An Innovative Approach to Oil Recovery

“Finding New Oil Where Oil Has Already Been Produced”
A Bridge to the Future

“Titan’s MEOR technology provides a “Bridge to the Future” allowing the world more time to find and invent alternative sources of renewable energy to replace oil”.
Ken Gerbino

Founder and Chairman of Titan

“A True Visionary”
Energy Is The Number One challenge
Of The 21\textsuperscript{st} Century

Koala – Genesis of Titan’s MEOR Technology
Today’s Oil Industry Had A Very Simple Beginning

Titusville Oil Well – 1859 Pennsylvania
First oil field drilled in the United States
The Oil Industry Has Become
Very Sophisticated And Complex

Today’s Offshore Platform
Today’s Oil Industry

• 40% of the world’s total energy comes from oil. Approximately 50% of this energy is used for transportation fuel.

• Coal, gas, wind, solar, nuclear, thermal, hydro, etc. are other forms of energy, but nothing comes close to oil.

• There are over 70,000 global oil fields.

• 80% of these oil fields are experiencing serious annual production declines of 6% to 9% (Mexico’s Cantrell Oil Field 15%).

• The Ghawar Field – Saudi Arabia – World’s largest – 1951 170 miles x 19 miles – 5MM BOPD – For over 50 Years. (Declining?)

• Oil has been the “engine” of the world for the past 153 years.
• The world needs more affordable oil. It will never run out of oil any time soon, but it will become too expensive for people to use.

• It has been estimated that about 65% of the 10 trillion barrels of original-oil-in-place (OOIP) on day one (1859) were trapped in global oil fields and considered unrecoverable using all of the available enhanced oil recovery technologies. This continues as one of the great challenges of the world today.

• Global unrecoverable oil today is about 6.2 trillion barrels of oil with a market value of over $600 trillion based on $100 oil.

• A 10% improvement of unrecoverable oil is a realistic objective – 620 billion barrels of oil with a market value of $6.2 trillion at $100 oil.

• A frame of reference - in July of 2008 the price of oil reached $147. Oil prices are increasing and are projected to go higher in the years ahead.
Some Other Facts About The Oil Industry

• The largest industry in the world – approximately $3 trillion of revenue per year. The total electronics industry (hardware and software) is estimated to be about $1 trillion.

• Approximately 35,000 oil fields, are or will be under waterflood - a prerequisite to using MEOR technology.

• Approximately 31 billion barrels of oil are consumed each year (or about 85 million barrels of oil per day). Globally, one thousand barrels of oil are consumed per second 24/7.

• Oil is used to produce transportation fuels (gasoline, diesel, jet fuel, kerosene, etc. as well as over 300,000 consumer products (plastics, chemicals, fertilizer, fabric, tires, ink, etc.). Oil should not be burned because it is too valuable.
More Facts About This Critical Industry

• United States with less than 5% of the world population uses about 25% of the world’s oil. China and India are the two of fastest growing countries with increasing oil needs.

• For every four barrels of oil consumed today only one new barrel is being discovered.

• **Approximately 35% of the original-oil-in place (OOIP) is recovered during the primary and secondary oil recovery stages leaving about 65% of the OOIP unrecoverable.**
Peak Oil

Peak Oil Is Becoming A More Accepted Concept

Definition of Peak Oil

• Demand for oil can no longer be met with an adequate supply.
• Maximum oil production has been reached.
• 50% of the original oil found-in-place has been consumed.
Whale Oil Played A Major World Energy Role Prior To The Drilling Of Oil Wells

Whaling in the 1850’s
Oil Is Recovered In Several Ways

• **Primary** – initial energy from Mother Nature’s pressure – 15% to 20%.

• **Secondary** – typically *waterflooding* is used to keep the pressure up in the oil reservoir and recover more oil – 10% to 15%.

• **Enhanced Oil Recovery (EOR) or tertiary recovery** – Up to 35%
  - Gas injection: CO2, natural gas, and nitrogen.
  - Chemical Injection: Polymers, surfactants, and alkaline solutions.
  - Thermal Methods: Steam injection, steam drive, or steam flooding, and in-situ combustion.

• **Microbial Enhanced Oil Recovery (MEOR)** – A subset of EOR – 3% to 10%.
Basically Two Technologies:

1. **Invasive MEOR Technology**
   - Injecting microbes and nutrients from the surface into an oil field reservoir. This is typically used by most of Titan’s competitors. Results have been “hit or miss” and generally unsuccessful.

