

# ENERGY DEVELOPMENT PARTNERS

MEOR 92% Average Production Increases World Wide!

The Titan Process is an important enhanced oil recovery breakthrough!

**“Average incremental cost per barrel in the trial MEOR application has been USD \$6.00”**

**-Husky SPE Paper 124319**

The patented Titan process increases profitability in mid-life & mature fields. This is a new form of Microbial Enhanced Oil Recovery (MEOR), the science of mobilizing the biology (microbes) that live in oil reservoirs to increase oil production. The process creates micro-droplets within the pore matrix which contribute to the various positive changes that result in higher recovery rates.

The Titan process can be applied to individual production wells as well as through existing water-flood operations, and works entirely within the natural ecology of the oil reservoir by selectively stimulating only certain targeted resident microbes with custom-formulated, biodegradable, organic nutrients.

Creating micro oil droplets in the pore spaces of an oil reservoir creates some or all of the following positive changes depending on various conditions within the reservoir. This is a major advancement in reservoir optimization.

<b>Improved Oil Mobility</b>	Smaller micro droplets can more easily move through the pore matrix and be recovered.
<b>Pore to Pore Displacement</b>	Fluids are now moving and creating a vacuum which is filled by fluids from adjacent pore spaces.
<b>Relative Permeability</b>	Water permeability to the reservoir rock decreases and oil permeability to the reservoir rock increases allowing for more oil cut.
<b>Wettability</b>	Oil droplets are more easily released from the rock surface.
<b>Water Cut Decreases</b>	Due to higher permeability of oil to the rock less water is produced.
<b>Viscosity</b>	Apparent viscosity decreases small droplets although the same viscosity as the larger oil globules are so much smaller the resistance to flow decreases. Therefore the apparent viscosity decreases aiding oil flow.
<b>Interfacial Tension</b>	The interfacial tension between the oil and water decreases as the resident microbes become activated by the Titan Process and change to a more hydrophobic form at the pore interphases and act to more easily separate the oil.
<b>Water-flood Sweep Efficiency</b>	Only in high permeability areas (thief zones), the combination of the micro-droplets, water and microbes can combine and agitate and form a temporary mild emulsion which temporarily diverts water elsewhere.

**“Titan’s Breakthrough technology works...I am impressed with the results...remarkable consistency”**

**-Dr. Alan Heeger- Nobel Laureate in Chemistry**

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The Titan Process increases the size of the natural biomass in an oilfield and creates a patented “activity” that agitates and releases significant quantities of trapped oil from the pore spaces of the reservoir. It also creates a natural unique emulsion that blocks their zones and channeling, thus reducing water cut in water-floods.

- Microbes in the reservoir change morphology (cell structure) and are forced by the physical effects to move towards “trapped” oil in the pore spaces of the reservoir and create micro-droplets that can escape through the tiny pore throats of the matrix.
- Microbes also dislodge oil from the rock surface that is held in place by electrostatic pressure.
- A natural emulsion may also be produced by the combination of some of the microbes, oil and water droplets moving through the high permeability zones of the reservoir. Therefore water-flood sweep efficiency is improved as their zones are blocked and water is diverted in different flow patterns. The mild emulsion is only created in high permeability zones.

The Titan Process uses no harsh chemicals, surfactants, polymers, acids and gases to increase oil production. The Titan Process is an advanced state-of-the-art recovery method that puts individual production wells and water-floods into a new realm of efficiency. The Titan Process will help to increase your production, cash flow and recoverable reserves.

## Global Results

**48 Commercial oil fields, four continents, over 300 well applications**

Type	Number of Treatments	Number of Wells	Number of Increase	Success Rate	Oil Increases
<b>In-Situ Producer Test</b>	49	47	36	73%	140%
<b>Producers</b>	19	18	17	89%	133%
<b>Injectors</b>	239	81	234	98%	54%
<b>Total</b>					92%

Titan’s Organic Oil Recovery (OOR) process has generated significant increases in the rate of production in over 94% of applications that meet it’s screening criteria. Further, Titan’s OOR has never reduced production or in any way damaged a reservoir or a well.

- Process is Biodegradable
- No Capital Expense
- Production is Increased
- Oil Cut is Improved
- Lifting Costs Per Barrel Decrease
- No Additional Infrastructure Required
- Trapped Oil is Released
- Movement and Energy within Pore Spaces Occurs by Action of the Microbes

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## Ideal Field Parameters

MEOR Field Parameters	Preferred Reservoir Profile
Temperature	Below 85C/185F
Formation	Sandstone or Carbonate
Oil Gravity	API 16-42
Total Dissolved Solids	Below 140,000 ppm TDS
Depth	Above 9250 feet/2,820m
Porosity	Normal 15-25% or higher
Permeability	Above 50md
Viscosity	Below 120
Water Cut	Preferred below 98%
<b>Water-Flooded sandstone fields are best</b>	Water-Drive, Water-Flood and Single Well

## Titan 10 Step Process

**Step 1: Submit Reservoir Data**-The first step is to submit the required petrophysical reservoir data. From that information Titan's petroleum engineers will determine if the reservoir has the characteristics and potential for a successful enhanced oil recovery treatment.

**Step 2: Fluid Samples Taken**-If the petrophysical information appears favorable, step two is to collect representative fluid samples and send them to Titan's microbiological laboratory for analysis.

**Step 3: Lab Analysis**-The third step is Titan's lab analysis to determine if a favorable microbial community exists in the reservoir, and for Titan to design a suitable nutrient stimulant for that specific community.

**Step 4: Pilot Test Agreement**-The fourth step is to enter a pilot test agreement with the field operator.

**Step 5: Field Analysis**-The fifth step is a field analysis to make sure equipment and other field data is known to Titan.

