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Pipeline Flow Improvement Using Advanced Oil Technology (AOT)

Energy Tech Premier Group LTD.

www.energytechpg.com

About Us

Energy Tech Premier Group ETPG has a strategic partnership with QS Energy Inc California USA previously named Save The World Air Inc. An American Incorporated Company (QSEP)

(www.qsenergy.com)

Core Expertise

Supply, Delivery, Installation, Service & Maintenance of patent-protected industrial equipment (AOT) designed to deliver *measurable performance and improvements* to crude oil pipelines.

Advanced Oil Technology(AOT)

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QSEP’S

- redu

electrical field to the feedstock, allowing pipelines to operate at a lower pressure and transport crude oil much more efficiently.

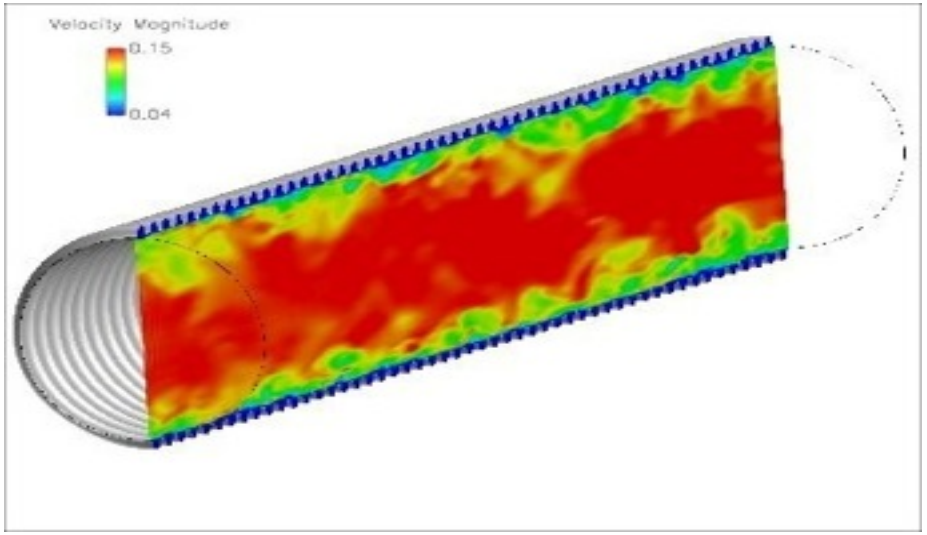
Background

- Developed for the accelerated growth of upstream production, AOT optimizes pipeline performance for greater operational efficiencies, to address pipeline capacity challenges.

Viscosity reduction = Increase in throughput.

The Problem We Address

- Key Factor in this industry is *friction loss.*
- *Friction Loss* per mile is important as it determines the power required to pump oil at a given velocity in a pipeline.
- *Power Usage* is directly proportional to friction head loss. As viscosity decreases the friction factor goes down.



How it works

- AOT delivers viscosity reduction by coagulating dissolved particulate matter found in crude oil into Nano scale particle clusters.
- By aggregating these particles their total surface area is minimized, lessening the friction drag of these particles against the rest of the bulk fluid, a key component in reducing viscosity and changing the hydro-mechanical behavior of the crude.

Info Graphic

Normal State

Paraffin molecules are randomly distributed as a suspension within the bulk fluid.

Transition State

Paraffin molecules are treated with a voltage potential field, dielectrophoretic action begins.

Treated State

Paraffin molecules aggregate together to form small micro clusters, reducing the interparticulate drag, improving flow performance.

AOT Benefits

By reducing viscosity on a wide spectrum of grades of crude AOT enables higher flow rates while delivering a variety of measurable operational efficiencies:

- Increased maximum flow rates for given MAOP ratings.
- Increased margins of safety via reduced pressures required to achieve constant flow rates.
- Reduced power consumption OPEX for midstream pump stations.
- Reduced wax deposition with pipeline infrastructure.
- Reduced pour point and wax appearance temperatures.
- Reduced reliance on bulk heating systems.
- Reduced reliance on chemical pour point WAT depressants.
- Reduced reliance on additives such as diluent.