2. **Titan’s MEOR Technology**
   - Injecting a specific nutrient formula (cocktail) that has been formulated for specific microbes living in a specific oil field reservoir. This is the Titan Process® - it is very specific.
An Old Idea With A Very New Approach To Oil Recovery

• Of the More than 70,000 Global Oil Fields, it is estimated that 50% are likely to be subjected to waterflood as a Secondary Recovery Process. Based on the physical characteristics of these 35,000 fields, up to 50% may be suitable for EOR/MEOR (or as many as 17,500 oil fields are good prime candidates for Titan’s technology).

• Titan’s MEOR technology called the Titan Process® is a proven, safe, proprietary, low cost, and specific next generation form of enhanced oil recovery.

• Titan’s process increases both current production (reduces production decline rate) and ultimate recovery from existing oil fields (produces oil for a longer period of time).

• Only 300 Enhanced Oil Recovery Projects actively underway globally (Oil and Gas Journal April 19, 2010)
The Titan Process® – A Revolutionary, Proprietary And Proven Technology

• Titan’s process is a low cost, safe, environmentally friendly, and an effective approach to improving oil production that will be utilized broadly in one of the largest industries in the world.

• Titan’s process is suitable for both onshore and offshore applications.

• No new facilities are required for either Titan or the field owner and the operator.

• Titan expects its MEOR Process to become part of the normal development of oil fields around the world.
MEOR Has Extremely Favorable Characteristics For Field Owners

- Increases current oil production and ultimate recovery from oil fields.
- Low cost and effective (full-field applications from $6-$10 per incremental barrel).
- Suitable for onshore and offshore fields.
- No new facilities are required for field owner to deliver the desired results.
- Complex Science – Simple Application.
The Oil Release Mechanism Is Complex

- Stimulates the growth of specific types of microbes.
- Microbes are induced to change from hydrophilic (liking water) to hydrophobic (disliking water).
- Microbes interact at the oil-water-interface within the pore space of the reservoir acting to reduce interfacial tension.
- Microbes allow the oil break up into micro-droplets that become more mobile allowing the oil to flow more freely.
Where Oil Is Found

- Target oil is mostly contained in sandstone and limestone porous rock layers, not in underground pools or lakes.

- Oil recovery takes place by drilling into these rock layers —up to four miles below the earth’s surface.
Waterfloods Are The Most Common Type Of Secondary Recovery
The Microbial Response Is Managed To Perform Desired Reservoir “Work”

- Selected microbial-populations increase dramatically when selectively stimulated with Titan nutrients.
- Microbes multiply rapidly through mitosis.
- Microbes become oil interactive when supplied with Titan’s specifically designed nutrient cocktail.
- Microbes attach to and surround trapped oil.
- Microbes deform and break apart residual oil.
  - Smaller droplets can now move through pore throats and channels in the geologic formation.
- Microbes create new mobility and activity in the static pore space of the reservoir rock formation.
The Titan Process

Simple Five-step Process Based on Complex And Sophisticated Science:

1. Field Screening - a paper process.
2. Laboratory Analysis - the "Core" of the Process.
3. **ISMRA*** An In-field Test Process and Analysis.
4. Pilot - a Field Trial of the Process.
5. Full-Field (or Expanded Pilot)

*ISMRA™: In-Situ Microbial Response Analysis. A field test to ensure that what took place in the lab will also occur under actual reservoir conditions.
Titan’s Oil Release Mechanism At Work In A Reservoir

Process recovers oil by making oil more mobile in the reservoir

Flow 30 cm/day → Pore throat

Hydrophobic ultra micro-bacteria

Brine

Oil
Historically, MEOR has been linked to reservoir plugging and formation damage.

- Creation of biomass when bacteria growth is stimulated.
- Problematic to injectors.

For the past four-plus years the NEW Titan Process has caused:

* No plugging.
* No production upsets.
* No oil treating problems.
* No change in oil characteristics.
The Nature of Microbes Is Well-Suited For "Reservoir Work"

- Microbes can reside in extreme conditions for millions of years.
- With the right specific nutrients microbes can be manipulated to perform valuable in-situ "work".
- Titan’s MEOR technology has been successfully applied at:
  - High reservoir temperatures (200°F / 93°C)
- Successful in a wide range of API Oil Gravity.
Titan Treatment Of A Canadian Oil Reservoir
Titan Treatment Of A California Los Angeles Oil Reservoir

