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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-4015-SPE | | **Title:** | Energy Efficiency Opportunities In Sour Gas Treatment Units To Improve Sustainability | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Improving sustainability | | **Keyword2:** | Energy-saving measures | | **Keyword3:** | Improving energy performance | | **Keyword4:** | Emissions Reduction | | **Authors:** | V. Parmar, H. Singh, F. Ragheb Kamal, NMDC Energy (formerly NPCC) | | **Abstract:** | **Objectives/Scope:** Sour gas treatment process involves amine solutions to remove acid gases such as hydrogen sulfide (H2S) and carbon dioxide (CO2) from hydrocarbon gases. The paper addresses energy efficiency opportunities in amine-based sour gas sweetening units, emphasizing potential improvements in energy performance and emission reductions in a process that is energy-intensive process due to the need for large amounts of heat and power. The involvement of NMDC Energy in a recently executed project highlights how energy efficiency opportunities can be leveraged within sour gas sweetening units to improve overall energy performance **Methods, Procedures, Process:** In the amine based Sour Gas Treatment Unit, high-pressure rich amine from the Amine Contactor is flashed to the Rich Amine Flash Drum. This process results in energy losses across Amine Contactor level control valve. One of the significant opportunities identified in the paper is the integration of Hydraulic Power Recovery Turbine (HPRT) to drive secondary equipment, that is the Lean Amine Circulation Pump. Another energy-saving opportunity comes from optimizing the Amine Regenerator Reboiler Heating Supply System. Traditionally, hot oil is used as the heating medium, but the paper suggests using hot water instead. **Results, Observations, Conclusions:** The energy wasted in the Amine Contactor level control valve can be recovered using the Hydraulic Power Recovery Turbine (HPRT). The basic idea is to recover energy from the pressure drop that typically occurs in the system and use it to drive the Lean Amine Circulation Pump. By using an HPRT, this energy is recovered and converted into mechanical energy to assist in driving the Lean Amine Circulation Pump, reducing electricity consumption. In a typical design, the Lean Amine Circulation Pump is driven by an electric motor. However, by integrating an HPRT and clutch system, the HPRT can provide supplemental power. Another energy-saving opportunity is around the Amine Regenerator Reboiler System. Water has a lower mass heat capacity compared to hot oil. This means that for the same amount of heat transfer, less energy is required when hot water is used as the heating medium. The change to hot water, coupled with more efficient pumping systems, can result in substantial energy savings due to reduced pump power requirements. **Novel/Additive Information:** While the technologies on the use of HPRT can lead to substantial energy and cost savings, the primary barrier remains the CAPEX for their implementation. However, as the industry becomes more focused on reducing emissions and improving sustainability, these energy-saving measures could become more attractive over time. This paper aims to share the energy efficiency opportunities that could lead to both economic and environmental benefits for energy-intensive sour gas sweetening processes, supporting the overall goal of improving energy performance and reducing emissions. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-4176-SPE | | **Title:** | Rerouting Hot Naphtha Streams From The Main Fractionator Reflux Drum And Debutanizer Bottom Directly To The MS Pool, Bypassing The Gas Concentration Unit And Naphtha Splitter Unit -A Landmark In Energy Optimization, Cost Reduction, And Operational Reliability | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | High ROI | | **Keyword2:** | Energy Optimization | | **Keyword3:** | Process Integration | | **Keyword4:** | Operational Reliability | | **Keyword5:** | GCU and NSU bypass | | **Authors:** | A. R, N.S. UPADHYAY, Bharat Petroleum Corporation Limited | | **Abstract:** | **Objectives/Scope:** The GCU and NSU Bypass Scheme was developed to optimize energy usage, reduce reboiler load, and enhance process reliability at PFCCU by BPCL inhouse team. The scheme involved rerouting hot naphtha streams from the Main Fractionator Reflux Drum (IFV-103) and Debutanizer Bottom directly to the MS pool, bypassing the Gas Concentration Unit (GCU) and Naphtha Splitter Unit (NSU). The initiative aligns with BPCL’s long-term vision of sustainability, improved asset reliability, and operational excellence through internal heat integration. **Methods, Procedures, Process:** The bypass strategy was based on rigorous lab analyses, simulations, and pressure surveys. MS samples from the MF reflux drum was found within RVP and sulfur specs, enabling its direct use in the MS pool. Aspen HYSYS simulation validated the impact of gradual diversion on product RVP and propylene yield. Existing coolers and refurbished control valves were integrated for product flow and temperature control. Two new pipelines (6” and 8”) were constructed with 104 high-quality welds in running plant. Seamless coordination among Process, Maintenance, Instrumentation, and Inspection ensured safe execution with UCVA surveillance and detailed JSA adherence. **Results, Observations, Conclusions:** Commissioned in May 2025, the GCU and NSU Bypass Scheme delivered remarkable energy savings and process simplification. HP steam generation improved in IFE-102, and excess column heat was redirected to the hot water system, lowering LP steam demand in the PRU. Power savings were realized by stopping 5 pumps (2 HCN and 2 LCN pumps and 1 NSU reflux pump), improving both energy efficiency and unit reliability critical under full-load operation. The project allowed routing of MS products directly to storage via existing coolers. NSU column was bypassed and preserved under nitrogen. Reboiling duties in NSU, Debutanizer, and Stripper columns dropped significantly enabling additional 10 TPH High pressure steam generation and saving 250 kWh. These translate to ~8,000 MTOE energy savings and an annualized profit of ₹23.61 crores. Simulations showed product RVP within spec limits, while propylene loss in FG dropped from 1.4% to 0.6%. The CAPEX of ₹51 lakhs resulted in a high ROI and a payback period of less than one month. This scheme not only improved energy efficiency and economics but also reduced the Energy Intensity Index (EII) by 0.5 at refinery level, setting a benchmark for refinery-wide optimizations. **Novel/Additive Information:** The GCU and NSU Bypass Scheme is a rare example of safely bypassing a major downstream fractionation unit in a live refinery without impacting product quality. It showcases practical integration of process simulation, lab validation, and hydraulic survey into project execution. This in-house solution, driven by necessity and innovation, stands out for its technical merit, safety management, and exceptional ROI. It can serve as a replicable model for energy optimization across refineries globally. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-4194-SPE | | **Title:** | Energy Optimisation And Transition Challenges, Technologies, And Innovative Practices | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Energy Optimization | | **Keyword2:** | Energy Transition | | **Keyword3:** | Business Model | | **Keyword4:** | Digital Transformation | | **Keyword5:** | Low-Carbon Economy | | **Authors:** | S. BODA, BHARAT PETROLEUM CORPORATION LIMITED | | **Abstract:** | **Objectives/Scope:** This paper investigates the critical challenges and emerging opportunities in energy optimization and the broader energy transition within the oil and gas industry. **Methods, Procedures, Process:** Energy optimization encompasses a range of practices aimed at maximizing energy output and operational performance while minimizing environmental and economic costs. Key challenges include aligning production objectives with sustainability goals, responding to volatile market conditions, and complying with increasingly rigorous regulatory frameworks. The adoption of digital technologies—such as artificial intelligence (AI), machine learning, and the Internet of Things (IoT)—enables real-time process monitoring and predictive maintenance, contributing to improved energy efficiency and decision-making. **Results, Observations, Conclusions:** The transition to low-carbon energy systems requires the integration of renewable energy sources, the deployment of carbon capture, utilization, and storage (CCUS) technologies, hydrogen production, and electrification of upstream and downstream processes. These measures support the sector’s shift toward sustainability while ensuring operational reliability. However, technical, financial, and infrastructural barriers persist, requiring coordinated efforts across industry stakeholders.The oil and gas sector is at a transformative inflection point, characterized by increasing pressure to reconcile energy production with environmental stewardship. By leveraging digital innovation, fostering strategic partnerships, embracing regulatory shifts, and investing in workforce development, the industry can position itself as a key contributor to a sustainable global energy future. This study underscores the necessity of integrated approaches that combine technological, organizational, and policy-driven strategies to achieve long-term resilience and relevance in the face of a dynamic energy transition. **Novel/Additive Information:** A successful energy transition demands not only technological advancement but also organizational and workforce agility. The emergence of new energy sectors necessitates reskilling and upskilling of the existing workforce, alongside the development of adaptable and forward-looking business models. Strategic partnerships between oil and gas companies and renewable energy firms are increasingly pivotal in facilitating knowledge transfer, innovation, and mutual growth.Policy and regulatory environments play a critical role in shaping the direction and pace of the energy transition. Governments and international bodies are progressively favoring investments in low-carbon technologies and sustainable energy infrastructure. Compliance with such policies requires oil and gas companies to align their operational strategies and capital allocation with evolving regulatory standards and sustainability benchmarks. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-4259-SPE | | **Title:** | Enhancing Operational Efficiency And Energy Savings Through A Fail-less Artificial Lift Strategy: A Case Study Of Long Stroke Unit Deployment In Field A, Petroleum Development Oman. | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | GHG Reduction | | **Keyword2:** | energy Efficiency | | **Keyword3:** | energy competitiveness | | **Keyword4:** | Best In Class | | **Keyword5:** | New Technology | | **Authors:** | G.N. AL Shukaili, H.K. Rady, S.S. Al-kindi, H. Al-Noumani, M. Al Lawati, Y.J. Al Riyami, A. Al Ajmi, Petroleum Development Oman | | **Abstract:** | **Objectives/Scope:** Field A, the largest cluster in Petroleum Development Oman (PDO), faced a significant challenge with a high overall artificial lift failure index, surpassing industry standards at 28% in 2020. The primary contributors to this index were beam pump (BP) wells. **Methods, Procedures, Process:** . In response, a comprehensive workshop was conducted involving all stakeholders to address the issue of artificial lift failures. Field A's artificial lift fail-less strategy was formulated and implemented as a result of this workshop. A long stroke unit (LSU) was deployed in Field A as a result of the persistently high failure rates for conventional beam pump units (BP), which exceeded 32% in 2020. In an effort to mitigate these challenges, a series of successful trials were conducted to evaluate the efficacy of LSU, which led to the conversion of 80 conventional BP units to LSUs between 2020 and 2024. **Results, Observations, Conclusions:** The results obtained from the deployment of LSU in Field A showcased significantly improved run life, indicated by a reduction in failure index. This increase in reliability contributed to the avoidance of subsurface deferments due to less failures and tripping, resulting in estimated additional production of 320 bbl/d. Additionally, LSUs reduced the number of well interventions, primarily due to fewer failures. It resulted in a substantial improvement in the life cycle of the wells, saving $2.94 million annually. As a result of the deployment of LSUs, power savings were also achieved. In comparison to conventional BP units, LSU demonstrated a remarkable 40% reduction in power consumption, resulting in a significant decrease in carbon dioxide equivalent emissions by 4575 tCO2e since LSUs deployment. This successful implementation not only addressed high failure rates but also enhanced system reliability, reduced corrective maintenance, lowered power consumption, and effectively reduced oil deferment. This abstract outlines these positive outcomes, the challenges faced during implementation, and strategies used to overcome them. Additionally, it presents a roadmap for deploying LSUs across Field ‘A , with plans for over 150 LSUs installation in the next five years. **Novel/Additive Information:** The study provides valuable insights for the oil and gas industry, showcasing the potential for wide adoption of LSUs to enhance performance in similar fields. [[A graph of a number of people  Description automatically generated](https://files.abstractsonline.com/CTRL/98/7/466/775/7F2/443/FA1/0A8/BF3/9CE/856/58/g4259_1.JPG)](https://files.abstractsonline.com/CTRL/98/7/466/775/7F2/443/FA1/0A8/BF3/9CE/856/58/g4259_1.JPG) [[A graph showing a number of green bars  Description automatically generated](https://files.abstractsonline.com/CTRL/98/7/466/775/7F2/443/FA1/0A8/BF3/9CE/856/58/g4259_2.JPG)](https://files.abstractsonline.com/CTRL/98/7/466/775/7F2/443/FA1/0A8/BF3/9CE/856/58/g4259_2.JPG) [[A graph showing the price of oil production  Description automatically generated](https://files.abstractsonline.com/CTRL/98/7/466/775/7F2/443/FA1/0A8/BF3/9CE/856/58/g4259_5.JPG)](https://files.abstractsonline.com/CTRL/98/7/466/775/7F2/443/FA1/0A8/BF3/9CE/856/58/g4259_5.JPG) | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-4323-SPE | | **Title:** | Reconfiguring Wellhead Control Panel For Energy Saving And Optimal Well Performance | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | wellhead | | **Keyword2:** | control panel | | **Keyword3:** | energy | | **Authors:** | A. Agarwal, M. Al Bloushi, M. Subaihi, M. Al Janahi, A. Al Teneiji, ADNOC ONSHORE | | **Abstract:** | **Objectives/Scope:** **Energy Conservation & Minimizing Downtime by Reconfiguration of Wellhead Control Panel Pressure Setting based on Well Performance during the Well Life Cycle** **Methods, Procedures, Process:** **The Control Panel utilized for operating the Downhole Safety Valve and Christmas Tree Valves generally operate at a predetermined pressure setting irrespective of the well performance during the life cycle.** **As per OEM Guidelines the maximum pressure required to operate the Downhole Safety Valve & Christmas Trees Valves is dependent on the wellhead pressure. Thus, changes in Well Performance also requires Control Panel Reconfiguration to mitigate over-pressurizing in order to minimize Environmental Footprint, workload for corrective maintenance and well downtime.** **Results, Observations, Conclusions:** **Trial was conducted on several wells by reducing the Control Panel Pressure based Maximum Wellhead Pressure and OEM Calculations. Pressure on several wells was reduced by more than 50% without any concern on well operability or performance.** **Positive outcome on below Strategic Pillars without any additional resources:** q **Sustainability: Less Power Consumption, Extend Solar Batteries Life, Prolong integrity of Safety Critical Elements (DHSV, wellhead seals, Christmas Tree Actuators and surface fittings)** q **People: Reduced Troubleshooting on Christmas Tree Actuators, Effective manpower utilization for Wireline & Maintenance Resource** q **Profitability: Improved Well Availability and inactive score, Saving on Power Consumption, Wireline Unit and Downhole Safety Valve Redressing** q **Observations & Conclusion: Downhole Safety Valve and Christmas Tree Valves are part of Safey Critical Equipment. Over-pressurizing the valves may result in breakdown and pose serious risk to Well Barrier Envelope.** **Novel/Additive Information:** **Reducing Wellhead Control Panel Pressure Setting during the life cycle of the well as the wellhead pressure depletes, not only conserves energy, but also prolongs the life of the Safety Critical Equipment while continuing to operate the well within the Safe Operating Limits. In addition, the proposal does not require any modification to the facility thus also providing the flexibility to revert to pressure settings in case well condition change say after workover** | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-4347-SPE | | **Title:** | Operational Mitigation And Automation Strategies For Addressing Existing Hv Motor Starting Challenges During Power Source Transition From Gtgs To Hvdc Source | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | intelligent Operation Strategy | | **Keyword2:** | Transition Challenges | | **Keyword3:** | Automatic Simulated Intelligence | | **Keyword4:** | Intelligent Control System | | **Keyword5:** | Environmental Sustainability | | **Authors:** | A. Mitra, S. Adak, S. Edwin Jose, R. Paul, F. Kamal, NMDC Energy | | **Abstract:** | **Objectives/Scope:** Modern offshore oil and gas operations require significantly increased power capacity to support evolving field development. Legacy GTGs, presently operating in island mode, are increasingly unable to meet this load growth and contribute considerably to carbon emissions. In alignment with environmental sustainability goals, end users are now transitioning to HVDC power systems. However, this transition introduces new challenges, particularly in the Direct-On-Line starting of existing large HV motors previously supported by GTGs. Due to space limitations on offshore platforms, existing HV motors were designed with compact frame sizes, weights and optimized for the dynamic electrical characteristics provided by GTGs—specifically, the fast voltage recovery enabled by AVRs. When powered by GTGs, these motors start reliably. However, the gradual phase-out of GTGs and the transition to HVDC, has led to a reduction in motor torque, causing rotor stalling and compromising operational reliability. **Methods, Procedures, Process:** Transitioning from GTGs to HVDC has revealed critical issues with DOL starting of large HV motors. The high inrush current drawn during startup, results in a significant voltage drop at the HV bus. Since motor torque is proportional to the square-of-the voltage, this voltage sag causes insufficient accelerating torque to overcome load inertia, leading to stalling of the motors. Unlike GTGs, which recover voltage within milliseconds via AVRs, HVDC systems rely on the OLTC of the power transformer—a slower mechanism incapable of addressing rapid voltage dips. Altering the load torque is often operationally infeasible, further complicating the issue. **Results, Observations, Conclusions:** To ensure reliable motor startup under HVDC conditions, an intelligent pre-boosting strategy is recommended. This involves elevating the HV bus voltage intelligently through the OLTC prior to motor start-up. Once the motor reaches its steady operating condition, the voltage is returned to nominal levels via OLTC readjustment. This controlled pre-boost approach restores the necessary startup torque without compromising system performance. By leveraging existing ECMS and ICSS infrastructure, this intelligent operational strategy ensures reliable DOL starting of Existing HV motors in HVDC-powered offshore environments. The pre-requisites shall be automatically derived by ECMS system using the simulated intelligence by sending the essential information to ICSS. Upon receipt of the same, ICSS automatically shall initiate the sequence of pre-requisites of HV motor starting by sending necessary instruction to ECMS. Upon receipt of instruction from ICSS, ECMS intelligently adjust the bus voltage to meet motor starting requirements and acknowledge to ICSS about the same. **Novel/Additive Information:** The above approach offers a cost-effective solution that enhances system performance and environmental sustainability without incurring additional CAPEX or OPEX on new HV soft starting device and optimizing additional space requirement in existing offshore platforms. It demonstrates the potential for improvement in power systems integration by maximizing the capabilities of intelligent control systems. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-4377-SPE | | **Title:** | A Large-scale Transformation Program: From Quick Wins To Long-term Value | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Digital Transformation | | **Keyword2:** | AI in Upstream Operations | | **Keyword3:** | Performance Management | | **Keyword4:** | Operational Excellence | | **Keyword5:** | Culture Transformation | | **Authors:** | A. Alkindi, M. Younes, S. Alhemeiri, A. Ramadan, ADNOC Onshore | | **Abstract:** | **Objectives/Scope:** A transformation program was initiated by a leading upstream operator to drive sustainable performance across operational, technical, and support domains. Known internally as '2.0,' the initiative focuses on embedding operational excellence through AI integration, performance governance, and transparency. Spanning nine streams, including HSE, drilling, reliability, and financial resilience — the program ensures initiatives are embedded, traceable, and sustainable. A 100-Day Plan launched at inception delivered quick wins and accelerated organization-wide momentum. **Methods, Procedures, Process:** Each stream operates under defined Key Strategic Initiatives (KSIs) and Key Performance Indicators (KPIs), which are tracked via a robust reporting rhythm. Bi-weekly progress updates are submitted by workstream secretaries, while monthly dashboards consolidate status across all deliverables and KPIs. To ensure traceability and streamline reporting, a centralized digital dashboard is developed—enabling executives, focal points, and transformation leads to visualize program progress in real time. This platform, linked to structured templates, offers a transparent view of status, timelines, and risk signals. AI and automation are embedded throughout—not only in operations, but also in governance—generating smart insights, exception alerts, and forecasting scenarios. **Results, Observations, Conclusions:** The program is advancing at pace and has surpassed several early milestones. The initial 100-Day Plan achieved full execution, unlocking rapid value in production, reliability, and process efficiency—establishing credibility across the organization. Governance structures are now fully institutionalized, with over 50 embedded deliverables tracked via a live dashboard, significantly reducing manual consolidation time and enhancing transparency. The shared reporting model has created a unified lens on progress and driven stronger accountability among workstream teams. With most foundational workstreams now operational, the program is transitioning into full-scale execution—continuing to deliver measurable improvements in safety, cost control, and performance agility. The widespread adoption of the reporting templates and transformation dashboards has also enabled more consistent stakeholder communication, improved tracking of KPIs/KSIs, and fostered data-driven decision-making. Teams now engage more proactively with transformation outcomes, using predictive insights to identify bottlenecks and implement timely corrective actions. **Novel/Additive Information:** What differentiates this transformation effort is a standardized enterprise-level integration of AI, performance management, and embedded delivery. Rather than operating as a parallel initiative, the transformation program is structurally woven into business functions—governed transparently, executed collaboratively, and tracked continuously. Enhanced performance, production gains and optimized processes from the 100-Day Plan acted as a catalyst towards structured transformation, which in turn when structured appropriately, can further accelerate change and performance at scale in complex upstream environments. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-4474-SPE | | **Title:** | Energy Conservation: Marjan Onshore Oil Facilities Case Study And Implementations | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Energy | | **Keyword2:** | Optimization | | **Keyword3:** | Value engineering | | **Keyword4:** | energy conservation | | **Authors:** | H. AL Qarzae, Saudi Aramco | | **Abstract:** | **Objectives/Scope:** The objectives/scope of the paper include: 1. Examining energy conservation strategies in the Marjan Onshore Oil Facilities, such as heat integration, TEG off-gas recovery, and flare gas recovery. 2. Highlighting Saudi Aramco’s best practices for energy optimization, including variable speed drives (VSDs) and compressed air systems. 3. Demonstrating the financial and operational benefits of these measures, like the $5MM NPV savings from VSD implementation. 4. Advocating for energy-efficient design in new and expanded facilities to align with Saudi Aramco’s corporate standards. **Methods, Procedures, Process:** The study employed a structured approach to energy optimization at the Marjan Onshore Oil Facilities: 1. \*\*Design Review\*\* - Conducted an Energy Optimization Study per Saudi Aramco standards for high-consumption facilities (100+ MMBtu/hr or 10+ MW). 2. \*\*Opportunity Assessment\*\* - Identified key areas like heat integration, VSDs, and flare gas recovery through value engineering workshops. 3. \*\*Implementation\*\* - Deployed VSDs on gas compressors (saving $5MM NPV) and integrated a low-CAPEX flare gas recovery system. 4. \*\*Validation\*\* - Estimated energy savings and financial returns to ensure alignment with corporate efficiency goals. This systematic process ensured measurable energy and cost reductions. **Results, Observations, Conclusions:** The Marjan Onshore Oil Facilities energy conservation initiatives yielded significant operational and financial results. Key outcomes included: - \*\*Energy Savings\*\*: Implementation of Variable Speed Drives (VSDs) in gas compressors reduced energy consumption, achieving an estimated net present value (NPV) savings of \*\*$5 million\*\*. - \*\*Flare Gas Recovery\*\*: By repurposing flare gas through a cost-effective system, the project minimized waste and enhanced energy efficiency. - \*\*Heat Integration\*\*: Optimized thermal management reduced excess heat loss and improved pre-heating processes. \*\*Observations\*\* highlighted the importance of proactive energy audits and adherence to Saudi Aramco’s engineering standards, which ensured systematic identification and execution of optimization opportunities. Value engineering workshops proved critical in prioritizing high-impact measures. \*\*Conclusions\*\* emphasized that integrating energy-efficient technologies (e.g., VSDs) and waste recovery systems early in design phases maximizes long-term savings. The project demonstrated that corporate policies mandating energy studies for large facilities effectively drive sustainability. Future expansions should continue leveraging such frameworks to balance operational demands with conservation goals. **Novel/Additive Information:** This paper contributes novel insights by: 1. \*\*Case-Specific Validation\*\*: Presenting real-world data from Saudi Aramco’s Marjan facilities, demonstrating the \*\*$5MM NPV savings\*\* from VSDs and flare gas recovery—rarely quantified in public literature. 2. \*\*Corporate Policy Impact\*\*: Highlighting how Saudi Aramco’s \*\*mandatory energy optimization standards\*\* (e.g., 100+ MMBtu/hr threshold) can be replicated industry-wide to bridge design gaps. 3. \*\*Low-CAPEX Solutions\*\*: Showcasing cost-effective flare gas recovery integration, challenging the assumption that sustainability requires high upfront investment. These actionable findings advance petroleum industry practices in energy efficiency. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-4668-SPE | | **Title:** | Conquering Challenges:a Case Study On Enhancing Operational Efficiency At Oil India Limited’s Secondary Tank Farm-a Focus On Power Generation | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Operational Efficiency | | **Keyword2:** | Captive Power Plant | | **Keyword3:** | Operational Hindrance | | **Keyword4:** | Load Management | | **Keyword5:** | Busbar | | **Authors:** | P. Das, Oil India Limited; D. Chatterjee, Oil India Limited (OIL) | | **Abstract:** | **Objectives/Scope:** Secondary Tank Farm (STF) of Oil India Ltd. has a crude oil storage capacity of 40,000 kl, aiming to reduce BS&W content to below 0.2%. The Captive Power Plant (CPP) operates 24/7 with a capacity of 5.76 MW. This paper highlights the challenges addressed and modifications made to ensure uninterrupted CPP operation while upholding best Health, Safety, and Environment (HSE) practices, thus preventing production loss, and aligning with company objectives. **Methods, Procedures, Process:** The CPP initially had four 1.44 MW GEGs—three operational, one standby—based on current and future load demands. Power was distributed via a 2,500A aluminium busbar, which later posed limitations. Load analysis showed one GEG could meet demands, prompting in-house modifications for momentary synchronization. This unified the system, improved maintenance, and increased standby units to three. Anticipated load growth led to exploring options like adding a GEG or sourcing power from the main plant or grid. Operating GEGs in standalone mode was inefficient, reinforcing the decision to either upgrade the busbar or build a higher-capacity substation for scalability. **Results, Observations, Conclusions:** Due to space constraints and the risk of operational outages, modifying the existing substation was impractical. As a result, a new substation is being constructed to meet safety and operational requirements, though it presents its own challenges—such as limited space, maintaining current operations, and preserving green belt areas. The existing 2,500A aluminium busbar system has led to several operational issues. Maintenance on multiple Gas Engine Generators (GEGs) disrupted plant operations due to load interdependence. Each GEG requires a minimum 30% load, often unmet during low demand or maintenance, risking instability. The busbar’s limitations also restricted synchronisation, leading to inefficient load management, power losses, and higher gas consumption. Additionally, auxiliary units were operated unnecessarily to meet load thresholds, resulting in energy waste. Planned modifications at the STF Captive Power Plant (CPP) aim to resolve these issues by enabling synchronised GEG operation, improving load flexibility, reducing artificial load creation, and optimizing energy use. These upgrades will enhance plant reliability, operational efficiency, and overall sustainability. **Novel/Additive Information:** Key lessons include the importance of designing based on actual load profiles and understanding operational dynamics to ensure system stability. Using smaller, multiple generation units provides greater flexibility and ease of maintenance. Additionally, incorporating high-tension substations enhances reliability and scalability. These insights are crucial for developing efficient, resilient, and adaptable power generation facilities in the future. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-4745-SPE | | **Title:** | Predictive Emissions Monitoring & Energy Efficiency | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Predictive Emissions Monitoring | | **Keyword2:** | PEMS | | **Keyword3:** | Energy | | **Keyword4:** | Energy Efficiency | | **Authors:** | C. Smith, Xodus Group Ltd | | **Abstract:** | **Objectives/Scope:** To demonstrate how the implementation of an online Predictive Emissions Monitoring System (PEMS) is useful to negate the requirements for extensive exhaust sampling, streamline compliance and inform maintenance staff with regards to combustion equipment health. **Methods, Procedures, Process:** Initial approach is to conduct physical sampling of the combustion equipment exhausts, obtain the concentrations of the various pollutants emitted from the engine at various load points. These concentrations can be used with numerous engine parameters collected in parallel to develop specific emissions factors for each item of combustion equipment (correlating to fuel consumption, temperature or power output). Once emissions factor development is complete, polynomials can be developed to match the curve obtained across the loads tested and set up into the PEMS system to offer real-time, online emissions readings from the combustion equipment based on condition. Further refinement can be implanted to account for degradation, efficiency monitoring and dashboarding. **Results, Observations, Conclusions:** Offshore emissions tests are typically required (for compliance purposes) to be conducted annually. This is not efficient, as mobilisation of equipment, test gases and personnel is heavy on resources and time. A PEMS system allows for an algorithm to estimate the emissions from a turbine (or other engine type) with a high degree of accuracy removing the need to mobilise persons and equipment; leading to streamlined operations, cost reductions and improvement in safety. In addition, the PEMS system can be used to inform maintenance decisions as to the condition of the equipment. **Novel/Additive Information:** PEMS systems are not common as historically the need has been absent. However, given the increase of legislation worldwide mandating physical emissions tests, the implementation of a PEMS system can reduce this burden. The paper will demonstrate the simplicity of PEMS implementation as well as directing the reader to the benefits of engine maintenance based on condition, emissions concentrations rather than on a running-hour basis which is the typical philosophy. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-4784-SPE | | **Title:** | Patented, Biodegradable Fuel Conditioners And Emulsifiers For The Energy Transition: Enhancing Efficiency And Reducing Emissions To Drive Operational Excellence Across Hydrocarbon-fuelled Applications. | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Low Carbon | | **Keyword2:** | Sustainability | | **Keyword3:** | Emissions reductions | | **Authors:** | B. Richardson, SulNOx Group Plc | | **Abstract:** | **Objectives/Scope:** The proposed paper will demonstrate how patented formulas of organic, biodegradablefuel conditioners and emulsifiers offer an immediate, scalable, zero-capex pathway toward sustainability, operational excellence and improved HSE performance in liquid hydrocarbon-fuelled industries. Applicable >70% of each barrel oil[1] and compatible with all internal combustion engines, the drop-in green-tech solutions extend fuel and engine life, enhance efficiency and reduce emissions. Therefore, improving asset performance and supporting decarbonisation where switching to low-carbon alternatives remains unfeasible. **Methods, Procedures, Process:** The products enhance fuel economy in liquid hydrocarbon fuels and biofuels through combined effects of four key mechanisms. First, the formulas emulsify small volumes of existing free water into the fuel [2], promoting the secondary atomisation effect [3][4], which improves the combustion profile and reduces greenhouse gas and particulate matter production [5][6][7][8]. Second, glycol ethers enhance fuel dispersion and introduce additional oxygen, further aiding the completion of combustion. Third, the products act as detergents, cleaning and decarbonising engine components. Finally, they add lubricity, reducing friction and wear, providing engine longevity without capital-intensive changes or infrastructure overhauls. **Results, Observations, Conclusions:** Lab tests, independent studies, field evaluations and repeat customers enable the proposed paper to conclude that the products’ novel formulas deliver measurable environmental, operational and financial benefits. Observations from independent studies in controlled environments show added lubricity, decarbonisation of engine parts and increased fuel efficiency (by 5-10%), and reductions in emissions (c.27% CO2, c.63% CO, c.15% NOX, c.64% SOX), particulate matter (c. 96%) and visible black smoke. By extending engine and fuel system life, the products enhance resource efficiency, maximising energy extracted per unit of fuel and supporting circular economy principles. Additionally, the biodegradable chemistry minimises end-of-life environmental impact and reduces downstream waste management burdens, while supporting Scope 1 and 3 emissions reductions. A full cradle-to-gate carbon footprint study verifies the low environmental impact and positions users for future carbon credit opportunities. Independent fuel quality testing confirms the products can scale without major obstacles while keeping treated fuel fully compliant with industry standards. This technology has greater global reach than any other direct fuel decarbonisation solution, with the potential to annually save 2.1 billion barrels of oil, 848 million tonnes of CO₂ and reduce health impacts from emissions linked to 4.2 million premature deaths each year. **Novel/Additive Information:** The green-tech solutions address critical HSE and regulatory compliance challenges across the energy value chain while remaining vital in a net-zero future. While compatible with existing infrastructure, the formulas support future upgrades including compatibility with novel first and second biofuel blends. Ongoing market-leading innovation focuses on enhancing energy efficiency, reducing lifecycle impact, and evolving chemistries for compatibility with jet fuels (including sustainable aviation and gas-to-liquid fuel) and other alternatives, ensuring long-term operational excellence and sustainability. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-4808-SPE | | **Title:** | Energy Balance In An Oilfield: Evaluating Future Loads, Planning Power Generation And Enhancing The Daily Asset Operation | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Energy Balance | | **Keyword2:** | Future Loads | | **Keyword3:** | Power Generation | | **Authors:** | T. Borba, Sensia | | **Abstract:** | **Objectives/Scope:** This paper describe an innovative workflow for having an ideal balance between energy supply and demand. By using the power high frequency data in conjunction with production data, it was possible to identify the most efficient wells in terms of the energy consumption KPI, to mitigate electrical grid risks, and hence to enhance the daily operations of an asset. The operator had also the ability to identify bottle necks and to make decisions in a holistic way. **Methods, Procedures, Process:** By initially having an amount of constrained energy for the daily operations of an asset, there are different energy scenarios that can be monitored and optimized through this methodology. After daily identifying, the more and less efficient wells behavior grouped through pie chart plots, operators can monitor and analyze the input and output power variables in real time. Operations such as the frequency increment of ESP equipment can then be monitored, identified its impact on the whole electrical grid, and in some cases, alarmed the operations team to keep the energy balance, and avoid oil production losses due to energy management. **Results, Observations, Conclusions:** In an oilfield of about 260 wells and with a demand of energy of 14.5 MW per day, an increase in energy demand was initially observed that was in accordance with OPEX and CAPEX increase activities in the last year. Based on historical behavior and, considering the government is responsible for providing the energy, operator could optimize its development plan considering the energy demand forecast, and support their demand for more energy from the government. It was observed that 36% of the wells of an area consume high power but have less fluid production. As a result, the energy efficiency KPI of these groups of wells showed an average of 0.17 to 0.20 KW/BFPD. After having analyzed their well production data, not only at well, but also at pad level, understanding the electric parameter behavior, and inclusively considering waterflooding impact area, many optimization proposals and scenarios from the energy point of view were raised to the development team such as increasing the chemical dosing, performing current analysis, and running thermography to check hot points. Holistic efforts and results were reflected by leveraging the tool and data on a single platform. **Novel/Additive Information:** This pioneering energy balance roadmap developed over a real time platform will contribute to any digital oilfield providing a holistic approach that will support the decision-making process of operators. By also having included into the platform the number of tons of CO2, not only energy efficiency results will be accomplished, but also the opportunity to reduce the asset CO2 foodprint. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-4874-SPE | | **Title:** | Edge Computing-enabled Real-time Electrical Signature Analysis For Esp Performance Optimization And Co2 Emissions Reduction | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | CO2 | | **Keyword2:** | Electrical | | **Keyword3:** | Signature | | **Keyword4:** | Performance | | **Keyword5:** | ESP | | **Authors:** | A.A. Claib Meinhardt, Sensia | | **Abstract:** | **Objectives/Scope:** Real-time power optimization of Electrical Submersible Pumps (ESPs), is significantly constrained by the inherent limitations in high-resolution power data acquisition after the Step-Up Transformer or at Medium Voltage Drives outlet, to quantify real power delivered to the motor. Often exhibits temporal sparsity, compromised data integrity, and standardization due to different acquisition systems. This paper demonstrates a methodology based on real-time electrical signature analysis, to optimize power consumption, enhance ESP performance, and mitigate atmospheric emissions. **Methods, Procedures, Process:** Electrical data is generated by a novel technology, which monitors and processes voltage and current (three-phase) direct measurements without human intervention, in synchronous acquisitions at a high-sampling rate. The measured data is transmitted to a hyper converged controller with cellular connectivity, which performs edge computations to yield results in both frequency and time domains, including electrical signals waveforms and phasor diagrams. This device is also connected to the ESP drive controller, capturing the downhole and surface information available. Everything is sent to a cloud based digital platform where it is historized and visualized in dashboards, providing comprehensive monitoring. **Results, Observations, Conclusions:** The actionable insights delivered facilitated well-informed decisions, resulting in enhanced power delivery to the ESP motor, a reduction in CO2 emissions, and improved overall operation conditions. These outcomes were achieved through real-time electrical signature analysis key outputs, including waveforms, phasor diagrams, power signal distortion, motor output power, real shaft speed and power factor; revealing correlations with operational conditions (surface and downhole), which allowed to identify opportunities for power optimization. Following the identification of the aforementioned correlations, operational adjustments were implemented, yielding immediate positive effects characterized by improved electrical performance and harmonics distortion reduction exceeding 60%, representing a power consumption optimization and subsequently CO2 emissions reduction around 2Kg/h per well. The above demonstrates that improving the power quality delivered to the ESP motor is directly associated with power consumption savings of around 4% per well and subsequently environmental impact reduction, without sacrifice oil production. **Novel/Additive Information:** Leveraging advanced analytics and high-resolution electrical measurement, enable intelligent decision-making in digital oilfield operations, enhancing safety and overcoming challenges in electrical signature analysis. Furthermore, validating quality of the power effectively delivered to the ESP shaft and its correlation with the overall ESP system’s behavior and power consumption. Consequently, engineering teams rapidly access historical contextualized data, performing meaningful analyses, and tracking the impact of operational changes on energy consumption. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5020-SPE | | **Title:** | Reduction In The Molecular Sieve Regeneration Temperature In Gas Dehydration Unit For Vessel Internals Integrity And Fuel Gas Optimization | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Molecular Sieve | | **Keyword2:** | Regeneration | | **Keyword3:** | Temperature | | **Keyword4:** | reduction | | **Keyword5:** | Fuel Gas | | **Authors:** | M. Nisar, R. Singh, ADNOC Sour Gas | | **Abstract:** | **Objectives/Scope:** In natural gas liquids (NGL) processing, molecular sieve dehydration units are critical for removing sulphur component and moisture. The regeneration cycle of molecular sieve beds typically involves a heating phase which is considered complete when the Bed Top temperature (Bottom-up Regeneration) reaches 260°C. However, during shutdowns, bed support gratings/panels were observed to damage at locations in all the adsorber beds. This paper highlights the changes done in the regeneration temperature to increase the integrity of Molecular sieve bed vessel supports also resulting in reduced fuel gas consumption and increase molecular sieves adsorbent run length. **Methods, Procedures, Process:** Best operating experience across other Adnoc sites were explored and licensor was consulted accordingly. It was observed that the bottom temperature was exceeding the Bed design temperature (290 deg C). A phased temperature reduction strategy was implemented in both the trains. This study a three-step approach to lower the heating cycle temperature from 260°C to 255°C. **Results, Observations, Conclusions:** Continuous evaluation during the implementation phase assessed the impact on molsieve performance, dehydration efficiency, and energy savings. Results indicate that the reduced regeneration temperature not only preserves molsieve integrity thereby extending media lifespan, but also lowers fuel consumption, contributing to operational cost savings and environmental sustainability. The successful implementation of the proposed temperature reduction strategy demonstrates its potential to enhance the efficiency and sustainability of NGL processing operations. This approach can serve as a model for other facilities aiming to optimize their molsieve regeneration processes. **Novel/Additive Information:** This paper presents the technical methodology, operational outcomes, and implications of this optimization strategy, offering a scalable model for molsieve regeneration in NGL plants worldwide. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5035-SPE | | **Title:** | Strategic Integration Of Energy Efficiency In Brownfield Offshore Water Injection Systems: Operational Optimization Without Structural Retrofit | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Energy Efficiency | | **Keyword2:** | Strategic Integration | | **Keyword3:** | Operational Optimization | | **Keyword4:** | Asset Lifecycle | | **Keyword5:** | Proactive Integration | | **Authors:** | T. Adamstephen, NMDC Energy | | **Abstract:** | **Objectives/Scope:** Energy efficiency represents a pivotal axis in the comprehensive assessment of life cycle costs for energy-intensive infrastructure, particularly within hydrocarbon production environments. Although the procurement of high-efficiency systems may necessitate elevated capital expenditures (CAPEX), the resultant operational expenditure (OPEX) savings over time—primarily driven by reductions in energy demand—can yield superior economic performance and sustainability outcomes. **Methods, Procedures, Process:** In offshore water injection systems—critical for pressure maintenance and production optimization—pumping units represent substantial energy loads and are thus focal points for efficiency enhancements. This paper explores energy performance improvement opportunities within a brownfield expansion project involving the installation of a new water injection module in parallel with existing modules. A core analytical emphasis was placed on spatial constraints and operational flexibility. While variable frequency drives (VFDs) offer superior dynamic control and energy optimization over traditional Direct-On-Line (DOL) motor configurations, their deployment in retrofit scenarios poses significant engineering challenges. Specifically, legacy offshore platforms often lack the spatial and electrical infrastructure to accommodate VFD systems without extensive and cost-prohibitive structural modifications, such as deck extensions. **Results, Observations, Conclusions:** In a case executed by NMDC Energy, a multidisciplinary 3D model review was employed to substantiate the spatial infeasibility of VFD integration in the existing modules. Consequently, an alternative operational paradigm was developed: the new injection module, designed for full-capacity operation, enables strategic shutdown or turndown of less efficient legacy modules to satisfy injection requirements. This approach circumvents major infrastructural interventions while still achieving measurable gains in energy performance. **Novel/Additive Information:** NMDC Energy has recently executed an EPC project involving assessment of Energy Efficiency for the facilities. This paper underscores the imperative of embedding energy efficiency metrics from the conceptual and Front-End Engineering Design (FEED) phases particularly in greenfield projects. The paper highlights that proactive integration of advanced energy-efficient technologies across design and execution phases is essential for optimizing performance and minimizing environmental impact across the asset lifecycle, providing benefits to all stakeholders in industry**.** | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5060-SPE | | **Title:** | Transformer Failure Innovative Emergency Action | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Transformer failure | | **Keyword2:** | Emergency action | | **Authors:** | S. Mayan Jothiram, Y. Alkuwaiti, G. Luthra, Adnoc Offshore | | **Abstract:** | **Objectives/Scope:** This paper addresses the problems and emergency action taken during the failure of the existing GTG-E transformer at Al Ghallan Island. **Methods, Procedures, Process:** The GTG-E transformer failed, leading to total black out at AGI and partial production losses. Immediate action was required to resolve this issue.The failed transformer was sent for refurbishment, and a new transformer was ordered in parallel. Considering that these solutions are long-term, emergency action was essential to ensure production is sustained with power availability.To ensure the production is not disturbed, spare transformer with a rating of 11/22kV,37.5 MVA was identified from different Asset to be replaced in place of failed transformer (11/138kV,50MVA). To achieve a workable solution, the feeding arrangement was modified to connect 22kV GIS switchgear instead of 132kV GIS Switchgear. The major challenge encountered was with respect to Busduct suitability with the spare transformer.Brain-storming session resulted in designing of a New Adapter box to interface the existing bus duct with the transformer.In-house Detailed design engineering requirements / package were shared with contractors for technical compliance considering criticality of use in hazardous area, obtaining a unique adapter box was a challenge. However, we managed to overcome this too and ensured timely manufacture.In addition, the engineering package included procurement, installation, laying, testing and commissioning activities of various equipment such as modification of F&G system, power cables, control cables, cable trays, cable termination kits, glands, civil foundation, concrete duct bank, and structural works.An engineering package was prepared on a war footing within a short span of time and sent for execution. **Results, Observations, Conclusions:** With this innovative design, the proposed solution will support in restoring power demand **Novel/Additive Information:** Mitigation plan prepared for any further eventuality leading to production losses. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5138-SPE | | **Title:** | Sulphur Recovery Unit Acid Gas Preheater Utilization Of Llp Steam Waste Heat From Third Sulphur Condenser Or Surplus Lp Steam | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Energy optimization | | **Keyword2:** | Saving | | **Keyword3:** | AcidGas | | **Keyword4:** | LLP Steam | | **Keyword5:** | waste heat | | **Authors:** | A.W. Alkayyoomi, ADNOC Sour Gas; V. Algule, ADMOC SOUR GAS | | **Abstract:** | **Objectives/Scope:** The primary objective of the Acid Gas Preheater project is to utilize LLP steam (waste heat) from the Third Sulphur condenser or surplus LP steam to enhance the efficiency and reliability of the preheating process. This initiative aims to prevent corrosion issues in the Acid Gas Preheater shell and optimize energy usage by raising the acid gas temperature to 110°C. The scope of the project includes the installation of the necessary connections to utilize LLP/LP steam, thereby reducing fuel gas consumption and greenhouse gas emissions. This approach not only addresses operational challenges but also contributes to ADNOC's sustainability goals. **Methods, Procedures, Process:** The primary method involves using LLP steam generated from the Third Sulphur condenser, which operates at approximately 1.5-1.9 barg. This steam is then utilized to preheat the acid gas, thereby preventing corrosion issues in the Acid Gas Preheater shell and enhancing energy efficiency. Additionally, surplus LP steam at 5 barg can be used for the same purpose.The acid gas from the Acid Gas K.O Drum is preheated using LLP steam. This preheated acid gas is then directed to the thermal stages consisting of main burners, reaction furnaces, waste heat boilers, and first condensers. The preheated acid gas is partially oxidized with preheated air and vent gases in the main burners/reaction furnaces according to the Claus process. This process ensures the complete destruction of BTX and other contaminants in the acid gas. The process gases from the waste heat boilers are further cooled in the first condensers, generating LP steam and condensing most of the elemental sulphur formed in the reaction furnaces.By utilizing LLP steam from the Third Sulphur condenser or surplus LP steam, the Acid Gas Preheater project aims to enhance operational efficiency, reduce fuel gas consumption, and contribute to ADNOC's sustainability goal **Results, Observations, Conclusions:** This project will bring positive results and conclusions as follows: Enhance the HP steam generation form SRU thermal Waste heat Boiler (**Additional HP Steam Generation 12 TPH).**Equivalent fuel gas consumption reduction in utility boilers. Reduced GHG emission (**15,000 Ton of CO2 Equivalent /yr).**Ensure superheating of acid gases to avoid corrosion **Payback Less than 1 year. And its economically feasible.** **Novel/Additive Information:** By using LLP steam, this project will successfully prevent corrosion issues in the Acid Gas Preheater shell and enhance energy efficiency. Observations indicate a reduction in fuel gas consumption and greenhouse gas emissions, aligning with ADNOC's sustainability goals. The project emphasizes the effectiveness of utilizing LLP steam in improving operational efficiency and contributing to environmental sustainability | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5146-SPE | | **Title:** | Optimizing Agru: Hp Reclaimer Technology For Enhanced Dga Recovery & Emission Reduction | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | HP convertor technology | | **Keyword2:** | Energy Savings | | **Keyword3:** | Optimized Operation | | **Keyword4:** | Acid Gas Removal debottlenecking | | **Keyword5:** | GHG emission reduction | | **Authors:** | E. Al Ali, J. Kaleem, ADNOC Sour Gas | | **Abstract:** | **Objectives/Scope:** In ultra-sour gas processing, solvent degradation poses significant operational challenges, leading to increased solvent losses, higher steam consumption, and elevated greenhouse gas (GHG) emissions. Traditionally, Low-Pressure (LP) Reclaimers have been used to manage degradation products; however, their efficiency in DGA (Diglycolamine) recovery is limited, resulting in excessive solvent waste and energy consumption. This paper presents a case study on transitioning to High-Pressure (HP) Reclaimer Technology, specifically designed to enhance DGA recovery and minimize solvent degradation impacts. The implementation of HP reclaimers has resulted in: • Significant steam savings, reducing energy costs and process inefficiencies. • Lower GHG emissions, supporting sustainability and regulatory compliance. • Extended solvent life, improving overall AGRU performance and reducing operational expenses. **Methods, Procedures, Process:** The HP Converter System converts BHEEU also known as “urea” back into DGA®. This conversion occurs within the HP Converter vessel at high temperature and pressure. The temperature of the HP Converter is controlled near 182°C and the control is important because at higher temperatures, a side reaction can occur that creates morpholine. Maintaining the correct amount of water within the system is also important as the water concentration is critical to the rate of the reaction with BHEEU to form DGA®. The HP Converter system is designed for constant flow of lean DGA solution. The operating liquid volume of 0731-E-108 is large enough which allows for adequate residence time to carry out the BHEEU conversion reaction. The feed to the HP Converter system is lean DGA solution at reboiler conditions as a boiling point liquid. During continuous steady state operation, the HP Converter design allows for the conversion of BHEEU while maintaining the overall BHEEU concentration in the circulating solution at or below 5.0 wt%. Within the HP Converter the lean DGA solution is further stripped of CO2 and H2S due to the elevated temperature while the high pressure helps keep water in the liquid phase. The constant vapor rate helps to maintain a relatively stable heat duty even with slight changes in composition and BHEEU content. The figure below shows the process scheme where the new technology modified is highlighted with green. **Results, Observations, Conclusions:** Reduced 50% of Mp steam consumption leading to reduced GHG emissions and enhanced solvent recovery. **Novel/Additive Information:** the technology novelty comes in a matter of advancing the operation of AGRU which designed to process ultra sour gas of more than 30% of feed gas sourness. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5251-SPE | | **Title:** | Turning Pressure Into Power: Hydraulic Power Recovery Turbines In Amine Sweetening Units | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | HPRT Power recovery turbines | | **Keyword2:** | Energy Optimization | | **Keyword3:** | Pressure Conversion to power energy | | **Keyword4:** | GHG emission reduction | | **Keyword5:** | Power recovery | | **Authors:** | E. Al Ali, J. Kaleem, ADNOC Sour Gas | | **Abstract:** | **Objectives/Scope:** This study will evaluate the feasibility of installing Hydraulic Power Recovery Turbines (HPRT) at AGRU Rich DGA line across HP absorber Level control valve by passing through turbo-generator system. HPRT aims to optimize energy by converting pressure energy to power energy, thereby maximizing power generation. **Methods, Procedures, Process:** Hydraulic Power Recovery Turbines technology could be defined as standalone solution that converts hydraulic energy to electrical energy. It is designed to replace flow control, level control and choke valves in acid gas removal section of gas processing plants and similar applications. This technology has been selected due to its capability in converting the excess pressure into mechanical shaft energy and increasing the overall process efficiency. The system usually comprises of a single turbine that drives a medium induction generator. The generator’s output is conditioned to match grid voltage and frequency at near unity power-factor using a regenerative variable frequency drive (VFD). The HPRT can be used to drive a pump, generator, compressor or other rotating machinery. However, due to unit’s locations of HP absorber and Regenerators the concept of turbine with generator has been evaluated in proposals. Split range liquid level controllers are typically used to regulate turbines. The controller adjusts the HPRT inlet valve or further opens the bypass valve when the turbine is overpowered. Overspeed trip devices are often furnished with hydraulic turbines. This device shuts the HPRT inlet valve and activates overspeed alarms when required. The figure below illustrates a typical HPRT installation. **Results, Observations, Conclusions:** In summary, the HPRT project presents a compelling economic case with a favorable NPV, robust IRR, and reasonable payback period, underscoring its potential to enhance operational efficiency, reduce costs, and deliver long-term value. **Novel/Additive Information:** non | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5290-SPE | | **Title:** | Asg Agru Challenges & Debottlenecking To Process Ultra Sour Gas At Higher Capacity | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | AGRU Debottlenecking | | **Keyword2:** | energy optimization | | **Keyword3:** | GHG emission reduction | | **Authors:** | R. Alameri, ADNOC; E. Al Ali, J. Kaleem, adnoc sour gas | | **Abstract:** | **Objectives/Scope:** Shad Arab Sour Gas field had got the potential to produce more hydrocarbons with existing wells. In order to exploit this potential, in Jan.’2017 MaxPro project has been initiated with an objective to maximize the capacity of the plant with minor modification and without big down time Study indicated that capacity of the plant can be increase to 120% (1264 MMSCFD at the inlet of HP Absorbers) with minor modifications in process units- such as Routing of semi rich DGA from HP Absorber Side Cooler outlet to Absorbers bottom along with flow control arrangement in units-0721/0722. **Methods, Procedures, Process:** **Challenge: Capacity limitation and Rich DGA Line Vibration**The main reason for limiting the plant capacity at 1,220 MMSCFD is heavy vibration observed in Rich DGA lines. Due to these high vibrations. Once the vibration issues are resolved in these units the capacity can be increased by another 20 MMSCFD**Modification: Rich Solvent Pipework (Vibration, Dynamics and Noise)**Thus, one of the main recommendation to be considered: Consider moving pressure drop closer to Solvent Regenerator inlet nozzle.**Challenge: High BTM absorber Temperature**Another faced challenge was higher outlet temperature observed in absorber side coolers which are contributing to higher absorber bottom temperatures. Consequently, HP absorber bottom temperature has exceeded the design of 97°C vs 92°C design. **Modification: Additional Absorber Side Cooler**Due to the increased cooling duty requirements of the side cooler circuit and the known underperformance of the existing air cooler, a new air cooler is required in series. To ensure that the undiagnosed issues - possible causes include hot air recirculation, increased fluid viscosity, tube-side fouling, etc. resulting in existing cooler underperformance canbe accommodated. One of the main recommendation is to Install new air cooler 0721-E-308 in series, downstream of 0721-E-307, as specified by datasheet OSEF-0721-24-DAT-0002 Rev T1.**Challenge: Lean/ Rich Exchanger Bypass operation**The opening of bypass results in increased duty on Reboilers and also increased duty requirement on Lean DGA solvent coolers. The bypass operation of lean rich exchanger is to be debottlenecked during OSGE evaluation which often required due to high DP across exchanger and high vibration as bypass operation as results in high duty limitation for downstream lean solvent cooler. **Modification: Lean/Rich Plate Heat Exchanger**Adding additional plates to the Rich/Lean Solvent Exchangers only provides a marginal benefit because the existing plates are not tall enough to provide sufficient flow length. Therefore, the design and installation of an entirely new set of plate and frame heat exchangers is recommended, able to meet the process requirements of datasheet. **Results, Observations, Conclusions:** The Above modifications has led to maximized benefits in terms of operation flexibilities, unit performance and energy optimization. **Novel/Additive Information:** NA | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5325-SPE | | **Title:** | Debottleneck Sulphur Recovery Unit Waste Heat Boiler To Resolve Water Carryover Issue. | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | SRU WHB | | **Authors:** | V.K. Algule, ADMOC SOUR GAS; A. Alkayyoomi, ADNOC Sour Gas | | **Abstract:** | **Objectives/Scope:** The objective of addressing the waste heat boiler carryover issue and implementing internal modifications is to enhance operational efficiency and ensure the reliability of the waste heat boiler system. This initiative aims to mitigate water carryover from the steam drums, which has been observed to affect steam quality and increase corrosion rates. The scope includes modifying the internal components of the waste heat boiler, such as adjusting the riser height and installing Chinese hats, to improve steam separation and reduce phosphate carryover. **Methods, Procedures, Process:** ASG has four identical, parallel Claus Sulphur Recovery and Tail Gas Treating Units (0751/0752/0753/0754) designed to handle acid gas for a nominal Sulphur processing capacity of almost 2,500 TPD per train. Plant throughput increased to 145% Sulphur processing capacity of almost 3400 TPD per train During test run to increase the plant capacity part of the new OSGE Expansion project, the SRU load increased. The process data collected during the test run showed liquid carryover indications from WHB steam drum V-104/105. This was confirmed by analyzing the steam quality (STH), special samples reported higher phosphate (PO4) content than normal as well as reduced superheated steam temperature in incinerator superheater coils outlet. Additionally, some integrity issues were rapidly noted in acid gas piping downstream of the ejectors as clear evidence of liquid in STH from WHBs used as motive steam for the ejectors. The analysis concluded that the increase in SRU train capacity is leading to water carryover into saturated HP steam from Steam drums (V-104 & V-105) due to steam drums capacity constraints. In CFD analysis, it has been observed that high-pressure steam is directly impacting the demister, resulting in water carryover. Additionally, the vapor disengagement height is less than what is required for the current high-pressure steam generation.The following modifications implemented to reduce water carryover in HP steam. To increase the vapor disengagement height in SRU WHB 1. Riser height reduced to 1950 mm from 2050 mm2. Riser opening reduced to 200 mm from 340 mm Riser flat hat modified the Chinese hat structure to prevent steam imparting on demister **Results, Observations, Conclusions:** The WHB internal modification led to enhanced steam quality and maintained superheated steam outlet temperatures, supporting the overall production increase, the production increase of **25 MMSCFD**. The value generation from O-Phosphate carryover results has shown a significant reduction in phosphate levels after the internal modification. Performance monitoring confirmed the effectiveness of these modifications in optimizing steam generation and preventing corrosion. **Novel/Additive Information:** In conclusion, these changes have demonstrated substantial benefits in terms of additional revenue generation, aligning with ADNOC's commitment to operational excellence and sustainability. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5347-SPE | | **Title:** | Ghg Emissions Reduction & Power Optimization Bycondensate Shipping Pumps Modification | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | GHG emissions | | **Keyword2:** | Modification | | **Keyword3:** | shipping pump | | **Authors:** | C. Chukkala, E. Al Ali, J. Kaleem, ADNOC SOUR GAS | | **Abstract:** | **Objectives/Scope:** The objective of this document is to evaluate the feasibility to reduce power consumption of Condensate Shipping Pump by modifying Pump Impeller. The idea has been generated while monitoring the historical pressure profile of condensate product pipeline where the actual head required found significantly less that design. This report narrates the technical evaluation of the idea and corresponding recommendations for further evaluation and implementation. **Methods, Procedures, Process:** The actual pressure profile of condensate product pipeline has been plotted in historian in order to assess the actual operating pressure at Condensate export pipeline shah battery limit and downstream at various Block valve stations (KP) and at tie-in locations as during normal operation the back pressure from Asab-Habshan condensate pipeline is very low, normally one condensate shipping pump is kept in operation which is close running close to maximum limit in the curve. However, post recent plant expansion, condensate flow rate expected to increase, and it is forecasted that two pumps operation will be required. Hence idea of reducing head for pumps by removing impellers is being studied considering two condensate shipping pumps operation in parallel post plant expansion. The modified pump required head has been calculated considering aforementioned sensitivity case post optimum expansion with two pumps in operation. PROPOSED MODIFICATION Condensate shipping pumps are Multistage Centrifugal barrel type (BB5) having 7 Impellers on the single shaft with rated head of 1193 m producing discharge pressure of 85.4 brag. The Motor is fixed speed type with 2965 rpm and 850 KW rating. Based on aforementioned process analysis considering the sensitivity case, the pump required head can be reduced to 800m considering discharge pressure of 62.8 barg to achieve 44.5 barg tie-in pressure at Asab- Hasbhan condensate pipeline. The Pump Modification details refer Mechanical Rotary Evaluation. This will result in lower power consumption from condensate shipping pump post recent plant expansion, 2 pumps operation and hence reduction in GHG emissions. Based on aforementioned data analysis 62.8 barg discharge pressure of pump is enough to support future operations. However, if there is any requirement of higher pressure in future, pumps impellers can be reinstated to original condition. **Results, Observations, Conclusions:** This project will bring positive results and conclusions as follows:   |  |  |  | | --- | --- | --- | | **Description** | **Units** | **Value** | | Existing Condensate shipping BHP (Post expansion- 2 pump operation) | Kw | 1300 | | Modified Condensate Shipping Pump BHP (Post expansion- 2 pump operation) | Kw | 960 | | Energy saving | kW | 340 | | Electrical power saving | MWH | 0.34 | | Power tariff | $/MWH | 44.7 | | Equivalent Saving | $/year | 133,134 | | Total saving (20 years) | MM $ | 2.66 | | Emission factor | ton/MWH | 0.45 | | **Equivalent GHG emission saving** | **tons / year** | **1340** | | Cost of pumps modification | $ | 250,000 | | Payback Period | years | 2 |   **Novel/Additive Information:** GHG and power saving while modifying pump impeller | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5464-SPE | | **Title:** | Removal Of Sulphur Vessel Vent Ejectors By Utilizing The Balance Line Between Sulphur Rundown And Third Sulphur Condenser | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Energy optimization | | **Keyword2:** | Revenue generation | | **Keyword3:** | Saving | | **Keyword4:** | Vessel Vent Ejectors | | **Keyword5:** | Waste heat utilization | | **Authors:** | A.W. Alkayyoomi, V. Algule, ADNOC SOUR GAS | | **Abstract:** | **Objectives/Scope:** The objective of this initiative is to improve the efficiency and reliability of the SRU by removing the Sulphur Vessel Vent Ejectors and using the balance line between the Sulphur Rundown Vessel and the Third Sulphur Condenser. This modification aims for major operational and environmental benefits:   * The removal of the Sulphur Vessel Vent Ejectors will eliminate the need for repeated maintenance, thereby reducing operational costs. * By optimizing the process flow, the initiative aims to save high-pressure steam, which is a valuable resource in the SRU. * The modification will contribute to the stable operation of the Reaction Furnace, ensuring consistent performance. * By improving the handling of vent gases, the initiative will reduce the inert content directed to the main burner, enhancing overall efficiency.   **Methods, Procedures, Process:** Implementation steps: Install balance line between the Sulphur Rundown Vessel (0751-V-109) and the Third Sulphur Condenser (0751-E-110). This will facilitate efficient handling of vent gases and improve the overall process flow. The Sulphur Vessel Vent Ejectors (0751-J-101 A/B) will be removed. This is crucial for eliminating repeated maintenance costs and enhancing operational stability. By removing the ejectors and installing the balance line, the process flow will be streamlined, reducing potential bottlenecks and improving efficiency. **Results, Observations, Conclusions:** The removal of Sulphur Vessel Vent Ejectors and the utilization of the balance line between the Sulphur Rundown Vessel and the Third Sulphur Condenser will result in significant operational improvements and cost savings, including the following benefits: The initiative will save approximately 4 TPH (tons per hour) of high-pressure steam per SRU, totaling 16 TPH across all SRUs. This represents a substantial resource saving and contributes to energy efficiency. By eliminating the vent ejectors, the process flow becomes more streamlined, reducing potential bottlenecks and improving overall efficiency. This simplification will enhance the reliability and performance of the SRU. The removal of the ejectors and the establishment of the balance line are expected to have high saving. These savings are derived from reduced maintenance costs and improved operational efficiency. The initiative will result in a reduction of 20,674 tons of CO2 equivalent per year. This significant reduction in greenhouse gas emissions underscores the environmental benefits of the modification. The technical paper outlines a well-defined initiative will enhance the efficiency and reliability of the SRU through the removal of Sulphur Vessel Vent Ejectors and the utilization of a balance line between the Sulphur Rundown Vessel and the Third Sulphur Condenser. The initiative promises substantial operational, environmental benefits, including reduced maintenance costs, HP steam savings, stable operation of the Reaction Furnace, and reduced inert content to the main burner **Novel/Additive Information:** This initiative demonstrates a strong commitment to improving process efficiency and sustainability providing both economic and environmental benefits. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5603-SPE | | **Title:** | Energy Optimization Through Sulphur Recovery Unit Flexsorb Pump Modifications | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Energy optimization | | **Keyword2:** | Revenue generation | | **Keyword3:** | cost Saving | | **Keyword4:** | Flexsorb Pump | | **Keyword5:** | operational and environmental benefits | | **Authors:** | A.W. Alkayyoomi, V. Algule, ADNOC SOUR GAS | | **Abstract:** | **Objectives/Scope:** The primary objective of this initiative is to optimize the lean solvent circulation rate, thereby reducing steam consumption in the regenerator reboilers and power consumption of the lean solvent pump motor. This optimization is crucial for energy savings and decarbonization of existing equipment **Methods, Procedures, Process:** The current operation runs at a lower than design concentration of Flexsorb (12% vs. 24%) due to higher sulfur recovery efficiency in the Claus section than initially expected. This lower concentration necessitates higher lean solvent circulation, leading to increased steam consumption. By increasing the amine concentration in the circulating solvent, we can reduce the amine solvent circulation without compromising its quality and function. To achieve this, a detailed analysis was conducted to understand the impact of varying amine concentrations on the overall system performance. Computational simulations and field tests were employed to determine the optimal concentration that balances efficiency and operational stability. The study also involved a thorough review of the existing pump specifications and their performance under different operating conditions. **Implementation:** The proposed modifications involve re-rating the existing lean solvent pumps (075X-P-207 A/B) to meet the new process duty conditions. The new pump specifications include a reduced capacity and differential head, leading to lower power consumption. The implementation plan includes detailed engineering design, procurement of necessary equipment, and a phased approach to installation and commissioning to minimize disruption to ongoing operations. **Results, Observations, Conclusions:** The optimization study revealed significant savings:   * **Steam Savings:** 365,440 tons per year * **Power Savings:** 167.5 kW * **CO2 Emissions Reduction:** 44,000 tons per yea   These results were achieved by re-rating the existing lean solvent pumps (075X-P-207 A/B) to meet the new process duty conditions. The new pump specifications include a reduced capacity and differential head, leading to lower power consumption. Additionally, the project identified potential areas for further optimization, such as improving heat integration and enhancing control strategies to maintain optimal performance. **Conclusion:**The Flexsorb pump optimization project demonstrates ADNOC Sour Gas's commitment to sustainability and operational excellence. The initiative not only achieves substantial cost savings but also significantly reduces the environmental footprint, aligning with ADNOC's broader sustainability goals. **Novel/Additive Information:** This project serves as a model for future energy optimization efforts within the industry, showcasing the potential for significant improvements through targeted modifications and strategic planning. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5615-SPE | | **Title:** | Optimization Of Selexol Circulation Rates In Natural Gas Liquid Regeneration Gas Purification Units | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Selexol | | **Keyword2:** | Regeneration | | **Keyword3:** | Flow | | **Keyword4:** | reduction | | **Keyword5:** | Fuel Gas | | **Authors:** | M. Nisar, R. Singh, ADNOC Sour Gas | | **Abstract:** | **Objectives/Scope:** Based on the current reduced contaminant ( Sulphur compounds) level in the sweet gas feeding the NGL Dehydration Unit, the Regeneration gas purification unit ( Selexol unit) were operating with reduced acid gas load. Considering the opportunity, Selexol circulation rates were optimised which was crucial for enhancing system performance and efficiency. **Methods, Procedures, Process:** Based on reduced contaminant level and reduced acid gas load to Selexol unit, Simulations were performed to check the reduction in the selexol circulation flow rates. Based on simulation reduction in flow rates were acceptable with No Acid gas slippage in Absorber overhead. Accordingly, In one train (0742), the Selexol circulation rate was reduced from 50 m³/hr to 37 m³/hr. **Results, Observations, Conclusions:** This reduction has yielded significant advantages, including a decrease in the flaring of Selexol off-gases and a reduction in steam consumption in the Selexol regenerator reboiler by approximately 400 kg/hr. The positive outcomes achieved in Unit 0742 were subsequently applied to another train (Unit 0741). By reducing the Selexol circulation rate, the performance and efficiency of the Selexol system have been optimized, resulting in energy savings and reduced emissions. Further improvements have been observed in overall system reliability and operational stability, contributing to enhanced environmental sustainability and long-term cost savings for the facility. **Novel/Additive Information:** The paper will enhance knowledge of the industry by providing insights into the potential for optimization based on actual contaminant levels in feed gas, enabling more effective management and operational strategies. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5621-SPE | | **Title:** | Enhancing Value Added Products Yield : A Simulation Based Case Study Of Propane Sub-cooling In The Dew Point Depression Unit | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Dew Point Depression (DPD) Unit | | **Keyword2:** | Sub-Cooling of Propane in Refrigeration | | **Keyword3:** | Value-Added Products | | **Keyword4:** | LPG & Naphtha yield | | **Keyword5:** | Payback period | | **Authors:** | J. Vasava, P. Dogra, Oil & Natural Gas Corp. Ltd.; M. Yadav, N. Joshi, Oil & Natural Gas Corporation Ltd; B. T, Oil & Natural Gas Corp. Ltd. | | **Abstract:** | **Objectives/Scope:** In natural gas processing facilities, gas is chilled to remove heavier hydrocarbons (HCs), which contribute to issues such as condensate holdup, gas hydrate formation, corrosion, and slug flow in long-distance gas pipelines. These heavier HCs, however, have commercial value as they are used in producing value-added products like liquefied petroleum gas (LPG) and naphtha. Propane refrigeration systems, particularly within the Dew Point Depression (DPD) unit, are critical for maximizing the recovery of these components. **Methods, Procedures, Process:** This study evaluates the feasibility of enhancing the propane refrigeration cycle by sub-cooling the propane refrigerant using a low-temperature condensate stream from the DPD unit. A process simulation was developed using a commercial process simulator to model the gas processing plant under typical operating conditions. The proposed modification introduces an additional propane-condensate heat exchanger to enable sub-cooling, which lowers the gas temperature and increases condensate recovery. **Results, Observations, Conclusions:** Simulation results indicate that the modified process significantly enhances hydrocarbon recovery, with LPG production increasing by 57.5 tonnes/day and naphtha production by 10 tonnes/day. A cost-benefit analysis shows that, after accounting for the heat exchanger installation, the payback period is less than two years. **Novel/Additive Information:** This approach presents a technically viable and economically attractive solution to improve energy efficiency and product yield in existing gas processing infrastructure. The study supports the integration of internal energy recovery schemes as an effective means to optimize performance and enhance economic returns. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5674-SPE | | **Title:** | Hydrogen Compression | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Hydrogen Applications | | **Keyword2:** | Compressor Technologies | | **Keyword3:** | Compression Efficiency | | **Keyword4:** | Reciprocating Compressors | | **Keyword5:** | