USING CLOUD SOFTWARE FOR FIELD MEASUREMENT ACTIVITIES

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Executive Summary

Data capture from field measurement activities is a critical part of efficient and accurate measurement reporting. The state of the art for field measurement activity is to deploy software to laptops used by field technicians, and to implement backend servers to collect information from those laptops for use in the measurement function.
While the cloud can offer significant benefits to the operations, operators are often concerned with the level of effort and risk associated with making changes to workflow and systems.
This paper presents the benefits and return on investment for migrating field measurement activities to the cloud which include reduced infrastructure requirements, reduced technical support, and improved process efficiency.

Introduction

Field measurement operations often rely on legacy infrastructure that includes:

- Proprietary software installed on a laptop for each field technician
- Proprietary software installed on servers to collect field data
- Processes whereby technicians synch data to the server infrastructure

The legacy systems cause data to be isolated to the measurement function. Additionally, activities supporting measurement such as tracking test equipment and its calibration, scheduling instrument replacement, and identifying safety issues are often implemented in disparate systems.

Cloud based systems can be deployed such that:

- No software is installed on the field technician’s device
- Laptops, tablets and smart phone cane be used
- No internal IT or server infrastructure is required
- Supporting activities, such as repair items, can be added to the measurement workflow
- Data can be synced to the cloud, without requiring action from the technician.

The project implemented at XTO demonstrates the feasibility and value of a significant change to the means of performing field measurement activities.

Overview of the Topic

Field measurement operations are vital for accurate and efficient reporting in the oil and gas industry. These activities directly impact the quality of decision-making and overall operational effectiveness. Traditional approaches typically rely on proprietary software installed on laptops and require costly server infrastructure, resulting in isolated data and cumbersome processes that make workers, and the operation in its entirety, less efficient. These operations provide essential data for measurement and broader objectives, such as compliance, safety, and process optimization. Transitioning to cloud-based systems offers a more integrated and flexible solution, streamlining workflows and enhancing the ability to meet these critical operational goals. By adopting cloud technology, companies can enhance data accessibility and collaboration, reduce overhead costs, improve operational efficiency, and increase field technician capabilities, enhancing the value of field measurement.

Legacy Infrastructure Challenges

Legacy infrastructure in field measurement operations rely on proprietary software installed on each field technician's laptop, creating a rigid and cumbersome system. This often leads to isolated data silos, where crucial measurement data is confined to specific devices or servers, making it difficult to share information across departments. Manual data synchronization adds inefficiency, causing delays, errors, and potential data loss. Additionally, these systems require significant technical support, as each device must be individually managed, updated, and troubleshot, increasing operational costs and slowing the ability to respond to field changes. The combined effect of these challenges severely limits the agility and effectiveness of the measurement function.

