Nigeria Hydrocarbon Measurement Conference

5TH EDITION 2025 REPORT

Fleissen EVENTS

5th NIGERIA HYDROCARBON MEASUREMENT CONFERENCE (NiHMEC) 2025

APPRECIATION

Fleissen Events extends sincere appreciation to the NiHMEC Chairman and members of the Technical Advisory Committee (TAC) for their pivotal contributions to the success of the 5th Nigeria Hydrocarbon Measurement Conference (NiHMEC) 2025.

The NiHMEC Technical Advisory Committee comprises distinguished professionals and thought leaders from Nigeria's oil, gas, and energy services sectors. Their technical guidance and industry insights continue to shape NiHMEC as the foremost platform advancing excellence in hydrocarbon measurement and accounting:

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APPRECIATION

We wish to express our profound appreciation to our very supportive sponsors, who provided the funds that facilitated the smooth running of NiHMEC 2025.

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NiHMEC 2025 Executive Brief

The fifth edition of the Nigeria Hydrocarbon Measurement Conference (NiHMEC)–2025 demonstrated how far the nation has advanced in restoring integrity to hydrocarbon accounting. With wide participation from regulators, operators, and technology providers, the conference confirmed that digitalisation, data integrity, and regulatory reform are driving the next phase of Nigeria's oil and gas transformation.

1. From Measurement Crisis to Measurable Progress

Nigeria has recorded an 89 percent reduction in crude oil losses between 2021 and 2025—from 37.6 million to 4.1 million barrels annually.

Forensic assessments revealed that about 40 percent of previous losses were due not to theft but to measurement inaccuracies.

This finding redirected national attention from pipeline security toward metering integrity, automation, and transparent data reconciliation. The industry now recognises that what is accurately measured can be protected, valued, and monetised.

2. Strengthened Regulatory Architecture
Reforms under the Petroleum Industry Act (PIA) and new measurement regulations have provided a coherent framework for accountability and transparency.

Highlights include:

- **Comprehensive metering regulations** defining standards for equipment certification, calibration, and audits.
- **Advanced cargo-tracking systems** assigning unique identification numbers to every export for real-time verification.
- **Integrated digital monitoring platforms** linking production data directly to regulators to maintain a single verified national record.

These developments have unified reporting, improved fiscal reliability, and reinforced investor confidence.

3. Digital Transformation Across the Chain
Automation now underpins both upstream and downstream operations.

Digital platforms for licensing, product tracking, and gas network management have reduced manual processing and improved visibility.

Operators are deploying smart meters, SCADA systems, and remote monitoring tools that deliver real-time analytics and automated reconciliation.

The transition from manual spreadsheets to intelligent systems has reduced reporting time by over 90 percent in some facilities and produced measurable operational and financial gains.

4. Technology and Innovation
NiHMEC 2025 showcased how technology is redefining precision and efficiency across the sector:

- **Water-Cut Meters:** Recent validation trials on multiple technologies have established reliable methods for accurately determining water content in crude—a crucial factor for asset valuation and cost allocation.
- **Virtual Flow Metering (VFM):** Uses computational models to estimate multiphase flow in real time, cutting costs and improving safety.
- **Self-Verifying Smart Meters:** Automatically detect calibration drift and adjust without interrupting operations.
- **Static Mixing Systems:** Ensure homogeneous sampling, eliminating costly reconciliation errors.
- **Compact Small-Volume Provers:** Deliver precision within 0.02 percent API tolerance with automated diagnostics.

Collectively, these advances have improved measurement accuracy, strengthened process safety, and reduced downtime.

5. Operational Efficiency and Emissions Accountability

Most residual losses now arise from operational inefficiencies, not theft. Optimisation of existing wells and processes could recover up to 2.8 million barrels annually without new drilling.

Measurement has also expanded into greenhouse-gas accounting. Accurate monitoring of flaring, venting, and fugitive emissions is now essential for carbon-intensity disclosure and access to cleaner-fuel markets. Digital flare-measurement systems are supporting Nigeria's Methane Reduction Programme and national climate-reporting goals.

6. Building Capacity and Securing Data
Domestic calibration capacity is improving through the National Metrology Institute, which is scaling ISO 17025 accreditation and providing local certification services.

Meanwhile, the expansion of connected devices has heightened cybersecurity risks.

Adoption of industrial-control security standards and separation of operational and corporate networks were highlighted as immediate safeguards to protect data integrity and revenue streams.

7. Remaining Challenges
Persistent barriers identified include:

- Cultural resistance to automation.
- Limited local maintenance and calibration expertise.
- Poor gas-composition data from unmaintained chromatographs.
- Perception of digitalisation as a cost rather than an investment.

Addressing these issues requires sustained collaboration, training, and local technology partnerships.

8. The Road Ahead
NiHMEC 2025 concluded with a shared vision to achieve near-zero measurement losses through full digital integration, continuous calibration, and capacity development.

Priorities for 2026 include embedding automation benchmarks in regulatory approvals, accelerating local metrology accreditation, and incentivising indigenous manufacturing.

The overarching message: measurement is the language of trust.

It underpins revenue assurance, environmental accountability, and sustainable growth.

Nigeria's progress in reducing yearly crude oil production losses from 37.6 million barrels to 4 million barrels over six years demonstrates that with accurate data, disciplined governance, and skilled professionals, the country can build a transparent and globally competitive hydrocarbon sector.

Welcome Address by NiHMEC Chairman

Mr Osten Olorunsola

The fifth anniversary of the Nigeria Hydrocarbon Measurement Conference opened with a brief and thoughtful address by the Chairman, Mr Osten Olorunsola. He welcomed regulators, industry leaders, sponsors, partners, and members of the Technical Advisory Committee to a platform built on collaboration and knowledge sharing. He reminded participants that NiHMEC is not an association but a professional forum that brings practitioners together to exchange practical experiences and strengthen Nigeria's capacity for accurate hydrocarbon measurement and accounting.

"NiHMEC is not an association; it is a platform that brings practitioners together to discuss real, technical, and practical issues around metering and hydrocarbon accounting."

Reflecting on NiHMEC's journey since 2021, he said the conference was launched during COVID-19 to promote integrity and transparency in hydrocarbon measurement across the value chain. Each edition, he noted, has advanced collaboration between regulators and operators, improved calibration and audit readiness, and connected the technical, commercial, and legal aspects of measurement.

"Two or three years ago, people questioned whether the industry even knew what it was measuring. Today, that narrative is changing. Trust is becoming more entrenched."

Speaking on the 2025 theme, Beyond the Meter: Leveraging Digitalisation for Accurate Hydrocarbon Accounting, he said digitalisation is reshaping how measurement is done across the industry. Instruments are now becoming intelligent systems capable of real-time data validation, anomaly detection, and predictive maintenance. He explained that NiHMEC 2025 introduced new Thought Leadership Sessions where companies shared practical experiences rather than theory. These sessions, he noted, reflect the industry's growing willingness to learn and exchange knowledge in areas such as audits, uncertainty management, and digital reconciliation.

"Knowledge of hydrocarbon measurement and accounting is no longer optional—it is essential. We must stay at the forefront of digitalisation to account for every molecule we produce."

He commended the Nigerian Upstream Petroleum Regulatory Commission for its leadership in strengthening oversight, standardisation, and compliance. As automation grows, he said, digital systems now enable virtual flow metering, cloud-based reconciliation, and analytics that close the gap between production and reporting.

He outlined the NiHMEC 2025 programme. The first day focused on improving upstream hydrocarbon accounting through real-time data and automation. The second examined how digital tools are transforming midstream and downstream measurement, especially custody transfer and value determination. The final day explored predictive analytics, digital twins, and emissions monitoring as tools for efficiency and environmental responsibility.

He reminded participants that accurate measurement links technology, commerce, and governance. It builds

investor confidence, protects government revenue, and reduces environmental risk. As Nigeria advances its energy transition, reliable and verifiable data is key to enforcement and performance.

He thanked the Nigerian Upstream Petroleum Regulatory Commission, the Nigerian Midstream and Downstream Petroleum Regulatory Authority, and the Nigerian Content Development and Monitoring Board for their commitment to measurement integrity. He also appreciated sponsors and exhibitors who continue to support NiHMEC's growth. He closed by acknowledging the Fleissen Events team and members of the Technical Advisory Committee for their commitment.

Mr Olorunsola's address set a clear and forward-looking tone for the conference, reaffirming NiHMEC's role in advancing accuracy, transparency, and digital transformation in hydrocarbon measurement and accounting.

Goodwill Message

Dr. Mohammed Bello Shehu, Chairman, Revenue Mobilisation, Allocation and Fiscal Commission (RMAFC)


Dr. Mohammed Bello Shehu

The goodwill message from Dr. Mohammed Bello Shehu, Chairman of the Revenue Mobilisation, Allocation and Fiscal Commission (RMAFC), was delivered on his behalf by Hon. Akeem Akintayo Amosun, Acting Chairman of the Crude Oil Monitoring Committee.

Dr. Shehu expressed appreciation to the organisers of the Nigerian Hydrocarbon Measurement Conference (NiHMEC 2025) for inviting the Commission once again and for maintaining focus on improving the accuracy of hydrocarbon accounting in Nigeria. He commended NiHMEC for bringing together key stakeholders in government and the private sector to share knowledge on measurement, metering, and accountability in the oil and gas industry.

He noted that the theme of the conference aligns with the Commission's constitutional responsibility to monitor the accruals and disbursement of revenue from the Federation Account and to advise government on ways to improve fiscal efficiency and enhance revenue generation.

Dr. Shehu reminded participants that revenue from oil and gas constitutes over half of Nigeria's total Federation Account inflows. He emphasised that the crude oil and gas sector remains a major source of export earnings, foreign exchange, and fiscal stability for the country. Oil alone, he said, accounts for more than a quarter of Nigeria's GDP, over 50 percent of government revenue, and about 95 percent of foreign exchange earnings. Because of this central role, accurate accounting and transparent management of hydrocarbon production and sales are essential for sustaining economic growth and national unity.


Hon. Akeem Akintayo Amosun

He said the Commission attaches great importance to ensuring that all revenue due to the Federation is properly accounted for and fairly shared among the federal, state, and local governments. The accuracy of hydrocarbon measurement, he noted, has a direct impact on the amount of revenue available for allocation and development at all levels of government.

Dr. Shehu urged the industry to look beyond metering alone and to consider hydrocarbon accounting as an integrated system that includes data management, allocation, reconciliation, inventory control, commercial analysis, and regulatory compliance. He explained that hydrocarbon accounting should be capable of tracking, controlling, and valuing hydrocarbons from source to sale, using robust software for data capture, loss tracking, and financial reporting.

He identified digitalisation as the key driver of modern hydrocarbon accounting. Digital systems, he said, enable data integration and process automation, improve efficiency, and enhance transparency. He called on operators and regulators to invest in digital solutions that minimise errors, prevent leakages, and strengthen

public confidence in Nigeria's revenue systems.

He concluded by encouraging the conference to develop actionable recommendations that would help transform Nigeria's oil and gas sector into one that reflects best global practices in accountability and efficiency. He commended NiHMEC's consistent efforts to raise the standard of hydrocarbon measurement and expressed hope that the outcomes of the 2025 edition would contribute to measurable improvements across the industry.

"Hydrocarbon accounting must go beyond simple measurement," he said. "It should provide a comprehensive framework that ensures transparency, supports fiscal decision-making, and strengthens confidence in how Nigeria's most important resources are managed."

Dr. Shehu ended his message by wishing all participants fruitful deliberations and reaffirmed RMAFC's support for initiatives that promote transparency, accuracy, and sustainable revenue management in Nigeria's oil and gas sector.

KEYNOTE ADDRESS

Accurate Measurement and Digitalisation: The Hallmark of Transparent Hydrocarbon Accounting

By Engr. Gbenga Komolafe, FNSE, Commission Chief Executive, Nigerian Upstream Petroleum Regulatory Commission (NUPRC)

Engr. Gbenga Komolafe, FNSE

Representing the Chief Executive of the Nigerian Upstream Petroleum Regulatory Commission, Mr Emmanuel Mac-Jaja delivered the keynote address titled *Accurate Measurement and Digitalisation: The Hallmark of Transparent Hydrocarbon Accounting.*

Engr. Komolafe stated that hydrocarbon measurement and accounting are central to Nigeria's oil and gas fiscal governance framework. He noted that without accurate measurement there can be no transparency, without digitalisation there can be no efficiency, and without both, the industry cannot build trust.

He explained that reliable production data is the foundation of fiscal integrity. Every unaccounted barrel of oil or molecule of gas represents a direct loss to national revenue. For many years, manual processes and disconnected systems reduced accountability, but the Commission is now closing these gaps through targeted regulation and digital systems.

Under the Petroleum Industry Act (PIA) 2021, NUPRC has made hydrocarbon accounting a key priority. Nigeria's proven reserves of about 37 billion barrels of oil and 210 trillion cubic feet of gas can only translate into value when production volumes are accurately measured and transparently verified. The Commission's end-to-end monitoring framework now tracks oil and gas flows from the reservoir to export terminals. It combines Maximum Efficiency Rate (MER) tests, Lease Automatic Custody Transfer (LACT) meters, static dip checks, and material-balance reconciliation to ensure that reported production figures are consistent and credible.

"Without accurate measurement there is no transparency, without digitalisation there is no efficiency, and without both there can be no trust."

The keynote also described two regulatory instruments recently introduced by the Commission to strengthen transparency, traceability, and data reliability in the upstream value chain.

- The **Upstream Metering Regulation (2024)** provides a framework for accurate and consistent hydrocarbon measurement. It requires all licensees and operators to install approved metering systems, use licensed service providers for installation and calibration, and ensure that all meters used for allocation or custody transfer are auditable and verifiable.

- The **Advanced Cargo Declaration Regulation (2024)** establishes a system for tracking every crude cargo exported from Nigeria. Each cargo is assigned a Unique Identification Number (UIN) to enable real-time monitoring of its origin, volume, and quality. The system automates export clearance, documentation, and reconciliation, giving regulators and operators a single source of verified export data and improving the transparency of Nigeria's crude trade.

Implementation of these regulations follows three

progressive phases: a national audit of all upstream measurement systems to establish a baseline; correction of deficiencies identified during the audit, including equipment upgrades and recertification; and integration of all facilities into a central digital platform for real-time production and export tracking. The address also referenced an operational monitoring centre where NUPRC tracks daily production and engages operators whenever discrepancies are detected.

On the issue of water-cut measurement, Engr. Komolafe noted that accuracy remains a challenge in most production facilities. Determining the proportion of water in produced fluids, he explained, is essential for both production optimisation and allocation. Reliable water-cut data ensures that each producing stream, partner, or shared pipeline user is properly credited for its actual hydrocarbon output. He added that inconsistent readings can distort operational and fiscal outcomes by affecting cost allocation, revenue sharing, and metering reconciliation.

Mr Emmanuel Mac-Jaja

The Commission, he said, is collaborating with producers and research institutions to evaluate current practices and establish new standards for calibration and verification. The study will define clear performance benchmarks for water-cut meters and provide guidance for certification under NUPRC's regulatory framework.

"The percentage of water in crude determines the true value of every barrel. If we cannot measure it accurately, we cannot price it correctly."

Engr. Komolafe noted that digitalisation extends beyond equipment; it demands a culture of transparency and cooperation across the industry. He urged operators and service companies to align with the Commission's plans and adopt shared data standards that ensure consistency across the sector. Accurate hydrocarbon measurement and accounting, he emphasised, form the basis for Nigeria's oil and gas fiscal governance. Reconciled production data supports royalty assessment, tax computation, cost recovery, and investment assurance.

He concluded by calling for collaboration and consistency, reminding participants that the industry must make accuracy a habit rather than an obligation.

Key Takeaways from the Keynote

1. **Accurate measurement drives transparency and revenue assurance.** It is the foundation of trust between operators, regulators, and the state, ensuring that reported production reflects true volumes.
2. **Digitalisation is now central to regulatory compliance.** Real-time monitoring, automated reconciliation, and integrated data systems are transforming how Nigeria accounts for its hydrocarbon resources.
3. **Regulatory reforms provide a new framework for accountability.** The Upstream Metering Regulation and the Advanced Cargo Declaration Regulation ensure traceability from production to export and establish clear expectations for all operators.
4. **Water-cut measurement is both a technical and commercial priority.** The accuracy of water content readings directly affects production allocation, cost sharing, and the fiscal value of crude oil.
5. **Data integration strengthens national reporting.** The central monitoring system under development will provide a unified view of production and exports, improving data reliability and dispute resolution.
6. **Collaboration is essential for sustainability.** Regulators, operators, and service providers must maintain calibration integrity, share data transparently, and work collectively to enhance Nigeria's hydrocarbon accounting system.

KEYNOTE ADDRESS

Accurate Measurement and Digitalisation as Pillars of Transparency in Petroleum Trade

Engr. Farouk Ahmed, Authority Chief Executive, Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA)

The keynote address of the Authority Chief Executive, Engr. Farouk Ahmed, was delivered by Engr. Lukman Cardoso. Engr. Ahmed began by stating that it was an honour to deliver his keynote address at a time when the petroleum industry is undergoing significant transformation driven by reforms, innovation, and the collective will to build a transparent and sustainable petroleum sector in Nigeria.

He explained that the theme of the conference, *Accurate Measurement and Digitalisation as Pillars of Transparency in Petroleum Trade,* is very relevant because it directly aligns with one of the core mandates of the NMDPRA — to foster transparency, accountability, and efficiency in the midstream and downstream petroleum industry for the benefit of stakeholders and the nation.

He said petroleum trade, whether in crude oil, natural gas, or petroleum products, is a business that depends on trust, and trust is dependent on verifiable data. Verifiable data begins with accurate measurement, without which there can be no certainty in transaction values or fairness in commercial dealings. He added that inaccuracies, whether deliberate or accidental, create revenue losses, reduce government earnings, and erode public confidence in the industry. In Nigeria, where petroleum trade remains a major source of foreign exchange and government revenue, measurement is not just a technical function but a matter of national interest.

Engr. Ahmed recalled that the Petroleum Industry Act (PIA) 2021 provides a framework for transparency, good governance, and accountability in the administration of Nigeria's petroleum resources. He said the Act also promotes a business environment that supports commercially oriented operations and the deepening of local content.

He explained that the NMDPRA is committed to ensuring that every hydrocarbon supplied, transported, processed, refined, stored, exported, distributed, or sold in Nigeria is properly accounted for with precision. For this reason, the Authority has developed strong regulations and guidelines that define measurement standards across the midstream and downstream value chain.

He said accurate measurement is now guaranteed through multiple layers of regulation, starting with the

Engr. Farouk Ahmed FNSE

Petroleum Measurement Regulations 2023, which are based on internationally recognised standards and best practices. These regulations provide for approved metering systems and measurement procedures, define the basis for calculating revenue to the government and licensees, and set clear requirements for enforcement, calibration, certification, reconciliation, and penalties for failure to comply.

On digitalisation, Engr. Ahmed said there is no better time to discuss this topic than now, when artificial intelligence is shaping global market trends. He described the positive connection between measurement accuracy and profitability as the reason the NMDPRA continues to partner with NiHMEC and other industry stakeholders. He said this relationship builds a strong basis that assures profits to businesses, taxes and levies to government, dividends to investors, and confidence for all stakeholders.

He explained that digital hydrocarbon measurement involves several key components that work together to provide accurate and reliable data. These include sensing elements, conversion elements, manipulation elements, data transmission, data processing, and data presentation.

He said modern digital measurement systems also incorporate flow computers, gas chromatographs, tem-

perature and pressure sensors, and communication interfaces that make it possible to achieve accurate, reliable, and transparent measurement data for applications such as custody transfer, process control, and fiscal metering. He added that this requires heavy investment in digital technologies and data.

Engr. Ahmed said measurement provides the data, but digitalisation provides the platform to secure, process, and make that data accessible. In today's economy, transparency cannot be achieved through manual processes alone. Digital platforms now allow regulators and operators to access information that builds trust and improves accountability.


Engr. Lukman Cardoso

He said the availability of automated platforms has reduced turnaround times for licence processing and issuance, and also reduced opportunities for fraud and manipulation. This has strengthened transparency between regulators and operators.

He added that digital monitoring systems at depots, retail outlets, and transportation channels make it possible to track petroleum flows in real time, while automation and smart sensors at processing plants enable remote monitoring and accounting of petroleum products.

He said that in the last four years, following the passage of the PIA, the NMDPRA has launched initiatives to integrate digital technologies into its regulatory functions. These include the online licensing portal, which reduces human interaction in approval processes; the real-time monitoring of petroleum product movement through the Authority's Enterprise Data Management System (EDMS) known as *Allegro*; and the **Gas Network Code**, which allows the Authority to monitor gas transmission and distribution.

According to him, these systems are designed to build a regulatory framework that prioritises openness, traceability, and efficiency.

"When the principles of accurate measurement and digitalisation come together," he said, "we build a system where revenue loss is reduced to the barest minimum, operators transact on a level playing field, investors see fairness and reliability, and consumers are protected from sharp practices."

He noted that transparency requires investment in modern technologies, continuous capacity building, and the collaboration of regulators, operators, and all relevant stakeholders to do what is right.

He outlined the Authority's key commitments under the PIA:

- Strengthening measurement infrastructure across the midstream and downstream petroleum value chain
- Driving digital transformation in regulatory oversight to ensure systems are secure and accessible
- Collaborating with industry players to ensure compliance while creating an environment that encourages innovation and investment

In conclusion, Engr. Ahmed said accurate measurement and digitalisation are not just regulatory requirements but strategic enablers of transparency, fairness, and growth in petroleum trade. They are the foundation for building a petroleum sector that is competitive, trusted, and globally respected.

