Flow Assured Systems & Technologies

Innovative Solutions with significant cost savings for enhanced production & offloading

- Pipelines
- Storage Tanks
- Production Wells

"Flow Assured Systems & Technologies (FAST)"
About Us

GRYPHON ENERGY

Gyphon Energy is an oil and gas technology provider offering:

• world’s first integrated proprietary technologies for marginal field development.
• value creating cutting edge solutions.
• significant savings with innovative products and solutions.

Business Overview

Gyphon Energy’s primary focus is to offer significant cost savings to its clients by delivering innovative solutions for early monetization of marginal fields and enhanced production in the oil & gas industry.

Gyphon Energy is the exclusive licensee of the MOPSU™ intellectual property rights.

The business model is based on a build-own-operate scheme, whereby the company takes the responsibility for the construction, ownership and operation of the MOPSU™ units. Gyphon is open to strategic partnerships. In the event that the client prefers to own a MOPSU™, the company will evaluate this on a case-by-case basis.

Gyphon Energy’s Flow Assured Systems & Technologies (FAST™) offer innovative methods of tackling the perennial issue of wax and asphaltene build-up in storage tanks, FSOs, FPSOs, tankers, pipelines and production wells.

These solutions serve to increase overall operating efficiency and enhance production and recovery rates without bringing on a host of problems that are associated with maintenance and other cost-intensive traditional methods.

A combination of applying microwave technology with the MFE™ system to heat up hydrocarbon products and Flow-Sol™, to enhance flow by melting hydrates and paraffinic deposits along pipelines and oil well tubing, allow for uninterrupted operations and prevent re-solidification.

Vision and Strategy

Gyphon Energy’s vision is to be a world-class value-creating company for small and marginal field developments.

Gyphon Energy leverages on its competitive advantages in design, engineering and project execution to offer cost-effective and innovative products and solutions to its clients, based on the proprietary MOPSU™ technology and FAST™.

Delivery of solutions is to be prompt and accurate, with strategic partnership arrangements with world-class partners in the oil & gas industry.

MOPSU™ with M_3 WHP™
MOPSU™ with built-in storage 90k to 200k bbl, and detachable Wellhead Platform.

The MFE™ is located at the easily accessible deck level where repair or maintenance is carried out.

Maintenance free waveguides carry the microwaves along the legs to the bottom of the storage tank to maintain the crude at 8°C above the wax appearance temperature.

Versatile and scalable self-installing solutions that drill, produce, store, offload and relocate...
The oil & gas industry is plagued by the perennial issue of wax and asphaltene build-up in storage tanks, pipelines and production wells. Problems associated with paraffin and asphaltene, in the form of deposition, vary from field to field, and sometimes from well to well in the same field. These negative effects steadily reduce the flow rate in the pipelines and wells, eventually stopping flow altogether whilst reducing storage capacity and creating difficulties in offloading from storage tanks. These undesirable deposits build-up reduce overall operating efficiency and raise production costs. Traditional methods of tackling the problem are fraught with their own host of problems and are usually not cost-efficient and are highly ineffective in producing a lasting solution.
Pipelines

Blockages in pipelines due to formation of wax and asphaltene deposits are a common problem in the industry. Gryphon Energy’s MFE-100™ eradicates the deposits by heating and melting the solid formations while Flow-Sol™ dissolves the deposits and keeps them in a liquid form. This allows the pipelines to operate optimally.

With the MFE-100™ and Flow-Sol™, there will be an immediate increase in the daily production rates and increased savings by eliminating the need for frequent pigging and other expensive cleaning methods. An example of cost benefits on a pipeline with 20% deposits and potential flow of 10,000 barrels per day will result in loss of revenue of approximately USD 140,000 per day (20% x 10,000 x USD70) if the problem persists.

Frequent pigging is the conventional method used for maintaining pipelines carrying waxy crude but economic costs must be clearly understood as deferred production costs can easily amount to 20 to 30 million US Dollars per annum.

Figure 1 illustrates treatment via a pig launcher with Flow-Sol™ pumped from storage drums to be preheated. Alternatively, this procedure can be carried out using existing chemical tanks with the microwave guide installed at a suitable location.

Figure 2 shows the MFE-100™ directing microwave radiation through a pipeline for remote heating.

Figure 3 shows uninterrupted-flow with deposits dissolved.

Sectional cut-out shows typical wax deposits.

