ProSep

Life Cycle Cost of Ownership: A Critical Forgotten Tool in the Oil and Gas Industry

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Executive Summary

Technology implementation can scare even the most forward thinking companies and operators into indecision. ProSep has found that focusing on a critical forgotten tool namely, Life Cycle Value Assessment or Cost of Ownership analyses, indecision can quickly turn into future planning and concrete action plans that create economic value. It is critical to keep this tool "front and center" in the decision making process to intelligently asses risks, evaluate long-term rewards, and advance adoption of game-changing technology. Furthermore, by clearly demonstrating the economic gains, companies and operators are free to further explore the social and environmental impacts of the new technology, which can have far reaching effects outside their own operating space.

Introduction

Implementation of technology that is different from the status quo/standard in the oil and gas industry poses many a challenge to companies. Companies utilize a variety of tools including return of investment, net present value, and capital expenditure requirement to assess the value of this implementation. Lack of internal experience with said technology can lead to uncertainty in how to proceed, reluctance to embrace technology, and evasiveness regarding final decision making. One forgotten tool namely, the Life Cycle Value Assessment developed by the Pembina Institute (reference), can be successfully utilized to overcome these challenges.

What is Life Cycle Value Assessment?

In the Life Cycle Value assessment approach, three impact areas affected by decisions - social, environmental, and economic - and their related opportunities and risks, are assessed throughout the full life cycle of a product, project, or service. When considering the three areas impacted above, the most obvious, and often most important, area to assess is the economics - does the product under consideration makes economic sense? Purchasing products that offer no savings in future operational or capital expenditure can often be eliminated right out of the gates, saving time for businesses over the more important and difficult decisions. But what about the other two impact areas? What shall we make of them? And how can we measure the impact that a new technology will have on the environmental and social issues surrounding them?

ProSep's approach to the question above is to first answer the economic impact question. Only when understanding the direct benefits of a product on the economics of a company or project, can we begin to measure the social and environmental impacts afterward. For instance, a new technology may allow a processing piece of equipment to become smaller. If a company can demonstrate that the direct economic benefit of a smaller unit outweighs the cost of the newly installed technology required, then that company can consider the social and environmental impact of pursuing the new technology for smaller units. With this new technology directly affecting the economics and finances within a company, we are now able to determine the effects of this smaller unit on the other impact areas. Since, in this example, the new technology requires less space for the same performance, it will have a knock on

effect for a number of other project considerations. These include: the amount of space required at the site, the amount of materials used in construction, the amount of time required to maintain units in operation, reduced logistics, transport, and mobilization costs to the site, and reduced resources in the overall procurement required. As the above are all reduced, so too are the environmental and social impacts, for which a company can now begin to calculate.

Cost Of Ownership (COO)

ProSep's methodology for proving the economic benefit for a range of its products and services can be summed up as a "Cost of Ownership" model. Consider, for example, a common example where cost of ownership is used to provide guidance for purchasers, automobile sales. Cost of ownership in this case would include, but is not limited to: the cost of insurance based on place of inhabitancy, fuel consumption and miles to be driven regularly over a period, likelihood of maintenance costs and their order of magnitude, and value at the end of life, if applicable.

ProSep's cost of ownership analysis, much like the best in class automobile cost analyses, is geared to equip the oil and gas industry with details of the benefits of the technologies we offer. When compared to other conventional technologies, the purchaser is able to confidently make their decision. This article summarizes the use of the COO method for two of our best in class proprietary technologies: Mixers and Osorb.

Cost Of Ownership for ProSep Mixers

Over the past decade, ProSep has incrementally increased its footprint in the chemical and wash water injection arena for crude production. Established technologies, familiar to all and barely upgraded over the last several decades, provide the means for chemical injection, dispersion, and mixing at almost all the world's gas and oil production sites. However, with an understanding that injected chemicals and wash water are only effective when contacting the target production product, such as demulsifier contact with emulsion, wash water contact with brine in crude, scavenger contact with H2S or O2, and TEG contact with H2O, ProSep set out to develop a better mixing device.

For too long, companies had accepted additional dosing as the easiest method for addressing issues where chemical and wash water injection were required. Injecting 50% more than required was considered good performance, and a necessary evil to meet the downstream specifications for entry into transmission and distribution lines, or as a requirement to keep production flowing and revenue streams flowing. With the invention and creation of ProSep's family of high efficiency mixers, injection, dispersion, and mixing all take place within an easily retrofitted in line mixing unit, whose 10 Year Cost of Ownership Analysis should clearly and quickly turn the discussion away from the technology and toward its benefits and implementation.