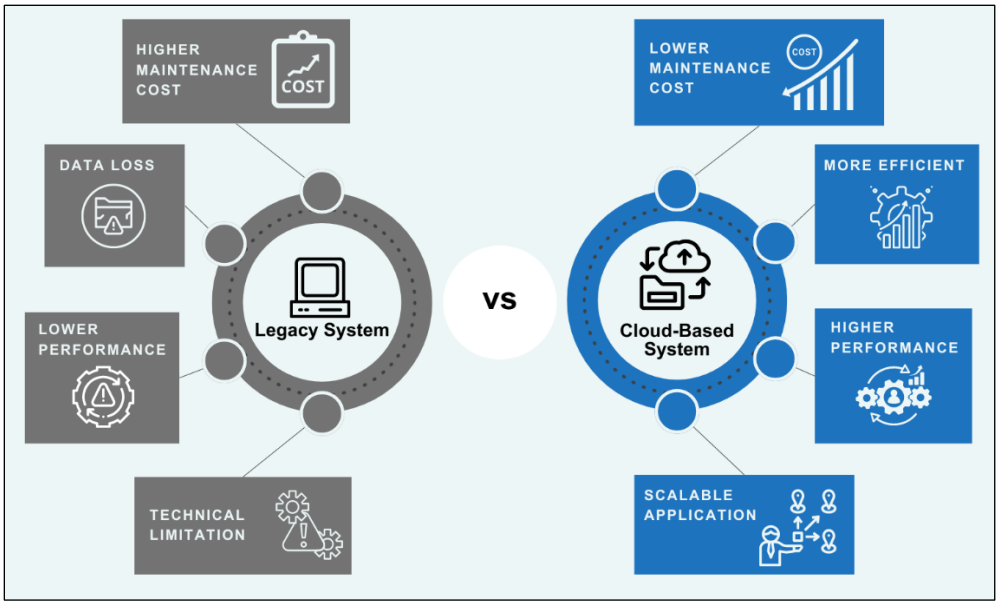

Figure 1. Legacy Infrastructure compared to cloud-based system

Over time, as the number of devices and data grows, the complexity of managing these legacy systems compounds, further straining resources. Moreover, the lack of standardization across different devices and software versions can lead to inconsistencies in data quality, making it harder to maintain accurate records. This fragmentation can also create barriers to integrating new technologies or processes, locking companies into outdated practices. Ultimately, these legacy systems can stifle innovation, as the effort required to maintain them detracts from opportunities to invest in more advanced, efficient solutions.

Evolution and Trends in Field Measurement Systems

Field measurement systems have evolved significantly over time, driven by technological advancements and changing operational needs. Initially, manual chart processes were replaced by dedicated electronic flow measurement hardware and software.

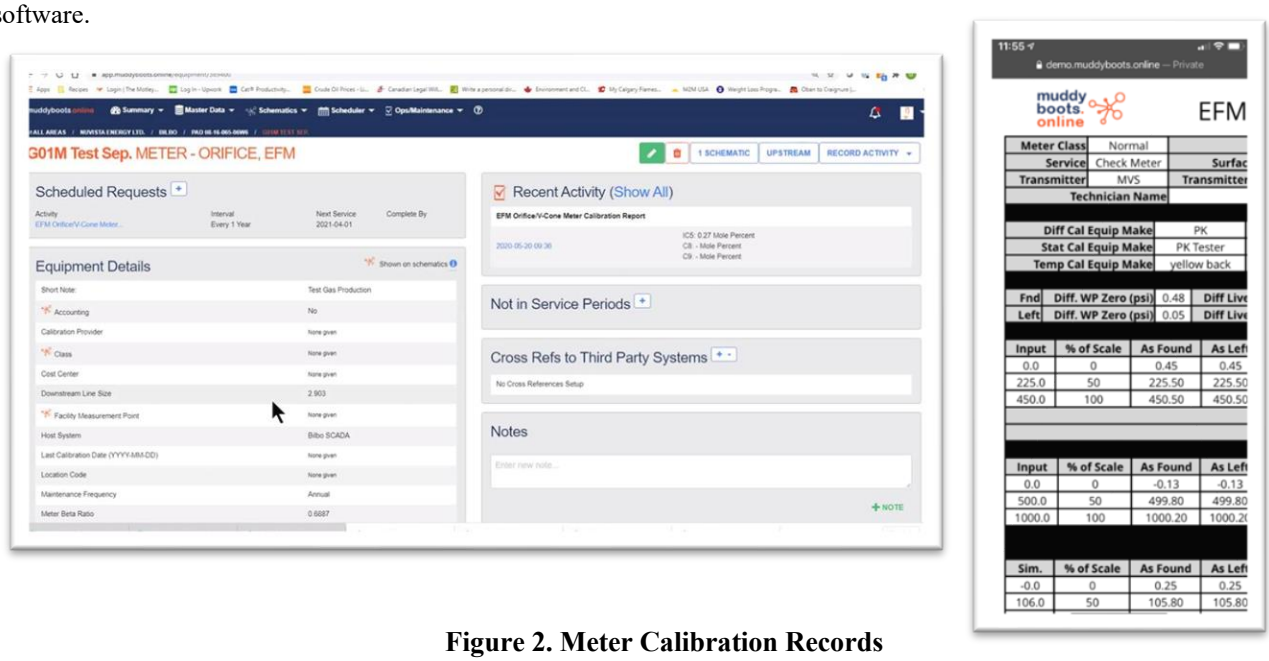

Figure 2. Meter Calibration Records

While these systems offered some automation, they were often standalone and lacked the flexibility and connectivity of modern solutions. The introduction of laptops into field operations marked a significant step forward. Laptops provided increased computing power and data storage, enabling more complex calculations and analysis. However, data management remained a challenge due to the isolated nature of these systems. The advent of the internet and connectivity paved the way for more integrated and interconnected solutions.

