Pipeline Flow Improvement Using Dielectrophoresis

STWA, Inc.
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About Us:

- STWA, Inc. is publicly-traded technology development Company (Inc. in Nevada) with offices in Santa Barbara, CA.

- STWA licenses, designs, develops, manufactures and deploys new technology for the energy production and transportation sector.

- STWA has recently commercialized a new solid-state pipeline flow assurance method for efficient crude oil viscosity reduction.

- The Company has commercial equipment in operation within the midstream sector in the United States.

- The Company is deploying additional commercial equipment in the midstream and upstream sectors throughout 2014.
Core Expertise:

- STWA is a corporation that works directly with educational institutions, scientists and R&D groups to identify new opportunities to improve the extraction and transportation of petroleum products.

- We marry the core technology from scientists together with input from industry to design, engineer, manufacture and deploy new solutions to the energy production and transportation industry.

- STWA has multiple relationships with proven manufacturers, equipment vendors & suppliers throughout the USA.

- STWA equipment meets industry certifications, specifications, regulatory approvals and quality control inspection processes from Fortune-500 corporations.

- STWA’s core team is comprised of many former members of the US Armed Forces and is a proud employer of veterans and disabled veterans.
Market Need Origins:

- Company identified in 2008 that the proliferation of combined HZ drilling and hydraulic fracturing in the domestic gas production space would likely be applied to liquids.

- This would ultimately lead to a widespread shortage in liquid transport takeaway capacities in many regions in the USA.
Market Need Overview:

- Initial takeaway capacity gains were realized via explosive rail growth.

- Pipeline takeaway demand growth would be next to follow.

✓ Simple conclusion was that flow assurance product demand would grow to facilitate pipeline additional flow demand.
Technology Origins:

- Original experimentation conducted by the inventor was funded by the US Military for altering the properties of rocket-slurry fuels in 1993.

- The crude oil application was first uncovered in further research by the inventor as a tenured professor of Temple University in the early 2000’s.
Technology Origins:

- The Company engaged Temple University with a research grant in 2008.
- Grant was to fund technology R&D for application in the crude oil production, transportation and refinement sectors.
- The associated Intellectual Property is owned by Temple University.
- The Company is the sole world-wide licensee of the base technology and its derivatives from the University in perpetuity.
Technology Overview:

- STWA’s AOT technology is a solid-state crude oil viscosity reduction system.
- AOT uses “dielectrophoresis” to aggregate sub-micron particulate matter (paraffin, asphalt, etc.) into nano and micron-scale clusters.
- The purpose of particulate aggregation is to introduce a conformational change to the dissolved content.
- This conformational change reduces the total surface area of the particles for a constant volume-fraction.
- Reduced particle surface area for a constant volume fraction enables reduced interparticulate drag against the bulk fluid, thereby reducing viscosity independent of heat and chemical volume-fraction.
Technology Basics:

- The new technology was invented by Dr. R. Tao, Ph.D.

- Tech is based on the principals of Electro-Rheology.

  - **Electro-Rheology** (ih-lek-troh-ree-ol-uh-jee) Show IPA noun Physics. the study or phenomenon of changes in viscosity in certain fluids due to the presence of an electric charge. Also called **electroviscosity**.

- Tech operates in essentially the same manner as existing Electrostatic Coalescers (EC) units commonly found in the E&P dewatering processes.
Product Origins:

- The Company licensed a new flow assurance technology in response to this anticipated pipeline growth need.
- The Company negotiated an operating agreement with the US Department of Energy to build a pipeline test facility in Wyoming on the Naval Petroleum Reserve #3.
- The Company began to work with the energy industry to develop the technology for use in the midstream sector by forming a supply-chain.
Product Development:

- The Company built a series of prototype devices for testing and 3rd party validation with the US DOE.
- Testing concluded in 2012.
- Industry inquiries responded to coverage in RigZone, World Pipelines and other industry / trade publication coverage.
Product Development:

- The Company began development of the commercial product development program with industry customers, manufacturers and vendors in 2012.

- By 2014, the Company had successfully navigated the design, engineering, regulatory review, fabrication and quality control inspections from a $35B customer.

- The commercial equipment has now made it through commissioning and PSSR documentation procedures, entering commercial service in 2014.

- Multiple Midstream firms of similar size have now begun the collaborative processes for installing AOT systems to additional midstream assets in North America.
Applied Oil Technology (AOT):

- AOT Midstream Viscosity Reduction System as installed to North American Midstream Pipeline Pump Station
How AOT Works:
AOT Applications:

- The Company believes that the AOT viscosity reduction system has numerous potential applications in addition to Midstream viscosity reduction flow assurance.
  - E&P:
    - dewatering facilities
    - gathering systems
    - emulsion separation
  - VLCC:
    - accelerated onload/offload time
    - bunker fuel enhanced combustion
  - Offshore:
    - cold environments
    - hydrates
    - paraffin deposition
Forward-Looking:

- The Company is actively seeking additional testing program partners for the evaluative testing of AOT and additional new equipment under development.

- Please stop by table #14 for additional information and to speak with an STWA representative directly.
THANK YOU.

- Company Information:

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