To demonstrate the Cost Of Ownership (COO) Analysis that ProSep offers two case studies for the use of ProSep mixers generated from actual client sites are illustrated in Figures 1 and 2. Figure 1 illustrates the Cost of Ownership (COO) comparison over a 10 year period for a ProSep AIM mixer versus a status-quo injection quill deployed to save production chemicals upstream of a several thousand barrels of oil per day production separator. Over a 10 year period deploying a ProSep AIM mixer saved the operator more than $1.5 Million USD in production chemicals.

Figure 2 illustrates the Cost Of Ownership (COO) comparison over a 10 year period for a ProSep MAX+ mixer versus a globe valve and static mixer arrangement upstream of a several thousand barrels a day

crude oil desalting application. Over a 10 year period the ProSep MAX+ mixer saves more than $2 Million USD in chemicals and water.

It should be noted that the total economic impact of a ProSep AIM mixer or a ProSep MAX+ mixer is significantly larger than the amount shown here as the mixer is largely maintenance free over a 20 year period and indirect cost savings for production chemicals and water have not been included.

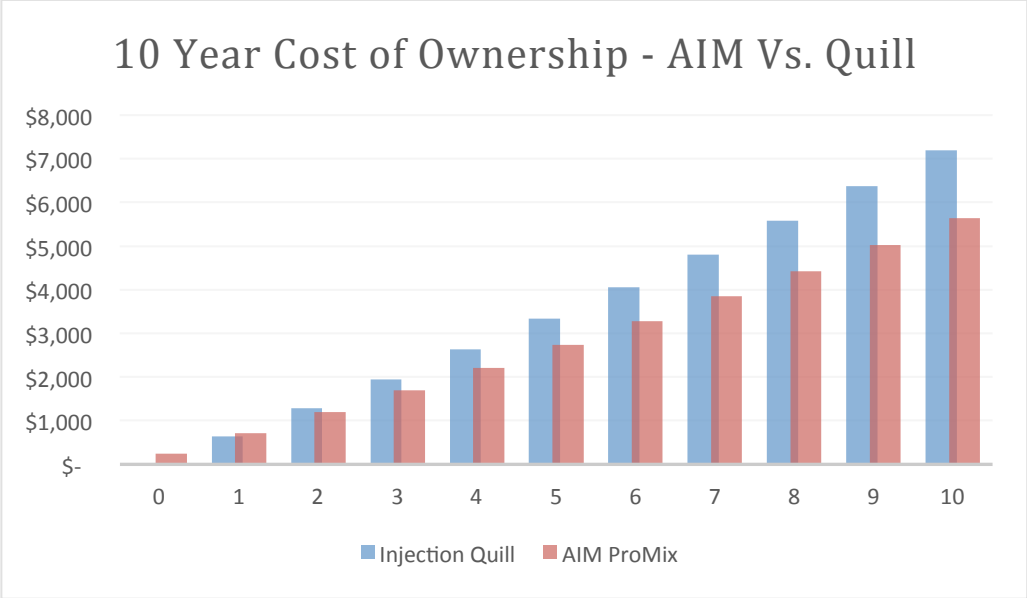

Figure 1 – Above shows the 10 Year Cost of Ownership of a ProSep AIM mixer versus a standard injection quill and static mixer. Values are in $K USD, with a Cost of Ownership savings of more than $1.5MM USD in favour of the ProSep AIM mixer

