ADVANCED OIL RECOVERY

Low Cost Enhanced Oil Recovery • Releases Trapped Oil
Alters Production Declines • No Capital Expense
Increases Reserves • 92% Average Production Increases World Wide
The Titan Process® can optimize reservoir performance and recovery rates with no capital expense and a cost per incremental barrel below $10.

The Titan Process is an important oil recovery breakthrough. Titan’s performance record is well established, which includes verification from three customers publishing SPE Papers reporting strong performance increases (averaging over 200% for 22 wells). The Process is low cost and a major benefit in both low or high oil price environments. It has been successfully applied onshore and offshore.

This brochure contains a series of commercial production graphs from oil fields around the world that clearly show the effect of the Titan Process technology. It is a proven and workable technology for increasing oil production in mid-life and mature oil fields, recovering trapped or immobile oil and increasing reserves.

The proprietary Titan Process is a new form of Enhanced Oil Recovery. The Process creates micro-droplets within the pore matrix which contribute to 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.

### The Micro Droplet Effect of the Titan Process

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.

<table>
<thead>
<tr>
<th><strong>Improved Oil Mobility</strong></th>
<th>Smaller micro droplets can more easily move through the pore matrix and be recovered</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pore to Pore Displacement</strong></td>
<td>Fluids are now moving and creating a vacuum which is filled by fluids from adjacent pore spaces</td>
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<tr>
<td><strong>Relative Permeability</strong></td>
<td>Water permeability to the reservoir rock decreases and oil permeability to the reservoir rock increases allowing for more oil cut</td>
</tr>
<tr>
<td><strong>Wettability</strong></td>
<td>Oil droplets are more easily released from the rock surface</td>
</tr>
<tr>
<td><strong>Water Cut Decreases</strong></td>
<td>Due to higher permeability of oil to the rock less water is produced</td>
</tr>
<tr>
<td><strong>Viscosity</strong></td>
<td>Apparent viscosity decreases as 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</td>
</tr>
<tr>
<td><strong>Interfacial Tension</strong></td>
<td>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</td>
</tr>
<tr>
<td><strong>Waterflood Sweep Efficiency</strong></td>
<td>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</td>
</tr>
</tbody>
</table>

- 48 Oil Fields, Four Continents
- Over 300 well applications
- 92% Average Production Increases
- The Titan Process Increases Oil Production at a Low Cost
- Process Releases Trapped Oil
- Alters Production Declines
- Process is Biodegradable
- No Capital Expense
Production graphs showing Titan Process results

California Offshore Success with the Titan Process
Production up 200% three years after last treatment

Beatrice Field, North Sea Production Increase (green) over Stated Decline (red line)
Production well now producing 140% above baseline four months after Titan Process application.

Field 8 Producer – Alberta, Canada
Production up 21 months after last treatment

Continued Success in Indonesia
Production well now producing 140% above baseline four months after Titan Process application.

Society of Petroleum Engineers Papers Published

- **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.

These Papers were selected for presentation and officially approved for publication by: The Program Committee for the 2009 SPE Annual Technical Conference in New Orleans, Louisiana 4-7 October 2009; The Program Committee for the 2010 SPE Improved Oil Recovery Symposium in Tulsa, Oklahoma 24 -28 April 2010; The SPE Kuala Lumpur, Malaysia Enhanced Oil Recovery Conference July 2011; The SPE Tulsa Improved Oil Recovery Symposium April 2012.
Approximately $45 million was spent developing and commercially proving the technology in Australia, Canada, North Sea, Texas, Alaska, Indiana, California and Indonesia. Titan’s proprietary process can decrease decline rates and release trapped oil, delivering recovery rates substantially above expected industry standards and at much lower costs than current enhanced recovery methods.

The Titan Process targets specific microbes in the oil field causing them to exponentially multiply as a result of a nutrient process. The microbes interact with the trapped oil, affecting the surface tension and reducing oil globules to unique microscopic droplets, allowing them to become more mobile and flow more easily within the reservoir pore matrix.

Benefits of the Titan Process
- Multi-year increases in daily oil production from mature fields
- Low cost to implement / low risk
- No capital outlay required
- Production increases usually within 2–12 weeks
- 100% environmentally friendly—no microbes or harmful chemicals are injected
- Increases oil cut
- Decreases lifting costs
- Life of field is extended for many years
- Costly oil field shutdown expenses for mature fields are postponed
- Applicable to both waterfloods, natural drive reservoirs and individual production wells

The Concept
- A new approach with microbes for enhanced oil recovery
- Resident microbes are the closest source of energy to oil droplets trapped in pore spaces
- Allow the microbes to create micro-droplets of oil that can flow more easily through the reservoir pore matrix

The Titan Process
- Utilizes resident microbes for enhanced oil recovery
- Only specific microbes are analyzed and selected for the process
- Microbes occupy pore spaces
- Special formulations are added to the reservoir
- A multi-phase feeding program is designed with special formulas based on each individual reservoir
- Microbes respond
- A natural optimization system that releases trapped oil and reduces water cut is now created in the reservoir.

Microbial Response
- Selected populations increase dramatically
- Microbes become larger
- Microbes then shrink

Microbes become oleophilic (attracted to oil)
- Microbes attach to and surround oil droplets
- Droplets are deformed by the action of microbes and break up into smaller droplets
- Smaller droplets are in turn broken up into micro droplets and are able to escape pore spaces

Reservoir Responses
- Trapped and immobile oil escapes pore spaces
- Microbes attached to water and oil droplets move faster though high permeable sections of the field (thief zones). This combination and fast flow creates a mild natural emulsion to form only in the thief zones.
- Some thief zones can be temporarily blocked
- Water is diverted to unswept areas of the field, increasing sweep efficiency

Reservoir Changes
- Smaller oil droplets can escape pore throats in the sand/ carbonate matrix
- An emulsion occurs only in higher velocity areas (thief zones) from the agitation of fluids and microbes
- Oil attached to the rock wall is also released as microbes move between the two surfaces and change the interfacial tension

Results
- Production is increased
- Oil cut is improved
- Lifting costs per barrel decrease
- Sweep efficiency of a waterflood is improved
- Trapped oil is released
- Movement and energy within pore spaces occurs by action of the microbes

Above: A series of microscopic photos shows the Titan Process with live microbes surrounding a droplet of crude oil, distorting its shape and finally causing a smaller droplet to break away.
Canadian Pilot Well
150% Production Increase Lasting Over Two Years

Canadian Unit Response to Titan Process

Saskatchewan WellResponse to Titan Process
200% Production Increase lasting two years from one treatment

Field 10, Offset Producer – Alberta, Canada

Field 8 Producer – Alberta, Canada

Canadian Water Injector Treatment Impacts Offset Producer
Production up 300%, three years after last treatment
An Illustrated Overview of the Titan Process

**1 OIL DROPLET PHASE 1:** Titan Process microbes surround an oil droplet, causing oil droplet to distort due to microbial action.

**OIL DROPLET PHASE 2:** Smaller droplets are formed by the microbes and begin to separate.

**OIL DROPLET PHASE 3:** Smaller droplets are in turn distorted further into micro-droplets able to flow through the pore spaces of the reservoir more easily and thereby more easily recovered.

**2 BEFORE THE TITAN PROCESS:** Oil is trapped in porous sandstone. Water flows without dislodging oil droplets from tiny pore spaces in the rock.

**3 AFTER THE TITAN PROCESS:** Titan nutrients create a new skin characteristic for the microbes, inducing them to seek out and surround oil droplets, causing the droplets to distort, break apart and dislodge from the microscopic pore spaces between the tiny sandstone and carbonate rock particles in the reservoir.

**4 A SINGLE WELL APPLICATION:** In most cases the single well application uses equipment readily available to oil operators. Titan nutrients are mixed with water and injected down the well bore (annulus). This would normally take 5-8 hours. The well is then shut-in for 6-7 days and then returned to production.

**5 AFTER PRIMARY PRODUCTION:** A great deal of oil still remains in the reservoir but is increasingly difficult to recover. At this time, many fields are put under waterflood. As the waterflood continues for some time, eventually the water finds the path of least resistance through the reservoir, and fissures (thief zones) open up in the oil-bearing rock. The majority of the injected water is then “short-circuited” directly to the production well without pushing much oil out of the rock. Oil production falls dramatically. It is at this time that many oil fields are shut down due to high operating costs and little return.

**6 TITAN PROCESS NUTRIENTS INJECTED:** Patented nutrients feed the trillions of specific existing microbes in the reservoir which multiply by thousands of times. These nutrients cause the microbes to seek out and attach themselves to trapped oil droplets, distorting them as well as dislodging them from the rock and sand. Some of the oil, water and microbes join to form a natural mild viscous emulsion when traveling through the high permeability thief zones which block off the thief zones. Water is then forced to travel through other untapped areas of the reservoir, thereby increasing oil production.
300 energy professionals vote Titan Oil Recovery the Most Promising Energy Company Award
World class oil professionals involved with the Titan Oil Recovery cutting edge technology

Gary Awad — Board of Directors Petro Life Energy, a Titan “sister company”. Managing Principal of Three G Capital, a private equity and VC company. Unocal Corporation ex- Executive Vice President, New Ventures division, developed energy projects in Europe, Africa, and the Middle East. Ex-Corporate VP Global Development for Fluor Corporation

William Daily — Ex-Vice President of Atlantic Richfield, China/Middle East/Africa with P&L responsibility of $1.5 billion in assets. Ex-Vice Pres. of Hondo Oil & Gas. He currently serves as Vice Chairman of Stanford University’s Petroleum Investments Committee. He has 35 years’ experience in executive management and global business development in the oil and gas industry.

Scot Evans — Board Member of Titan. Scot Evans is currently Vice President of Halliburton’s Integrated Asset Management Group, responsible for global oil and gas asset management. He has 21 years experience with Halliburton.

Sammy Hamzah — Vice Chairman of the Indonesian Petroleum Association, Indonesia, the world’s 23rd largest oil producer. CEO of PT Ephindo Indonesia, Former Senior Vice President of Unocal Indonesia.

Ron Harrell — Former CEO and Chairman of Ryder Scott, a top oil engineering and consulting firm. Senior Adviser to Carlyle Group and Morgan Stanley Energy Partners. Board member of Petro Life Energy, a Titan “sister” company.

Dr. Alan Heeger — Dr. Heeger is the recipient of the Nobel Prize in Chemistry 2000 for his research and discoveries in the field of conductive polymers. He is currently Professor of Physics and Professor of Materials at the University of California, Santa Barbara. Dr. Heeger has 60 issued patents and has written over 600 professional articles for leading scientific publications. Member of Titan’s Advisory Board.

BrianMarcotte — Ex-CEO of Titan Oil Recovery, Member of Titan’s Board of Directors. Ex-President Unocal Thailand, President Unocal Indonesia, President Unocal Netherlands, and Corporate Vice President Unocal. He served as Chairman of the Unocal Foundation.

Dr. Warren Kourt — Chairman of Petro Life Energy’s Advisory Board. Adjunct Professor in the Dept. of Energy Resources Engineering at Stanford University. Member of Stanford’s Petroleum Investments Committee and the Society of Petroleum Engineers. BS degree in Petroleum Engineering from the University of Oklahoma and an MS degree in Mineral Engineering from Stanford University.

“Average incremental cost per barrel in the trial MEOR application has been USD $6.00”
— Husky SPE Paper 124319

“Titan’s breakthrough technology works... I am impressed with the results... remarkable consistency.”
— Dr. Alan Heeger
Nobel Laureate in Chemistry
Advanced Technology

The Titan Process is a unique and totally new form of Microbial Enhanced Oil Recovery (MEOR), the science of mobilizing the biology (microbes) that live in oil reservoirs to increase oil production. Titan believes its field-proven, leading-edge technology will help you enhance recovery rates at your fields.

The Titan Process increases the size of the natural biomass in an oil field 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 thief zones and channeling, thus reducing the water cut in waterfloods.

- 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 waterflood sweep efficiency is improved as thief zones are blocked and water is diverted in different flow patterns. The mild emulsion is only created in high permeability zones.

Titan Advantages

- Significant increase in production and cash flow
- Low risk: A simple low cost pilot test is implemented on 2–3 wells
- No capital or equipment expense
- Field life extended for years with increased recovery
- Reduced lifting costs
- Costly shutdown expenses postponed for many years
- Environmentally friendly/biodegradable (no harsh chemicals used; no in-fill drilling needed; H2S decreases)
- Oil production in most cases should increase within two weeks for individual wells and one to three months depending on well spacing for waterfloods

Titan Competitive Advantage

The Titan Process uses no harsh chemicals, 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 waterfloods into a new realm of efficiency. The Titan Process will help to increase your production, cash flow and recoverable reserves.

Titan believes this technology is the most efficient and low-cost enhanced oil recovery technology available in the world. Titan Oil Recovery offers you a complete, start to finish program to bring new life to your mature fields and to extend the life of offshore platforms.

Fast, Cost-Effective and Field-Proven

The Titan Process can increase your daily production and extend the life of your field for many years. No polymers, acids or surfactants are used in the process. Titan Oil Recovery can prequalify your field and then do a simple pilot test on one or two wells. Results usually take place within 2–8 weeks.

Visit the Titan web site and review our easy-to-understand engineering and technology information. We look forward to hearing from you.

www.TitanOilRecovery.com
International: 001-310-281-0015
U.S. & Canada: (310) 281-0015
Step 1: Submit Reservoir Data
The first step is to submit the required petrophysical reservoir data to Titan. From that information Titan's petroleum engineers will determine if the reservoir has the general favorable characteristics and potential for a successful enhanced oil recovery treatment. Submit at Titan's website.

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 the 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.

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 & 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.

Contact us for low-cost testing to determine if the Titan Process is right for your oil fields.