Product Development

- Kinder Morgan Pipeline – AOT on *Condensate*
- TransCanada AOT installation On Keystone Pipeline – *Crude Oil*

Temple University

Petro China (CNPC)

Key Stone,
Kinder Morgan,

Constant Throughput

- QSEP'S AOT installation is expected to reduce the back pressure and in turn reduce power requirements and energy consumption. Running at a lower pressure reduces energy costs, improves safety, and reduces downstream temperatures, which reduces vapor pressure.

- In addition, preliminary studies indicate the AOT technology may reduce wax deposition, potentially decreasing maintenance costs and downtime related to pigging operations. However, further testing is required to determine the full extent of this effect.

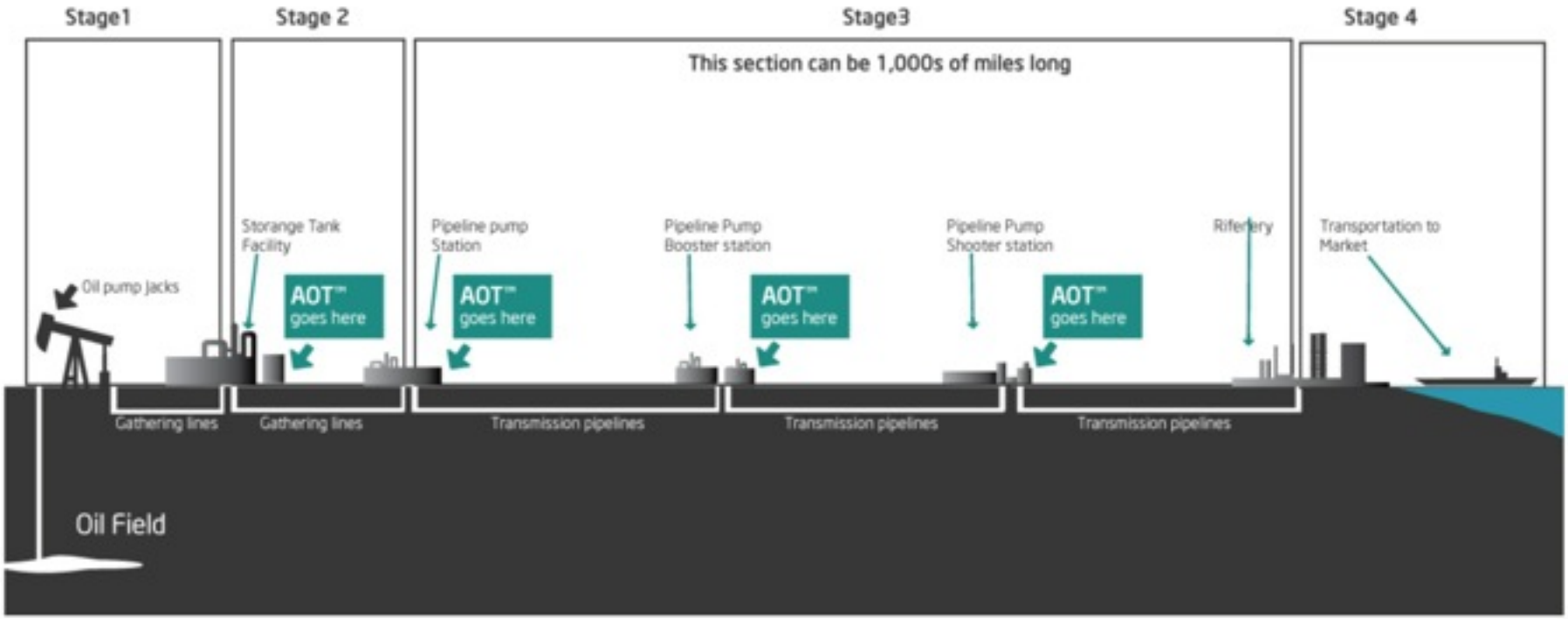
Increase Throughput

- A 10-25% decrease in viscosity would, increase pipeline capacity, throughput and revenues by 1-4% dependent on crude type.

- Additional throughput also provides the flexibility to unload crude storage more quickly.

