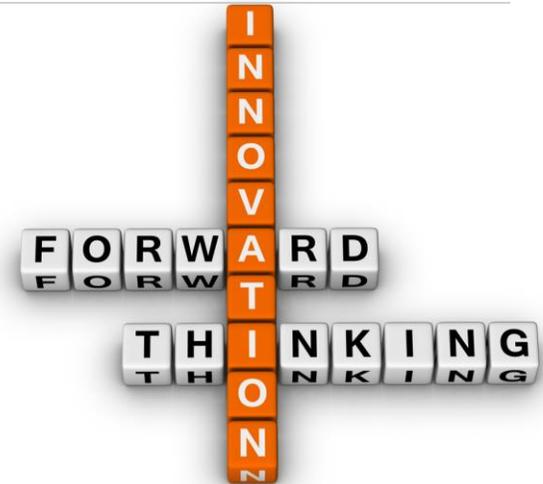
Conclusions...

- **The opportunity to improve the petroleum upstream segment is well defined if we can economically provide a collective solution to raise the recovery of 150 billion barrels of existing reserves by 1%, which at \$50/barrel, is worth \$75 billion/year to the industry. This is clearly worth investing in!**
- **It is clear this needs to move from government R&D , e.g. DOE/ARI, into an industrial, cross-disciplinary investment – because to effect industry change, broader participation is required. We are now beyond the past haphazard “wild west” – the critical mass for a different approach has been reached.**



Pathway Forward ...

Let us discuss this with your EOR team so we can explain the interest and complexities expressed by pending participants.



Please indicate your interest by return email or call:

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We will follow-up with you in order to address any questions or provide further clarification.

Contact Us



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