He urged participants at NiHMEC 2025 to remain committed to these two pillars and said:

"Let us measure accurately and digitalise transparently, so that we can trade responsibly and grow together."

Key Takeaways

- Accurate measurement remains the foundation of transparency and fairness in petroleum trade.
- The *Petroleum Measurement Regulations 2023* provide clear standards for calibration, certification, reconciliation, and enforcement.
- Digital systems such as **EDMS (Allegro)** and the **Gas Transportation Network Code** now make real-time monitoring and accountability possible.
- Digitalisation builds trust between regulator and operator and reduces opportunities for manipulation.
- Transparency requires continued investment, training, and collaboration among all stakeholders.
- Accurate measurement and digitalisation together strengthen Nigeria's reputation and safeguard national revenue.

KEYNOTE ADDRESS

Enhancing Hydrocarbon Measurement and Accounting in Support of National Revenue Goals

Engr. Bashir Bayo Ojulari, Group Chief Executive Officer, NNPC Limited

The keynote address of the Group Chief Executive Officer of NNPC Limited, Engr. Bashir Bayo Ojulari, was delivered on his behalf by Mr. Olanrewaju Richard Igandan, Head of Joint Venture Investment Management (JVIM), Nigerian Upstream Investment Management Services (NUIMS).

Engr. Ojulari began by expressing appreciation to the organisers of the Nigerian Hydrocarbon Measurement Conference (NiHMEC) for sustaining a professional platform where key industry stakeholders meet to exchange knowledge and advance solutions to issues that affect hydrocarbon measurement and accounting in Nigeria. He said the theme of this year's conference is timely because accurate measurement and transparent accounting are essential to achieving Nigeria's revenue objectives.

He stated that hydrocarbon resources remain the backbone of Nigeria's economy and a major source of foreign exchange earnings. Revenue from oil and gas funds infrastructure, health, education, and other public services that improve national development. He said that for Nigeria to achieve its fiscal and developmental goals, the accuracy and integrity of hydrocarbon measurement must remain a national priority.

"What is not properly measured cannot be fully monetised, and what is not transparently accounted for cannot sustainably support national development," he said.

He explained that the enactment of the Petroleum Industry Act (PIA) 2021 transformed NNPC Limited into a fully commercial company with a clear mandate to operate profitably and efficiently while maintaining transparency and accountability in all its operations. Hydrocarbon measurement and accounting, he said, are critical components of this mandate.

Engr. Ojulari noted that NNPC Limited is working closely with the Nigerian Upstream Petroleum Regulatory Commission (NUPRC) and the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA) to enhance metering systems and ensure that every barrel of crude oil and every cubic foot of gas is properly measured and accounted for.

He explained that NNPC Limited has embarked on several initiatives to improve hydrocarbon measurement across its operations. These include the deployment of modern custody transfer meters, advanced tank gauging systems, and multiphase flow measurement technologies at production and export facilities. The company is also expanding the use of automated systems for real-time monitoring of production and exports to reduce human error and improve data reliability.


Engr. Bashir Bayo Ojulari

He said NNPC is also addressing crude oil theft and associated losses through a combination of digital surveillance technologies, collaboration with security agencies, and continuous engagement with host communities. These efforts are supported by the use of drones, satellite monitoring, and other digital tools that help identify and prevent illegal activities along pipeline routes.

He emphasised that NNPC continues to benchmark its operations against international best practices and global industry leaders such as Aramco, Petrobras, and Petronas. The company is also investing in research and development, training, and local capacity building to sustain operational excellence in hydrocarbon management.

According to him, these efforts are already yielding measurable results. Improved hydrocarbon measure-

ment and accounting systems have enhanced government revenue assurance, reduced uncertainty, and improved investor confidence in Nigeria's oil and gas sector. Every accurately measured barrel of crude oil or gas, he said, translates into greater fiscal stability and more resources for national development.

"Hydrocarbon measurement is not just a technical activity," he said, "it is a strategic enabler for achieving Nigeria's revenue goals and ensuring long-term economic prosperity."

Mr. Olanrewaju Richard Igandan

He emphasised that transparency in hydrocarbon accounting cannot be achieved by one institution alone. It requires joint responsibility among regulators, operators, and service providers to maintain integrity, accuracy, and openness in all aspects of production and trade.

Engr. Ojulari reaffirmed NNPC Limited's commitment to supporting government initiatives aimed at improving transparency and efficiency in the petroleum sector. He said the company will continue to invest in advanced technology, strengthen its measurement infrastructure, and foster collaboration with all relevant stakeholders to protect value and optimise Nigeria's hydrocarbon resources.

He concluded by assuring that NNPC Limited remains dedicated to driving reforms that will safeguard national revenue, enhance operational efficiency, and position Nigeria as a reliable and transparent player in the global energy market. He called on all stakeholders to continue working together to ensure that the gains of accurate measurement and transparent accounting translate into lasting benefits for the country.

Key Takeaways

- Hydrocarbon measurement is central to national revenue assurance and fiscal stability.
- The Petroleum Industry Act 2021 has strengthened NNPC Limited's commercial and governance framework.
- NNPC is deploying advanced custody transfer, tank gauging, and multiphase flow meters across its facilities.
- The company is using digital surveillance and stakeholder collaboration to reduce theft and improve data integrity.
- Hydrocarbon measurement directly supports transparency, investor confidence, and sustainable development.
- Collaboration among regulators, operators, and service providers remains key to building trust and accountability.
- NNPC continues to benchmark its operations with international best practices to enhance accuracy and efficiency.

"What is not properly measured cannot be fully monetised, and what is not transparently accounted for cannot sustainably support national development."

CEO Panel Discussion

Moderator: Mr. Osten Olorunsola, Chairman, NiHMEC

Panelists:

- **Engr. Gbenga Komolafe, Commission Chief Executive, NUPRC (represented by Mr. Emmanuel Mac-Jaja)**
- **Engr. Farouk Ahmed, Authority Chief Executive, NMDPRA (represented by Engr. (Dr.) Lukeman Ayorinde Cardoso)**
- **'Gbite Falade, Managing Director/CEO, Aradel Holdings Plc**
- **Engr. Chichi Emenike, Managing Director, Neconde Energy Limited**
- **Etta Agbor, Managing Director/CEO, SeaQuest E&P Services Limited**

Mr. Osten Olorunsola opened the CEO session by welcoming the panel and participants to a conversation that, in his words, "must go beyond the technicalities of metering to the bigger questions of accountability and leadership." He said the goal was to examine how regulatory reforms, technology, and collaboration are shaping hydrocarbon measurement and accounting in Nigeria under the Petroleum Industry Act (PIA).

He explained that accurate measurement is not a stand-alone technical matter but a strategic issue that influences revenue assurance, investment confidence, and long-term industry credibility. He invited each panelist to share their perspectives based on their institutional roles and practical experience.

Strengthening Measurement Governance

Speaking first, Mr. Emmanuel Mac-Jaja, representing the Commission Chief Executive of the NUPRC, said the Commission is focused on standardising hydrocarbon measurement and deepening digitalisation across all operations.

He explained that after the implementation of the PIA, the Commission issued the *Upstream Measurement Regulation* and the *Advanced Cargo Declaration Regulation* to promote transparency, predictability, and accountability in oil and gas operations.

He disclosed that the NUPRC had completed a nationwide audit of all upstream metering facilities. The audit, he said, identified both compliance gaps and areas of excellence. The findings will guide new investments,

Mr Osten Olorunsola

metering upgrades, and targeted interventions by operators.

According to him, this work is helping the Commission build a more reliable measurement environment that meets international standards and strengthens investor confidence in Nigeria's production data.

Midstream and Downstream Oversight

Engr. (Dr.) Lukeman Cardoso, representing the Authority Chief Executive of the NMDPRA, explained that data integrity and digitalisation are central to the Authority's work in managing midstream and downstream petroleum flows.

He said the *Petroleum Measurement Regulation 2023* defines meter classes, certification requirements, and reconciliation procedures to ensure accuracy across pipelines, depots, and retail facilities.

Cardoso added that the Authority has automated more than seventy percent of its licensing and monitoring processes. Through the online licensing system, the gas management portal, and a national data dashboard, the NMDPRA now tracks product movements and reconciles figures in near real time.

He noted that the Authority's digital transformation reduces manual reporting, improves traceability, and promotes accountability among operators.

Industry Leadership and Innovation

Mr. 'Gbite Falade, Managing Director of Aradel Holdings, described data as the lifeblood of the modern petroleum business. "You cannot run a business without accurate data," he said. "For us, data is as important as the molecules themselves."

He explained that Aradel's integrated structure — covering oil, gas, and refining — depends on metering systems that provide real-time information for production planning, budgeting, and performance management.

Falade said Aradel has invested significantly in measurement infrastructure from the wellhead to refining operations, integrating these systems into a central data platform that supports decision-making and compliance. He emphasised that accuracy in measurement is not only a regulatory requirement but also an operational and commercial necessity for efficiency and competitiveness.

Service Sector Realities

Etta Agbor, Managing Director of SeaQuest Integrated Services, spoke on the evolving role of local service companies as indigenous operators take over more onshore assets. He said this shift demands higher technical capability and closer collaboration across the industry.

Agbor explained that accurate data at each transfer point — including water-cut measurement, automatic sampling, and laboratory analysis — is essential for reconciling volumes in shared pipelines and terminals.

He called for stronger coordination between regulators, operators, and service providers to achieve consistent measurement standards across all operations. He said standardisation reduces disputes and improves confidence in the data that drives fiscal and operational reporting.

Operational Integrity and Digital Transformation

Engr. Chichi Emenike, Managing Director of Neconde Energy, shared the operator's experience managing complex field networks such as OML 42, which involves multiple producers and third-party injections.

She explained that Neconde has upgraded its Lease Automatic Custody Transfer (LACT) units to digital systems that provide remote monitoring, real-time data capture, and direct reporting. These upgrades, she said, have improved transparency between operators and regulators.

Emenike added that Neconde employs drones and digital surveillance tools to monitor infrastructure and minimise production losses due to theft and vandalism. She noted that regular reconciliation of data between operators and regulators has strengthened relationships with lenders and investors who rely on verified production figures.

Building Human Capital

The panel agreed that developing skilled professionals is vital to sustaining the progress made in measurement and automation.

Falade said Aradel operates an Integrated Operations Control Centre that functions as both a monitoring hub and a learning platform, where staff can analyse data trends and simulate operations. This, he said, builds internal capacity and reduces dependence on external experts.

Emenike added that Neconde invests heavily in retraining technical teams to interpret data and manage modern metering systems effectively.

Agbor proposed that future NiHMEC events include poster and case-study sessions to allow practitioners to share field experiences and practical solutions, which he said would strengthen local expertise and harmonise best practices across the sector.

Regulatory Progress and Transparency

In response to a question from the moderator, Mr. Mac-Jaja explained that the NUPRC's *National Production Monitoring System (NPMS)* has eliminated inconsistencies that previously resulted in multiple, conflicting national production figures. Operators now report data directly to the Commission in real time, ensuring a single, verifiable national record.

He added that the Commission has implemented the *Mass Balance Methodology* at export terminals such as Bonny and Forcados to enhance reconciliation and prevent under-reporting. The system ensures that all produced and transferred volumes are captured, even where multiple operators use shared infrastructure.

Closing Reflections

In his closing remarks, Mr. Osten Olorunsola thanked the panel for their contributions and said the discussion reflected the progress being made in institutional reforms and digital transformation. He said hydrocarbon measurement is no longer a narrow technical task but a foundation for transparency, investment confidence, and sustainable revenue growth.

"The more we share data, the more confidence we build. Transparency must be backed by evidence, not perception," he said.

"Hydrocarbon measurement is the language of accountability and business survival," one of the panellists added.

Key Takeaways

- Hydrocarbon measurement underpins transparency, fiscal accuracy, and investor confidence.
- The NUPRC has completed a national metering audit and is enforcing upgrades under new measurement regulations.
- The *Mass Balance Methodology* has improved reconciliation accuracy at export terminals.
- The NMDPRA has automated over seventy percent of its processes, using real-time data dashboards for product tracking.
- Operators are investing in digital LACT units, central data platforms, and surveillance tools to strengthen accountability.
- Service providers emphasise collaboration and standardisation to ensure data consistency.
- Human capital development and knowledge sharing remain essential for sustaining automation and digitalisation progress.

LEAD INSTITUTIONAL SPEECH

Continuous Improvement of Hydrocarbon Measurement for Fair Trade and Regulatory Confidence

Engr. Dr. Samuel Ayuba Ushe, Head, National Metrology Institute (NMI), Standards Organisation of Nigeria (SON)


Engr. Dr. Samuel Ayuba Ushe

Engr. Dr. Samuel Ushe, Head of the National Metrology Institute, delivered a presentation on the role of metrology in ensuring accurate measurement, traceability, and reliability of data across Nigeria's oil and gas industry. He said the National Metrology Institute is a directorate of the Standards Organisation of Nigeria (SON) and serves as the custodian of Nigeria's national primary measurement standards. Its function is to provide traceability of all measurements in the national economy to the International System of Units (SI).

He explained that NMI operates from its headquarters in Enugu with liaison offices in Lagos, Kano, Port Harcourt, and Abuja. The Institute maintains laboratories dedicated to calibration in the areas of mass, temperature, pressure, flow, length, dimension, torque, electrical, and chemical metrology.

Dr. Ushe described the NMI's facilities, including the flow calibration laboratory and prover tanks for meter verification, weighbridges for high-capacity load measurement, and mobile calibration trucks that provide on-site services when environmental conditions make field calibration difficult. He also noted the Institute's investment in precision reference standards such as E1 and E2 class weights, which are among the most accurate in the world.

He said these capabilities have allowed the Institute to help oil and gas operators save costs by reducing the need to send meters abroad for calibration. He cautioned operators against using improvised materials such as cement bags for weighbridge calibration, describing the practice as inaccurate and unsafe.

The presentation also covered calibration services for small weighing scales used in gas distribution outlets. He said NMI ensures that measurement devices used in commerce and industry conform to standards traceable to international references, thereby supporting fair trade and regulatory confidence.

Dr. Ushe explained that metrology is the science of measurement, not to be confused with meteorology or metallurgy. He said accurate measurement underpins every part of life—from trade and manufacturing to healthcare, safety, and energy. He illustrated that uncalibrated or faulty instruments can cause significant errors in industrial production, healthcare testing, and even household transactions.

He emphasised that calibration and verification are distinct. Calibration establishes the accuracy of a device against a traceable standard, while verification

> **"Measurement is the invisible foundation of trust in trade. When every litre, barrel, and cubic metre is traceable to a national standard, disputes disappear and confidence rises. Our goal at the National Metrology Institute is simple — to make every measurement in Nigeria speak the same language as the International System of Units."**

applies to instruments used for trade and ensures they remain within permissible error limits. Both processes, he said, are vital for maintaining measurement integrity in oil and gas.

Dr. Ushe noted that the NMI is a member of the Africa Regional Metrology System (AFRIMETS), the ECOWAS Metrology System (ECOMETS), and the International Bureau of Weights and Measures (BIPM). It has successfully participated in international comparison exercises organised by PTB Germany and ECOWAS, demonstrating the reliability of Nigeria's calibration results in mass, pressure, temperature, and small-volume measurements.

He said the Institute's laboratories are in the process of being accredited to ISO/IEC 17025:2017 for mass, temperature, pressure, and small volume calibration, with assessment visits scheduled from the Egyptian Accreditation Council (EGAC).

Dr. Ushe explained that accessing calibration services requires submitting an application to SON's Director-General, either in hard copy or by email, through any of its state offices. The Institute then reviews the request, issues a calibration bill, and schedules service after confirmation of payment.

During the discussion, participants asked about NMI's registration status with NUPRC and its operational reach within the Niger Delta. Dr. Ushe clarified that NMI has ongoing collaboration with NUPRC and is working toward completing the required registration for oil and gas operations. He also confirmed that liaison offices in Port Harcourt and other regions make

access to NMI services easier for companies.

He ended by reaffirming NMI's commitment to continuous improvement through stakeholder engagement, acquisition of modern equipment, and expansion of calibration infrastructure. He called on industry stakeholders to patronise NMI's calibration services, saying that accurate measurement builds confidence, prevents loss, and supports fair trade.

Key Takeaways

- The National Metrology Institute (NMI) is Nigeria's custodian of national primary measurement standards.
- Calibration ensures accuracy and traceability of measurement in oil and gas operations.
- Verification applies to instruments used for trade and confirms compliance within error limits.
- NMI operates laboratories for mass, pressure, temperature, flow, and other calibration services in Enugu, Lagos, Kano, Port Harcourt, and Abuja.
- Facilities include prover tanks, flow benches, weighbridges, and mobile calibration units.
- NMI's reference standards are traceable to international systems under AFRIMETS and BIPM.
- Accreditation to ISO 17025:2017 is in progress for key laboratories.
- NMI is engaging NUPRC to finalise registration for oil and gas calibration services.
- Accurate and traceable measurement supports fair trade, safety, and regulatory confidence.

LEAD INDUSTRY SPEAKER

Unlocking Production Deferment Through Effective and Efficient Optimization, Underpinned by Metering Accuracy

By Dr. Ken Uwalaka, Technical Manager, Production Optimization – Americas, Wood

Dr. Ken Uwalaka delivered a practical and data-based presentation on how accurate metering and digital optimization can reduce production deferment and recover lost volumes in Nigeria's oil and gas industry. Drawing from field experience and case studies, he explained how digital tools and virtual flow metering can improve operational efficiency and revenue recovery.

He began by stating, "You cannot measure what you cannot optimise, and you cannot optimise what you cannot measure" He said most production losses in the upstream sector do not come from sabotage or theft but from inefficiencies, inaccurate measurements, and delays in field intervention. When wells are run without reliable data or continuous monitoring, small changes in pressure, temperature, or choke performance can accumulate into large deferments over time. He said deferment is rarely temporary; once a well is shut in or underproducing, the lost volumes are unlikely to be recovered.

"Oil deferred is oil lost," he cautioned. "What you do not produce today, you cannot recover tomorrow."

Citing data from NUPRC's 2024 audit, he noted that about 4.1 million barrels of oil were lost, with roughly 3.6 million barrels linked to non-kinetic factors such as operational inefficiencies. His analysis showed that around 80 percent of these losses are related to poor automation, unreliable instrumentation, and metering issues. While kinetic losses are being reduced through security and surveillance, non-kinetic losses require better automation and predictive maintenance.

Using examples from marginal field operations in the Niger Delta, he presented a simple production model based on eight wells, each producing about 250 barrels per day. The model showed that a 50 psi increase in pressure and a 10 degree rise in temperature could deliver a 10 to 14 percent gain in production. He said this proves how optimization and metering accuracy work together, and how real-time data on well performance can improve recovery.

Dr. Uwalaka said accurate metering is the foundation of optimization. Without confidence in flow data, operators cannot make the right decisions or take timely


Dr Ken Uwalaka

action. Systems built around accurate measurement, supported by dependable sensors and predictive analysis, give operators the visibility to identify problems before they escalate.

He explained that virtual flow metering is an effective alternative to conventional test separators in marginal fields. Virtual flow metering uses pressure, temperature, and differential data to estimate multiphase flow rates without interrupting production. When combined with predictive diagnostics, it helps operators detect anomalies, adjust flow parameters, and control production remotely.

Accurate metering also supports proper production allocation and financial accountability. Unreliable data can lead to operational losses and disputes between partners. Reliable metering promotes transparency and trust in both operations and regulatory reporting.

Based on field simulations, Dr. Uwalaka estimated that applying optimization methods such as thermal uplift, virtual flow metering, and predictive analytics to 144 wells of similar profile could recover up to 2.8 million barrels per year. He emphasized that this potential re-

covery does not require new drilling but better management of existing assets.

He added that automation should be seen as a production enabler rather than a cost, especially for operators who depend mainly on operational expenditure to sustain output. "Every barrel matters," he said. "A one percent improvement across producing wells is a national gain."

Dr. Uwalaka praised the Nigerian Upstream Petroleum Regulatory Commission for its focus on metering and digitalisation, saying these reforms are vital for accountability and performance. He encouraged the Commission to include automation and digital monitoring benchmarks in field approvals and metering standards, and urged closer collaboration between regulators and operators to develop an integrated database that links production, metering, and export systems. Such integration, he said, will reduce discrepancies, improve forecasting, and strengthen audit reliability.

"Technology is not replacing people; it is equipping them to make better decisions faster and with confidence."

He closed by warning that complacency can cause industries to lose relevance, quoting a former Nokia executive: "We didn't do anything wrong, but somehow, we lost." He said the oil and gas industry must not make that mistake, stressing that innovation must remain ahead of decline.

Key Takeaways from the Presentation

- Accurate metering is the base of production optimization. Without reliable data, field teams cannot identify or recover deferred production effectively.
- Deferment represents a permanent loss. Unproduced volumes today cannot be recovered tomorrow, so real-time monitoring and quick response are essential.
- Automation and predictive monitoring can reduce non-kinetic losses, which account for about 80 percent of deferment.
- Virtual flow metering is a practical option for mature and marginal fields where traditional test separators are not feasible.
- Field data shows that small improvements in temperature and pressure can produce up to 14 percent higher output per well.
- Aligning technology with regulation will strengthen transparency and efficiency in hydrocarbon accounting.
- Innovation and digitalisation should be seen as normal parts of production management, not optional costs.

LEAD INDUSTRY SPEAKER

Meter Developments in Small Volume Prover Technology for Liquid Custody Transfer

David Thacker, Global Development Manager, Meter Engineers

David Thacker began his presentation by thanking NiHMEC for the opportunity to share new developments in meter proving technology. He said it was his first visit to Nigeria and that he was pleased to see the country's growing attention to hydrocarbon measurement integrity.