Radio telecommunication and network-connected laptops facilitated data sharing and remote access, but these capabilities were still limited in scope. Today, the convergence of robust cloud infrastructure, high-speed internet connectivity, and powerful mobile devices has created an environment ripe for cloud-based field measurement systems. This convergence enables data capture, analysis, and sharing in real-time, transforming the way field operations are conducted.

Advantages of Cloud-Based Solutions

Migrating to cloud-based systems for field measurement operations can significantly enhance both efficiency and effectiveness. By eliminating the need for individual software installations and reducing server infrastructure requirements, cloud solutions lower hardware and maintenance costs.

Field technicians benefit from increased flexibility, as they can access systems using a range of devices—laptops, tablets, or smartphones—without needing specific software installations. Cloud-based systems also promote seamless data integration, improving collaboration and decision-making and making operations more adaptable to changing field conditions.

The scalability of cloud solutions ensures organizations can easily adjust to fluctuating demands (i.e., meter counts), as assets are acquired and divested. Additionally, the rapid deployment of updates and new features keeps field measurement operations at the forefront of technology, continually boosting their efficiency and effectiveness.

Overall, the adoption of cloud-based systems offers a transformative advantage for field measurement operations, delivering both immediate benefits and long-term strategic gains.

Integration of Supporting Activities

Cloud-based systems are essential for integrating supporting activities—such as equipment tracking, calibration scheduling, and safety issue identification—into the primary measurement workflow. By consolidating these tasks within a single platform, cloud solutions ensure that all critical functions are interconnected, minimizing the risk of oversights or delays.

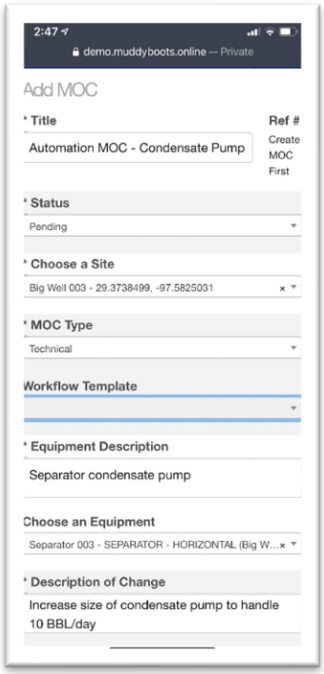

Figure 3. Management of Change

For example, equipment tracking is streamlined as field technicians and managers can access real-time schematics, diagrams, and maintenance histories directly on-site. This connectivity helps prevent equipment downtime and ensures that resources are readily available when needed. Calibration scheduling is also optimized through automated reminders and integrated calendars, guaranteeing that calibration tasks are completed on time and maintaining the accuracy and reliability of measurement instruments.

Figure 4. Schematics

Additionally, cloud platforms enhance safety management and operations by enabling the tracking and historical reporting of potential hazards and allowing for opening of workorder for equipment maintenance and repair. This capability allows for faster identification and resolution of issues, improving overall operational safety and compliance.

Integrating these supporting functions into the core workflow with cloud-based systems results in a more cohesive and responsive operation. All components work together seamlessly, enhancing both the efficiency of the measurement process and the overall effectiveness of field operations.

Return on Investment

Adopting cloud-based software for field measurement operations represents a significant investment, but the return on this investment is both immediate and long-lasting. By streamlining calibration processes, optimizing technician routes, and enhancing regulatory compliance, these systems not only improve operational efficiency but also reduce overall costs. The ability to automate and integrate various measurement activities leads to a more productive workforce, while the ease of information access and control further supports decision-making and client communication. Together, these benefits justify the shift to cloud technology, offering tangible value that enhances both daily operations and long-term strategic goals.

- Increased Efficiency in Calibration: Field staff can calibrate meters faster with cloud-based tools, eliminating the need for manual calculations and reducing data entry time. This efficiency allows technicians to complete more calibrations within the same time frame.
- Optimized Meter Calibration: The distance capability feature enables technicians to view and calibrate meters that are closest to them, increasing the number of meters serviced and reducing travel time between locations.
- Enhanced Regulatory Compliance Burden: Cloud-based systems minimize the risk of errors and missed calibrations, leading to fewer re-dos and improved adherence to regulatory requirements. Automatic record-keeping simplifies audit processes, saving time and reducing compliance costs.
- Improved Scheduling Efficiency: The map feature optimizes technician routes based on geographic locations, ensuring that calibrations are conducted more organically as work progresses. This leads to better resource utilization and reduced travel time.
- Comprehensive Measurement Management: The software captures a wide range of measurement activities, enabling

technicians to accomplish more tasks efficiently and improve overall productivity.