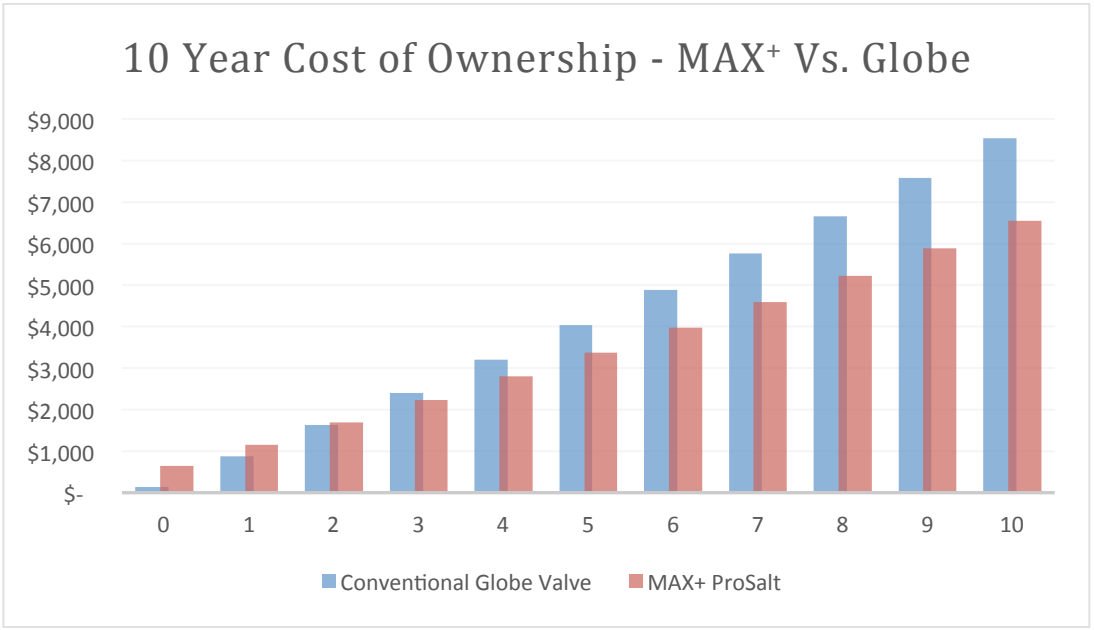

Figure 2 – Above shows a chart of the 10 Year Cost of Ownership of a ProSep MAX$^+$ mixer versus a standard globe valve and static mixer arrangement. The ProSep MAX$^+$ mixer shows nearly $2MM USD saved over 10 years, along with a pay out of less than 2 years

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Cost of Ownership for Osorb Produced Water Polishing System

Oil and gas operators are increasingly being compelled to treat and handle larger quantities of produced water and to reach and obtain lower levels of contaminants. The prospect of finding a reliable technology that can remove organics to fine, low levels in the effluent streams, below the detection limit of most inline analyzers, while also minimizing energy input, consumables, and operator intervention is consider the ideal candidate technology to address the above concerns.

ProSep has been working with a novel, organo-silica media, Osorb, since 2011. Osorb relies on the 'like-for-like' solvation of organics through the addition of a bridging agent which has a physio-attraction to many hydrocarbons, both dispersed and soluble. The silica backbone of the media provides strength with regard to the media, and allows for a multitude of regeneration options, from steam and solvent flushes, to natural gas and natural gas liquids. This range of uses, from soluble to dispersed organics capture, coupled with a variety of media regeneration options and a sturdy material, make Osorb a prime candidate solution for applications where meeting low level discharge is a requirement.

Since 2015, ProSep has undergone a thorough battery of tests for one such application in the Gulf of Mexico (GOM). The operator came to ProSep looking for a solution for benzene, toluene, ethyl-benzene, and xylene (BTEX) and condensate removal from a rich water stream at on onshore production facility handling deep GOM natural gas production. The natural gas is injected with methanol offshore to prevent hydrate formation. Eventually, the methanol comes onshore to the production facility, where it is washed in a water tower. The resultant rich water stream is a mostly water stream with a small percent of methanol, and low ppm levels of BTEX and condensate. As the water is recycled back through to the tower, the methanol must first be separated at a distillation column. While this separation is achieved, it comes with the cost of sending BTEX and condensate contaminant along with the methanol stream, resulting in a contaminated product stream with a low resale value, and perhaps even a disposal cost requirement.

As the operator searched for solution to treat their water/methanol stream to produce a cleaner and purer methanol product, the cost of ownership of such a technology was at the forefront of their thinking and investment strategy. Natural gas production and methanol injection would continue, but the sticking question was whether the current strategy of methanol product removal was akin to tossing money away? Did such a technology exist that could remove BTEX from methanol?

ProSep demonstrated in 2016 that an Osorb Media System separated out enough BTEX that the resulting methanol stream would become pure enough to reach a higher resale value. ProSep analyzed the Cost of Ownership (COO) for the client. The client's question was: Did the increase in value in the methanol product warrant the initial investment for an Osorb Media System versus maintaining the same status quo production system and dealing with contaminated methanol by product?

ProSep COO analysis for the Osorb versus status quo system is illustrated in Figure 3. Analysis of the costs associated with both options, pay back period, discount rate, fluctuation in price of the methanol, internal rate of returns and return on investment for the operator indicated that ProSep's best-in-class Osorb treatment system saved more than $3.5 Million USD compared to the status quo solution over a 10 year period.

