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# BLENDING OIL WITH RFID

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The oil and gas industry is facing increasing pressure to improve operational and financial results, while continuing to meet the expected demand for energy. Use of RFID has been well established for retail industry, but the possible uses of RFID in the Oil and gas industry has not been publicized much.

This white paper explores the possible uses of RFID in oil & gas industry. Increased use of RFID in the industry can enable the O&G companies to be cost efficient and to be closer to their customers.



WHITE PAPER



VIBHOR GUPTA

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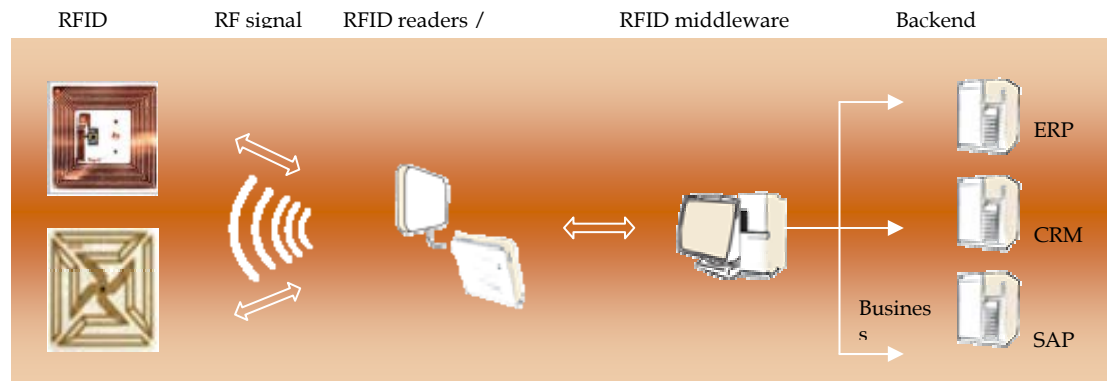
## INTRODUCTION

The oil and gas sector is heading into uncharted waters. The majority of oil reserves readily available on land have already been tapped and companies in the oil and gas industry are finding themselves heading into exploration of deep water and very remote areas of the globe. The economy is requiring higher production of oil and gas to meet the demands of an energy guzzling community. The oil and gas sector is responding to heightened costs in exploration and production by outsourcing non-core activities to service providers, and implementing operational excellence initiatives that can save costs. In the past these companies had not provided a steady return on investment and now must use all possible avenues to deliver value to shareholders through increased productivity, increased revenues and reduced costs.

Use of RFID is a major area in which improvement in the supply chain and updating of information in real-time can boost performance without sacrificing cost effectiveness. RFID can help the oil & gas companies to sustain and compete in the cut-throat market environment.

## WHAT IS RFID

RFID or Radio frequency identification technology deals with the remote collection of information stored on a tag using radio frequency communications. In the simplest terms an RFID (radio frequency identification) system consists of a tag (transponder) and a reader (interrogator). Information stored on the RFID tag can range from as little as an identification number, to kilo-bytes of data written to and read from the tag, to dynamic information maintained on the tag, such as temperature histories. The information from the tag/reader combination is either presented to a human operator typically using a hand-held device with an alphanumeric display or a host computer, which automatically manages the information.



RFID technology provides a quick, flexible and reliable way to electronically detect, track and control a diverse range of items. This technology, although similar to the well established bar coding, is quickly gaining attention in the Automatic Identification and Data Capture (AIDC) industry. RFID technology has the added capability of an integrated circuit embedded in the small tag, containing digital memory that can be programmed or re-programmed using radio signals. One of the most outstanding benefits of RFID is its ability to read through the tough environments at remarkable speeds - responding in less than 100 milliseconds in most cases.



Critical performance variables in an RFID system involve the range at which communication can be maintained, the size of the information space contained on the tag, the rate at which the communication with the tag can take place, the physical size of the tag, the ability of the system to communicate simultaneously with multiple tags, and the robustness of the communication with respect to interference due to material in the path between the reader and the tag.

Several factors determine the level of performance that can be achieved in these variables. The factors include the frequency of the radio frequency carrier used to transport the information between the tag and the reader, and whether or not a battery is included in the tag to assist in communicating back to the reader.