**Step 6: Pilot Test Planned**-This is usually a one well test to make sure the lab work and actual field responses are in sync. The main purpose of the in-situ test is to make sure the microbial reactions in the reservoir under actual field conditions are the same as what was observed in the lab.

**Step 7: Monitoring Protocol Established**-The seventh step is to establish the protocol and set up the pre-treatment monitoring system that will be required for a proper "before and After" evaluation of the success of the treatment.

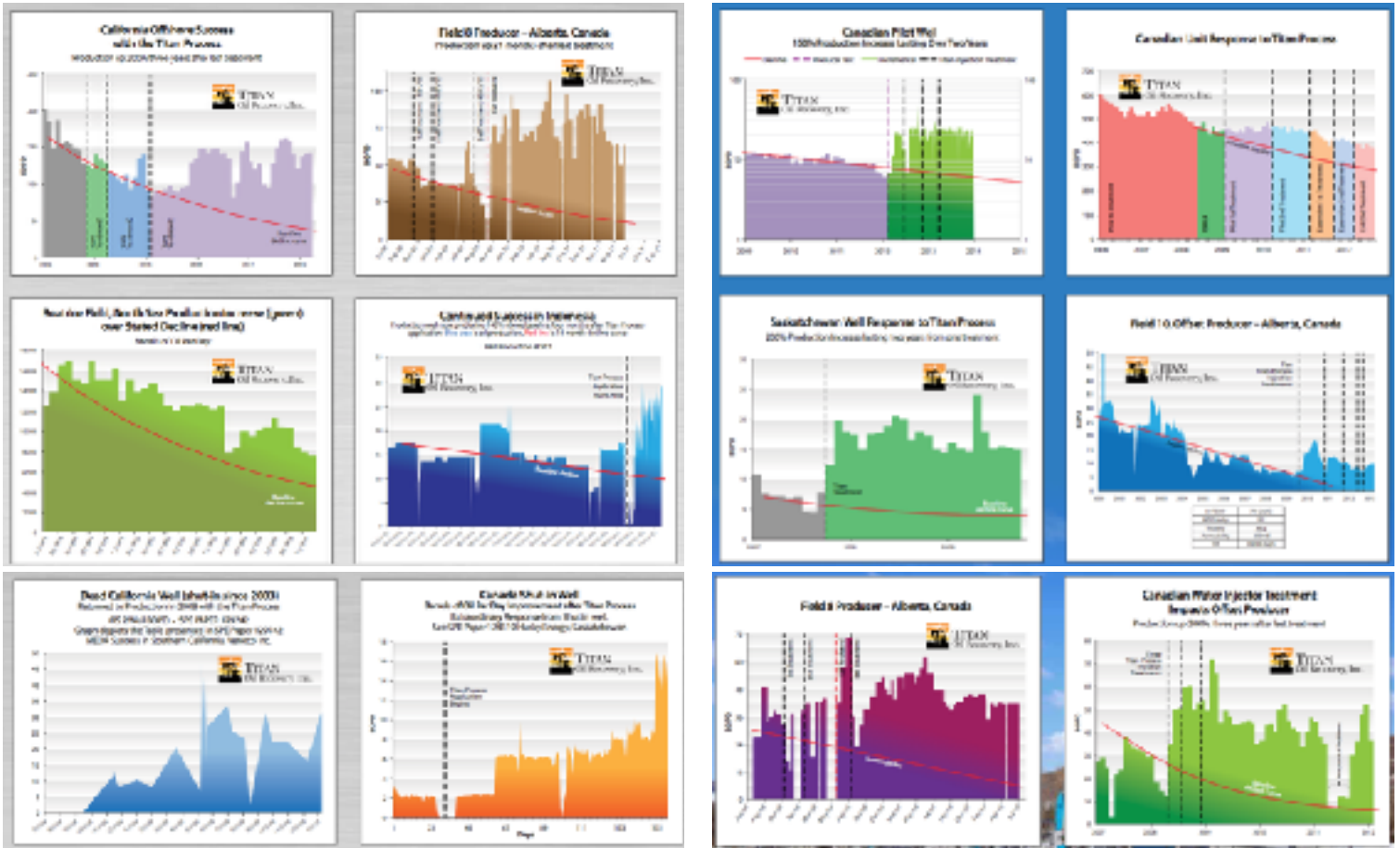
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**Step 8: Titan Process Starts**-The eighth step is to deliver the nutrient stimulants to the reservoir and follow the injection protocol and schedule.

**Step 9: Monitoring and additional Treatments**-Step nine is monitoring the results and administering subsequent treatments as dictated by the reservoir response.

**Step 10: Evaluation and Analysis**-Step ten is the evaluation and analysis of the pilot test.

## Documented Results



## Society of Petroleum Engineers Production increases reported was over 200%

- **SPE 124319 MEOR Success in Southern Saskatchewan:** Husky Energy: Documents oil production increases of: **225%, 450%, 100% and 533%** on various test wells.
- **SPE 129742 MEOR Success in Southern California:** Venoco Inc.: Documents oil production increases of: **300%, 15%, 27%, and 752%** on various well tests in Southern California.
- **SPE 145054 What Has Been Learned From 100 MEOR Applications:** Husky, Venoco, Titan Oil Recovery: 100 Applications documenting an average oil production increase of **127%** from pre-treatment rates to post-treatment maximum rates.
- **SPE 154216 A Texas MEOR Application Shows Outstanding Production Improvement:** Atinum E&P, Inc. Documents oil production increases ranging from **25-90%** with a dramatic reduction of water cut.