Generated microwaves elevate temperature to at least 8°C above wax appearance temperature (WAT) remotely from platform to dissolve and eliminate formation of deposits.
The main problems associated with the storage facilities of FPSOs, FSOs, oil tankers and other crude oil tanks in general are flow assurance related, caused by inadequate heating or failure of the heating coils to maintain the crude above the wax appearance temperature. This complicates the offloading of the storage contents and can lead to reduced production or in the worst case shutting down production altogether. This deferred production can result in millions of US Dollars per annum.

The MFE-100™ has been designed specifically to heat up hydrocarbon products in storage tanks replacing or supplementing heating coils for assured cost effective offloading. With the MFE-100™, the hydrocarbon products in the tanks are heated up and maintained at the desired temperature to avoid formation of coagulants and paraffin build-up. The system incorporates maintenance free waveguides located at the bottom of the storage tank. Any repair or maintenance is carried out at the easily accessible deck level where the MFE-100™ is located.

Close-up view of typical waveguides depicting a series of perforations through which microwave radiation is absorbed by the tank contents to elevate its temperature to the desired levels for flow assurance.
Production wells

Deposition of compounds such as paraffins in petroleum well tubing has been a problem for many years. Common solutions to the problem have involved the use of scrapers and pulling off the tubing periodically to remove the wax deposits. Using microwave radiation produced by a MFE-series generator and a proprietary deployment system, sufficient heat is provided to maintain temperature of the production well and the tubing above wax appearance temperature, thereby preventing wax deposition. This results in reducing periodical servicing of the tubing and subsequently increasing the hydrocarbon production that can be recovered. MFE™ can also be used in certain applications involving injection of wax dispersants/dissolvents (Flow-Sol™) to restore production to optimal levels.

Microwave radiation is directed through a metallic waveguide formed by a specially designed coiled tubing unit to the well region where the wax are deposited.

Close-up view depicting the bottom hole assembly of the coiled tubing showing series of perforations. Microwave radiation is directed into the well through these perforations and absorbed by the well fluids to elevate its temperature to the desired level for flow assurance.
MFE-100™

Magnetor Flow Enhancement System

Effective & Cost Efficient Flow Assurance for Pipelines, Tanks and Wells

Gryphon Energy’s Magnetor Flow Enhancement System, MFE-100™ provides a revolutionary means of improved flow assurance using microwave technology offering tremendous benefits over the cost of implementation. The 100kW-rated MFE-100™ is a reliable and energy efficient microwave source, operating at 915 MHz.

The MFE-100™ has been designed specifically to:

(i) heat up hydrocarbon products in storage tanks to replacing or supplementing heating coils for assured offloading. The inability to offload not only results in incurring daily rental rates but in the worst case can lead to shutting down production altogether.

(ii) enhance flow by melting hydrates and paraffinic deposits along pipelines and oil well tubing. An example of cost benefits on a pipeline or producing well with 20% deposits and potential flow of 10,000 barrels per day will result in loss of revenue of approximately (20% X 10,000 X USD70) USD 140,000 per day if the problem persists.

General Description

The MFE-100™ is capable of delivering 100 kW output power of microwave radiation at 915 MHz. The output power is adjustable and is controlled either manually or automatically. The MFE-100™ is designed to be a free standing unit or bolted to the floor. The microwave generator of the MFE-100™ is housed in a pressurized cabinet with the magnetron, circulator and electromagnet water-cooled in a closed-loop distilled water system that is isolated from the high-voltage section.

Advantage of Microwave Technology

The Magnetor Flow Enhancement System, MFE-100™ presents a series of advantages over conventional heating:

• Higher power densities, reduces heating time and cost
• Precisely controllable and can be turned on and off instantly, eliminating the need for warm-up and cool-down
• Microwave energy is selectively absorbed by areas of greater water content. This results in localised heating of those areas without affecting surrounding regions. This is important in applications when targeted heating of hydrates or paraffinic deposits along pipelines is desired
• Microwave radiation can travel through cylindrical or rectangular waveguides with reduced attenuation. This allows placement of the MFE-100™ away from hazardous zones or heating area
• For heating of liquids contained in storage tanks there are no components requiring maintenance installed inside the storage tanks
• Avoidance of combustible gaseous by-products, eliminating the need for environmental permits and improving safety at worksites

MFE-100™ Modular Components

MFE-100™ system controls

Microwave circulator, absorbing any undesired reflected radiation

Modular design circuitry with safety door interlocks
MFE-100™
Magnetor Flow Enhancement System

Advanced Features Of The MFE-100™

- "Extended Magnetron Life" – With lower stored energy compared to other switch mode systems, the MFE-100™ treats the magnetron with the gentleness required to maximise life.