David Thacker

He introduced Meter Engineers as a company that has operated for nearly fifty years, manufacturing and servicing every type of prover — unidirectional, bidirectional, tank, and small volume provers. He explained that provers are essential across the oil and gas value chain — from production platforms and gathering stations to refineries and loading terminals — wherever custody or fiscal transfer occurs. Their purpose, he said, is to verify the accuracy of flow meters and ensure that the numbers being reported truly represent the measured volume.

Thacker traced the history of meter proving, explaining that early systems were crude and manual. Operators once used open buckets to measure oil flow, introducing significant uncertainty. The first pipe provers appeared in the 1950s and were several miles long. By the 1960s, developments driven by NASA's need for precise rocket fuel measurement led to innovations such as double chronometry and pulse interpolation. These principles paved the way for modern small volume provers (SVPs), which became commercially available in the late 1960s.

He explained that technological progress since then has transformed proving accuracy. Early provers used mechanical plungers with response times of about eight milliseconds, while today's photoelectric sensors operate within 50 nanoseconds — about sixteen thousand times faster. The result is lower measurement uncertainty, faster proving cycles, and smaller required volumes.

Thacker compared traditional pipe provers with small volume provers. The latter, he said, offer lower pressure drops, faster proving times, broader operating ranges, and easier onsite maintenance. They also have smaller footprints and reduced downtime during repairs. These advantages, combined with automation and diagnostics, have made small volume provers the preferred choice in many markets, including the United States, Canada, and the Middle East.

He then explained how pairing small volume provers with modern manufactured pulse meters such as Coriolis and ultrasonic meters has evolved. In earlier years, many operators experienced inconsistent results because pulse generation in these meters was not proportional to flow. Over time, industry studies established that the key to reliable performance lies in maintaining a minimum pass time of one second between detector switches. This technical standard, he said, now ensures repeatability within 0.05 percent, in line with API requirements.

Another factor is the "pre-run" — the brief interval between the poppet closing and the start of measurement. During this moment, a change in flow rate can distort readings if the meter has not stabilized. Most manufacturers recommend a minimum pre-run time of 0.25 seconds, but Meter Engineers designs its provers with at least 0.4 seconds to improve repeatability and confidence in the results.

Thacker described several design innovations introduced over the years to make provers simpler and more reliable. Earlier designs relied on complex mechanical assemblies with chains and belts. New models use ball-screw or linear magnetic drives, servo motors for precise positioning, and optical systems that minimize pressure drop and moving parts. These changes reduce maintenance, improve durability, and lower total ownership costs.

He highlighted the benefits of using a single optical eye rather than multiple sensors. A single eye, combined with fixed optical flags, simplifies troubleshooting, reduces downtime, and eliminates the need for repeat calibration after sensor replacement. In testing, Meter Engineers replaced the optical eye 27 times and recorded consistent calibration results within the 0.02 percent tolerance required by API — demonstrating the stability of this approach.

The piston and poppet assemblies, he said, have also been redesigned for greater strength and longevity. Features such as reinforced pistons, conical springs, and proprietary seal orientations improve sealing performance and reduce wear during operation.

A major recent advancement, Thacker noted, is the use of automated diagnostics. New provers can now self-test their internal seals, electronics, and shaft seals using onboard sensors and software. This reduces operator intervention, removes the risk of human error, and allows faults to be detected early. The system can simulate proving runs electronically to identify whether repeatability issues originate from the mechanical system or the electronics, enabling faster troubleshooting.

He added that environmental protection features are now standard in modern designs. Leak detection sensors collect any fluid escaping from the piston seals and trigger alarms to the flow computer, preventing pollution and ensuring safety compliance.

In conclusion, Thacker said the future of small volume provers will continue to be defined by three main factors:

1. Technical integrity in sizing and pre-run configuration.
2. Prover designs that prioritise simplicity and operator usability.
3. Integration of digital and automated diagnostic systems that minimise downtime and improve performance certainty.

He encouraged regulators and operators in Nigeria to adopt these advances as part of their drive for higher measurement accuracy and transparency.

“Innovation is not just about new equipment,” he said. “It’s about making what we already use simpler, smarter, and more reliable.”

Key Points for Industry Reference

- Small Volume Provers (SVPs) have evolved from mechanical to digital systems, offering higher precision and lower uncertainty.
- Modern photoelectric switch technology provides 16,000 times faster response than mechanical plungers.
- Reliable proving with Coriolis and ultrasonic meters requires at least one second of pass time and a pre-run of 0.4 seconds.
- Simplified drive systems, single optical eyes, and improved piston assemblies reduce maintenance and downtime.
- Automated diagnostics now allow internal seal and electronic integrity tests without human intervention.
- SVPs are becoming the preferred standard for custody transfer due to their efficiency, portability, and reduced life-cycle cost.
- The next phase of prover development will focus on digitalisation and integration with automated control and reporting systems.

“Measurement isn’t just the foundation of fiscal credibility—it’s the bedrock of our entire industry. When we measure accurately, we don’t just build trust; we forge unbreakable bonds across the value chain, securing revenue, investment, and sustainability for generations to come.”

LEAD INDUSTRY SPEAKER

Measurement for GHG Emissions Accounting and Reduction in Oil and Gas Operations – An Emerging Role of Measurement and Hydrocarbon Accounting Professionals

Sunday Kanshio, PhD, Managing Partner, Fleissen & Company

Dr. Sunday Kanshio, Managing Partner of Fleissen & Company, presented on the role of measurement in greenhouse gas (GHG) emissions accounting and its growing relevance to hydrocarbon measurement and accounting professionals.

He opened by explaining that while greenhouse gas emissions may seem a distant or regulatory issue, it is rapidly becoming a central area in oil and gas operations, with direct implications for production measurement, facility operations, and trade. He said the European Union has already introduced a "material regulation" that restricts crude oil and gas imports to only those classified as clean or low-carbon, meaning that producers must now quantify and report the emissions intensity of their operations.

Dr. Kanshio said measurement underpins both hydrocarbon accounting and greenhouse gas accounting. He defined measurement for GHG accounting as involving not only volume and mass flow rates but also composition, temperature, and pressure data—all necessary to calculate emissions accurately.

He explained that in the past, most operators focused only on production volumes, but today, carbon intensity has become a critical business metric. He said carbon intensity, measured as tonnes of carbon dioxide equivalent per barrel of oil equivalent, is now influencing international oil pricing, just as API gravity determines quality and value.

He outlined three major drivers for GHG measurement and reporting in oil and gas operations:

1. **Regulatory compliance** – Nigeria's regulators now require operators to quantify and report emissions.

2. **International disclosure** – Many Nigerian companies have voluntarily joined UNEP's Oil and Gas Methane Partnership (OGMP 2.0), which mandates annual emissions disclosure.

3. **Sustainability commitments** – Most oil companies now publish sustainability reports, which must include verified emissions data.

Sunday Kanshio, PhD

He stressed that measurement accuracy is essential because the data collected for hydrocarbon accounting are also used for emissions reporting. Without reliable flow and composition data, emission inventories can be overstated or understated.

He discussed the relationship between measurement and emission sources in oil and gas facilities, identifying four major sources: stationary combustion, flaring, venting, and fugitives.

Stationary combustion refers to equipment such as generators and gas turbines that burn fuel to generate power. He explained that the combustion process produces carbon dioxide, unburnt methane, and nitrous oxide, all of which must be accounted for. Measurement requires accurate flow metering of fuel input and composition analysis to quantify these emissions.

Flaring is another significant emission source. He explained that while flaring is a normal part of operations, especially during start-up or shutdown, it must be measured to determine the volume and composi-

tion of gas burnt. He said operators must know the destruction efficiency and oxidation factor of their flare systems to calculate unburnt methane accurately. He emphasised that maintaining flare meters is critical because poor maintenance leads to either overstatement or understatement of emissions.

Venting, he said, occurs during depressurisation or process shutdowns and is difficult to measure because of the high velocity and temperature drop during the release. He described ultrasonic flow meters as the most accurate but most expensive method for vent quantification.

Fugitive emissions, he explained, are leaks from valves, flanges, and gauges that release methane into the atmosphere without being detected. He said such emissions are unintentional but often significant. To identify and quantify these leaks, he recommended implementing Leak Detection and Repair (LDAR) programmes using optical gas imaging (OGI) cameras, which can visualise invisible methane plumes.

He showed examples of LDAR surveys using OGI cameras and explained that once leaks are detected and quantified, operators can prioritise repairs and reduce emissions.

He added that poor gas composition data is one of the biggest challenges for accurate emission estimation. Many operators, he said, rely on design-stage gas composition rather than current operating data because of difficulties maintaining gas chromatographs. He advised operators to treat composition measurement as a continuous requirement, not a one-time calibration.

In his conclusion, Dr. Kanshio stated that climate measurement is now part of the hydrocarbon measurement function. Measurement engineers and hydrocarbon accountants must expand their skills to include GHG accounting and emissions quantification. He said smaller operators, who may not have dedicated emissions specialists, can assign this responsibility to their measurement or hydrocarbon accounting teams.

He said, “Climate measurement is now part of your work. The same data you generate for revenue accounting will now determine your carbon footprint.”

He concluded that hydrocarbon accountants must understand measurement systems, and metering engineers must learn GHG protocols so that both functions work together to produce reliable emission inventories.

Key Takeaways

- Measurement is the foundation for both hydrocarbon and greenhouse gas accounting.
- Carbon intensity (tonnes of CO_2 equivalent per barrel of oil) is becoming a key pricing and performance metric.
- Major emission sources include stationary combustion, flaring, venting, and fugitives.
- Accurate flow and composition measurement are essential for emission quantification.
- Flaring efficiency and unburnt methane must be determined using maintained flare meters.
- Venting and depressurisation require high-precision meters such as ultrasonic or thermal mass devices.
- Fugitive emissions should be detected and quantified through LDAR surveys using OGI cameras.
- Measurement engineers and hydrocarbon accountants must now play an active role in GHG data management.
- Reliable composition data and continuous monitoring are critical for accurate reporting.
- Integrating measurement integrity with emissions accounting strengthens transparency, safety, and sustainability.

Climate measurement is no longer an add-on—it is the core of your work. The very data you generate today for revenue accounting will tomorrow determine your carbon footprint, your market access, your license to operate, and your competitiveness in a world where carbon intensity prices oil just as surely as API gravity once did.”


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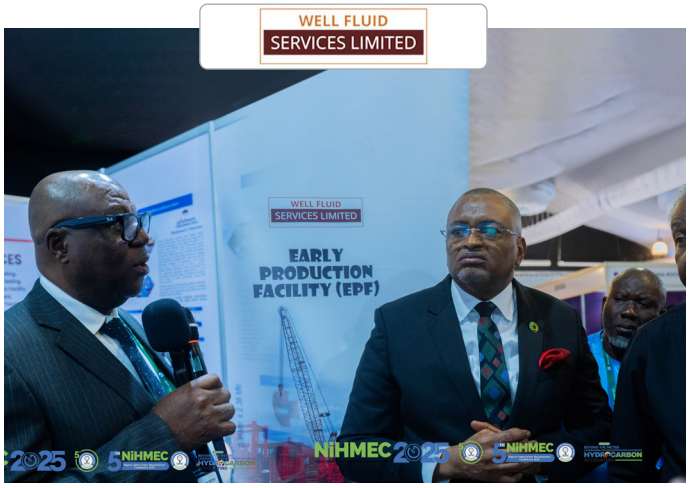

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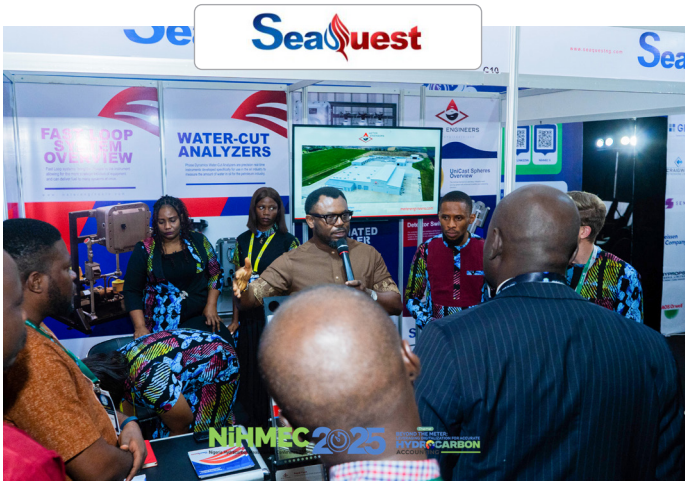

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THOUGHT LEADERSHIP SESSION BY SENSIA AND LOCAL PARTNERS

Transforming Hydrocarbon Measurement with Digital Intelligence

Moderator: Samuel Omonoseh, Umugini Pipeline Infrastructure Ltd

Speakers:

- **Fuzail Kagzi**, Measurement Segment Manager, Sensia
- **Tommy Leach**, Metering Control Solutions Manager, Sensia
- **Engr. Solomon Arharhire**, GM Operations Support, Heritage Energy Operational Services Ltd
- **Essien Eka**, Head of Engineering and Projects, Heirs Energies

Subtopics covered:

- **Industry observations and the transformation of metering through digitalization**
- **Ultrasonic metering and hydrocarbon sampling case studies**
- **Digital metering systems and flare monitoring examples in Nigeria**

The session hosted by Sensia Global and local industry partners examined how automation, smart metering, and digital systems are changing hydrocarbon measurement and production management. It was moderated by Samuel Omonoseh of Umugini Pipeline Infrastructure Ltd and featured presentations by Fuzail Kagzi and Tommy Leach of Sensia, with industry reflections from Engr. Solomon Arharhire of Heritage Energy and Essien Eka of Heirs Energies.

The discussion focused on three areas: how digital transformation is reshaping measurement systems, case studies on ultrasonic metering and hydrocarbon sampling, and the application of digital metering and flare monitoring in Nigeria. The speakers outlined practical ways technology is improving accuracy, reducing losses, and supporting more reliable reporting across operations.

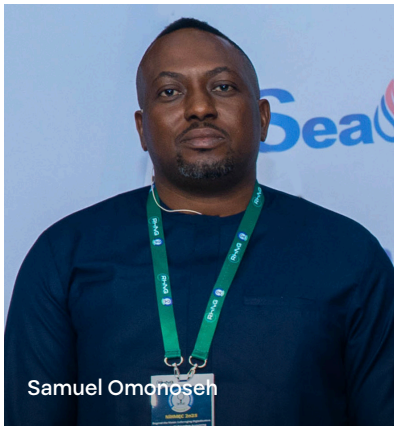
In his opening remarks, Samuel Omonoseh said that efficiency and accountability depend on accurate measurement. He observed that while operators have invested in infrastructure, many assets are still operated manually. He noted that NiHMEC serves as a platform for collaboration among regulators, technology providers, and operators, and encouraged open discussion on the practical barriers to digital adoption.

Tommy Leach, Metering Control Solutions Manager, Sensia

Fuzail Kagzi explained that Sensia is a joint venture between Rockwell Automation and SLB created to unify automation, control, and measurement on a single platform. He said the aim is to help operators use data for timely decisions and reduce reliance on manual processes. He noted that Nigeria is moving toward predictive operations but that adoption rates vary. "Digitalisation is a journey," he said. "It works best when operators chip away at the problem one step at a time."

Tommy Leach explained Sensia's self-verifying ultrasonic meter, which measures flow and verifies its accuracy while in operation. The meter detects drift and adjusts automatically, reducing the need for manual calibration. He shared examples from the North Sea and Australia where this approach reduced maintenance work and improved reliability during custody transfer. He said the same system is being adapted for crude operations in Nigeria's swamp and delta fields.

He also presented a Nigerian case where a Coriolis-based lease automatic custody transfer unit was deployed for a marginal field operator. The system,


Samuel Omonoseh

powered by solar energy and linked to the Avalon Connected Production platform, transmits real-time data from a swamp location to a central control room. The result has been fewer reconciliation errors, shorter proving time, and better reporting. He also described a sampling system that uses jet mixing to ensure uniform samples in high water-cut conditions while lowering power demand and equipment size. "Sampling integrity is as critical as flow measurement," he said. "Without representative samples, the meter only tells part of the story."

"You cannot digitalise everything at once," said Leach. "Chip away at the problem, and something valuable will be created."

Engr. Solomon Arharhire said digital metering should be seen as essential to transparency and operational reliability. He explained that manual systems continue to cause data gaps and disputes. At Heritage Energy, integrating digital systems into existing SCADA infrastructure improved accountability and reconciliation within six months.

Essien Eka said accuracy in metering should be part of the operational culture, not just a compliance requirement. He said it builds trust between operators, regulators, and partners. "Oil measurement must move from the clipboard to the control room," he said. "What you cannot measure, you cannot manage." He called for every operator to install accurate metering at each custody transfer point and plan automation early in project design.

The panel discussed the role of regulation as a key driver for consistent practice. Participants noted the contribution of the Nigerian Upstream Petroleum Regulatory Commission through its metering and cargo declaration regulations, which have encouraged automation and real-time monitoring. They also called for closer collaboration with Nigerian engineers, fabricators, and service companies to adapt technology locally.

Fuzail Kagzi said localisation must include skill transfer to ensure systems are maintained by local engineers. "It is not enough to install digital systems," he said. "They must be owned and understood locally." He said Sensia is working with universities and local partners to develop technical capacity in metering and automation.

In closing, Samuel Omonoseh said Nigeria can achieve full digital integration in metering within five years if regulators sustain reforms and operators align investments with clear implementation plans. "The future of measurement is digital, integrated and collaborative," he said. "When data becomes visible, losses become preventable."

Key Takeaways from the Session

- Digitalisation should begin with pilot projects and expand gradually.
- Self-verifying meters improve measurement confidence and reduce calibration downtime.
- Accurate sampling is essential for reliable hydrocarbon accounting.
- Solar-powered LACT systems show that local field deployment is possible and effective.
- Metering accuracy must be part of daily operations, not just regulatory compliance.
- Regulation and enforcement are central to building consistency in metering practice.
- Collaboration and skill development are needed to sustain digital systems and reduce dependence on imports.

THOUGHT LEADERSHIP SESSION BY SEAQUEST

The Future of Hydrocarbon Measurement: Leveraging Smart Metering to Minimize Losses, Enhance Transparency, and Accountability

Session Overview by: Etta Agbor, Managing Director/CEO, SeaQuest E&P Services

Moderator: Oghenewede Otokumor, Measurement Assurance Engineer, NLNG Limited

Panelists:

- **Gogo Eneyok – Chief Strategy Officer, SeaQuest E&P Services**
- **Joseph Okhiku – Flow Assurance Expert**
- **Leo Adoghe – Technical Director and CEO, LANAD Energy Limited**
- **Harry Obera – Technology Director, Petrodecision**
- **David Thacker – Global Development Manager, Meter Engineers**
- **Engr. Victor Ibanga – Technical Director and CEO, Avotech Multi-Concept Limited**


Etta Agbor

The session was facilitated by Oghenewede Otokumor, Measurement Assurance Engineer at NLNG Limited, who brought extensive expertise in measurement integrity and hydrocarbon accounting to guide the discussions.

In his opening remarks, Mr. Etta Agbor, Managing Director/CEO of SeaQuest E&P Services, explained that the session was designed to bring together practitioners to discuss the future of hydrocarbon measurement and how to leverage metering technologies to minimize losses and promote transparency. He noted that transparency and proper audit trails have become critical as operators seek funding from lenders and are obligated to remit revenues to the Federation Account.


Oghenewede Otokumor

He highlighted five discussion areas: the changing industry landscape, existing challenges, the role of the regulator, key levers for transition, and a shared vision for the future of metering. He observed that traditional metering systems—often manual and prone to reconciliation errors—are being replaced by data-centric approaches that rely on digital tools such as artificial intelligence, Internet of Things (IoT), and blockchain.

Agbor said the shift to data-driven measurement is necessary because multiple operators now inject into shared pipelines and facilities, creating a need for transparent, auditable, and tamper-proof data. He called for industry collaboration and integration, stressing that technology alone will not solve the problem without competence and trust among practitioners.

He also pointed out that measurement data serve dual purposes: ensuring fiscal accuracy for lenders and regulators, and providing subsurface engineers with reliable information for reservoir modelling and production forecasting. He concluded that the shared future of hydrocarbon accounting must rely on "machine-verified truth rather than human-verified judgment."

Discussion Highlights

Gogo Eneyok began the panel by explaining that smart metering offers a major improvement over traditional systems. He traced the history of metering from the early days of single-operator infrastructure to today's complex environment with hundreds of operators injecting into shared pipelines. Traditional systems, he said, were designed for simple custody transfer but cannot cope with the multiple injections and withdrawals seen today.

He explained that smart metering, integrated with digital control systems, allows operators to monitor pressure, temperature, and flow changes across pipelines in real time. This helps detect leaks quickly, reduce losses, and prevent disputes between joint-venture partners. He added that smart metering improves investor confidence because lenders can now verify production data independently through automated systems.

Harry Obera observed that hydrocarbon losses have shifted from physical theft to operational inefficiencies. He said kinetic losses—such as sabotage and vandalism—have declined due to recent government and NUPRC interventions, but non-kinetic losses caused by inadequate metering and manual intervention remain significant. He said smart metering and digital integration are essential to reducing these non-kinetic losses.

Obera noted that operators are no longer seeking alternative crude evacuation routes but are now focused on optimising the existing network using technologies such as virtual flow metering and smart sensors. He described data as the "new backbone" of loss prevention and called for combining smart metering with data analytics to improve system reliability.

Joseph Okhiku spoke on how smart metering supports production optimisation. He said data from smart meters provide real-time insight into field performance, allowing operators to identify poorly performing wells and make timely adjustments such as gas or water injection. He explained that proactive maintenance enabled by smart meters can significantly reduce downtime and improve production uptime, moving the industry closer to international benchmarks of 95 percent.