- Streamlined Information Access and Control: Reduced time spent searching for information, preparing reports, and sharing data with clients. The system also aids in quickly identifying equipment performance trends and potential issues, allowing for proactive maintenance.
- Lower Administrative Burden: The automation and integration provided by cloud-based systems reduce administrative tasks and training time, allowing staff to focus more on critical operational activities.

Cost Comparisons

Cost / Benefit for Cloud

Assumptions

Tech Hourly Rate	$ 60.00	
Office Hourly Rate	$ 75.00	
Calibrations/Month	2000	
Number Techs	25	
Avg Time to do a cal	1.25	Hours
Cost Vehicle Mile	$0.70	
Annual Cost Server Maint	$5,000	

Calculations

			Formula	Time Savings	Monthly Savings	Annual Savings
Efficiency for field staff - *there are many ways that Muddy Boots makes the field techs work more efficient.*						
- ability to record a calibration faster due to software efficiency and a company standardized process (eg.no side calcs required by tech)	Reduced Time/Mins	15	Reduced time x Calibrations/Month	500	$ 30,000	$ 360,000
- ability to calibrate more meters (using the distance capability to see what work is close by)	Additional Calibrations/month/tech	1	Additional calibrations x avg time to do a cal x Number techs	31.25	$ 1,875	$ 22,500
- reduced windshield time	Miles/Month/Tech	100	Miles/month/tech X drive cost/mile		$ 1,750	$ 21,000
Increased compliance - *with builtin API 21.1 and BLM tolerance rules compliance is much higher*						
- reduced audit/reduced redo time/less rework/less calibrations missed in a month.	Number fewer calibrations/tech	1	Number Fewer Calibrations x Avg Time X Tech Hourly Rate x Number techs		$ 1,875	$ 22,500
- less time spent applying meter factors/less time working on audits	Total Hours Month	50	Hours x tech hourly rate		$ 3,000	$ 36,000
Scheduling Efficiency - *graphic/auto reschedule capabilities reduce the scheduling effort*						
- schedule by area using the map feature, guide the tech to	Mins/tech/Month	15	Min/tech/month x Number techs x Hourly rate		$ 375	$ 4,500
- calibration optimization based on geographics.						
- will organically happen as work is done (techs can see what is close by)						
Efficiency to complete additional tasks online - *enter ATGs, witnessing …. All other activities can be done in Muddy Boots.*						
- doing all other activities electronically while onsite	Mins/tech/Month	60	Min/tech/month x Number techs x Hourly rate		$ 1,500	$ 18,000
Efficiency of information access and control						
- reduced time looking up information and reporting	Hours/Month	10	Hours x tech rate		$ 600	$ 7,200
- reduced time sharing information with clients	Hours/Month	10	Hours x tech rate		$ 600	$ 7,200
- trending - identify bad actors (meters with repeat issues)			subjective			
Administrative Burden Reduced						
- reduced time to add new meters, new users (puts the work in the hands of the people doing it)	Hours/Month	10			$ 600	$ 7,200
- reduced training time (onboarding straight forward)	Hours/Month	10			$ 600	$ 7,200
Cloud Based Advantages						
- no server needs (hardware and IT support savings)	Number of Servers	10	Number of Servers x Annual Cost/Server			$50,000
- enhancements immediately available, no need to work on implementing upgrades	Avg Annual Upgrade Effort/hours	400	Upgrade Effort x Hourly Rate			$ 30,000
Totals					**$ 42,775**	**$ 593,300**

Figure 5. Cost Benefit Worksheet

Other Benefits

- techs are happy that they have a better tool (less frustration)
- faster to onboard new techs
- secure auditable database
- easy to refine processes to improve operation
- Ability to focus on Measurement Assets
- Dashboard - auto KPIs ==> help manage your workforce
- API capability - easily push data to other tools
- MB Connect ability - have outside services companies use the system
- Regulatory Reporting More Streamlined

Key Highlights

- Significant Reduction in Calibration Time: reduces calibration time by 15 minutes per instance, leading to substantial annual savings
- Increased Efficiency: Additional calibration capabilities, reduced windshield time, and optimized scheduling all contribute to efficiency improvements
- Enhanced Compliance: Compliance with API 21.1 and BLM standards reduces rework
- Cloud-Based Cost Reductions: Transitioning to cloud services eliminates the need for physical servers and ensures faster access to necessary software upgrades
- Overall Impact: Integration of software offers a comprehensive saving of nearly $600,000 annually, highlighting its critical role in operational efficiency, compliance, and cost management

While some benefits of adopting cloud-based software are easily measured, others are more nuanced but equally impactful. Technicians experience less frustration and greater job satisfaction with improved tools, leading to a more motivated and productive workforce. The streamlined onboarding process for new hires reduces training time, allowing them to contribute more quickly. A secure, auditable database ensures data integrity and simplifies regulatory reporting, giving companies confidence in their compliance efforts.