### RFID Tag types

Tag performance typically reflects semiconductor chip performance, tag antenna size and efficiency, and whether a battery is included in the tag. There are two broad classes of tags with respect to the source of energy used to power the tags: passive tags are those that receive their energy solely from the radio frequency field supplied by the reader, and active tags are those that include a battery to increase the read range of the tag.

### Read Range of tags

In many cases there is a sharp delineation between the read range of two classes of tags employing passive technology, those that have a relatively short read range and those that have a relatively long read range, especially at low frequency and high frequency. Like many radio systems, short ranged RFID systems tend to be less expensive and relatively easy to design and build. Long ranged RFID systems tend to be more expensive and difficult to build. Typically, the range performance of RFID systems is determined to a major extent by the reader, the power of the signal it radiates and the sensitivity of its receiver.

### Anti-Collision

In many applications it is desirable to communicate with a tag when other similar tags are simultaneously visible to the reader. The ability of the tag/reader system to talk unambiguously with one tag at a time is determined by the anti-collision algorithm used to identify each tag and establish a communication session with the tag.

### Tag/Reader Communication Protocols

The communication of information with the tag has historically been determined by the original designer of the semiconductor device in the tag. These protocols vary widely in the ways the carrier is modulated, the data is encoded, read/write/verify commands are structured, how multiple tags are read without interfering with one another, and whether privacy/security services are provided. These varying protocols have relative advantages and disadvantages, depending upon the application being considered.

### Standards

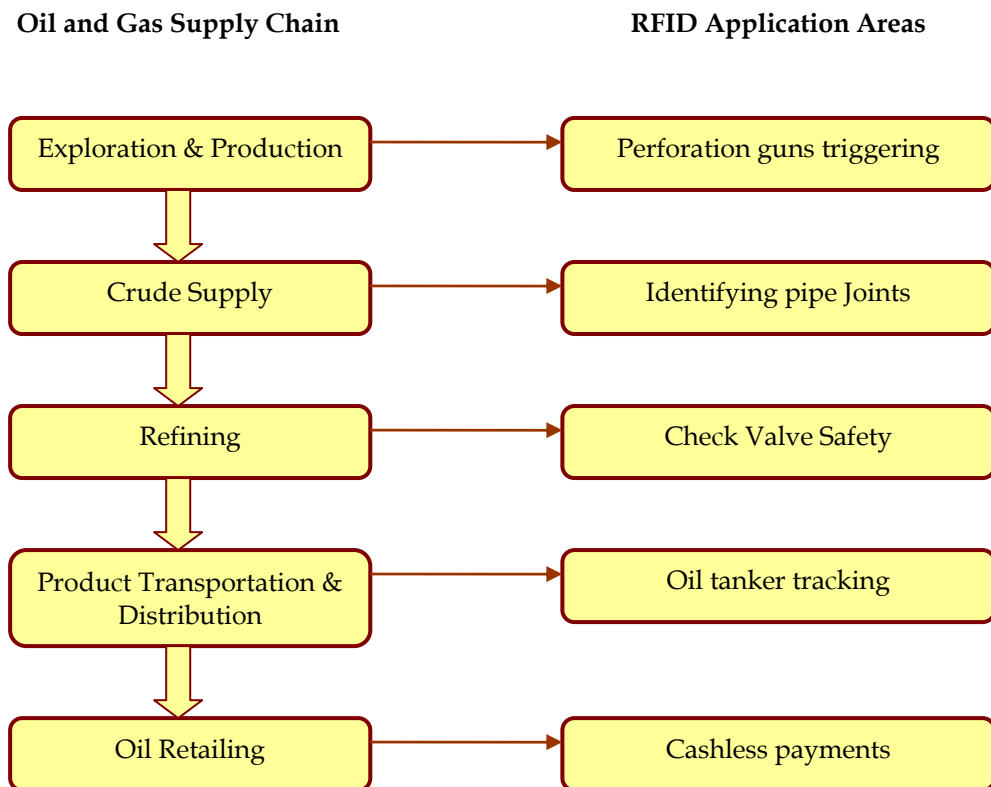
Over time RFID manufacturers and users have typically concluded that while there are advantages to having several communication protocols from which to choose for any application, there would at each frequency be an advantage to settling on one protocol, or at most a couple of protocols, which multiple suppliers could offer chips and readers.