Much like the mixer solution above, this does not begin the consider the social and environmental benefits of a much cleaner and purer methanol stream as it relates to logistics, transportation, chemical re-use, etc., all of which would lead to even larger benefits for the operator.

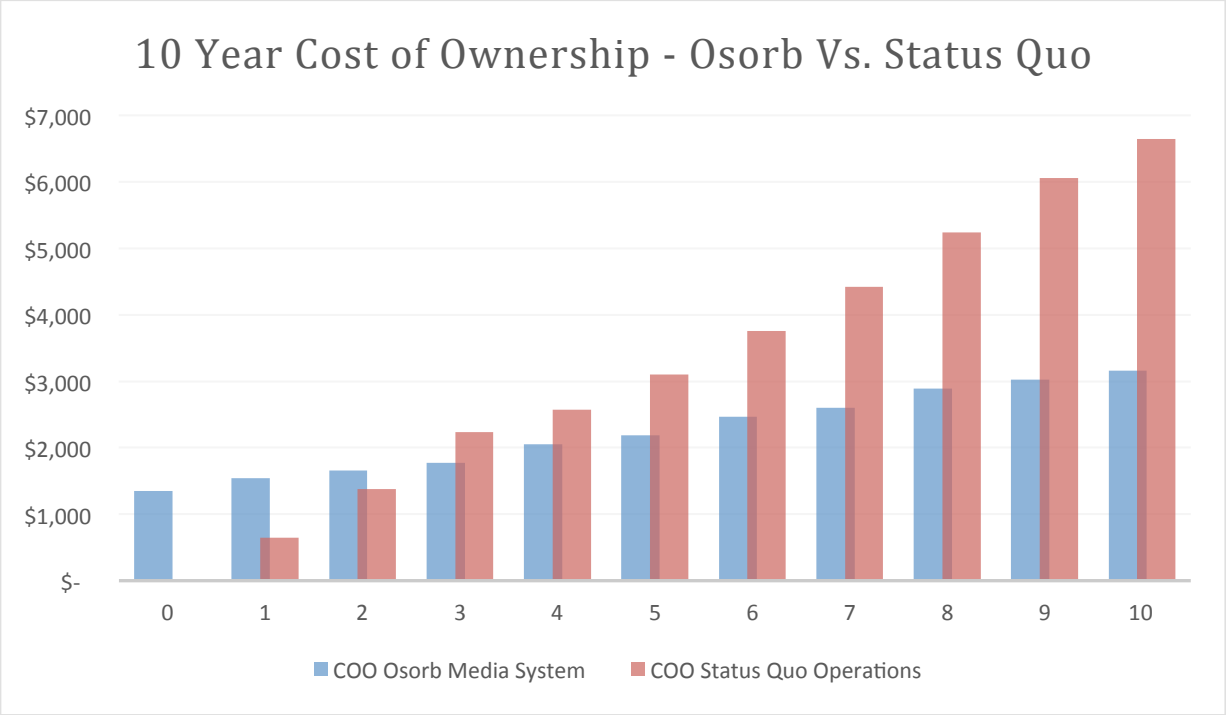

Figure 9 - Above shows a chart of the 10 Year Cost of Ownership of a ProSep Osorb Media System versus the status quo production of natural gas with methanol hydrate inhibition. The ProSep Osorb Media System shows nearly $3.5MM USD saved over 10 years, along with a pay out of less than 3 years

Environment and Social Impact of ProSep Proprietary Technologies

But what about the social and environmental impacts? Remember them? The impact of reducing chemical injection requirements by 20-50%, and wash water injection requirements by the same percentages, speak for themselves. The reduction in chemical usage will necessarily reduce the amount of logistics and transport required for the chemical in question. For remote and isolated well sites or process facilities, this can save loads of operational expenses. It also reduces the amount of fuel required to transport those chemicals to site, thus lessening the impact on environment. Less driving and transport of chemicals also has the social benefit of requiring less driving time, therefore reducing man hours on the road and decreasing the risk of accidents. Less production of a chemical can lead to production of other more useful products, and of course the use of less chemical also means that the chemical is less likely to find its way into the environment, either through accidents (spills), or by design (discharge or other by-products of processing).

The impact of reduced water usage is similar. Since reduction of water in place means a gain in another, the additional water saved from more efficient crude desalting usage can be applied to agriculture or municipal sources. Likewise, less water used in desalting applications means less water required to clean

in downstream processes after the water has been separated from the crude. This could also save on chemical use at the water treatment facility, and impact the sizing of the facility required. In various ProSep studies, millions of gallons of water are saved each year once the ProSep mixer is placed into the process line.