- Resulting shorter load times, and more time for maintenance. As described in the Constant Throughput case above, reduced wax deposition may provide additional ancillary benefits.

Typical Pipeline Layout & AOT installation



Preliminary Financial Results on a Middle Eastern Pipeline

A **decrease in crude oil viscosity 20% to 25%**, Increased pipeline capacity from **400,000 to 500,000 barrels per month**.

Pro forma analysis based on a conservative estimate of **15% viscosity reduction** demonstrated an annual benefit, net of AOT operating costs, in excess of **$5 million.**

Joule Heat System

Internal Treatment

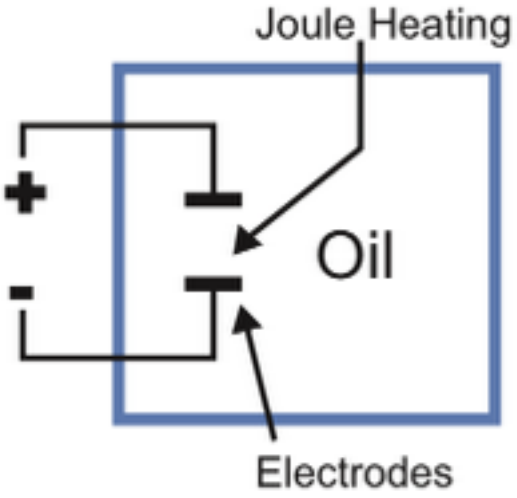
QJH subjects the oil to a direct and intense electric field which increases oil temperature uniformly without interruption of flow.

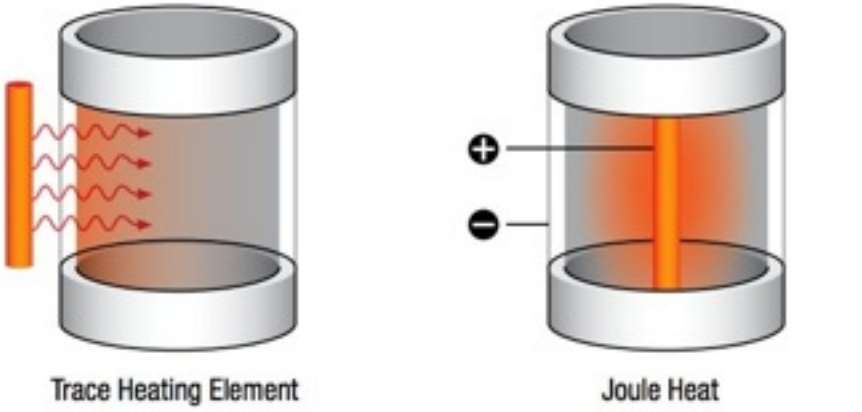
Preliminary testing suggests efficiencies of over 60% in converting electrical energy into internal energy in oil compared to efficiencies of approximately 30% typical in heat trace systems.

Technology Overview

Comparison Old Vs. New

Inside out approach to industrial heating.





Traditional trace heating generates heat via a resistive trace heating element which transfers energy into the oil. Joule heating applies an electrical charge directly to the oil, generating heat within the flow itself.

Unlike traditional trace heat and bulk heat systems, QJH is configured to deliver maximum heat conductivity by making direct contact with feedstock within the apparatus, an ASME- code pressure vessel, providing better performance at a lower operating cost.

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Technical Questions & Answers

Frequent Questions

1. **Cathodic Protection**

Q. **Does the AOT system introduce an electrochemical cell environment in the pipeline and/or interfere with existing Cathodic protection systems?**

A. *The AOT system is fully independent of Cathodic protection systems. The vessel and the internal components are separated from each other by a proprietary polyurethane lining that insulates and isolates each sets of electrical systems from each other.*

Frequent Questions

2. Pour Point Improvement

2.1 **What is the pour point % improvement in relation to the achieved viscosity improvement?**

The pour point improvement can only be determined on a case by case basis as tested in the laboratory.

2.2 **Can the installation of the AOT eliminate all pipeline heating of the FO other than at the storage tanks?**

Again, this is determined on a case by case basis, as each type of crude oil responds to treatment differently, and as a function of operating parameters and any/all additives present. AOT is to be considered a supplemental treatment to current methodologies such as heating.