The RFID industry today represents a dynamic attempt by manufacturers and users to build and deploy solutions reflecting trade-offs between a wide range of technical, political, and regulatory constraints.

## RFID APPLICATIONS IN OIL AND GAS INDUSTRY

Use of RFID has been well established for retail industry applications for tracking the goods at different points in the supply chain, but the possible uses of RFID in the Oil and gas industry has not been publicized much. Although the applications of RFID can be limitless, few applications relevant to the Oil & Gas industry are described here.



### Exploration/Production: Triggering of perforating guns inside the oil wells

RFID finds application in the oil production by being put to use for triggering perforating guns that are put down inside the oil wells. By eliminating the need for lengthy gun gamma-ray positioning tools, this technology can save oil companies a lot of money. Gamma ray tools are used to record naturally occurring gamma rays in the formations adjacent to the wellbore. Effective in any environment, gamma ray tools are the standard device used for the correlation of logs in cased and openholes.

Oil may be trapped in several different layers of rock, along with gas and water. After the well is drilled, a steel pipe is inserted into the well and concrete is poured around the outside of the pipe for strength. Isolation valves are used to seal off sections of the well. Then, perforating guns shoot holes in the casings, so that oil can flow in and be pumped to the surface. The right guns need to be fired at the right time. If the wrong gun is fired, the well could fill with water. It is here that RFID comes into picture. The use of RFID passive



tags will eliminate the need for repeat correlation logs. Only one base evaluation log is drawn, correlating the passive tags with the well-bore responses and each consecutive logging run will tie in, when the reader recognizes the passive tags placed in the pipes at the specified depths. In effect, accurate depth is measured and the activation location of the perforating guns is preplanned. Thus, oil companies won't have to rent the expensive gamma ray equipments and haul it out to remote locations. In-depth systems, a technology company set up by Marathon Oil offers RFID solutions for the oil well applications including the one for triggering perforating guns.

### Crude Supply: Identifying individual pipe joints in harsh environments

RFID technology can also be used by the oil and gas companies to improve their pipework jointing identification systems. A key element in the construction and maintenance of oil and gas facilities is the integrity of the pipeline joints in pressurized systems. RFID tags can be used to identify individual pipework joints to ensure that pipework systems are correctly assembled with the correct gasket, bolts and to the correct bolt tension (torque). Incorrect assembly invariably leads to leaks that are costly and can be a serious safety issue, due to the flammable/explosive nature of some of the products routed through the pipework systems. Previously, identification had been by hand written labels, metal asset labels or reference to drawings.

By identifying each joint using auto identification technology, a database could be built up to hold information specific to each joint thus ensuring the operatives carried out the correct procedures and used the right parts during a new build or rebuild of pipe work systems. By recording electronically the identification of each joint as it was 'worked', a full traceability system could be set up. Significant benefits that can be obtained over barcode labeling and scanning are: No line of sight reading would be required for reading the tags, permanent attachment to the joint/asset in question can be done, and RFID tags housed in ruggedised encapsulations provide data integrity in the harshest of weather and operating environments. The only disadvantage being the RFID set up is much costly as compared to the bar-coding solutions but this cost differential reduces as time passes due to the ability of RFID tags to withstand harsh environs. Hydratight (part of NYSE listed Actuant), engaged in bolt loading and joint integrity technology to support the oil and gas industry, has used RFID technology to help them improve their pipework jointing identification systems.

### Oil Refineries: Oil Refinery Check valve safety & audit

Oil and gas refineries use RFID tagging to capture information on pressure safety relief valves in major vessels, pipework and process equipment. The system can be based on a tag reader suitable for use in the hazardous and hostile environments typical for offshore oil and gas platforms, refineries and petrochemical processing. The equipment for RFID would have to be designed to be Intrinsically Safe that is to be used in a live plant (plant that is fully operational).

In live plants the need is for 100% accuracy and assurance that the correct safety equipment is in the correct location and set at the correct pressure rating. This involves validating the safety equipment in a hazardous environment, and identification of correct pressure settings. This information is normally carried on a visible nameplate or 'brass tag', which is 'cold stamped' and wired to the valve.