- "Improved Efficiency" – With a power supply efficiency greater than 97% compared to 90% for other switch mode systems, the MFE-100™ is the obvious choice for saving energy.

- "Exceptional Reliability" – The modular power supply design with built-in redundancy ensures that in the event of switching component failure, the fault can be easily isolated and the system will continue running, giving unparalleled process reliability.

- "Power Supply Tolerance" – With a tolerance of up to ±7.5% in supply disturbance the MFE-100™ system will handle the most demanding electrical environments.

- "Remote Access & Data Logging" – The built-in data logging facility allows detailed analysis of system parameters at any time from a safe zone.

- "Rapid Response" – The ability to respond rapidly to process variations ensures critical variables are controlled: from zero to 100kW in 3ms.

- "Harsh Environments" – The MFE-100™ is completely sealed, allowing placement in environments with ambient temperatures ranging from 10 to 45 degrees Celsius.

- "Optimisation" – With direct fiber-optic feedback of filament resistance you can ensure that this critical parameter is always optimized for spectral purity and extended magnetron life. Other systems use lookup tables to maintain filament resistance and take no account of magnetron aging, efficiency or reflected power.

- "Low Maintenance & Set-Up Costs" – The MFE-100™ system does not require components to be installed inside storage tanks or pipelines in order for the microwave heating process to work, thus requiring less maintenance and lower set-up costs to operate.

MFE-100™ Technical Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microwave power</td>
<td>Programmable 5 - 100kW continuous duty</td>
</tr>
<tr>
<td>Frequency</td>
<td>915MHz ±10MHz (compliant to FCC rules)</td>
</tr>
<tr>
<td>Input Power</td>
<td>415VAC, 3 phase, 180 A</td>
</tr>
<tr>
<td>Motors/controls/fans</td>
<td>3kW</td>
</tr>
<tr>
<td>Total power consumption</td>
<td>116kW ± 4%</td>
</tr>
<tr>
<td>Magnetron Protection</td>
<td>Circulator with water load protection</td>
</tr>
<tr>
<td>Circulator</td>
<td>Provided</td>
</tr>
<tr>
<td>Output Fitting</td>
<td>WR-975 waveguide</td>
</tr>
<tr>
<td>Cooling water (distilled, de-ionised)</td>
<td>20 l/min required (not supplied)</td>
</tr>
<tr>
<td>Generator Cabinet</td>
<td>Powder-coated mild steel, Ex’p’ protection</td>
</tr>
<tr>
<td>Overall Dimensions</td>
<td>1800 x 1900 x 1750 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 1.4 MT</td>
</tr>
</tbody>
</table>

The system uses an Allen-Bradley PLC (SLC 500 series) with a RS Linx communication package allowing seamless connection to PLCs via direct or modem connection. RS Linx will also allow remote program modification or fault finding with minimum effort or disruption from a safe zone.

Controls
All system control functions are located on an operator friendly control panel.
The control panel includes
- Key switch
- Start button
- Stop button
- Run light
- Power control (1 - 100kW)
- E/stop
- Fault indication
Flow-Sol™

Maximise Productivity in Flow Assurance Services for Pipelines, Storage Tanks and Production Wells

Description

Flow-Sol™ is a revolutionary solvent that breaks down wax and asphaltene deposits in pipelines, storage tanks and production wells allowing for uninterrupted operations. It is a bio-based blend that is both oil soluble and water dispersible and it dissolves the paraffin into a saleable hydrocarbon solution with a high BTU value without carcinogenic and toxic properties. Once it emulsifies and encapsulates the paraffin molecules into a liquid hydrocarbon solution, the Paraffin-Flow-Sol™ hydrocarbon blend is then oil-soluble and water-dispersible.

How It Works

Paraffin, asphaltene and bitumen are heavy organic compounds contained in crude oil products. These components are the primary cause of oil flow blockages. Paraffin causes deposition due to the lowering of crude oil temperatures, changes in pressure, and other factors resulting in the formation of crystalline solids. These heavy solids line up the walls of all equipment coming in contact with the crude oil including flow lines, separators, pumps, and tanks. As the paraffin builds up, arterial blockage occurs, resulting in increased friction, greatly reduced oil flow, and/or full restriction. The increased friction from this build-up can also cause further problems including equipment failure and breakdown. Paraffin removal as part of a scheduled maintenance program can greatly increase yield and reduce costs.

Flow-Sol™ effectively liquefies and breaks down the paraffin and other heavy deposits to the point where they can no longer precipitate again. Flow-Sol™ can be used wherever paraffin build-up occurs including oil wells, pipelines, and storage tanks.