Frequent Questions

3. Batching Operations

3.1 **In the case that different products are batched through the pipe line, if the AOT installed is based on the most viscous fluid, what is the effect on the less viscous fluids (e.g. FO vs. Kerosene)?**

AOT treatment responds via the dielectric conductivity of the crude oil or batched petroleum product in the line. For fluid types with a greater conductivity inherent to their nature, the power consumption on the current side will fluctuate proportional to this dielectric conductivity.

The AOT automatically responds to these fluctuations on the fly as a function of the power supply hardware. It is not software dependent.

3.2 **Is there appreciable value noted in less viscous fluids like motor gasoline and/ or jet fuel?**

Again, this is determined on a case by case basis, as each type of crude oil responds to treatment differently. Fluids that have an inherent greater concentration of paraffin and/or asphaltene particle content tend to respond more strongly,

whereas less viscous and fluids with greater purity tend to respond less strongly. We always advise individual testing for modeling purposes.

Frequent Questions

3. Batching Operations

3.3 **Are there known limitations on the AOT on either end of the viscosity spectrum?**

Again, this is determined on a case by case basis, as each type of crude oil responds to treatment differently. As a general trend, AOT tends to favor heavier viscosity fluids, and lower Reynolds numbers, making it a unique player in the flow assurance space. Laboratory testing is required to determine specific information.

Frequent Questions

4. AOT OPERATIONS

4.1 **Will there be addition equipment required in order to facilitate clearing of the AOT (e.g. blow-down system)?**

In particular cases it may be necessary to add trace heating if a pour point issue may be encountered in order to clear solidified wax from the internal components prior to operations

4.2 **What happens in the case of bi-directional flow?**

AOT is compatible with bi-directional flow as there are no moving parts. It is to be noted however that any other equipment attached to the system such as flow meters or other monitoring equipment must also be compatible with the bidirectional flow through the same pipeline.

4.3 **Is there an operating manual available including but not limited to start-up and shut-down details?**

AOT when shipped contains a fully detailed set of plans and instructions for installation and operation.

Frequent Questions

5. Range Of Viscosity for feasible operation

- *AOT is designed for effective use on a wide variety of viscosities as a supplemental treatment system to other methodologies in use.*

- *AOT operates most effectively on high viscosities as a method by which to increase the pipeline's Reynolds number without changing the chemical formula or with the addition of heat. Recommended candidates for AOT deployment are for systems desiring a Reynolds number increase.*

- *A typical placeholder baseline minimum viscosity number for AOT implementation would be 30-50 Centistokes with effectiveness increasing with higher Centistoke numbers 400+centistoke.*

- *Laboratory testing of the actual crude oil identified for treatment is required for specific viscosity reduction anticipated results and laboratory data generation. Actual results may vary.*

Frequent Questions

6.Effect of operating temperature on decay time and viscosity reduction

AOT viscosity reduction technology operates best in cooler temperatures. High operating temperatures also allow for viscosity reduction by means of thermal viscosity reduction and reduce the viscosity reduction effect and decay time(s). Laboratory testing of the actual crude oil identified for treatment is required for specific viscosity reduction anticipated results. Actual results may vary.

7. Effect of operating pressure on decay time and viscosity reduction

Operating pressure does not affect decay time and viscosity reduction. Laboratory testing of the actual crude oil identified for treatment is required for specific viscosity reduction anticipated results. Actual results may vary.

Frequent Questions

8. Pressure Gradient against decay time

Pressure gradient does not necessarily affect decay time and viscosity reduction. Laboratory testing of the actual crude oil identified for treatment is required for specific viscosity reduction anticipated results. Actual results may vary

9. Solar panel size for solar operation

Solar panel size(s) and/or wind power for remote locations are dictated by number of AOT systems installed, power supply type(s),quantities, weather conditions, climate, elevation and installation regional location(s), backup power requirements, and other factors to be determined on a case-by-case basis by customer request.

10. Typical weight of on AOT System unit

Each AOT Midstream dry weight is approximately 40,000lbs.

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Thank You