Passive RFID tags can be embedded in both the valve and the flange of the vessel or pipeline to keep records of relevant critical technical and process information. The engineers can use the tag reader to read the RFID tags on the flange and the valve to confirm that this is the correct valve, in the correct location, and set at the correct pressure. The information



stored in tags could be more useful for the Greenfield refinery projects in setting up the correct valves at the correct location.

When the user places the RFID reader (which is connected to the PC) in its cradle, data gets transferred to the host PC by serial link. Refineries have a statutory requirement to test every safety relief valve and certify that it is operational. Using RFID also reduces these safety checks that cause the oil refinery downtime. By using this technology, the cycle time for recertifying or repairing a safety relief valve can be reduced to less than half over the traditional manual methods of hard copy inspection/repair sheets and certificates. An oil and gas refinery in the US of US oil major is using RFID based systems to capture information on pressure safety relief valves in major vessels, pipework and process equipment.

### Product Distribution: Delivery movement & tracking of oil tankers

To cut costs out of fleet operations, oil and gas companies must be able to manage its trucks and shipments in real time. With instant visibility, they can streamline delivery operations, minimize costly vehicle and driver downtime, and optimize asset performance. With fleet management solutions, developed using RFID systems, these oil companies can save time and money, and can track the delivery and movement of their crude oil/gasoline tankers. TransCore, a US based company, provides RFID based fleet and commercial vehicle tracking systems. RFID tags work in conjunction with the readers to provide efficient fleet utilization. The system works using fixed site or mobile RFID readers that read the embedded data on the transportation RFID tags, which are mounted on vehicles. This embedded data is captured by the reader and sent to a host computer that records the passage of tag-equipped vehicles into or out of each reader-equipped terminal location.



Source: [www.transcore.com](http://www.transcore.com)

These RFID solutions can help companies streamline their maintenance operations performed on the fleet. These solutions can help them gain control over the dispatch, pick-up and delivery processes, from loading dock to gas stations and back again, by arming the drivers with mobile computers. Also, the companies will be able to streamline load planning, routing and scheduling and eliminate costly misloads. By using these solutions, companies will be able to accurately monitor driver and vehicle performance and relay dynamic routing decisions to help them reduce their costs, create new revenue opportunities and increase productivity. Advanced data capture technologies like RFID, when used for automatic tracking, will also cut out costly paper-based processes by eliminating the need to maintain the stock details of the tankers. When the tanker arrives at the terminal for offloading the wet stock, the data is captured from a read-write RFID tag (embedded in the truck) and the fresh stock situation is uploaded in the tag.



## Retail: Cashless transactions at Gas stations

State-of-the-art radio frequency identification (RFID) technology provides oil retailers with automatic recognition of consumers to boost revenues, to speed purchases, to personalize services, to create automated loyalty programs, and to build new marketing tools. Applying RFID technology to consumer retail fueling is a logical next step after it has been used extensively for retail applications. Oil retailing firms can team up with fuel dispenser manufacturers to develop a highly functional, accurate, robust system that provides speed and efficiency at the pump, and makes it simpler for the customer.

### Benefits to both Customers and Retailers

RFID simplicity—both to the customer and to the retailer—is a significant benefit. Just pass the tag past the reader and the transaction is initiated. The unique ID stored in the tag is registered to a customer and can be linked to any preferred credit card. From the customer's point of view, input is minimal. Once he/she registers for the tag, that's it. The customer does not re-register at each retail outlet that uses the system.

Tags and readers are optimized for retail environments. For the oil retailers, readers are located at point-of-sale locations such as gas pumps, check out counters and drive-thru windows. They can be integrated with the existing POS or stand-alone. Since individual transactions are logged at the point of sale without customer intervention, retailers can unobtrusively collect and store vital information on customer buying patterns. At this point, it is up to the retailer to analyze and use the data creatively in designing new selling opportunities.

Ensuring the security of the card and the purchase transaction are major issues, especially for credit card transactions. RFID can provide unique safeguards. Firstly, silicon based RFID tags are difficult and costly to copy. In addition, RFID tags have a proprietary challenge/response authentication feature that includes a secret key, a fixed algorithm, and the generation of a unique digital signature for each transmission between the tag and the reader. The host system performs the same algorithmic calculation as the tag. When the two solutions match, the tag is deemed authentic and a transaction is processed. Surprisingly, this whole sequence of events takes place in milliseconds. This is deemed more secure than conventional credit card methods.

It is estimated that magnetic stripe cards must be replaced two to three times per year. This is not the case with RFID tags, as there are no exposed and vulnerable parts to break on this rugged device. This is true of reader electronics, as well, that are kept safe inside a closed box. There are no insertion points to get damaged, as with card readers. The lifetime investment and ongoing maintenance costs for RFID is below that of the known alternative choices like magnetic stripe systems.

An RFID system can give gas stations, the ability to provide preferred services to each customer. The tag can indicate preferences, such as the type of fuel, amount of fuel required to be filled each time—providing the visitor a truly customized experience. RFID solutions for oil retailers can be customized to a company's business strategy while remaining cost-effective. In fact, RFID solutions can be built on existing infrastructures, extending and optimizing company assets. The oil retailers can have the ability to identify their most profitable customers. A loyalty program built on recognizing and then rewarding these most profitable consumers is a natural fit for RFID.





As a data collection tool, the RFID tags provide better information about customers—that is, the what, where, and when of each transaction. The more the knowledge of the individual transaction, the more able an oil retailer is to improve service, and gain repeat business and increased revenues. The use of this RFID technology can help attract and retain customers and multiply sales. A US based Oil giant is already using this technology at their fuel pumps since 1997, to speed retail gasoline and product purchases.

### Management of equipment servicing & corrective actions

One corporate measure of operational excellence is equipment reliability. Real time management of equipments, utilizing RFID technology, can improve the equipment maintenance process by quickly providing critical personnel with the information necessary to manage the equipments. Downtime of the equipments can be minimized by ensuring fixes are made only when necessary — rather than according to a pre-established plan. Equipment reliability is increased through the power of knowledge. As maintenance is performed on the equipments, it is recorded on the RFID tag. Operators and end users can view the equipment maintenance history from a web-based terminal or an RFID reader. The time lag related to the paper trail and subsequent time for data entry of current maintenance operations is completely eliminated.

### Oil carrying Trucks/Tankers cleaning regime

Vehicle-performance data can also be made available by simply reading the truck's RFID tag and the maintenance activities can be planned accordingly. Using RFID technology, technicians have immediate access to information about maintenance history of trucks and tankers, parts availability and repair instructions. The tag can store information like last cleaned date, the frequency of cleaning required, due date for planned cleaning, the age of the tanker etc. The cleaning regime of the vehicle can thus be maintained as per the plan.

### Restricted areas access management

Personnel's tracking is yet another area where RFID can find application. RFID tags can be used in place of smart cards with the readers deployed at different entry/exit points of important areas, while the employees of the firm can be asked to carry the tag (in some casing). RFID tags can be used for centralized management and tracking of special restricted areas on the offshore rigs or in the oil refineries. These can also be used for issuance of access permits to different level restricted areas. To enable rapid response during an emergency, location of the key personnel can be quickly identified, and the employees working in critical or sensitive areas can be tracked continuously. Finally the applications built around can be used for generation and analysis of reports on entry permits and the analysis of territorial distribution of staff at different periods of time, with the possibility of tracking staff members' individual movements. ActiveWave is one of the companies which are engaged in developing solutions for access control and personnel tracking.

### Track of customer purchases (goods sold at convenience stores)

Today, loyalty has very little to do with the reason why customers stop at convenience stores. Instead, it's usually the location. Because customers are nameless, on the go, and expect fast service, there is little opportunity to establish a relationship or encourage repeat business. RFID provides the ability not only to speed the process of servicing the customer, but also to identify them. The customer information, which usually goes un-captured, is now accessible because of the cross matching between the credit card number and the unique customer ID stored on the system. Once these customers are identified, regulars can be rewarded with loyalty points or with discounts on special promotions. The unique ID stored in the tag is



registered to a customer and can be linked to any preferred credit card just in the same way as was done to carry out transactions at the fuel outlets. Once customer registers for the tag, it does not re-register at each convenience store that uses the system.