The bar chart compares the oil production and water cut before and after treatment. The chart indicates a significant increase in oil production (BOPD) and a decrease in water production (BWPD) post-treatment.
<table>
<thead>
<tr>
<th>Summary</th>
<th># of Wells</th>
<th># of TMTs</th>
<th># of Increases</th>
<th>Success Rate</th>
<th>% Oil Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRODUCERS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISRMA</td>
<td>28</td>
<td>32</td>
<td>20</td>
<td>71%</td>
<td>192%</td>
</tr>
<tr>
<td>Producers</td>
<td>13</td>
<td>14</td>
<td>12</td>
<td>92%</td>
<td>176%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>41</strong></td>
<td><strong>46</strong></td>
<td><strong>32</strong></td>
<td><strong>78%</strong></td>
<td><strong>186%</strong></td>
</tr>
<tr>
<td>Pending</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>INJECTORS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Injectors</td>
<td><strong>41</strong></td>
<td><strong>121</strong></td>
<td><strong>40</strong></td>
<td><strong>98%</strong></td>
<td><strong>35%</strong></td>
</tr>
<tr>
<td>Pending</td>
<td>15</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ALL WELLS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wells Treated-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirmed Results</td>
<td><strong>82</strong></td>
<td><strong>167</strong></td>
<td><strong>72</strong></td>
<td><strong>88%</strong></td>
<td><strong>102%</strong></td>
</tr>
<tr>
<td>Wells Treated -</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pending</td>
<td>16</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>98</strong></td>
<td><strong>183</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Summary Of Field Treatments

- Number of oil fields treated (18)
- Number of oil wells treated (98)
- Total Number of treatments delivered to these oil wells (183)
- Average oil production increase on treated wells (102%)
- Overall success (injection and producing wells (88%)
- Payout for clients based on the cost of Titan services (288%)
- Estimated cost per incremental barrel of oil - $6.00 to $10.00
## How Titan’s Customers Have Benefited

<table>
<thead>
<tr>
<th>Number of Treatments</th>
<th>183</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titan Charge*:</td>
<td>$4,425,174</td>
</tr>
<tr>
<td>Incremental barrels:</td>
<td>190,955</td>
</tr>
<tr>
<td>Incremental Client Income @ avg. oil price: $90</td>
<td>$17,185,925</td>
</tr>
</tbody>
</table>

*Excludes non-Titan charges

**Estimated Incremental Revenue Increase After Cost**

- 288%

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Titan’s projected average cost of incremental oil - $6.00 to $10.00
## How Titan’s MEOR Technology Compares With Other EOR Technologies - Cost Per Barrel

<table>
<thead>
<tr>
<th>Method</th>
<th>Cost per Barrel of Oil Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titan*</td>
<td>$6-10</td>
</tr>
<tr>
<td>Mid East New</td>
<td>$10-25</td>
</tr>
<tr>
<td>Conventional Oil</td>
<td>$10-40</td>
</tr>
<tr>
<td>CO2 Enhanced Recovery</td>
<td>$20-70</td>
</tr>
<tr>
<td>Other Enhanced Methods</td>
<td>$30-80</td>
</tr>
<tr>
<td>Deep Water</td>
<td>$40-65</td>
</tr>
<tr>
<td>Heavy Oil Bitumen</td>
<td>$40-80</td>
</tr>
<tr>
<td>Oil Shales</td>
<td>$50-100</td>
</tr>
<tr>
<td>Gas to Liquids</td>
<td>$30-105</td>
</tr>
<tr>
<td>Coal to Liquids</td>
<td>$45-105</td>
</tr>
<tr>
<td>Biomass to Liquids</td>
<td>$60-100</td>
</tr>
<tr>
<td>Ethanol</td>
<td>$40-105</td>
</tr>
<tr>
<td>Biodiesel</td>
<td>$60-145</td>
</tr>
</tbody>
</table>

Number Of Field Treatments Titan Is Projecting For 2012

- **Maximum 299**
- **Most Likely 195**
- **Minimum 94**
“Unfortunately, existing oil and gas reservoirs are diminishing at a rapid rate. Large fields are becoming increasingly difficult to locate, and a great deal of effort is placed to recover more of what has already been found. Discovered, unproduced reserves present a huge opportunity to increase existing supplies, and new advanced recovery techniques have become available to extract these minerals in places and ways that were unknown even a few short years ago.” (President of Apache Corporation 1.16.12)
“Titan Expects To Become A Routine Part Of Oil Field Development And A Major Part Of The Industry’s EOR Efforts”