The application of Flow-Sol™ incorporates the blending of its chemicals with water and subsequently heating the resultant mixture to a temperature between 50°C (122°F) and 120°C (248°F).

Flow-Sol™ Characteristics

Flow-Sol™ has the following characteristics:

- Non-Toxic
- 100% biodegradable
- 100% pure plant-based
- Non-aromatic
- Non-carcinogenic
- Environmentally friendly
- Not a recognized water contaminant
- Approved GRAS by the U.S. FDA (Generally Recognized As Safe)
- Able to hold dissolved paraffin in a permanent oil-soluble state resulting in no waste and a saleable product

Benefits Of Flow-Sol™

- No production downtime
- Increased efficiency - less energy needed to pump the same volume of oil, resulting in lower production costs
- Savings on cost of hot oiling, wire lining, knifing, and chemical batching
- Increased production with no re-precipitation
- Low maintenance
- Environmentally safe - not hazardous to the workers or the environment
- Products are oil-soluble and water-dispersible

How Flow-Sol™ Works

Picture of a typical sample of paraffin deposit that builds up in oil production equipment causing flow restrictions and equipment failure.

Flow-Sol™ solution is added and it immediately starts to dissolve the paraffin.

After heating the mixture, the solution becomes transparent indicating that the paraffin has been completely broken down and liquefied.

“Flow Assured Systems & Technologies (FAST)”
SAFETY

MFE-100™
The MFE-100™ system complies with Australian Standard AS2772.1 -1998 "Maximum Exposure Levels - 100kHz to 300GHz" and ATEX, the European Standard for hazardous areas. MFE-100™ system is ATEX certified for Hazardous Area, Zone 1, gas group IIA, and temperature class T3, having a pressurized enclosure (Ex "P" protection). In order to ensure operator safety, each door is fitted with safety interlocks. Although the design of the MFE-100™ system ensures a level of radiation at a fraction (1/20th) of the FDA specified level for domestic microwave systems, the level of microwave radiation is continuously monitored and displayed by a dedicated microwave leakage detector integrated into the system. In the unlikely event of the microwave radiation getting higher than the safety level, the system will shut down automatically.

Frequently Asked Questions

1. How does microwave radiation heating of a substance differ from conventional heating?

Conventional heating is achieved through conductive heating with an external source, passing first through the walls of the vessel in order to reach the substance. This is a slow and inefficient method of transferring energy into the system being limited by the rate of heat flow into the substance from the surface as determined by its specific heat, thermal conductivity, density and viscosity. Surface heating is not only slow, but also non-uniform with the surfaces, edges and corners getting much hotter than the inside of the material.

Microwave heating is a very different process. Microwave radiation interacts directly with the molecules of the substance, leading to a rapid rise in the temperature. Because the process is not dependent of the thermal conductivity of the vessel holding the substance, the result is an instantaneous localized heating of the substance.

2. How efficient are MFE™ microwave generators?

Gryphon Energy MFE™ microwave generators have 85% efficiency in producing electromagnetic energy from electric power. However, the conversion of that energy into useful heating is often greater than 95%. With Gryphon Energy’s 915 MHz microwave technology the total system efficiency usually exceeds 80%.

3. Does microwave radiation affect the molecular structure of organic substances?

The energy of microwave photons (0.037 Kcal/mole) is very low relative to the typical energy required to cleaver molecular bonds (80-120 Kcal/mole), thus microwave will not affect the structure of an organic molecule. The effect of microwave absorption at the molecular level is purely kinetic (rotation of the molecules) resulting in only the transfer of energy and heating of the substance only.

Flow-Sol™
Flow-Sol™ is bio-degradable and completely non-toxic to the health of workers and to the environment. The application process is also devoid of the need of using hot oil and other inflammable chemicals, hence enhancing overall work safety.

<table>
<thead>
<tr>
<th>Product Comparison Chart</th>
<th>Flow-Sol™ Asphaltenes and Paraffin Dissolver</th>
<th>Toluene/ Xylene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teratogen (reproductive hazard)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Suspected Carcinogen</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>SARA Title III (Section 313)</td>
<td>Not Subject</td>
<td>Yes</td>
</tr>
<tr>
<td>GRAS - Generally Recognised As Safe by U.S FDA</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Regulated Drinking Water Contaminant</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>U.S. Federal Bio-based Products Preferred Procurement Program</td>
<td>100% compliant</td>
<td>Not compliant</td>
</tr>
</tbody>
</table>