For convenience stores and drive thru outlets at gas station, RFID also offers the unique ability to discretely know every customer and every purchase. Marketing takes on more precision, adding to profitability. Retailers of different segments at the C-stores can form alliances so that customers can use the same tag at different outlets. Stored information about customers' preferences also provides the opportunity to humanize the transaction—even when gaining economies of scale from offering the same services consistently nationwide or even globally. One of the large foods giant in the US has tied up with Oil Company to provide customers, an option to make payment through the RFID tags at their drive thru outlets located at gas stations. Customers point their key ring tags to the readers placed at the payment counter, as they take their delivery, the system automatically bills purchases to the credit/check card of customer's choice. Texas Instruments in conjunction with other technology players like 2Scout systems and FreedomPay provide systems for cashless transactions and customer tracking.

### Asset management and tracking

Due to the high cost of tracking and transporting assets across remote exploration sites, companies in the oil and gas industry are overstocking assets to minimize downtime and delays at work sites. Overstocking work sites is extremely expensive and companies are searching for a cost effective solution to manage asset allocation and thereby reduce the need to overstock expensive equipment.

RFID is often described as the latest evolution in asset management technology. RFID tags are placed on assets such as inventory or equipment. These tags store data important to their respective asset and are activated by an RFID reader which then communicates and updates the data to a worker, database, or virtually any other asset management interface.

To successfully exist in the diverse world of oil and gas, an asset management solution must provide seamless integration into current operating systems and be accessible in real-time, at a low cost. RFID technology is an inexpensive solution with the ability to capture and transmit mission-critical asset information throughout the exploration and production lifecycle. Asset management personnel can access up-to-date asset information like asset purchase information, maintenance contract information, information on the department to which it belongs and information on installation locations and also track the asset location from any computer with internet access.

Remote monitoring of the location and status of physical assets, through RFID, aides management in making crucial decisions on asset deployment based on accurate and timely asset information; thus, eliminating the necessity to deploy a complete inventory to each exploration and production site.

RFID provides operators with improved asset visibility and information validity resulting in effective decision support for timely cross project asset allocation. Real-time information is available to management to make decisions regarding asset procurement, supply, deployment and retirement. Asset management solutions, involving RFID technology, focus on increased access to current, valid information and timely decision making. Swordfish is one such company which is focused on delivering asset and equipment identification solutions for field service companies that are challenged with the identification and management of assets and equipment in a distributed and dynamic operating environment.



## Gas cylinder tracking throughout the supply chain

RFID based solutions can also be used for reliable identification and tracking of industrial or domestic gas cylinders. Hand-wheel/shroud RFID tags are employed for identifying gas cylinders either individually or in whole shipments on the back of trucks or in pallets. Cylinders can thus be tracked throughout their lives, from the filling plant through the delivery cycle back to the owner, with real-time delivery of feedback to management information systems.

RFID tagging on cylinders not only prevents theft, damage and loss of cylinders, but it also helps to improve the supply chain processes by ensuring that the correct cylinders are loaded and delivered and that cylinders don't stay with customers longer than necessary. Hand-wheel tag can be easily retrofitted on the old cylinders in use and the new cylinders can be manufactured with the tags already part of them.



Source: [www.ac-corporation.com](http://www.ac-corporation.com)

Long range reading is done either by overhead portal readers for trucks and forklifts or by handheld readers with wireless LAN. Both readers link to a central database. The tags used for such applications have to be environmentally tested and supposed to survive all expected temperature and weather extremes. The key attribute of the RFID tag used is that it provides a robust local and secure read-write data cache, which always contains the most recent information pertinent to the cylinder.

The RFID tagging on cylinders can be used to track the following information

- Manufacturer Information (Serial number, model, working & test pressures and other OEM information)
- Asset Management Information (Asset or inventory number, asset receipt date and current location)
- Inspection Information (Key safety related data, type of inspection, retest and repair, date and location of last inspection and retest, date of the next inspection)
- Cylinder Filling Information (Current cylinder contents, date and place of last refill, type of gas, fill pressure, fill counter to determine the number of fills in life time etc)

RFID implementation provides improved asset visibility to the gas suppliers and manufacturers and hence can be used to make decisions on the supply. The information made available can also be used to take decisions on the retirement (replace the cylinder after its lifetime). The benefits can also accrue from tracking the end customers and their usage patterns. The suppliers would also be able to prevent pilferage/thefts using RFID solutions.



There are lots of technology players competing in this space, Laudis Systems, Avatar partners and Tagsys are few of them.

## RFID CHALLENGES AND RISKS

A number of challenges are currently hindering widespread adoption of RFID in the marketplace. These challenges can pose significant risks to the companies as they consider RFID adoption. In order to develop successful mitigation strategies, all three types of these obstacles – economic, technical and implementation – must be carefully examined.

### Economic Challenges

For many companies, the cost of tags and supporting RFID equipment (e.g. readers, encoders, and IT hardware) remains a barrier to adoption. At present, tags are far more expensive than barcodes. However, growing demand is expected to bring costs down from the current 30-80 cents per passive tag to an estimated 5-10 cents per tag over the next three to four years. As the cost of tags declines, the companies will likely chose to adopt the new RFID technology.

Initially, it can be difficult for companies to view RFID favorably due to the potentially high costs. The long-term challenge, however, involves determining whether or not downstream, internal RFID initiatives can generate adequate ROI to warrant moving beyond basic compliance or security requirements for the companies.

To determine if and when to invest in RFID, companies should develop a thorough business case that assesses all of the benefits. These benefits include the ability to provide new services to customers and the visibility of equipments in premises. Companies who do not conduct a comprehensive business case could fall behind their competitors, as the cost pressures mount on them.

### Technical Challenges

Several technical issues surrounding the RFID marketplace also pose challenges. While industry and government mandates are driving change, the marketplace for RFID technologies still remains noisy and immature. Advances have been made in hardware, but the marketplace is still in the early stages of development. The ability of many middleware systems to process tag data and interconnect efficiently to legacy systems without significant effort remains unproven. RFID middleware is a software layer that resides between RFID hardware and the existing back-end system or application software. It takes out data from the RFID integrators and filters it. It then aggregates it and routes it to enterprise applications like ERP etc. One of the most significant challenges in creating middleware is that companies are rushing to adopt RFID without knowing all the future applications of the data. This scenario has led middleware providers to use a distributed architecture that will work for early adopters and still allow for future applications.

Furthermore, standards need to be established around Electronic Product Codes (EPC), which are used by RFID. While these standards are coming closer to reality, they remain an unresolved topic, with suppliers and customers, at present, being forced to choose one standard over another.

In addition, the RFID vendor landscape is still evolving. Many mid-size and small vendors are likely to consolidate in the next few years or simply go out of business. Big technology



players have recently purchased some small, but visible, RFID vendors in an effort to dominate this evolving technology. This behavior will likely continue to increase until a few key players remain.

Oil & gas companies will need to carefully select their technology partners to ensure ongoing capabilities for the future. This means that companies will need to objectively perform due diligence, examining vendors' financial viability as well as their technological strengths. As market consolidation occurs, companies must reassess their vendor and technology selections to ensure extendibility of their RFID architectures.

### Implementation Challenges

RFID implementations can be complex, touching multiple points across the enterprise as well as throughout the supply chain. Implementation risks can be mitigated, however, through proper planning and by building upon best practices. Much of the implementation complexity arises because RFID systems generate substantial volumes of data.

RFID reader network generates large set of event data. This is because an array of RF readers is placed in the setup to catch the RF waves from the tag continuously. The challenge however is how to deal with this humungous data. Captured data is filtered to remove any basic duplicate/redundant sets. Data from different readers is consolidated upstream to reach the data management layer. This consolidated and pre-computed data has to be managed in databases/data-warehouses. Further, the data management optimizations are performed on this data for effectively using it afterwards.

In addition to the challenges of synchronizing data with existing systems, companies will eventually demand access to this information. Consequently, energy companies and their suppliers will need to redesign their information-sharing and data management processes and policies. They will also need to further integrate their existing enterprise applications to facilitate data exchange. RFID based data should be rightly formatted and packaged for Enterprise applications' consumption. This packaging of data can be brought about, using and optimizing the data warehousing solution. Data analytics can be performed on this data using an ETL engine.