Engr. Victor Ibanga addressed reconciliation challenges that occur when multiple operators inject into shared pipelines. He said traditional manual systems often result in conflicting data and unresolved reconciliation meetings. Smart metering, he explained, can automate data capture, transmit readings in real time, and make them available to all partners simultaneously. He cited examples of systems that send hourly production emails or display live readings through Human-Machine Interfaces (HMI). Such transparency, he said, helps partners identify discrepancies early and resolve them before reconciliation meetings.

Leo Adoghe discussed barriers to adopting smart metering. He said most resistance is cultural rather than technical or financial. According to him, legacy work habits and lack of communication among operators create hesitation toward change. He acknowledged that regulators have provided strong policy direction through the Petroleum Industry Act and subsequent regulations but called for greater collaboration and shared learning across the sector. He advised companies to quantify the economic value of measurement losses to demonstrate that the benefits of smart metering outweigh the costs.

David Thacker emphasised the human element in technology adoption. He compared data management to a patient ignoring a smartwatch health alert, saying the best technology fails without user action. Thacker stressed that every stakeholder—from operators and engineers to financiers and regulators—must understand and act on the data provided by smart systems. He added that effective smart metering requires consistent data sharing, clear responsibilities, and capacity building to ensure sustainability.

Harry Obera later returned to discuss the environmental benefits of smart metering. He said better metering frameworks help reduce emissions by identifying and preventing gas leaks, venting, and flaring. Automation, he said, enables more efficient gas utilisation, supports emission tracking, and contributes to meeting energy transition goals.

Engr. Victor Ibanga responded to a question on how smart metering aligns with regulatory requirements. He said regulators have already embraced digitalisation and are open to approving smart technologies that meet international standards. He recalled that in the past, certain meter types were rejected because they had not been verified locally, but today both NUPRC and NMDPRA encourage adoption of approved smart systems that ensure traceability and accuracy.

Leo Adoghe added that regulators have done well in creating frameworks but should now focus on promoting integration among service providers and operators. He said collaboration among metering companies, regulators, and operators will make digital adoption faster and more consistent.

David Thacker addressed concerns about uncertainty, saying smart meters do not increase measurement error. Instead, they offer more stability when properly maintained and verified. He cautioned that the greater

risk lies in the inability to service or repair advanced equipment locally, and he called for more local training and technical partnerships.

Gogo Eneyok concluded by looking ahead to the future of hydrocarbon accounting. He said full digitalisation will depend on integrating artificial intelligence, IoT, and blockchain technologies to combine data from sensors, custody transfer units, and production systems into a unified platform. He said the future will be defined by automation and transparency, where data can be accessed instantly, and decision-making will rely on real-time digital insights rather than manual reports.

Audience Interaction

During the Q&A session, regulators reaffirmed their openness to collaborate on new technologies through NUPRC's Standard Conformity and Technology Adaptation Team, which evaluates and approves emerging solutions. An audience member raised the issue of local certification for meters to avoid production downtime. In response, panelists agreed that developing local certification and maintenance capacity is essential for sustainable deployment of smart meters.

Closing Summary

Moderator Oghenewede Otokumor closed the session by thanking the panel and participants. He noted that smart metering discussions must continue beyond the conference halls and encouraged participants to take the conversation to their organisations to develop practical implementation plans.

"The future of measurement is not about devices alone—it is about people, systems, and collaboration," he said.

Key Takeaways

- Smart metering provides real-time data for leak detection, production optimisation, and loss reduction.
- Hydrocarbon losses have shifted from theft to inefficiencies, highlighting the need for digital solutions.
- Reconciliation challenges can be reduced through automated data sharing among operators.
- Barriers to adoption are mostly cultural; collaboration and communication are essential.
- Smart metering supports emission reduction by improving gas utilisation and preventing flaring.
- Regulators have embraced digitalisation and welcome new technologies that meet international standards.
- Human capacity development and local certification are critical to sustaining smart metering systems.
- The future of hydrocarbon accounting lies in AI-driven, data-integrated, and blockchain-secured systems.

THOUGHT LEADERSHIP SESSION BY AOS ORWELL:

Digital Solutions and Innovation in Measurement Technologies

Moderator: Victor Columba, Aradel Holdings Plc

Panellists: Simon Egloff (Endress + Hauser Africa), Benoni Udoh (AOS Orwell), Clinton Idibia (AOS Orwell)

The session explored how digital solutions are shaping the future of measurement systems in oil and gas operations, with a focus on accuracy, reliability, and transparency.

Moderator Victor Columba opened the session by welcoming the panel and the audience. He said the industry is at a point where automation and digitalisation must move beyond discussion into actual field practice. He highlighted that improved data visibility and real-time measurement are essential for reconciling production and strengthening trust between operators and regulators.

Simon Egloff, Business Development Manager for Endress + Hauser Africa, led the discussion with an overview of the company's operations and innovations in flow and instrumentation technology. He explained that Endress + Hauser manufactures over 2.9 million sensors annually and invests heavily in research and development to advance measurement accuracy.

Benoni Udoh, Head of Sales for Electrical and Instrumentation at Aos Orwell

He described the Coriolis flow meter as the most precise instrument for custody transfer, with an accuracy of ±0.1 percent and repeatability within ±0.05 percent. Because it directly measures mass flow and density, it does not require external compensation for temperature or pressure. The meter, he said, has no moving parts and needs minimal installation space, reducing maintenance requirements and downtime.

Egloff also introduced the Promass X 16-inch Coriolis meter, the largest in the world, capable of measuring up to 4,100 tonnes per hour. He presented this as an example of how technological advancement continues to redefine scale and precision in measurement.

He further described innovations in radar and radiometric level instruments for tank gauging and LNG measurement. These devices, operating at 80 gigahertz, can achieve millimetre-level accuracy under challenging process conditions.

Egloff demonstrated Heartbeat Technology, a built-in verification system that monitors device health, detects calibration drift, and generates automatic diagnostic reports without interrupting production. He said this allows operators to shift from reactive maintenance to predictive management.

Responding to the moderator's question on local relevance, Egloff explained that Endress + Hauser's partnership with AOS Orwell ensures local training, servicing, and calibration support for Nigerian operators. The partnership, he said, is key to building self-sufficiency in instrumentation management and lifecycle maintenance.

Benoni Udoh, Head of Sales for Electrical and Instrumentation at AOS Orwell, spoke on Nigeria's broader measurement landscape. He said that improved regulatory monitoring has reduced national crude losses from 37.6 million barrels in 2021 to about 4.1 million barrels in 2024 and 2.04 million barrels in the first half of 2025. He attributed this progress to better metering and closer collaboration between regulators and operators. He added that digitalisation would further reduce uncertainty, especially as Nigeria expands its gas operations where flow dynamics are more complex.

Clinton Idibia, Head of New Service Business at AOS Orwell, addressed the operational challenges of digi-


Simon Egloff

tal adoption. He said many operators still view automation as an expensive upgrade rather than a tool for improved efficiency and decision-making. He stressed that digitalisation enhances field visibility, supports remote monitoring, and reduces the risk of prolonged production downtime.

As the session closed, Victor Columba thanked the speakers and summarised the discussion. He noted that digital systems are helping the industry close long-standing gaps in accuracy, data reliability, and measurement integrity. He said that collaboration between regulators, OEMs, and operators will be critical in ensuring these innovations translate into measurable improvements in the field.

"The message from this session is clear," Columba said. "Digital systems are not a luxury—they are becoming the backbone of transparency and accountability in measurement."

Key Points for Industry Reference

- Coriolis flow meters remain the most accurate and maintenance-free option for custody transfer, with typical accuracy of ±0.05 percent.
- Radar and radiometric systems enable high-precision measurement in tanks and LNG facilities, with millimetre-level accuracy.
- Heartbeat Technology supports predictive maintenance by providing continuous self-verification and diagnostics.
- Improved regulatory oversight has already reduced measurement-related crude losses in Nigeria.
- Digital adoption should be seen as an operational improvement, not a capital burden.
- Integration of digital measurement systems improves data reliability and supports real-time reconciliation.
- Collaboration across the value chain remains essential for sustained accuracy and transparency in hydrocarbon accounting.

THOUGHT LEADERSHIP SESSION BY DAPTEM ENGINEERING

Digital Intelligence in Hydrocarbon Measurement: Powering Accuracy, Accountability, and Climate Action

Moderator: Dr. Muhammad Abba, Founder/CEO, Nordatech Energy Ltd

Speakers/Panelists:

- **Engr. Oladapo Ojo, Managing Director/CEO, DAPTEM International Nigeria Limited**
- **Rohan Chandrakant, Regional Sales Manager, Sub-Saharan Africa, Fluenta**
- **Dr. Cornelius Emeka Agu, Senior Modelling & Software Development (R&D) Leader, Abbon Industrial Company**

The session was moderated by Dr. Muhammad Abba, Founder/CEO of Nordatech Energy Ltd, who skillfully guided discussions among a distinguished panel of industry experts. The panelists included Engr. Oladapo Ojo, Managing Director/CEO of DAPTEM International Nigeria Limited; Rohan Chandrakant, Regional Sales Manager for Sub-Saharan Africa at Fluenta; and Dr. Cornelius Emeka Agu, Senior Modelling & Software Development (R&D) Leader at Abbon Industrial Company.

The DAPTEM Engineering Thought Leadership Session brought together these industry experts to discuss how digitalisation, automation, and data-driven technologies are transforming hydrocarbon measurement, loss prevention, and environmental compliance in Nigeria's upstream oil and gas industry. The session showcased practical applications from DAPTEM, Fluenta, and Abbon, focusing on leak detection, flare gas monitoring, and multiphase flow measurement..

1. Digital Leak-Plugging and Crude Oil Loss Reduction – Engr. Oladapo Ojo

Engr. Oladapo Ojo opened the session with a presentation on "Digital Leak-Plugging: Leveraging Technology for Accurate Crude Oil Accounting and Loss Reduction." He stated that crude oil losses remain one of the most serious challenges affecting Nigeria's upstream sector, directly impacting government revenue, joint venture performance, and investor confidence.

He explained that losses occur along the entire production and export chain—from the wellhead to terminal—due to theft, pipeline leaks, meter inaccuracies, and poor reconciliation. Traditional loss management

Engr. Oladapo Ojo

methods, he said, are reactive and fragmented, lacking the real-time visibility needed for modern hydrocarbon accounting.

Ojo said digitalisation offers a more effective solution. Using IoT-enabled sensors, SCADA systems, and digital reconciliation platforms, operators can now monitor, detect, and address losses in real time. Automated reconciliation reduces manual data errors and enhances transparency at custody transfer points.

He also discussed the integration of blockchain technology for audit trails, the deployment of drones and satellite systems for pipeline monitoring, and the use of advanced analytics for data-driven decision-making.

Ojo highlighted several proven technologies that DAPTEM deploys for operators:

- **Fluenta ultrasonic flare meters** for accurate and continuous flare gas measurement.
- **Xsens clamp-on ultrasonic meters** for multi-

phase and water cut measurement without process interruption.

- **Abbon modular multiphase meters** for compact, non-radioactive production monitoring.
- **GoEasyFlow wireless IoT sensors** for real-time leak detection and pipeline surveillance.
- **AVEVA PI and SCADA platforms** for centralised data management and reconciliation.

He said integrating these systems provides a single view of production, flow, and storage data, allowing operators and regulators to identify inconsistencies early and prevent financial loss.

"Digitalisation makes crude oil losses measurable, explainable, and controllable," Ojo said. "When we measure correctly, we manage better."

He concluded by recommending that regulators and operators establish a joint metrology taskforce, invest in digital pilot projects, and build local capacity through training to improve transparency and accountability in Nigeria's oil and gas sector.

2. Empowering Nigeria's Climate Goals with Fluenta's Flaresens System – Rohan Chandrakant

Rohan Chandrakant presented Fluenta's Flaresens System, explaining how it supports Nigeria's national methane reduction and climate goals. He said that flaring has evolved from being an unregulated practice to a key focus area for emissions reduction.

Chandrakant highlighted that methane (CH_4) is up to 80 times more potent than carbon dioxide (CO_2) as a greenhouse gas and that incomplete flare combustion can release large volumes of methane into the atmosphere. He said Nigeria's participation in the Nigeria Methane Reduction Pilot Programme (NiMERP) and the National Greenhouse Gas Emission Monitoring Programme (NGHGEMP) underscores the importance of accurate flare measurement.

Fluenta's Flaresens system provides continuous flare gas measurement, analysis, and reporting. It records flow rate, temperature, pressure, and gas composition in real time and calculates methane and CO_2 emissions based on combustion efficiency. The system integrates with plant control systems via Modbus and produces dashboards, alarms, and reports to support regulatory compliance.

Chandrakant explained that Flaresens offers:

- Real-time visibility of flare performance and gas composition.
- Remote configuration and diagnostics over secure web access.
- Integration with environmental reporting systems.
- Long-term data logging for audit and compliance.

He said Flaresens enables operators to reduce flaring inefficiencies, cut emission-related penalties, and support methane reduction targets under NiMERP.

"Flaresens is more than a measurement tool—it is a catalyst for Nigeria's climate ambitions," he said.

3. Multiphase Flow Metering and Reservoir Monitoring – Dr. Cornelius Emeka Agu

Dr. Cornelius Emeka Agu presented on "Reservoir Monitoring and Management Using Multiphase Flow Meter Output Signals." He explained that multiphase meters are vital for understanding well performance, water breakthrough, and production optimisation in real time.

Abbon's modular multiphase meter, he said, eliminates the need for bulky test separators, reduces equipment footprint, and cuts operational costs. The meter uses microwave resonance technology rather than radioactive sources, making it safer and easier to deploy both topside and subsea.

Dr. Agu said the system provides continuous measurement of oil, water, and gas fractions, even under high gas volume fraction (GVF) conditions. By integrating multiphase meter data with reservoir models, operators can identify water breakthrough earlier, improve reservoir management, and reduce unplanned shutdowns.

He explained that Abbon's digital solutions also support field automation, remote diagnostics, and predictive maintenance—further improving operational efficiency and sustainability.

"Real-time measurement data from multiphase meters is no longer just for production accounting; it is now a tool for reservoir intelligence," he said.

Key Takeaways

- Digitalisation enables accurate, transparent, and real-time hydrocarbon measurement and accounting.
- Integrated use of Fluenta, Xsens, Abbon, GoEasy-Flow, and AVEVA technologies addresses losses, inefficiencies, and emission monitoring.
- Flaresens supports Nigeria's methane reduction and climate targets by providing continuous flare gas data.
- Multiphase meters from Abbon improve reservoir management and eliminate costly test separators.
- IoT, blockchain, and advanced analytics offer a new level of visibility and accountability in oil and gas operations.
- Collaboration between regulators and operators is essential for scaling digital adoption across Nigeria's upstream sector.

THOUGHT LEADERSHIP SESSION BY GIL AUTOMATION

Building Cyber-Resilient Hydrocarbon Measurement Systems for Operational Integrity and safety

Moderator: Moses Tele, NMDPRA

Speakers and Panelists:

- **Engr. Gbolahan Lawal – Managing Director/CEO, GIL Automation Ltd**
- **Engr. Martins Chijioke Nwachukwu – Regional Sales Manager, Fixed Gas Detection Systems, Honeywell Sub-Saharan Africa**
- **Engr. Adebayo Johnson – Chief Operating Officer, GIL Automation Ltd**
- **Mr. Afolarin Kalejaiye – AGM, Sales and Channels Business, GIL Automation Ltd**


Engr. Gbolahan Lawal

The session opened with the moderator, Moses Tele from the NMDPRA, who explained that this discussion would focus on how metering control systems and cybersecurity influence hydrocarbon data integrity. He noted that as the oil and gas industry embraces digitalisation, the protection and accuracy of data have become critical to both safety and revenue assurance.

Engr. Gbolahan Lawal, CEO of GIL Automation, gave a presentation on "Metering Control Systems: Securing Hydrocarbon Data in an Era of Cyber Risk." He said that data is now one of the most valuable assets in oil and gas operations because every metering and control process produces information that determines commercial outcomes. He explained that a metering control system includes flow computers, PLCs, and human-machine interfaces used to convert field measurements into usable business data.

Lawal said that as metering and automation systems become more connected for remote access and monitoring, they also become vulnerable to cyber threats. He mentioned real examples of how automation systems in other industries had been compromised, leading to operational disruptions. He advised operators to separate their operational technology (OT) networks from corporate IT networks, limit remote access, and conduct regular vulnerability tests to identify weak points.

He said that adopting global standards such as IEC 62443 and API RP 11171 would help improve cyber resilience in Nigeria's oil and gas industry. He encouraged regulators to include cybersecurity requirements in metering and automation contracts and to support training for engineers in this field.

He summarised five key principles for building secure systems: change management, compliance, cost awareness, continuity of data access, and network convergence. He said companies should treat every system change as a potential cybersecurity risk and review their defences regularly.

He concluded by saying, "The oil of the future is data. If we do not protect our metering systems, we will lose both revenue and reputation."

Engr. Martins Chijioke Nwachukwu of Honeywell gave a presentation on gas detection systems for hydrocarbon facilities. He explained that gases such as methane, hydrogen sulfide, and carbon monoxide present serious safety risks in oil and gas operations. Prolonged exposure to hydrogen sulfide can cause people to lose their sense of smell, making leaks harder to detect.

He described Honeywell's range of gas detection systems, including infrared, electrochemical, and ultrasonic detectors that can identify leaks too small to be heard or seen. He also explained how these systems

integrate with plant control systems to trigger alarms and automatic shutdowns during incidents.

Nwachukwu mentioned Honeywell's open-path infrared detectors and the FS24X Plus flame detectors that operate reliably in fog, rain, and smoke. He said that all Honeywell devices are certified for use in hazardous environments under international standards such as ATEX and IECEx. He ended by saying, "Gas detection is not an extra cost; it is the cost of staying alive."

Engr. Adebayo Johnson, Chief Operating Officer of GIL Automation, spoke about the challenges of integrating cybersecurity with existing metering and control systems. He said most legacy systems were not designed with encryption or remote access security in mind, so operators must upgrade gradually. He added that cybersecurity should be viewed as part of operational integrity rather than as an optional IT function.

Mr. Afolarin Kalejaiye discussed the business implications of data protection. He said that data integrity influences investor confidence and compliance. He explained that GIL Automation includes cybersecurity and data protection in all systems it deploys and aligns its practices with ISO 27001 standards.

During the discussion, the moderator asked participants to rate the industry's level of cybersecurity awareness. The speakers agreed that IT departments are about 80 percent prepared, but automation and metering teams are closer to 50 percent, showing a gap that must be addressed.

In closing, Moses Tele said cybersecurity and gas detection systems should now be treated as part of standard operational planning. He compared cybersecurity to fire prevention—often neglected until a problem occurs but essential for long-term safety and reliability. "You never know when a cyberattack will happen, just like you never know when a fire will start. Investing in protection before it happens makes all the difference," he said.

Key Takeaways

- Hydrocarbon measurement data must be treated as a financial asset that requires protection.
- Nigeria should adopt and localise cybersecurity standards such as IEC 62443 and API RP 11171.
- Operators should separate OT from IT networks and carry out vulnerability tests regularly.
- Gas detection systems are essential for protecting lives and assets.
- Legacy systems should be upgraded to include cybersecurity features.
- Data integrity improves operational reliability and investor confidence.
- Cybersecurity awareness in metering and automation departments needs improvement.
- Integrating safety and cybersecurity is key to building a resilient, transparent, and reliable energy sector.

SECTOR EXPERTS

Upstream Hydrocarbon Accounting and Measurement with Digitalisation

Moderator: Chidi N. Nwosu, Deputy Manager, Hydrocarbon Accounting (NUIMS/JV/ Production Management)


Chidi N. Nwosu

In his brief opening, Mr. Chidi N. Nwosu welcomed participants to the session on *Upstream Hydrocarbon Accounting and Measurement with Digitalisation*. He acknowledged the presence of the NiHMEC Chairman, regulators, and industry participants, noting that the session would focus on how digitalisation is reshaping upstream measurement and accounting practices.

He explained that the session was structured to feature expert presentations from both regulators and operators, with emphasis on practical field experiences and new approaches to data integrity and reconciliation.

He then invited the first speaker, **Engr. Mohammed Sirajo**, Metering Manager at the Nigerian Upstream Petroleum Regulatory Commission (NUPRC), to make his presentation on *Evaluating the Application of Watercut Meters for Production Monitoring in the Nigerian Oil and Gas Industry.*

Evaluating the Application of Water-Cut Meters for Production Monitoring in the Nigerian Oil and Gas Industry

Engr Mohammed Sirajo, Senior Manager, Nigerian Upstream Petroleum Regulatory Commission (NUPRC)

Engr Mohammed Sirajo began his presentation by appreciating the NiHMEC organisers for sustaining a forum that continues to strengthen dialogue among regulators, operators, and technology providers on the issues that define Nigeria's hydrocarbon measurement landscape. He said that the Commission views NiHMEC as a technical platform for advancing industry understanding of measurement accuracy and for sharing results from research and regulatory initiatives that shape operational policy.

He explained that his presentation focused on a major joint evaluation project undertaken by the Nigerian Upstream Petroleum Regulatory Commission (NUPRC) in partnership with Chevron Nigeria Limited, Chevron U.S.A., and the American Petroleum Institute (API). The objective was to assess how water-cut meters perform under real production conditions and

Engr Mohammed Sirajo

to determine their suitability for production monitoring and allocation in Nigerian oil fields.

He gave a short background, noting that as multinational oil companies continue to divest from mature assets, many indigenous operators have inherited aging facilities that now produce high-water-cut crude, often between 70 and 80 percent. Many of these facilities were originally designed for lower water production, leaving operators to manage high volumes of produced water with outdated sampling and metering systems. In several cases, unseparated well fluids are injected directly into third-party pipelines, which increases water transportation, corrosion, and fiscal uncertainty.

He said these challenges led the Commission, Chevron, and API to collaborate on a structured evaluation of water-cut measurement technologies that can measure water content accurately from 0 to 100 percent in real time.

The testing was conducted at the multiphase flow facility of the Southwest Research Institute in San Antonio, Texas, under controlled laboratory conditions. Seven different meters from Original Equipment Manufacturers (OEMs) were tested in a blind experiment using reference fluids. The study examined accuracy, repeatability, and stability under varying flow rates, pressures, temperatures, salinity levels, and gas volume fractions. Samples were collected manually for laboratory verification using the Karl Fischer and Kanshio methods.

A total of 83 test runs were conducted using West Texas Light crude oil with salinity levels of one to three percent. Meters were installed in both horizontal and vertical orientations, depending on the manufacturer's specifications. The study found that meter accuracy depends on the measurement principle and flow regime.

Infrared and microwave-based meters maintained accuracy within one to two percent across the full water-cut range, while some devices experienced greater deviation in oil-continuous flow regimes or when gas was present. The Coriolis-based meter performed well when combined with density calibration. The presence of gas had a measurable impact on accuracy, with errors increasing as gas content rose from zero to ten percent. Despite this, several meters demonstrated acceptable repeatability and consistency for production monitoring.

Based on the results, NUPRC approved a pilot deployment of water-cut meters in selected Chevron-operated facilities in Nigeria to verify field performance under local conditions. The American Petroleum Institute has also incorporated the study findings into its revised *Manual of Petroleum Measurement Standards (MPMS) Chapter 10.10*, which now provides guidance on the installation, calibration, and proving of water-cut meters for field application.

Engr Sirajo said the study marks an important regulatory milestone for Nigeria. For the first time, the Commission and industry have a benchmark for evaluating water-cut meter performance under both laboratory and operational conditions. This, he said, would help address long-standing issues in high-water-cut fields, improve production allocation, and support fair and accurate reporting of produced volumes.

He concluded by stressing that accurate water-cut measurement is fundamental to fiscal governance, investment confidence, and operational accountability. He called for continued collaboration among operators, regulators, and equipment manufacturers to extend testing, build local proving facilities, and train field personnel in water-cut measurement and verification.

"Measurement is the foundation of fiscal credibility. When we measure accurately, we build trust across every part of the value chain." — Engr Mohammed Sirajo

Key Takeaways

Regulatory Benchmark Established

The NUPRC, through collaboration with Chevron, has completed the first formal evaluation of water-cut meter for deployment in Nigeria. The study provides a technical basis for the adoption, proving, and regulation of water-cut meters in the upstream sector.

1. **API Standard Now Recognises Water-Cut Metering**

2. The results of this study have informed the inclusion of *API MPMS Chapter 10.10*, which sets clear guidelines for water-cut meter installation, calibration, and performance validation. This provides operators, auditors, and regulators with a unified international reference.

3. **Pilot Deployment Underway in Nigeria**

4. Chevron Nigeria has received Commission approval to pilot water-cut meters in selected facilities. The results of this deployment will guide broader adoption across the industry.

5. **Technical Findings for Field Application**

- Several infrared, microwave, and Coriolis-based meters achieved accuracy within ±2 percent across the 0–100 percent water range.
- Gas volume fraction and salinity were found to affect meter performance; proper configuration and calibration are required.
- Repeatability remained within acceptable limits for production monitoring and allocation.

1. **Operational Relevance**
2. Water-cut meters provide continuous, real-time data for production monitoring, reducing dependence on manual sampling and improving accuracy in allocation, reconciliation, and cost recovery.
3. **Regulatory Implications**
4. NUPRC now recognises water-cut metering as a valid technology for production monitoring. The Commission plans to incorporate its application into metering system design approvals, allocation reporting, and field audits.
5. **Industry Action Points**

- Operators should review their measurement architecture for high-water-cut wells and evaluate the integration of water-cut meters.
- OEMs and service providers should localise manufacturing, proving, and after-sales support.
- Training and certification on water-cut measurement should be included in operator competency frameworks.
- Collaboration among operators, regulators, and research bodies should continue to refine measurement practices under Nigerian field conditions.

Well Test Measurement Beyond Data Collection: Unlocking the Full Value of Test Data

Dr. Martins Okoro, CEO, Well Fluid Services Limited


Dr. Martins Okoro

In opening his presentation, Dr. Martins Okoro took a step back to ask a question that is often overlooked: what happens to well test data after it is collected? He noted that while operators invest heavily in equipment and logistics to conduct well tests, the information gathered is often underutilized or inadequately validated. The true value of testing, he said, lies not in the figures recorded on a data sheet but in how those figures are interpreted to inform operational and commercial decisions.

Drawing from decades of work in field measurement and testing, Dr. Okoro described well testing as the heartbeat of production monitoring. Every barrel of oil or cubic metre of gas reported to regulators begins as data collected during well tests. If that data is wrong, he warned, everything that follows—from production allocation to fiscal reporting—is affected. He urged the industry to move beyond "data collection" and embrace a new mindset of "data intelligence."

He explained that well testing is not a one-time operation but a cycle that begins before the equipment reaches site. The process should include design, calibration, execution, and continuous validation. In most operations, errors start early—from instruments not properly verified, to poor sampling, to human oversight during data recording. A shift in thinking, he said, is needed: the goal is not to collect data but to generate knowledge that helps operators understand how their wells behave over time.

In recounting a field case, Dr. Okoro mentioned an onshore facility where gas production was consistently

lower than gas injection rates. The discrepancy triggered a full investigation. His team discovered leaking manifolds, defective transmitters, and uncalibrated pressure sensors. Once these were fixed, data balance was restored, and the company's production reconciliation improved within weeks.

He noted that such issues are not isolated. In another example, a mismatch between injection and recovery was traced to a faulty orifice plate and worn control valves. After recalibration, the well performance curve stabilised, and the operator avoided an unnecessary shut-in. The lesson, he said, is that well testing must include an analytical mindset — understanding the relationships between surface data, reservoir behaviour, and equipment condition.

"Each test is a story," he told participants. "If you don't read it correctly, you repeat the same mistake at the next well."

Dr. Okoro explained that with the growing adoption of digital tools, operators can now monitor data in real time and detect anomalies before they lead to errors. Digital acquisition systems, if properly configured, make validation faster and more transparent. He advised that every field test should be planned with quality assurance built into its design, including redundancy in measurement points, multiple sensors for cross-checking, and a defined calibration chain.

He outlined six guiding principles for reliable well test data:

- Integrate well, surface, and data systems as a single unit.
- Ensure every measurement is traceable to a certified calibration standard.
- Introduce redundancy in key sensors to verify readings.
- Apply continuous data validation using trend analysis.
- Train field teams to interpret data behaviour rather than just record numbers.
- Establish a feedback loop so that lessons from analysis guide future tests.

He reminded the audience that measurement integrity is not the responsibility of one team alone; it requires collaboration between operators, service companies, and regulators. He recommended stronger field supervision, regular verification audits, and the use of third-party Maximum Efficiency Rate (MER) tests to ensure accuracy in reported data.

Dr. Okoro also encouraged companies to invest in centralised data management systems that allow field results to be reviewed and validated remotely. This, he said, closes the gap between field operations and engineering analysis, reduces delays, and builds a consistent database for future planning.

He ended his talk with a caution that the industry must stop treating well test data as paperwork and start treating it as a decision-making tool. "The value of testing is not in the test itself," he said. "It is in how you use the data to make the next decision better."

Key Takeaways for Industry Reference

- **Well testing defines production reality.** Every production figure reported to the regulator starts as well test data, making test integrity central to fiscal accuracy.
- **Quality begins with design.** Calibration, validation, and redundancy must be built into every test plan before field mobilisation.
- **Real-time data gives operators control.** Digital systems enable immediate validation and correction of errors during testing.
- **Human factors drive reliability.** Field teams should understand the meaning of data, not just the process of recording it.
- **Redundancy and traceability are non-negotiable.** Dual sensors and calibration standards prevent error accumulation.
- **Centralised data systems improve coordination.** Linking field and office teams enhances interpretation, reporting, and audit readiness.
- **Regulatory verification remains essential.** Independent MER assessments strengthen confidence in reported production.
- **The industry must turn data into intelligence.** When test results are validated, analysed, and shared, they improve both operational performance and decision quality.

SECTOR EXPERTS

Ensuring Accuracy and Integrity in Hydrocarbon Accounting Through Effective Reconciliation and Fiscal Allocation

Abiola Abiodun, Hydrocarbon Accounts Advisor, Heritage Energy Operational Services Limited


Abiola Abiodun

Mr. Abiola Abiodun began by explaining that hydrocarbon accounting represents the process of tracking, measuring, and allocating produced oil and gas volumes from the point of production to the point of sale. He said accuracy in this process is central to fiscal accountability, operational efficiency, and compliance with regulatory requirements.

He explained that reconciliation and allocation are the key activities that sustain the integrity of hydrocarbon accounting. Reconciliation involves comparing, adjusting, and resolving differences between measured volumes recorded at different points in the production system. Allocation distributes the reconciled volumes to wells, flowlines, facilities, and partners, especially when direct measurement is not available.

He noted that the integrity of these two processes determines the accuracy of reported production figures and the confidence of all stakeholders — operators, partners, and regulators — in the results. Without effective reconciliation and allocation, it becomes difficult to establish ownership and financial value, which can lead to disputes and revenue losses.

Mr. Abiodun highlighted that reconciliation must be both technical and transparent. It should identify and explain all production variances arising from measurement errors, losses, or data inconsistencies. Allocation, on the other hand, must follow an approved methodology, taking into account measurement points, flow characteristics, and production conditions.

He explained that a good hydrocarbon accounting system depends on four key elements:

1. Reliable metering and measurement systems at all custody transfer points.
2. Accurate and timely data capture.
3. A defined reconciliation and allocation procedure approved by the regulator.
4. A clear governance structure that assigns accountability across all functions involved.

He pointed out that at Heritage Energy, reconciliation and allocation activities are conducted monthly in line with regulatory requirements. This process involves comparing measured production at the wellhead, flow station, and terminal, and reconciling them against export figures. Variances are analysed, documented, and communicated to all relevant stakeholders, including the regulator.

He explained that the reconciliation process also helps to identify sources of production losses such as theft, measurement uncertainty, equipment downtime, and operational inefficiencies. Once these are identified, corrective actions are implemented to minimise future discrepancies.

According to him, fiscal allocation is done using proportional methods, taking into account each well's contribution to total production based on test and measurement data. The allocation results form the basis for revenue sharing, cost recovery, and regulatory reporting.

He emphasised that maintaining data integrity throughout this process is essential. Data should be traceable from the field instrument to the final report, and every change in data must be auditable.

Mr. Abiodun noted that the adoption of automated systems has improved accuracy and reduced human error. Automation, he said, allows real-time visibility of production data and supports faster reconciliation. He also mentioned that regular meter proving and calibration help sustain confidence in the numbers used for allocation and reporting.

He described some of the challenges in hydrocarbon accounting, which include inconsistent field data, delayed reports from operators, poor communication between operations and accounting teams, and limited automation in data management. He said these issues can be addressed through stronger coordination, staff training, and a structured workflow that connects field measurement, production reporting, and accounting.

In concluding, he said that hydrocarbon accounting is not just a reporting function but a financial control mechanism that ensures transparency and builds trust between operators, partners, and regulators. He stressed that effective reconciliation and fiscal allocation are vital to Nigeria's oil and gas revenue management framework.

"Hydrocarbon accounting is about accuracy, transparency, and accountability. When these are in place, everyone — the operator, the partner, and the regulator — can trust the numbers."

Key Points

- Hydrocarbon accounting tracks and allocates oil and gas volumes from production to the point of sale.
- Reconciliation resolves discrepancies between measured volumes at different points in the production chain.
- Allocation distributes reconciled volumes to wells, flowlines, and partners based on approved methods.
- Reliable metering, accurate data capture, and defined procedures are essential to maintain integrity.
- Regular meter proving, calibration, and automation improve data quality and reduce manual errors.
- Monthly reconciliation identifies losses, theft, and operational inefficiencies for corrective action.
- Fiscal allocation forms the basis for cost recovery, equity determination, and regulatory reporting.
- Transparency and collaboration between operations, accounting, and regulation sustain industry confidence.

Leveraging Digital Transformation for Improvement in Upstream Hydrocarbon Accounting Practices in Marginal Fields – Aradel Case Study

Emmanuel Ayodele, Patrick Akuagwu and Adefolaju Adewumi, Aradel Holdings Plc

The presentation by Emmanuel Ayodele, Patrick Akuagwu and Adefolaju Adewumi examined how digital transformation is improving hydrocarbon accounting practices at Aradel Holdings Plc's Ogbele Integrated Production Facility. The speakers explained that accurate hydrocarbon accounting is critical to Nigeria's oil and gas sector, which remains a major source of national revenue. For marginal field operators, reliable measurement and reconciliation are necessary to maintain efficiency, meet regulatory standards, and ensure business sustainability.

Patrick Akuagwu began with an overview of the context behind the study. He noted that a forensic audit conducted by the NUPRC between 2020 and 2022 found that about 40 percent of reported crude oil losses were due to inaccurate measurement rather than theft. By mid-2025, daily crude loss had dropped to about 9,600 barrels per day — the lowest in sixteen years — showing that improved oversight and collaboration between operators and regulators were yielding measurable results. He said marginal field operators must now build on this progress by modernising their

Adefolaju Adewumi

own accounting systems to strengthen transparency and revenue assurance.

The objective of the presentation was to demonstrate how Aradel is using digital systems to improve accuracy, data integrity and operational efficiency in hydrocarbon accounting. Akuagwu said the company's efforts align with the Petroleum Industry Act (PIA) 2021, which mandates verifiable production reporting across the value chain. The law provides a framework for proper metering, record keeping and auditing, ensuring that operators maintain consistent standards in production reporting.

The speakers identified challenges that affect hydrocarbon accounting in integrated operations such as those at Ogbele, where a flow station, gas plant and refinery operate within one facility. Measurement accuracy is influenced by changes in fluid behaviour, multiphase flow interference and separation limitations. Manual processes such as tank dipping and the use of spreadsheets also increase the likelihood of errors and delay reconciliation.

Adefolaju Adewumi explained how Aradel is addressing these issues through its Well, Reservoir and Facility Management (WRFM) framework and the gradual implementation of a Digital Oil Field (DOF) system. The WRFM framework, originally developed within Shell, provides a structured way to optimise well and facility performance. At Aradel, this has evolved into a digital integration project that uses real-time data, sensors and automated workflows to monitor production and manage assets more efficiently.

He outlined three stages of Aradel's digital transition. The first was a manual stage that relied on spreadsheet-based calculations and fixed assumptions. The second stage introduced semi-automated tools that combined model-based and statistical methods for validation and reconciliation. The current phase integrates real-time sensor data, virtual metering and digital models that enable continuous allocation, predictive optimisation and scenario analysis across the field.

Adewumi also described the architecture of the digital system. Data from sensors installed at wells, flowlines and process units feed into a central digital oil field platform. The platform integrates modules for well integrity, production data logging, facility modelling and performance tracking. The system produces outputs that are linked to Aradel's hydrocarbon accounting software, where production data can be viewed and analysed in real time.

He said the digital system has begun to deliver tangible benefits, including improved data integrity through continuous monitoring, faster reconciliation and measurable financial gains. The company projects a return on investment of about 200 percent within two years and a benefit-to-cost ratio of 3 to 1. Virtual metering also provides more reliable production tracking at both the well and reservoir level, reducing dependence on test separators.

The speakers concluded that moving from manual methods to integrated digital systems is now essential for hydrocarbon accounting in Nigeria. They said Aradel's experience shows that digitalisation enhances compliance with the PIA 2021, minimises revenue losses and builds confidence among partners and regulators. They encouraged other operators to adopt similar approaches, invest in automation and continuous staff training, and work closely with regulators to promote a standardised digital reporting framework.

Patrick Akuagwu

"Digital transformation is not a cost," one speaker said. "It is an investment in accuracy, transparency and the future of the industry."

Key Points for Industry Reference

- Accurate hydrocarbon accounting is central to transparency and revenue assurance under the PIA 2021.
- About 40 percent of previously reported crude losses were linked to measurement inaccuracies, underscoring the need for improved metering.
- Integrated facilities face challenges from multiphase flow, phase interference and manual reconciliation.
- Aradel's WRFM and Digital Oil Field systems integrate sensors, SCADA and virtual metering for real-time monitoring.
- Automated data collection and digital calibration improve accuracy and reduce reconciliation delays.
- The digital initiative targets a 200 percent return on investment within two years and strengthens regulatory compliance.
- Regulators should consider incentive frameworks for digital metering and automation.
- Continuous training and technical collaboration are necessary to sustain the benefits of digital transformation.

SECTOR EXPERT

Sector Expert Session on Upstream Hydrocarbon Accounting and Measurement with Digitalisation

Moderator: Engr. Victor Ibanga, Technical Director and CEO, Avotech Multi Concept Limited


Engr. Victor Ibanga

Engr. Victor Ibanga opened the session by welcoming participants and setting the tone for an engaging discussion on *Upstream Hydrocarbon Accounting and Measurement with Digitalisation.* He said the session would move quickly, allowing each speaker ten minutes to present their key ideas before moving into the question-and-answer segment.

He reminded participants that the aim of the discussion was to explore new frontiers in hydrocarbon accounting and how technologies such as virtual flow metering are transforming field operations.

Before introducing the speakers, he announced that refreshments were available for participants during the session, noting that they could step out briefly and return to continue the discussion.

He then invited the first speaker to begin the presentation on *Revolutionizing Hydrocarbon Accounting: The Role of Virtual Flow Metering.*

Revolutionizing Hydrocarbon Accounting: The Role of Virtual Flow Metering (VFM)

Obatarhe Osiobe, Hydrocarbon Accounting Field Engineer, Heritage Energy Operational Services Limited (HEOSL)

Obatarhe Osiobe presented a paper on the role of Virtual Flow Metering (VFM) in improving hydrocarbon accounting and operational efficiency. He said the technology offers a cost-effective and reliable alternative to conventional multiphase flow meters by using computer models and existing field sensors to estimate oil, gas, and water flow in real time.

He began by thanking the NiHMEC organisers and noted that he had participated in every edition of the conference since its start in 2021. He said his presentation was developed from field experience and was

intended to show how data-driven measurement can improve transparency and efficiency in production operations.

He explained that Virtual Flow Metering combines engineering, data science, and digital technology. Instead of using physical devices, VFM relies on pressure, temperature, and choke valve data to calculate flow rates using either mathematical or data-driven models. He identified three main types of VFM models: physical models that apply thermodynamic principles, data-driven models based on machine learning, and hybrid models that combine both.

Osiobe said that VFM is scalable, non-intrusive, and can be linked directly to existing control systems such as DCS or SCADA. It can serve as a main metering system or as a backup to physical meters. Because it does not require frequent calibration or shutdown for installation, it is particularly suited to marginal fields and remote facilities where cost and access are challenges.

He listed the main benefits of VFM as cost efficiency, real-time monitoring, improved accuracy through continuous learning, scalability, and safety. He said the system also reduces human intervention, making data more objective and traceable.

In hydrocarbon accounting, Osiobe explained that VFMs improve real-time allocation, well performance tracking, and back allocation accuracy. Continuous flow data allow engineers to detect production issues early, such as leaks or choke malfunctions, and help maintain production stability. VFMs also provide regulators and partners with verifiable data that support fiscal accountability.

He described how VFM implementation requires proper data quality and model calibration. Poor field data, he said, will lead to wrong results. The process involves model design and validation, followed by continuous adjustment as new data become available. He also noted the importance of training engineers and operators to interpret VFM data correctly.

Osiobe presented global case studies. In Russia, VFMs were used to improve responsiveness and reduce downtime. In Norway, they supported digital oilfield systems and remote operations. ADNOC in Abu Dhabi used VFM to optimise well-test planning. In Nigeria, VFMs have been successfully deployed in the Bonga field, helping to reduce deferment and improve well-test accuracy.

He said the next phase of VFM development will involve integration with digital twins and artificial intelligence to allow predictive and autonomous operation. The system will be able to adjust production parameters automatically to maintain optimal flow and detect failures before they occur.

Osiobe said virtual flow metering has moved from concept to necessity. He described it as a proven and reliable technology that can support cost reduction, transparency, and accountability in hydrocarbon management.

“Virtual flow metering will become a fundamental part of digital oilfield systems and an enabler of autonomous production,” he said.

He closed by emphasising that adoption of VFM is no longer optional for operators who want to remain competitive. He said accurate measurement is not only a technical requirement but also a matter of trust and fairness across the value chain.

“Adoption is no longer optional—it is a competitive advantage,” he said. “Measurement is not only about technology; it is about fairness, trust, and sustainable cooperation.”

Key Takeaways

- Virtual Flow Metering (VFM) estimates multiphase flow using existing sensor data and computer models.
- It reduces cost and downtime compared to physical flow meters.
- VFMs provide continuous real-time production and allocation data.
- Proper data quality, calibration, and training are critical to successful deployment.
- Integration with artificial intelligence and digital twins will drive future automation.
- The technology supports transparency, efficiency, and accountability in hydrocarbon accounting.

SECTOR EXPERT

Advancing Hydrocarbon Measurement Through Innovative Static Mixing Solutions

Alphonse Mendy, Applications Specialist Engineer, Komax Systems Inc.

Alphonse Mendy

Alphonse Mendy presented on how static mixing technology can improve the accuracy and reliability of hydrocarbon measurement. He explained that Komax Systems Inc., based in Huntington Beach, California, designs and manufactures static mixers used across various industries, including oil and gas, water treatment, and chemical processing.

He said accurate and representative measurement is critical for custody transfer, fiscal metering, and process control. Inaccurate measurement, caused by non-homogeneous flow, can result in financial losses, operational inefficiency, and regulatory non-compliance. The presentation focused on how Komax's static mixing systems help to homogenize flow in pipelines and sampling systems, thereby ensuring more reliable data.

Mendy explained that Komax mixers are ISO 9001 certified and comply with API and ISO standards. The devices have no moving parts, require no maintenance, and provide energy-efficient mixing. Unlike dynamic mixers, static mixers create uniform flow with minimal pressure drop, using fixed internal elements that generate turbulence.

He said that both API MPMS 8.2 and ISO 3171 standards require a homogeneous mixture of fluids before sampling. These standards define a ratio known as C1/C2, which compares the water concentration at the top and bottom of a pipeline. A ratio between 0.9 and 1.0 indicates good dispersion, while values below 0.4 indicate poor mixing. He noted that Komax designs its mixers to consistently achieve a C1/C2 ratio of 0.9 or higher.

To demonstrate, Mendy discussed the Komax Triple Action Mixer, which produces three simultaneous mixing patterns—dividing, cross-current, and reverse-flow mixing. The design achieves complete homogenization of fluid flow and prevents stratification where heavier fluids settle at the bottom of the pipeline.

He said the triple-action mixer generates higher turbulence than most conventional designs while maintaining a low-pressure drop. It requires no external power and provides uniform mixing for a wide range of densities and viscosities.

However, he pointed out that C1/C2 performance tends to favour high-viscosity, high-density fluids, which already have better mixing characteristics. Lighter or low-viscosity crude oils, on the other hand, are harder to homogenize because of reduced turbulence within the flow. To address this, Komax developed a new mixing technology known as the CRV (Counter Rotating Vortices) Static Mixer.

The CRV mixer uses specially designed mixing elements that push fluid from the pipe wall toward the centre and back again, producing a continuous rotational flow that improves mixing without increasing pressure loss. The design is aimed specifically at lighter crudes and low-viscosity applications, ensuring that even these fluids achieve a uniform composition before measurement or sampling.

He said that in some applications, Komax now uses a Uniformity Index (UI) instead of the traditional C1/C2 value. The Uniformity Index provides a more accurate assessment of fluid mixing by comparing the concentration across multiple points in the pipe cross-section. A UI of 0.8 or higher indicates good mixing, while anything below that is considered inadequate.

Mendy presented computational fluid dynamics (CFD) simulations showing how Komax mixers

achieve uniform flow distribution, even under challenging conditions. The results showed that traditional orifice plates and wafer-type mixers produce incomplete mixing, while Komax's designs achieve consistent dispersion throughout the pipe.

He noted that the use of static mixers reduces the need for complex and costly sampling systems. By ensuring homogeneous flow, the mixers eliminate sampling bias and improve the accuracy of flow meters such as Coriolis and ultrasonic meters.

Mendy emphasised that Komax mixers are designed to meet international standards, including API MPMS 8.2 and ISO 3171, which govern sampling and measurement accuracy in hydrocarbon systems. They are suitable for both turbulent and laminar flow regimes and can be fabricated in various materials to suit customer specifications.

He said Komax has supplied its mixers to major oil and gas companies around the world, including projects in Nigeria through its African partner, Craigwal Petroshore Limited. He mentioned a recent installation for Seplat Energy, where Komax supplied two six-inch static mixers for use in their LACT (Lease Automatic Custody Transfer) unit.

He concluded by saying that static mixing technology offers a reliable, low-cost, and maintenance-free way to improve hydrocarbon measurement accuracy. It ensures that flow meters and sampling systems receive a representative mixture, reducing uncertainty and improving compliance with fiscal and regulatory requirements.

"Static mixing is not just a mechanical solution," he said. "It is a foundation for accurate measurement and trust in hydrocarbon accounting."

Key Takeaways

- Static mixers create homogeneous flow, improving the accuracy of hydrocarbon measurement.
- API MPMS 8.2 and ISO 3171 require a uniform mixture (C1/C2 ratio of 0.9 to 1.0) before sampling.
- Komax's Triple Action Mixer and CRV (Counter Rotating Vortices) designs ensure uniformity for both heavy and light crudes.
- The mixers require no moving parts, power, or maintenance and operate with minimal pressure loss.
- CFD simulations confirm higher mixing performance compared to orifice plates and wafer mixers.
- Uniformity Index (UI) offers an improved method for evaluating flow homogeneity.
- Komax mixers meet international standards and are in use by major operators, including Seplat Energy.
- Static mixing provides a dependable and economical way to enhance accuracy, compliance, and confidence in hydrocarbon accounting.

Increasing Profitability by Accurate Pipeline Mixing and Sampling

Pieter Blanksma, Sales Director, Kimman Process Solutions

Pieter Blanksma began by introducing himself as a mechanical engineer and Sales Director at Kimman Process Solutions, a company that designs and builds crude oil sampling and mixing systems. He said the focus of his presentation was on how improving the accuracy of mixing and sampling directly increases profitability in oil and gas operations.

He explained that the financial value of a shipment of crude oil depends not only on the volume measured by the meter but also on the quality of that crude — specifically the water content. A small difference in measured water content can translate into large financial losses.

He gave practical examples from operations in Europe, explaining that in ports like Rotterdam, the variation in measured water between different laboratories can range from 0.2 to 5 percent. For a cargo of 1.9 million barrels, a difference of only 0.2 percent water can result in a loss of about 300,000 USD, while a 5 percent difference could mean up to 8 million USD lost. These errors, he said, demonstrate why good sampling and mixing systems are critical to ensure fairness and profitability.

Blanksma explained that in a pipeline, crude oil and water do not always mix uniformly. Without proper mixing, samples taken for quality analysis will not represent the actual composition of the flow. The top of the pipe will usually contain lighter oil, while heavier water settles at the bottom. If the sample is not representative, the analysis will be wrong and the calculated value of the shipment will be inaccurate.

He said the goal of a good mixing system is to create a uniform flow before sampling. He described how Kimman has focused on developing efficient jet-mixing technologies to achieve this. Traditional static mixers are effective at creating turbulence but cannot be pigged and have a limited operating range. Jet mixers, on the other hand, can handle wider flow variations and are easier to install, but many of the earlier designs consumed too much energy or lost efficiency over time.

To solve this, Kimman developed an improved e-Jet Mixer that uses an eductor principle to mix oil and water efficiently with lower power consumption. The design avoids the build-up of sediment and wax that usually affects older jet mixers. It also maintains accuracy even at lower flow rates.

Blanksma presented test results from the NEL Flow Centre in Scotland, conducted with Aker BP. The e-Jet mixer achieved what he called an A-rating, meaning it consistently performed within the most accurate range defined by industry testing. In field tests on 30-inch and 36-inch crude pipelines with water contents between 1.4 and 1.5 percent, the e-Jet mixer maintained the same high performance.

He showed plots comparing measured versus injected water content, demonstrating how the system maintained accuracy over different velocities and flow conditions. He noted that because the e-Jet mixer provides uniform mixing, it improves the reliability of custody transfer systems and reduces losses caused by unrepresentative sampling.

Pieter Blanksma

He said Kimman's technology is designed to operate with minimal maintenance and lower energy costs, making it suitable for both onshore and offshore pipelines. The system can be adapted for new installations or retrofitted into existing sampling skids.

Blanksma concluded that accurate pipeline mixing and sampling are among the most effective ways to improve profitability and transparency in oil and gas operations. He said the focus should be on reliable systems that maintain mixing performance under real field conditions, not only during laboratory testing.

"Volume tells you how much oil you have, but sampling tells you what that oil is worth," he said.

"When the sample is right, the business is right."

Key Takeaways

- Profitability depends on both accurate volume measurement and representative sampling.
- Even small errors in measured water content can cause significant financial losses per cargo.
- Uneven oil-water flow in pipelines makes good mixing essential before sampling.
- Kimman's e-Jet Mixer provides effective mixing with low power use and minimal maintenance.
- Field and laboratory tests at NEL with Aker BP confirmed consistent A-rated performance.
- Reliable mixing and sampling reduce unaccounted losses and improve transparency in trade.

SECTOR EXPERT

From Manual Paper to Digital: Automating Product Tank Charting for a More Accurate and Efficient Hydrocarbon Accounting – The Aradel Case Study

Emmanuel Ayodele, Franklin Fidelis, and Tonye Wokoma, Aradel Holdings Plc

Franklin Fidelis

Emmanuel Ayodele began the presentation by explaining that proper hydrocarbon accounting is central to refinery and product load-out operations because it ensures product monetisation, value preservation, and reduction of losses. He said that at Aradel Holdings Plc, product storage tanks were historically managed through manual dip measurements cross-checked against printed tank charts. This method, though common in the industry, often resulted in transcription errors, slow reconciliations, and inconsistencies between internal figures and regulatory submissions.

He said that the traditional approach required operators to physically dip each tank, record the height, and then manually search through pages of calibration charts to find the corresponding volume. In a refinery with multiple products and up to twenty tanks, this process was repetitive and prone to error, especially when regulators required daily reports by specific times.

Ayodele explained that the objective of their project was to eliminate manual processes and move toward a digital, real-time, and scalable solution that improved accuracy, transparency, and efficiency. The team designed a digital solution that incorporated the effects of temperature and density on product volatility, allowing for more accurate volumetric computation of refined products.

He outlined the main problems the project set out to solve:

- Inconsistent unit standards between dipping tapes (imperial units) and tank charts (metric units), which created conversion errors of up to 8.3 percent.
- Tank breathing losses from volatile products, which were not being quantified in hydrocarbon balances.
- Delays in manual reading and report preparation.
- Over-reliance on paper documentation, which conflicted with Aradel's ESG and sustainability goals.

To address these challenges, the team digitised all approved tank charts that previously existed only in PDF format. They manually entered height and volume data into Excel, linked the cells using formulas such as *IF statements* and *VLOOKUP*, and created a model that could instantly compute tank volumes. The new digital chart accounted for top-of-volume, gross standard volume, and net volumes without assuming a perfect cylindrical shape, thereby improving accuracy.

The Excel-based system was later expanded into a mobile app called "Refine at Aradel." This allowed field operators to input dip heights, product temperature, and density directly on their phones and instantly obtain computed volumes. The app was integrated with SharePoint so that teams in the control room, laboratory, and load-out units could access data in real time. This eliminated delays between measurement, validation, and reporting.

Franklin Fidelis, who led the app development and implementation phase, explained that the SharePoint integration improved data validation and collaboration across departments. Laboratory staff could input density and temperature data directly, while the control room and dispatch teams could access up-to-date information on product volumes and pumpable quantities.

He described the stepwise implementation process as follows:

1. Manual paper tank charts were converted to editable Excel files.
2. The Excel tool was enhanced with formula-based computation.
3. A mobile app calculator was developed for field use.
4. The app was integrated with SharePoint for quality assurance and control.
5. Plans were made to deploy the same system to other business areas such as flow stations and alternative crude evacuation barges.

The project team encountered several constraints, including:

- The need to align operational procedures with industry standards during migration from manual to digital.
- Difficulty converting existing calibration charts from PDF to Excel format.
- Integration challenges with other hydrocarbon accounting software already in use.
- The requirement to update calibration data every five years, which meant recurring data entry.

Despite these challenges, the results were significant. The digital tool reduced report preparation time by more than 90 percent, eliminated manual calculation errors, and provided a single source of truth for all departments. The inclusion of temperature and density corrections also improved reconciliation accuracy and reduced unexplained volume differences.

The team also developed a method for quantifying tank breathing losses using vapor recovery systems installed on storage tanks. These losses, previously unaccounted for, were now included in material balance calculations, supporting Aradel's environmental and sustainability goals.

Franklin explained that the project aligns with Aradel's broader digitalisation strategy, advancing its goal of semi-automating fiscalisation processes and promoting data-driven decision-making. He added that the system can be upgraded to interface with ultrasonic or radar level gauges, enabling real-time monitoring and integration with digital oilfield infrastructure.


Emmanuel Ayodele

The presentation concluded with a set of recommendations:

- Adopt a single unit standard across tank calibration and dipping equipment to eliminate conversion errors.
- Extend the digital solution to other refinery and upstream operations.
- Integrate the system with existing hydrocarbon accounting software for automation and scalability.
- Encourage regulators, particularly the NMDPRA, to review current accounting practices for storage tanks to reflect digital standards.
- Promote the use of vapor recovery systems on storage tanks to reduce emissions and support ESG compliance.

Ayodele said the transition from paper to digital tank charting has transformed Aradel's hydrocarbon accounting process. It has improved accuracy, reduced operating cost, and enhanced transparency for both internal and regulatory reporting.

"When data is digital, we eliminate guesswork," he said. "It is not only about efficiency—it is about accuracy and accountability."

Key Takeaways

- Manual tank charting caused delays and errors in hydrocarbon accounting.
- Aradel developed a digital tank chart system using Excel formulas and later built a mobile app.
- The app integrates with SharePoint for real-time data sharing between departments.
- The solution reduced reconciliation and reporting time by over 90 percent.
- Temperature and density corrections improved volume accuracy.
- Tank breathing losses are now quantified through vapor recovery systems.
- The tool can be scaled to flow stations and integrated with digital oilfield systems.
- Adoption of uniform measurement units and digital standards will further enhance industry-wide transparency.

SECTOR EXPERT

Beyond the Meter: Leveraging Digitisation – Lessons from a Pipeline Operator

Okeoghene Ugbehe, Head, Business Development, Umugini Pipeline Infrastructure Limited (UPIL)

Okeoghene Ugbeh

Okeoghene Ugbehe began by thanking the organisers of NiHMEC for inviting Umugini Pipeline Infrastructure Limited to contribute from a pipeline operator's perspective. He said that while many discussions at the conference focused on the quality and quantity of measurement, the presentation would highlight the role of pipeline operations and digitalisation in achieving accurate hydrocarbon accounting.

He explained that the pipeline plays a crucial role in connecting upstream production to export terminals, ensuring that crude oil of known quality and quantity is delivered efficiently and securely. He described Umugini's 51.4-kilometre pipeline in Delta State, which transports crude oil from multiple operators to the Shell-operated Trans Forcados Pipeline (TFP).

Ugbehe said pipeline efficiency is central to hydrocarbon measurement because any inaccuracy, delay, or unaccounted loss during transportation affects the fiscal balance and the confidence of both regulators and operators. He identified three core areas that underpin Umugini's operations—safety excellence, operational excellence, and stakeholder management—and said that these have contributed to the company's success over the last decade.

He noted that Umugini began operations using positive displacement (PD) meters but quickly saw the need to transition to digital metering systems. Within two years of commencement, the company adopted Coriolis meters and implemented a full supervisory control and data acquisition (SCADA) system to enable real-time monitoring. He said the company also introduced automatic samplers and short displacement prover loops to ensure high accuracy in custody transfer operations.

Ugbehe explained that when the company first attempted to secure regulatory approval for Coriolis meters, the process took almost two years. At that time, there was no formal mechanism for evaluating

or approving new metering technologies. Umugini had to demonstrate the system's performance directly to the regulators through technical testing and documentation before approvals were granted. He said this experience showed that digitalisation requires investment, training, and persistence because new technology must be proven in the field before it gains acceptance.

He highlighted that Umugini now operates fully digital metering systems that allow remote calibration, online meter proving, and automatic reporting. Meter proving that once took hours can now be completed with the click of a button, and system-generated reports are automatically produced daily without manual intervention.

He said the company has achieved over 95 percent uptime across its operations while maintaining only one major incident in ten years. This, he said, demonstrates that digitalisation supports not only measurement accuracy but also operational safety and reliability.

Ugbehe explained that Umugini's digital journey started earlier than most. Between 2014 and 2018, the company deployed PD meters, then SCADA systems, followed by Coriolis meters, fibre optics, and IoT sensors for pipeline surveillance. It later introduced a digital twin for real-time monitoring and predictive maintenance. He said that these efforts achieved 99.9 percent metering accuracy, 20 to 30 percent improvement in asset utilisation, up to 50 percent reduction in unplanned downtime, and 5 to 20 percent improvement in decision-making quality.

He said digitalisation has also reduced dependence on third-party vendors and cut maintenance costs. Fewer personnel are required for field operations, while automated systems reduce human error and improve the quality of decision-making.

Ugbehe noted that while digitalisation comes with cost and complexity, it offers long-term benefits in efficiency and transparency. He advised operators to choose technologies that are adaptable to their systems, ensure adequate staff training, and prepare for the learning curve that comes with adoption.

He also spoke about the company's business model, explaining that Umugini provides midstream services that allow upstream producers to focus on drilling and production while relying on the company to handle transportation, measurement, and delivery to terminals. This, he said, ensures each operator receives full value for its production with minimal loss.

He added that Umugini currently serves several clients, including Midwestern, Energia, Platform Petroleum, and Heritage Oil, among others. He said the company's success is rooted in collaboration with regulators and communities, maintaining open communication and adherence to safety and environmental standards.

Ugbehe concluded by saying that digitalisation is the future of hydrocarbon measurement and accounting. He encouraged operators and regulators to work together to advance the use of smart meters, digital twins, and automation across Nigeria's pipeline network.

"Digitalisation comes with a cost, but the benefit far outweighs it," he said. "You cannot go digital if you are not ready to invest in people, systems, and the future."

"Beyond the meter, we must pay attention to safety, operational excellence, and stakeholder engagement—because accurate measurement starts with reliable operations."

Key Takeaways

- Pipeline operators play a critical role in ensuring accurate hydrocarbon measurement between production and export points.
- Umugini's 51.4-km pipeline connects multiple operators to the Trans Forcados Pipeline with over 95% uptime.
- The company transitioned from PD meters to Coriolis meters, automated samplers, and SCADA systems within two years of operation.
- Full digitalisation now enables real-time monitoring, online meter proving, and automated reporting.
- Regulatory approval for new technologies requires field demonstration and persistence.
- Digitalisation has improved accuracy, reduced downtime, and cut maintenance costs.
- Success depends on combining technology with safety, stakeholder engagement, and staff training.
- Umugini's model allows producers to focus on production while it handles transportation and measurement.
- The future of measurement lies in integration of digital twins, IoT, and predictive analytics.

SECTOR EXPERT

Sector Expert Session on Measurement for Emissions Reduction, Process Safety, and Gas Billing

Moderator: Engr. Iheanacho Bob Ibegbulam, General Manager, PNG Gas Limited

Engr. Iheanacho Bob Ibegbulam

In his opening remarks, Engr. Iheanacho Bob Ibegbulam welcomed participants to the session on *Measurement for Emissions Reduction, Process Safety, and Gas Billing*. He described it as one of the most important discussions of the conference, noting that while measurement is often associated with profitability and revenue assurance, it is equally critical to safety and environmental performance.

He said the conversation would explore how accurate measurement supports emissions reduction, enhances process safety, and improves gas billing systems. He explained that when measurement integrity is weak, both environmental accountability and financial accuracy are compromised.

He highlighted that process safety goes beyond preventing incidents—it also involves protecting people, equipment, and investments across operations. He encouraged speakers to link their presentations to practical challenges faced by operators and to demonstrate how better data and automation can improve both efficiency and safety outcomes.

Engr. Ibegbulam closed his opening remarks by assuring participants that the session would remain interactive and solution-driven. He then invited the first presenter from Aradel Holdings to begin the discussion.

Integration of Real-Time Measurement of Key Production System Parameters for Improvement in Operational and Environmental Excellence: Case Study in Aradel Holdings

Adefolaju Adewumi, Collins Alaka, Iheanyi Achareke, Ibekwe Isaac, Aradel Holdings Plc

Adefolaju Adewumi presented a case study from Aradel Holdings on integrating real-time measurement systems across production facilities to improve operational performance, hydrocarbon accounting, and environmental management.

He began by referring to the earlier remarks of Aradel's Managing Director, who had stressed that accurate measurement is not only essential for hydrocarbon accounting but also for achieving operational excellence. Adewumi said these two pillars form the foundation of Aradel's digital transformation and measurement strategy.

He outlined Aradel's hydrocarbon accounting framework, describing it as a continuous process of mea-

Adefolaju Adewumi

surement, allocation, reporting, and value tracking. Measurement, he said, is the starting point for all other stages and must be accurate to ensure reliability across the entire process.

To show the relevance of accurate measurement, he cited NUPRC data showing that Nigeria recorded 22 fatalities and 31 incidents in 2024 linked to measurement system failures. Between 2014 and 2023, he said, the country lost about 362 million barrels of crude to errors, sabotage, and adjustment factors. These figures underscore the economic importance of reliable measurement.

He said crude losses fell to a 16-year low of 9,600 barrels per day in 2024–2025, partly due to improved monitoring and digitalisation. He also referred to a McKinsey study showing that digitalisation can reduce operational costs by up to 25 percent per barrel, validating the business case for real-time data systems.

He described the digital oilfield architecture that enables this, using sensors at wellheads to measure parameters such as pressure, temperature, and flow rate. These data are transmitted wirelessly to gateways and then to the cloud, where they feed into systems for asset integrity, production management, and enterprise planning.

Adewole explained that Aradel combines these real-time data streams with periodic well tests to build virtual metering models for each well. These models estimate bottom-hole pressure and production rates without installing downhole gauges, reducing cost and operational risk.

He showed examples of Aradel's digital dashboard, which displays temperature and flow trends for each well and allows remote access to real-time field data.

He said deployment of the system has reduced downtime, improved data accuracy, and strengthened both hydrocarbon accounting and environmental compliance.

On lessons learned, he said the main challenges were stakeholder engagement, data quality control, cybersecurity, and integration with legacy systems. Overcoming these required close coordination across operations, engineering, and IT teams.

He said the next phase for Aradel is to complete full integration of real-time systems across other assets and incorporate artificial intelligence and predictive maintenance into daily operations.

He concluded that digital measurement systems have improved Aradel's operational reliability, transparency, and regulatory alignment. "Digital transformation builds trust through transparency and data integrity," he said. "When we strengthen our data, we strengthen accountability and national planning."

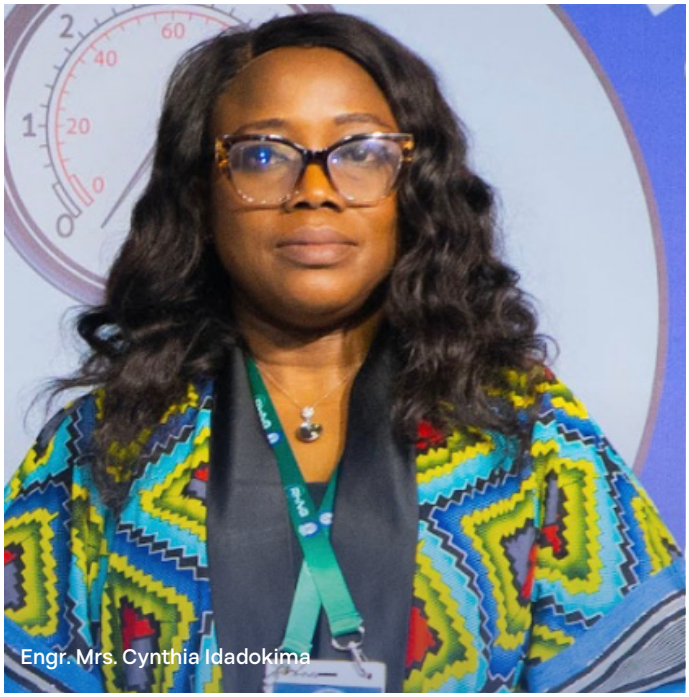
Key Takeaways

- Measurement is central to hydrocarbon accounting and operational reliability.
- Real-time systems integrate sensor data with cloud-based monitoring and control platforms.
- Virtual metering supports production estimation and reservoir management.
- The system has improved data visibility, regulatory compliance, and cost efficiency.
- Challenges include stakeholder coordination, cybersecurity, and data quality control.
- The next phase includes AI-driven workflows and predictive maintenance tools.

SECTOR EXPERT

Integrating Process Safety into Measurement Integrity: Lessons from an Indigenous Integrated Facility in the Niger Delta

Presenters: Engr. (Mrs.) Cynthia Idadokima and Mildred Nkemjika, Aradel Holdings Plc



Engr. Mrs. Cynthia Idadokima

The session was jointly presented by Engr. (Mrs.) Cynthia Idadokima and Mildred Nkemjika of Aradel Holdings Plc, focusing on how process safety principles are being integrated into measurement integrity practices at Aradel's Ogbele Integrated Facility in the Niger Delta.

Mildred Nkemjika opened the presentation by describing measurement as the "powerhouse of operations," explaining that accurate data forms the foundation for operational decisions and safety assurance. She said measurement accuracy goes beyond data validation—it also serves as a layer of defence in process safety. When measurement fails, she noted, the consequences extend beyond production deferment and can lead to safety incidents.

She defined process safety as the discipline of keeping hydrocarbons within their containment systems to prevent hazardous releases. Measurement integrity, she explained, supports this goal by providing reliable data that operators use to make decisions affecting containment and safety.

She illustrated how process safety underpins four main pillars: asset integrity, environmental protection, operational excellence, and regulatory compliance. Asset integrity ensures that equipment and systems remain safe throughout their lifecycle. Environmental protection involves preventing emissions, leaks, and spills. Operational excellence improves reliability and performance, while compliance ensures that all activities meet regulatory standards.

Nkemjika gave an example of a potential failure scenario—an operator monitoring a human-machine interface (HMI) that shows a safe pressure reading when, in reality, pressure is building up in the field. Such undetected overpressure, she said, could result in vessel rupture and fatalities. She cited the 2005 BP Texas City refinery explosion, where the U.S. Chemical Safety Board found that a faulty level transmitter led to an overflow and fire that killed fifteen people. She said incidents like this show that measurement integrity failures can have severe human, financial, and reputational consequences.

She explained that at Aradel, the company integrates process safety with measurement integrity through several methods, including safety studies such as HAZOP (Hazard and Operability) analysis, safety integrity level (SIL) assessment, and routine calibration audits. She said these efforts ensure that instrumentation systems and alarms remain functional and that operators are guided by accurate data.

At this point, Engr. (Mrs.) Cynthia Idadokima continued the presentation, explaining how process safety is embedded across the entire facility lifecycle—from design to construction, commissioning, operation, and decommissioning. She said Aradel ensures that safety studies are carried out at each stage to identify and mitigate risks before they escalate.

She described how process safety begins with hazard identification and risk assessment during the design stage, followed by implementation of control measures and verification of their effectiveness. During operations, the company conducts periodic hazard reviews, operational HSE case assessments, and management of change (MOC) reviews whenever equipment, processes, or configurations are altered.


Mildred Nkemjika

Idadokima said Aradel has achieved progress in integrating process safety and measurement integrity through proactive monitoring and diagnostics. Operators monitor both inside and outside the control room, checking for equipment alarms, calibration status, and deviations. The company also tracks data from smart devices to detect equipment failure early and ensure timely rectification.

She added that Aradel is working to implement a digital risk-visualisation tool that consolidates data from compliance, maintenance, and control systems into a single platform. This allows management to view real-time facility risk exposure and take immediate action. The company also conducts weekly console reviews to identify and correct anomalies in instrumentation data.

She said competence development is a major focus, ensuring that personnel recognise measurement as a safety-critical function. More than 270 field staff have been trained through Aradel's barrier management and technical assurance programmes to understand their roles in maintaining safety-critical systems.

Other ongoing initiatives include digital tracking of safety actions raised during reviews, redundancy planning to prevent data gaps in case of instrument failure, and improved alarm rationalisation so that operators can respond appropriately to alerts.

Idadokima said the integration of process safety with measurement integrity enhances safety, reliability, and profitability. She noted that Aradel's approach goes beyond compliance and is based on a culture of ownership, accountability, and operational excellence.

She concluded that integrating process safety into measurement integrity ensures safer operations, higher data reliability, and better environmental performance. "What you measure safely, you can manage effectively," she said. "Companies must look at process safety and measurement not in silos, but as one system that guarantees trust, reliability, and sustainability."

Key Takeaways

- Measurement accuracy supports both operational decisions and process safety.
- Process safety ensures hydrocarbons remain contained and prevents hazardous releases.
- Failures in measurement integrity can lead to serious safety incidents, as seen in the BP Texas City case.
- Aradel integrates process safety across the facility lifecycle—from design to operation and decommissioning.
- Safety tools such as HAZOP, SIL assessment, and calibration audits assure system integrity.
- Real-time diagnostics and digital dashboards help detect equipment failure early.
- Weekly console reviews and digital risk visualisation strengthen operational monitoring.
- Over 270 staff have been trained in barrier management and technical assurance.
- Integrating process safety with measurement integrity improves reliability, safety, and compliance while reducing losses and environmental risks.

SECTOR EXPERT

Driving Profitability in the Digital Era: A Strategic Approach to Efficient Billing in the Gas Sector with MDM Technology

Presenter: Engr. Damilola Awosanmi, Automation and Control Engineer, TREXM Energy

Engr. Damilola Awosanmi

Engr. Damilola Awosanmi, an automation and control engineer at TREXM Energy, spoke on the role of Meter Data Management (MDM) systems in improving billing efficiency and profitability across Nigeria's gas sector.

He began by explaining that efficiency in billing is central to profitability and that every gas producer or transporter aims to maximise value by improving how customers are billed. He noted that in many cases, estimated or manual billing practices still lead to disputes between suppliers and end users, causing losses and delays in payments.

He said that as the gas market grows rapidly, particularly with rising demand from the power and industrial sectors, the need for accurate, automated billing is more urgent. According to him, efficiency in gas billing directly supports investment growth, operational stability, and trust between producers and consumers.

Engr. Damilola introduced Meter Data Management (MDM) as a digital solution that captures, validates, stores, and manages large volumes of data from smart meters across the gas value chain. He described MDM as a software layer above SCADA systems, allowing not only process data such as flow, pressure, and temperature to be collected, but also meter configuration data, calibration records, and audit information.

He said that with an MDM platform, companies can aggregate meter data from multiple assets, validate the accuracy of readings, and use analytics to identify losses and improve operational decisions. He added that MDM provides a unified structure for both process and configuration data, allowing operators and end users to verify readings and track performance in real time.

To illustrate its use, he explained how TREXM Energy deploys Honeywell's PowerSpring MDM system, developed in partnership with Honeywell. The system is cloud-based and built on a Microsoft SQL database. It collects real-time data from smart meters in the field and transmits them securely through the company's existing network to a central database.

He said PowerSpring is scalable and can handle up to one million devices, enabling operators to manage readings and billing data across several sites on a single platform. The system includes data validation and storage, a web-based dashboard, and audit logs that record timestamps for every data entry.

According to him, one of the system's most useful features is its web interface, which allows operators and off-takers to log in and view meter data in real time. Each user can see only the meters associated with them, reducing disputes during billing reconciliation.

He said the system also has an application programming interface (API) that allows integration with other enterprise systems such as ERP, SCADA, or billing software. This means data can be automatically transferred to analytics tools like Microsoft Power BI for deeper insights, trend analysis, and predictive billing.

He explained that MDM systems improve accuracy, consistency, and transparency across operations and provide an audit trail that simplifies regulatory reviews. The system can trace the "as-left" configuration of each meter, showing when it was last calibrated and what changes were made. This, he said, helps resolve billing disputes by providing traceable evidence of data integrity.

He also discussed cybersecurity, stating that the system architecture follows international ISA and IEC standards for data protection. It is built to prevent unauthorised access and phishing attacks, ensuring both data and operational networks remain secure.

He concluded that the PowerSpring MDM platform enables transparency between gas producers and consumers, ensuring that billing disputes are reduced and trust is improved. With accurate and traceable data, operators can achieve greater profitability through efficient billing and data-driven decision-making.

He said, "MDM allows transparency, consistency, and trust between producers and end users. It gives operators control of their data and confidence in every transaction."

Key Takeaways

- Gas sector growth demands accurate and efficient billing systems.
- MDM captures, validates, and manages real-time data from smart meters across the network.
- Honeywell's PowerSpring MDM system provides a unified, cloud-based database for gas metering data.
- The platform supports ERP, SCADA, and analytics integration, improving accuracy and decision-making.
- Web access enables off-takers to view consumption in real time, reducing disputes.
- Built-in audit trails ensure traceability and data integrity during calibration and billing.
- The system follows international cybersecurity standards and supports large-scale deployment.
- Efficient billing through MDM strengthens transparency, trust, and profitability in the gas sector.

SECTOR EXPERT

Orifice Meter Performance Issues and Design Solutions

Presenter: Engr. Uto Eferire, MD/CEO, GENTEC Engineering Limited

Engr. Uto Eferire

Engr. Uto Eferire, Managing Director and Chief Executive Officer of Gentec Engineering Limited, delivered a detailed presentation on the performance challenges associated with orifice meters and how proper design, installation, and inspection can address these issues.

He began by describing the orifice meter as one of the oldest and most widely used differential pressure flow measurement technologies in the oil and gas industry. Despite being criticised for perceived inaccuracies, he noted that it remains the most common meter across facilities worldwide because of its simplicity, reliability, and well-established standards.

He explained that an orifice meter operates by forcing a fluid through a restriction, known as an orifice plate, which creates a pressure drop. The differential pressure between the upstream and downstream sides of the plate is used, along with fluid properties, to calculate

flow rate. He said there are three basic configurations: dual-chamber, single-chamber, and orifice flange assemblies.

Eferire emphasised that while the principle is straightforward, the accuracy of an orifice meter depends heavily on adherence to design and maintenance standards. Many measurement errors, he said, come from poor installation, infrequent inspection, or nonstandard operating conditions.

He identified several common performance issues observed during audits of Nigerian facilities:

- Presence of liquids in the gas stream.
- Deposits and contamination on the orifice plate or meter tube.
- Improper plate design or replacement using nonstandard parts.
- Meter tube damage and poor surface finish.
- Lack of proper flow conditioning before the plate.

Using photographs from field inspections, he showed several examples of orifice plates covered with soot, grease, and condensate, and meter tubes filled with debris. These, he said, are common in custody transfer systems and are responsible for large discrepancies between metered and actual volumes.

He presented a case study where an audit conducted by Gentec revealed that a client had used the same orifice plate for fifteen years without inspection. When the plate was cleaned and replaced with one that met standard smoothness requirements, the measured gas volume increased instantly by nine million standard cubic feet per day. This under-recording, he noted, had continued for years without the operator's knowledge.

Eferire explained that meter tube roundness, internal diameter, and surface roughness must meet API and AGA specifications to maintain accuracy. For example, 12-inch tubes should not exceed a surface roughness of 300 microinches for β ratios below 0.6 and 250 microinches for β ratios equal to or above 0.6.

He said that many of these issues persist because operators limit inspections, citing the cost or the need for shutdowns. However, he stressed that proper installation—such as ensuring the orifice plate is easily accessible and correctly centred—reduces maintenance time and improves reliability.

Eferire also mentioned that the presence of multiple bends in a pipeline can create flow distortion known as "swirl," which can persist for up to 100 meters without a conditioner. He advised that meter runs should be designed with sufficient straight lengths and proper conditioning to restore laminar flow.

He concluded by saying that orifice metering can be accurate and reliable when the right standards are followed and inspections are conducted regularly. "Most metering errors are not because the orifice meter is outdated," he said, "but because it is not properly maintained or calibrated."

He urged regulators to strengthen field inspections and for operators to adopt structured calibration and audit schedules that include checking plate smoothness, centricity, meter tube condition, and proper β ratio selection.

Key Takeaways

- Orifice meters remain reliable when installed and maintained according to standards.
- Common issues include contamination, improper plate design, poor tube condition, and absence of flow conditioning.
- Deposits and liquids inside the meter tube significantly distort readings.
- Routine inspection and calibration are essential to sustain accuracy.
- Meter tube surface roughness and roundness directly influence discharge coefficients.
- Operators should use certified plates and maintain clean, smooth meter tubes.
- Regular audits prevent cumulative under-recording and financial losses.

Closing Remarks

Sunday Kanshio, PhD. Managing Partner, Fleissen & Company

In his closing remarks, Dr. Sunday Kanshio reflected on the journey of NiHMEC, describing it as a remarkable evolution that began informally in 2016 and formally held its first edition in 2021. He said what started as a modest professional gathering had grown into an industry-recognised event, now in its fifth edition.

He noted that NiHMEC 2025, themed *"Beyond the Meter: Leveraging Digitalisation for Accurate Accounting,"*reinforced the importance of accuracy in measurement and the value of digitalisation in improving data integrity. He explained that measurement should not be seen only as a regulatory requirement but as a key driver of business performance. "Measurement does not just end with the meter," he said, "the data must be accurate and automated to reduce human interference."

Dr. Kanshio added that this year's conference concluded with discussions that touched on environmental responsibility and the integration of sustainability into measurement and accounting systems.

He expressed appreciation on behalf of the NiHMEC Chairman, Mr. Osten Olorunsola, and the Technical Advisory Committee to all participants, regulators, and sponsors. He thanked the Nigerian Upstream Petroleum Regulatory Commission (NUPRC) and the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA) for their consistent financial and institutional support over the past three years, noting that both agencies have continued to demonstrate leadership and commitment to strengthening hydrocarbon measurement and accounting in Nigeria.

He acknowledged and thanked the platinum sponsors of NiHMEC 2025, which included FIRST Exploration & Petroleum Development Company (FIRST E&P), NUPRC, NMDPRA, Chevron Nigeria Limited, SeaQuest E&P Services, GIL Automation, AOS Orwell, and DAPTEM International Limited.

Silver sponsors were Aradel Holdings Plc, Hyprops Nigeria Limited, , and Craigwal Petroshore Limited. The bronze sponsors included Waltersmith Petroman Oil Limited, Seplat Energy, Shoreline Energy International, and Pipeline Infrastructure Nigeria Limited.

He also recognised companies that provided specific support to the conference. Robert House Nigeria Limited sponsored the delegate tags, while Trexm Nigeria Limited supported the raffle draw.

Sunday Kanshio, PhD

Dr. Kanshio extended special thanks to the NiHMEC Chairman, Mr. Osten Olorunsola, for his leadership, and to members of the NiHMEC Technical Advisory Committee (TAC) for their guidance and contributions to the continued success of the conference. He listed the members as:

Osten Olorunsola (Chairman), Dr. Sunday Kanshio, Dr. Femi Olarewaju, Andrew Orji, Godfrey Omokaro, Dr. Kenneth Uwalaka, Mary Alugbin, Remilekun Adeeyo, Dr. Muhammad Abba, Chidi N. Nwosu, Agatha Orisanaiye, and Adedeji Tejuoso.

He acknowledged their technical insight and commitment to building a credible industry platform that promotes measurement integrity and collaboration across the upstream, midstream, and downstream sectors.

Dr. Kanshio said the success of NiHMEC 2025 was made possible through the combined efforts of the organising team, exhibitors, speakers, and participants. He thanked the exhibitors for their commitment and consistent participation, including Aradel Holdings, Sensia, GIL Automation, AOS Orwell, DAPTEM International, SeaQuest, Gentec Engineering, Kimman Process Solutions, Komax Systems Inc., Meter Engineers,

Avotech Multi Concept, PetroDecision, WaveFlute, LANAD Energy, Verbeck, and Craigwal Petroshore. He noted that the exhibition segment had become a major feature of NiHMEC, allowing operators and technology providers to share innovations that enhance measurement accuracy and accountability.

He expressed appreciation to the conference master of ceremonies, Mr. Steven, and to the technical and logistics teams, as well as to Federal Palace Hotel, Lagos, for their excellent hosting of the event.

He concluded by thanking all delegates for their active participation and reaffirming NiHMEC's commitment to continuous improvement. He invited everyone to the post-conference lunch and dinner, noting that future editions would continue to expand the platform's reach and impact.

He ended with gratitude, saying the success of NiHMEC 2025 belonged to the collective effort of the entire industry.

POST-EVENT SOCIALMEDIA FEED...

AOS Orwell Limited
49,602 followers
2w • + Follow ···

Day 1 at #NiHMEC2025 was a success!
From engaging conversations at our exhibition booth to our impactful Thought Leadership Session on "Digital Solutions and Innovation in Measurement Technologies," Day 1 was all about driving connections, innovation, and conversation.
We were also honoured to host several industry leaders and VIPs who visited our booth to explore how #AOSOrwell is redefining measurement excellence in Nigeria's hydrocarbon space.
Looking forward to more meaningful engagements as the conference continues! More to follow>>>
#AOSOrwell #NiHMEC2025 #MeasurementSolutions #DigitalInnovation #Er
Bhatia Simon Egloff Benoni Udoh

Aradel Holdings PLC
35,630 followers
1w •

At the recently concluded Nigeria Hydrocarbon Measurement Conference (NiHMEC) 2025, our MD/CEO, Gbite Falade, participated in the CEO session where he highlighted the critical role of measurement and digitalisation in building a sustainable business at Aradel Holdings Plc. He emphasised that accurate data and efficient metering are central to operational excellence and long-term value creation.

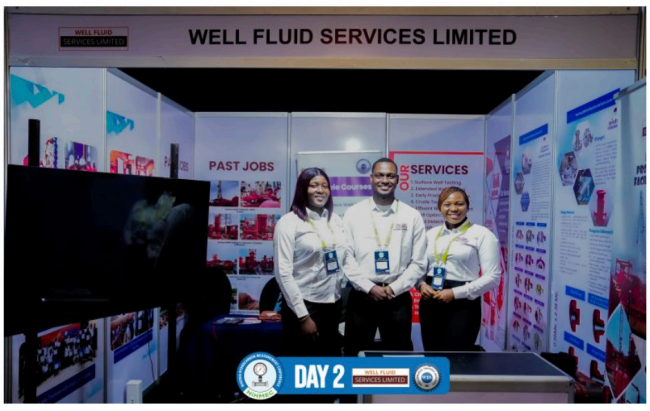
#NiHMEC2025 #AradelHoldings #SustainableEnergy

Well Fluid Services Limited · 2nd
No. 1 Well Testing Company in Nigeria and Sub-Saharan ...
2w • + Follow ···

🚀 **NIHMEC Exhibition & Conference 2025 — Day 2 Highlights!** 🚀

Day 2 at the **NIHMEC Exhibition & Conference** 2025 was nothing short of remarkable!
We had the pleasure of welcoming several guests and industry professionals to our booth — engaging in meaningful conversations, answering inquiries, and showcasing how #WellFluidServicesLimited continues to deliver innovative solutions that address real-world challenges in the oil and gas sector.
At Well Fluid Services, we take pride in being problem-solvers — providing reliable, data-driven, and efficient well testing and production solutions that drive value for our clients and the industry at large.
📍 Visit us at Booth Stand C2 as the exhibition continues — let's connect and explore opportunities to transform field performance together!

#NIHMEC2025 #WellFluidServices #OilAndGas #Exhibition #Innovation #W



Engr. Chichi Emenike FNSE · 2nd
Acting Managing Director & Gas Asset Manager at Neconde Energy Limite...
1w • Edited •

CEO'S ROUNDTABLE
OML42 is a total of about 804sqkm so you can imagine the many moving parts and different points of accountabilities. Whether you call them custody transfer or fiscalization points, ultimately the very bane of our type of business and its commercialization in the industry is hinged on metering. The underpinning agreements for all these set ups are premised on Hydrocarbon accounting and its optimization is very key to business owners, operators and all stakeholders. I was on a panel recently at Nihmec 2025 where I spoke on how we manage this even on our dual methods of crude evacuation (FOT&Barging)on the Asset as well as Gas metering (ELPS). Up to the FOT, there are many injectors on the Trans Forcados Pipeline (TFP)System, where we have some of our producing fields (we have four) going through- the allocation of production using proper accounting methods is not up for discussion. Smart metering, calibration and enhanced efficiency are all important. I had one key takeaway...these meters can even be used for reservoir performance management and tracking. The use for planning&decision making especially for us team leads and even our financiers/lenders, the Regulatories (Royalty and taxes calculations) is important. Thank you Nigeria Hydrocarbon Measurement Conference (NiHMEC) for the platform..I gave and I took knowledge...there must be a Science to this madness...and hey 👋 shout out to Sensia Global the OEM doing one of our latest metering systems for our FSO. We thank the Nigerian Upstream Petroleum Regulatory Commission (NUPRC) too for the support. We keep moving 🚶🚶🚶🚶🚶🚶. It can only get better; continuous improvement for Accountability!!!
Mercy Tom Dr. David Editang,FIMC,CMC Esther Ifueko Chinedu, MBA, ANIPR Aradel Holdings PLC Gbite Falade Osten Olorunsola

POST-EVENT SOCIALMEDIA FEED...

Heirs Energies
69,995 followers
5d •

At Heirs Energies, we are driving progress toward more accurate, efficient, and transparent hydrocarbon measurement and accounting practices.

At the 5th Nigeria Hydrocarbon Measurement Conference (NiHMEC) 2025, our representatives' Rosemary Nsolo Ekwueme, Head, Hydrocarbon Accounting & Metering, and Engr Pascal Ugochukwu Nwadike MNSE R. Engr., Head, Metering, joined industry leaders to exchange insights on strengthening upstream measurement systems.

The conversations reinforced the vital role of digital transformation and automation in driving efficiency, reducing losses, and improving accountability; priorities that align with our commitment to operational excellence and innovation in Nigeria's oil and gas sector.

#HeirsEnergies #NiHMEC2025 #OperationalExcellence

Kimman Process Solutions B.V.
1,112 followers
2w •

Very proud to be presenting at Nigeria Hydrocarbon Measurement Conference (NiHMEC) 2025 (https://nihmec.com/) with our trusted channel partners Hyprops Nigeria Limited

Please join us at our booth talk about sampling and quality measurement.

DAPTEM
1,246 followers
2w •

Highlights from Day 1 of the Nigeria Hydrocarbon Measurement Conference (NiHMEC)

It was exciting , interactive and engaging moments for our clients , partners and the DAPTEM team.

NiHMEC 5 : " BEYOND THE METER: LEVERAGING DIGITALISATION FOR ACCURATE HYDROCARBON ACCOUNTING"

DAPTEM engineering
Innovation, Value , Time & Quality

Petrodecision
48 followers
2w •

Higlights from the Nigeria Hydrocarbon Measurement Conference (NiHMEC) last week.

Meter Engineers
2,531 followers
2w •

David Thacker presented today at Nigeria Hydrocarbon Measurement Conference (NiHMEC) on the future of proving and small volume provers. Followed by a joint panel led by SeaQuest Exploration and Production Services. Together, we are excited to build the future of measurement in Nigeria!

#meterprover #custodytransfer #smallvolumeprover

Sensia Global
37,157 followers
1w •

NiHMEC 2025 was a resounding success, and we extend our sincere thanks to the event organizers, **Fleissen & Company Limited**, as well as our valued partners, Vhelbherg and Sojay Automations. We also appreciate the opportunity to engage with so many esteemed industry peers throughout the week.

Sensia proudly participated in a technical panel session featuring Segment Managers **Fuzail Kagzi** and **Tommy Leach**, joined by **Essien Eka - FNSE, COREN, MSc, PMP®, IMechE** (**Heirs Energies**), Omale Solomon (Sojay Automations) and Samuel Omonoseh (**Umugini Pipeline Infrastructure Limited**). The discussion focused on the evolving landscape of Measurement and Digital Technology in the Oil and Gas sector.

Key topics included the integration of connected domain expertise, real-time measurement enabled by emerging technologies, and the role of edge intelligence. The panel emphasized the industry's need for enhanced operational visibility to drive smarter decision-making, optimize production, and reduce both costs and carbon footprint.

Learn more about how Sensia is powering digital transformation in measurement: **https://loom.ly/1BN6-Zo**

SLB Rockwell Automation Swinton Technology

#NiHMEC2025 #OilGas #Automation

Shoreline Natural Resources Limited
7,069 followers
1w •

Reflecting on an engaging week at NIHMEC 2025!

Last week, delegates from Shoreline Natural Resources attended the 5th Nigeria Hydrocarbon Measurement Conference (NiHMEC), where we were proud Bronze Sponsors of this leading international platform advancing hydrocarbon measurement and accounting.

The three-day conference brought together key stakeholders, regulators, and industry experts to exchange insights, strengthen collaboration, and promote greater accuracy, transparency, and innovation across Nigeria's oil and gas measurement systems.

#NiHMEC2025 #Oilandgas #Upstream
#EnergyLeader #SNRL

TREXM Holdings
5,820 followers
2w • Edited •
+ Follow ···

It's day two of the Nigeria Hydrocarbon Measurement Conference (NiHMEC) and we're fully on ground.

Ready to glean knowledge from every of the powerful conversations and presentations today.

Join us tomorrow for:

- Our Expert session presentation anchored by Engr Damilola Awosanmi

- Our Raffle Draw

Come: learn and win amazing prizes!

#trexmenergy #nihmec2026 #hydrocarbonaccounting

Umugini Pipeline Infrastructure Limited
415 followers
2w •
+ Follow ···

Day 2 Highlights from NiHMEC 2025 – "Beyond the Meter: Leveraging Digitalisation for Accurate Hydrocarbon Accounting."

Yesterday marked another great step forward in advancing digitisation in hydrocarbon metering and measurement across Nigeria's oil and gas industry. Umugini Pipeline Infrastructure Limited (UPIL) who is a key stakeholder in hydrocarbon quantity and quality measurement as part of storage and transportation proudly shared valuable insights from a pipeline operator's perspective through a technical presentation titled:
🎙 "Beyond the Meter: Leveraging Digitisation – Lessons from a Pipeline Operator."

The session presented by **Okeoghene Ugbehe** (Head, Business Development) showcased Umugini's transformative journey in embracing digital technologies to enhance pipeline operational efficiency, data integrity, and reliability along this journey that has positioned Umugini as Nigeria's leading midstream energy transportation and infrastructure companies.

Umugini remain committed to driving innovation, sustainability, and collaboration in the hydrocarbon transporation, metering and measurement ecosystem.

Stay tuned for more updates from Day 3 — the conversation continues! 💡
#NiHMEC2025 #UmuginiPipeline #Digitisation #HydrocarbonMeasurement #C
Nigeria Hydrocarbon Measurement Conference (NiHMEC)Midwestern Oil & Gas Company LimitedSunTrust Atlantic Energies LimitedIngentia Energies LimitedNigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA)Nigerian Upstream Petroleum Regulatory Commission (NUPRC)MidSun GGF Global Limited (Midwestern Subsidiary)Heirs EnergiesAradel Holdings PLCShoreline Natural Resources LimitedShellAsharami SynergySahara GroupPipeline Professionals Association of NigeriaUmugini Pipeline Infrastructure Limited

POST-EVENT SOCIALMEDIA FEED...

Dr. David Editang,FIMC,CMC · 1st
Business Development | Government Relations & Stakeholders Manageme...
1w ·

Great takeaways from Nigeria Hydrocarbon Measurement Conference (NiHMEC).

Last week, I had the pleasure of making a brief stop at the Nigeria Hydrocarbon Measurement Conference (NiHMEC) 2025 — an engaging platform that brought together brilliant minds across the energy sector.

The discussions around metering ,hydrocarbon accounting ,data integrity and efficiency were truly insightful and a reminder of how digital transformation and data integrity drives progress in our industry.

Grateful for the shared commitment to excellence in Nigeria's oil and gas space.
Engr. Chichi Emenike FNSEEsther Ifueko Chinedu, MBA, ANIPRGil Lawal GbolahanEngr. GIFT OSEGHALE (MNSE)Joy OserohwovoDamiete Thomas@ayo

#NiHMEC2025 #OilAndGas #EnergyLeadership #Innovation #MarconiNGEP

GIL Automations
14,507 followers
2w · Edited ·

Amazing Day 2 at Nigeria Hydrocarbon Measurement Conference (NiHMEC) 2025!

We truly shined among others as industry stakeholders and partners engaged with our innovative solutions and expertise at Booth Stand C1.

NiHMEC 2025 continues to be a hub of impactful conversations and cutting-edge technologies.

Don't miss Day 3 as we take the stage for a technical panel session on: "Metering Control Systems: Securing Hydrocarbon Data in an Era of Cyber Risks."

Our Speakers & Panelists:

- Engr. Martins Nwachukwu – Honeywell Regional Sales Manager, Fixed Gas Detection Systems (Sub-Saharan Africa)
- Engr. Gil Lawal Gbolahan – CEO, GIL Automations
- Engr. Adebayo Johnson – COO, GIL Automations
- Afolarin Kalejaiye – AGM, Sales & Channels Business, GIL Automations

Venue: Federal Palace Hotel, Victoria Island, Lagos
Date: 9th October, 2025

Register now to attend:
https://lnkd.in/dcqkkbrj

#NiHMEC2025 #GILAutomations #HydrocarbonAccounting #Digitalization

Obatarhe Osiobe · 1st
Hydrocarbon Accounting Field Engineer at Heritage Energy Operation...
2w · Edited ·

Thrilled to share that I presented today at NiHMEC 2025 in Lagos! 🌟

It was an honour to contribute to an expert session on "Revolutionising Hydrocarbon Accounting: The Role of Virtual Flow Metering."

I delved into how this transformative technology is reshaping our industry by providing real-time, data-driven insights for more accurate and efficient production monitoring. Key takeaways from my discussion included:

🔷 How VFM enhances measurement accuracy and complements traditional methods.
🔷 Its critical role in optimising production and supporting better decision-making.
🔷 The value of continuous data in improving fiscal accountability and reservoir management.

A big thank you to the organisers for putting together a world-class event, and to the brilliant panelists and attendees for an engaging and thought-provoking conversation. The energy and innovation in NiHMEC are truly inspiring!

#NiHMEC2025 #OilAndGas #DigitalTransformation #VirtualFlowMetering #

Abiola Abiodun Alhaji Shehu Grema Adetola Olashore Adesola Adebawo Olamide Yusuf Sunday Kanshio, PhD. MBA. Nigeria Hydrocarbon Measurement Conference (NiHMEC) Chiamaka Ezeonwuka (MBA,M.Sc, CIPD) Heritage Energy Operational Services Limited Shoreline Natural Resources Limited Stephen Owotemu Petroleum Engineers Association Pieter Blanksma Kolawole Bakare Lola Oyenekan

Rebecca Muoneke · 1st
Hydrocarbon Resource analyst at NEPL
2w ·

What you can't measure, you can't improve!
This quote framed the entire Nigeria Hydrocarbon Measurement Conference (NiHMEC) put together by Fleissen & Company Limited.

The central message is simple: Data Integrity is non-negotiable.
The theme, "Beyond the Meter: Leveraging Digitalisation for Accurate Hydrocarbon Accounting," showed us why: If the first measurement is wrong, every financial and operational decision that follows is wrong.

The path forward requires us to stop relying on bulk estimates and move toward individualized, high-resolution measurement from the reservoir to the terminal. This shift is crucial because reconciliation challenges and data errors often stem from slow, manual entry.
By leveraging Automation and IIoT, we establish a single, reliable audit trail, turning HCA data into the accurate 'Cash Register' of our industry for smarter production planning, less revenue leakage, and stronger national accountability.
This requires focusing on process and technology equally.

I'm grateful for the valuable professional connections and as well as many thought-provoking ideas this conference generated.

What digital tool has made the biggest difference in your team's data accuracy?

#HydrocarbonAccounting #DataIntegrity #DigitalTransformation #OilAndGa
Obatarhe Osiobe
Abiola Abiodun
Sunday Kanshio, PhD. MBA.
Bello Aminu, MNIP, MNSE

AOS Orwell Limited
49,603 followers
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Day 1 at #NiHMEC2025 was a success!
From engaging conversations at our exhibition booth to our impactful Thought Leadership Session on "Digital Solutions and Innovation in Measurement Technologies," Day 1 was all about driving connections, innovation, and conversation.
We were also honoured to host several industry leaders and VIPs who visited our booth to explore how #AOSOrwell is redefining measurement excellence in Nigeria's hydrocarbon space.
Looking forward to more meaningful engagements as the conference continues! More to follow>>>
#AOSOrwell #NiHMEC2025 #MeasurementSolutions #DigitalInnovation #Er
Bhatia Simon Egloff Benoni Udoh

Dr. Ken Uwalaka B.Eng, MBA, MISM,PMP, Ph.D. · 1st
Technical Manager Production Optimization Upstream - Americas Transfor...
1w • Edited •

The Nigeria Hydrocarbon Measurement Conference (NiHMEC) 2025 was a huge success, literally just a week ago, especially as we marked our 5-year anniversary. However, the discussions and atmosphere continue to reverberate with attendees (participants, sponsors, speakers, etc.). It was once more a distinct delight to engage with various teams of oil and gas professionals and regulators. The theme, meticulously chosen by the NIHMEC Technical Advisory Council, fulfilled its commitments. "Beyond metering: Utilizing digitalization for precise hydrocarbon accounting." This theme influenced my choice to focus extensively on a topic of considerable importance to most operators, titled "Unlocking the Production Deferment: Effective and Efficient Optimization, Underpinned by Metering Accuracy." Emerging from apprehension regarding global industrial issues, what follows after metering, or what occurs if there is nothing to meter? Consequently, the highly regarded lecture on effective and efficient optimization, which supported precise metering, is central to the issue. Optimizations are fundamental to production sustainability for most operators, especially in the absence of capital expenditures (CAPEX). Our approach to production optimization has a significant impact on our financial performance, focusing on three key components: thermal optimization inefficiencies, shortcomings in virtual flow meters, and gaps in predictive diagnostics. One may question how this relates to successful metering, innovation, and automation in field operation practices, which I identified as a strategic correlation. Optimization is contingent upon measurement; one cannot optimize that which cannot be measured—incorrect hydrocarbon data results in suboptimal choke configurations, deferred output, and misallocated royalties. Measurement relies on innovation: Conventional metering methods are susceptible to drift, manipulation, and latency. Innovation facilitates closed-loop optimization.
In conclusion, Virtual flow meter (VFM) is the foundation of this transformation, guiding our path from deferred diagnostics to real-time optimization and from disjointed metering to intelligent flow recovery. The barrels are already in the pipeline; we must measure them more intelligently. Concurrently, we provided advice to operators, regulators, and chief executives.
For the chief executive, this is not merely technical optimization but a strategic change. We are converting deferred barrels into realized value, complying with regulatory standards, and achieving investor-grade performance. My advisory note to the operators: Embrace field innovation not as a cost, but as an incentive for enhancing production.
Operators can substantially reduce unplanned deferment by incorporating VFM with thermal optimization and predictive diagnostics, thus diminishing metering and measurement uncertainties arising from manual metering and fragmented data. Nigeria Hydrocarbon Measurement Conference (NiHMEC)

Daniel Clement · 1st
Petroleum Engineer | Asset Management | Flow Assurance | Ex-PwC | Ex-H...
1w • Edited •

What an electrifying experience at the just concluded NiHMEC conference!!!

I was beyond proud to represent SeaQuest Exploration and Production Services, where we shone as the Platinum Sponsor and brought our A-game as exhibitors! 🚀

Each day, I had the exciting opportunity to contribute during the VIP tours, introducing SeaQuest's bold vision and game-changing solutions to industry leaders. The energy was contagious!

Our team, in collaboration with our incredible OEM partners, Meter Engineers, hosted a panel discussion that sparked thought-provoking ideas and showcased our leadership in the energy space. A huge thank you to them for amplifying our impact! 🙌

From engaging with potential customers to networking with brilliant professionals, every moment was a chance to connect, inspire, and explore new possibilities. The conversations we had are already paving the way for exciting collaborations, and I'm pumped about what's next for SeaQuest! 🌍

A massive shoutout to the Nigeria Hydrocarbon Measurement Conference (NiHMEC) organizers for an unforgettable event and to the SeaQuest crew for their relentless support.

Let's keep pushing the boundaries of innovation and excellence in the oil and gas space! 💪

What was your favorite moment from NiHMEC? Drop a comment, I'd love to hear! 👇

Etta Agbor SeaQuest Exploration and Production Services Nigeria Hydrocarbon Measurement Conference (NiHMEC) David Thacker Gogo Eneyok Joseph Okhiku Pattykate Agbor Charity Adeyemi Leo Adoghe Victoria Eroli

#NiHMEC #SeaQuest #EnergyInnovation #OilAndGas

George Onuma, m-MBA · 1st
Head, Strategic Partnerships & Innovation
2w •

Reflective & Appreciative

NIHMEC 2025 — That's a wrap!

Three days of powerful conversations, bold ideas, and meaningful connections.

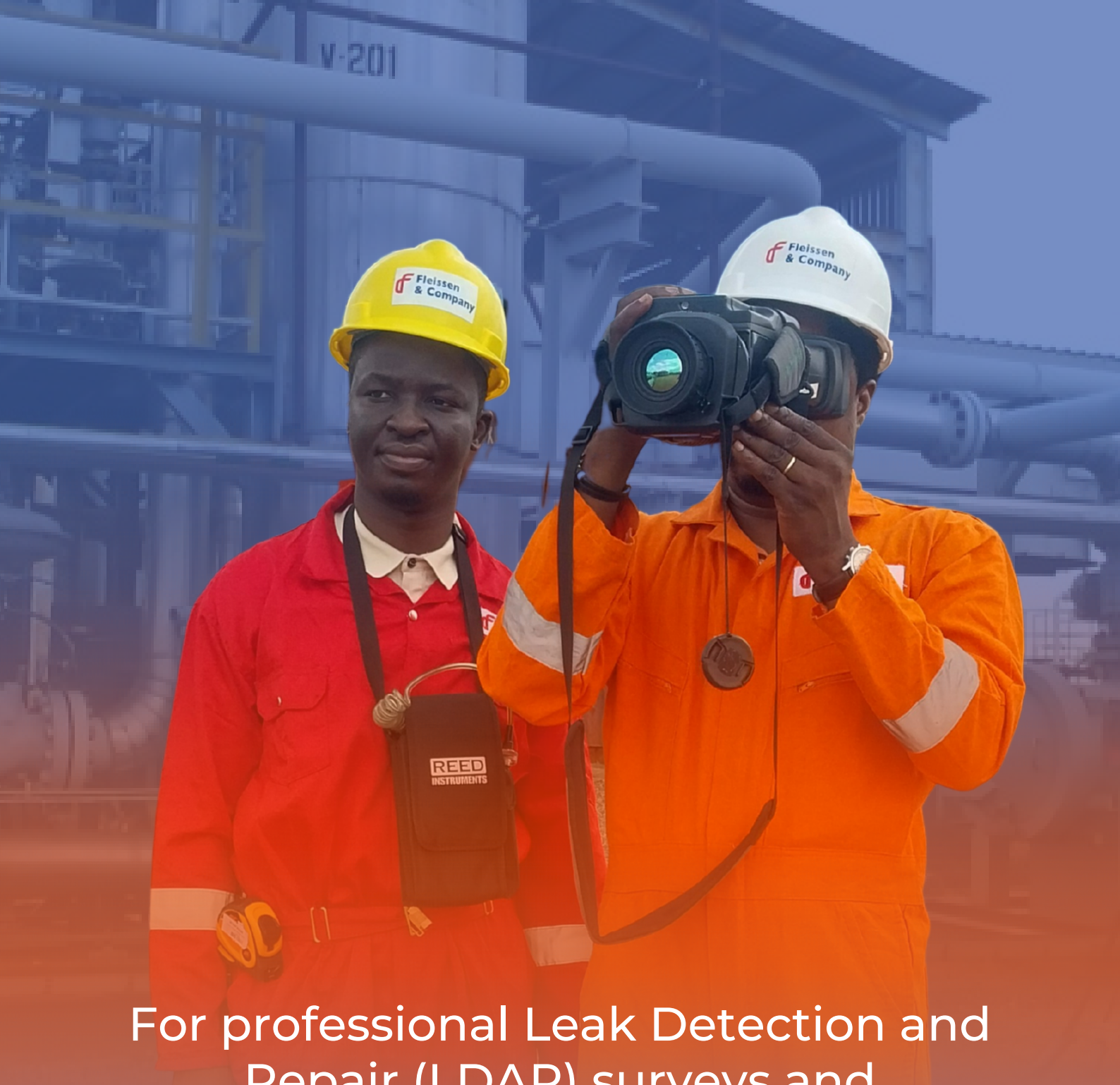
Craigwal Petroshore Limited and Komax Systems, Inc. showed up with purpose and left with momentum.

From upstream innovation to strategic partnerships, we're proud of the impact we made and the future we're building.

To everyone who stopped by, shared insights, or simply said hello — thank you.

The energy was electric, and the journey continues.

#NIHMEC2025 #CraigwalPetroshore #EnergyLeadership #HydrocarbonInnc



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