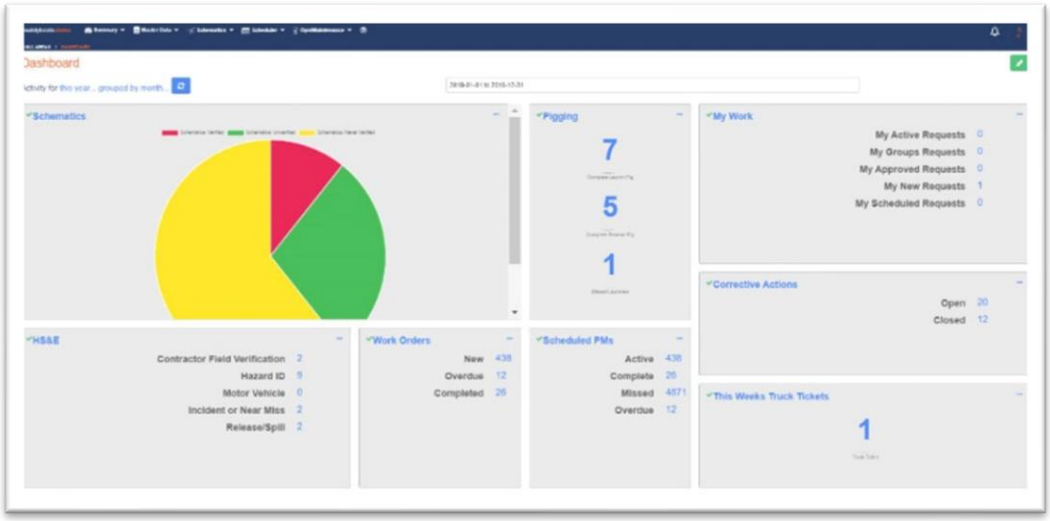

Figure 6. Performance Dashboard

Additionally, the use of intuitive dashboards with relevant Key Performance Indicators (KPIs) allows management to refine processes and focus on critical measurement assets. This functionality supports more informed decision-making and improves team management by providing clear insights into performance metrics important to the organization. Often, the software will feature API capability for seamless data integration with other tools.

These cost savings are more than just theoretical; they translate into tangible financial benefits for operators. By reducing inefficiencies, minimizing manual labor, and optimizing resource allocation, organizations can expect to see substantial reductions in operational costs. This leads to a direct positive impact on the bottom line, demonstrating that the investment in cost-saving measures yields significant and measurable economic advantages.

A Case Study in Implementation

- XTO Energy Case Study: A detailed case study on how XTO Energy successfully implemented a cloud-based measurement system, highlighting the practical benefits and ROI (Return on Investment).

Specific Challenges XTO Faced with Their Legacy System

- Outdated technology: The system was described as "pieced together through acquisitions" and "dated," suggesting it was not equipped to handle modern operational requirements.
- Inefficient processes: Technicians reported spending excessive time (over 45 minutes) recording a single calibration, indicating a cumbersome and time-consuming workflow.
- Data synchronization issues: The system was prone to corruption and synchronization problems, leading to data loss and IT burden.
- Lack of compliance feedback: The system did not provide real-time feedback on compliance with industry standards and company regulations.
- High operational costs: The legacy system required significant IT support, including maintaining 17 dedicated servers and spending 2-3 hours setting up each technician's laptop.

Key Factors Influencing XTO's Decision to Move to the Cloud

- Efficiency gains: The desire to streamline operations and reduce the time spent on data entry and manual tasks.
- Cost savings: The potential to reduce IT infrastructure costs and operational expenses.
- Improved data management: The need for a more centralized and accessible data repository.
- Enhanced compliance: The desire to ensure compliance with industry standards and regulations.
- Scalability: The ability to adapt to changing business needs and scale the system as required.
- User-friendliness: The preference for a system that is easier to use for both field technicians and back-office staff.

Quantifiable Results

- Increased efficiency: Technicians reported significant time savings in completing calibrations.
- Reduced administrative burden: User setup and system adjustments became much faster.
- Improved data accuracy: The standardized forms and automated processes helped reduce errors.
- Enhanced compliance: The system provided feedback on compliance and simplified audit trails.

Considerations for Implementation

- Thorough evaluation: Conduct a thorough evaluation of existing systems and identify specific pain points.
- Pilot testing: Implement a pilot program to assess the new system's functionality and identify potential issues.
- Customization: Ensure the system is customized to meet specific business needs and workflows.
- User training: Provide comprehensive training to ensure users are comfortable with the new system.
- Data migration planning: Develop a detailed plan for migrating data from the legacy system to the new one.
- Change management: Implement effective change management strategies to address resistance and ensure adoption.
- Ongoing support: Establish a support process to address any issues that may arise after implementation.

Generalized Approach to Implementation

1. **Assessment:**
   - Identify specific challenges and goals for field measurement operations.
   - Evaluate the capabilities of existing systems and their limitations.
   - Define key performance indicators (KPIs) to measure success.
2. **Research and Selection:**
   - Research cloud-based field measurement software options.
   - Compare features, pricing, scalability, and security measures.
   - Select a solution that aligns with the identified needs and budget.
3. **Customization:**
   - Configure the software to match specific workflows, data requirements, and compliance standards.
   - Customize forms, reports, and dashboards to meet user needs.
   - Integrate with existing systems (e.g., ERP, GIS) if applicable.
4. **Migration:**
   - Develop a plan to migrate existing data from legacy systems to the cloud.
   - Ensure data integrity and accuracy during the migration process.
5. **Training:**

- Develop comprehensive training materials for field technicians, managers, and other relevant personnel.
- Conduct training sessions to familiarize users with the new system's features and functionalities.

6. **Pilot:**
   - Implement the system in a limited area or department to test its performance and identify potential issues.
   - Gather feedback from users and make necessary adjustments.
7. **Rollout:**
   - Implement the system across the entire organization.
   - Provide ongoing support and assistance to users during the rollout process.
8. **Monitoring:**
   - Continuously monitor system performance and user adoption.
   - Collect feedback and make necessary adjustments to improve efficiency and effectiveness.
   - Leverage data analytics to identify opportunities for optimization.

Cloud-based measurement systems have the potential to evolve further, incorporating advanced technologies such as predictive analytics and machine learning. By analyzing historical data, these systems can anticipate equipment failures and optimize maintenance schedules, reducing downtime and costs. Furthermore, integrating with IoT devices allows for real-time data collection and analysis, enabling organizations to make more informed decisions and improve operational efficiency. Expanding remote monitoring capabilities can provide greater control and oversight, further enhancing the value of cloud-based solutions.

Consider Adopting Cloud-Based Software for Measurement Operations

This paper has presented a compelling case for migrating field measurement activities to cloud-based systems. Compared to traditional legacy infrastructure, cloud solutions offer significant advantages, including:

- Reduced Infrastructure Requirements: Eliminates the need for dedicated servers and software installations, lowering hardware and maintenance costs.
- Improved Efficiency: Streamlines workflows, automates tasks, and facilitates data sharing, leading to faster calibration times and increased technician productivity.
- Enhanced Data Management: Centralizes data in a secure and accessible platform, ensuring data integrity and simplifying regulatory compliance.
- Increased Scalability: Adapts to changing operational demands, allowing for easy scaling up or down as needed.
- Lower Administrative Burden: Automates processes and reduces data entry tasks, freeing up valuable staff time for other critical activities.

The XTO Energy case study exemplifies the tangible benefits of adopting cloud-based solutions. By eliminating inefficiencies and streamlining workflows, XTO achieved significant improvements in data accuracy, efficiency, and compliance.

Looking ahead, cloud-based measurement systems will continue to improve and add more functionality, incorporating advanced technologies such as predictive analytics and real-time data collection through IoT integration.

Transitioning to cloud-based field measurement systems presents a strategic opportunity for organizations to modernize their operations, optimize resource allocation, and gain a competitive edge. Given the transformative potential of cloud technology, organizations in the field of measurement should carefully consider its adoption to capitalize on the benefits of improved efficiency, data management, and overall performance.