Thus, a company must assess its existing infrastructure not only for its ability to integrate and utilize RFID generated information, but also for its ability to accommodate future technology evolution (e.g. system flexibility, scalability, etc.). Also, a company's RFID solution should be designed as an integral part of its existing enterprise applications portfolio in order to extract maximum benefit from an RFID deployment.



There are certain physical challenges (part of implementation challenges) that are prohibiting the proliferation of RFID. Some examples of physical challenges are given below:

<b>RFID Physical Challenges</b>	
Reader Collision	Occurs when multiple readers placed in closed vicinity attempt to read the same tag at the same time
Tag Collision	Occurs when one reader receives signals that have reflected back from multiple tags at the same time. This confuses the reader because it cannot distinguish between the tags.
Signal Interference & noise	Occurs when ambient conditions where tag is placed, distort the electromagnetic signals sent by the tag and/or reader.
Inconsistent Data	Occurs when readers at different points along the supply chain receive inconsistent information from the same tag.

Although the expertise is limited, engineering best practices can remedy all of these challenges.

Another attribute of RFID implementations that creates risk is the technology's pervasive impact throughout the organization. RFID implementations must be accompanied by appropriate changes in business processes in order to reduce costs, increase revenue, optimize asset utilization and enhance safety and quality. This includes the redesign of some of the supply chain processes and alteration of supporting tasks and functions.

Employees at many levels of an organization will be required to adjust and learn new skills. As a result, an effective change management program must accompany any RFID initiative. Active management of communications, training, commitment-building, performance measurement and overall change leadership is just as important to a project's success as the implementation of the technology itself.

Companies face additional RFID implementation challenges related to the present shortage of available RFID resources. As a result of this scarcity, companies must make an extraordinary commitment to retraining their staff members and by retaining outside expertise when necessary to meet their objectives and to complete projects within the desired timeframes. Associations like CompTIA (Computing Technology industry association) is helping industry to prepare a pool of skilled workers who will take center-stage when the time to shift to RFID approaches, by offering certification courses. The beta exam can be given by those who have between half a year and two years of experience in the RFID sector. Upon successfully clearing the exam, the examinee will become a certified CompTIA RFID professional.



## STEPS FOR RFID BUSINESS CASE

Energy companies should do a thorough analysis of any RFID implementation. Their analysis should reveal whether it should go forward with some form of RFID adoption or not. As a next logical step they should be developing a business case supporting the implementation. The following are critical steps in developing an RFID business case:

- Identify oil supply chain pain points and business issues
- Develop model(s) to quantify the RFID-related improvement opportunity for each pain point and issue
- Analyze the financial cost/benefit impact of each RFID related opportunity in the industry
- Develop a portfolio view of the collective opportunities
- Strategically assess the portfolio to determine overall risks, benefits, costs, and other impacts

These steps will help the energy companies to ensure that its RFID transformation efforts support one or more of the primary drivers of shareholder value:

- Increased revenue
- Reduced operating costs
- Optimized asset utilization
- Enhanced quality and risk control

## CONCLUSION

In today's marketplace, many energy companies are ill equipped to manage a new generation of risks. These new risks along with the cost saving potential, make now the perfect time for the companies in the oil & gas industry not only to take an in depth look at but also to embrace the newer technologies like RFID. On the one hand the benefits from RFID implementations can be huge, on the other hand companies need to overcome the challenges hindering the adoption of such technology.

Companies need to recognize that they can meet with challenges while deciding on these adoptions but early adopters to the RFID technologies will see increasing business value over time as they overcome the initial hurdles. For the integrated energy companies the benefits of RFID implementations can be huge. These companies can gain competitive advantage by adopting this technology at its nascent stage.



## ACRONYMS

BI – Business Intelligence  
CRM – Customer Relationship Management  
C-stores – Convenience stores  
EPC – Electronic Product Code  
ERP - Enterprise Resource Planning  
ETL – Extract, Transform and Load  
IT - Information technology  
POS – Point of Sale  
RFID – Radio Frequency Identification  
ROI – Return On Investment  
SCM - Supply Chain Management

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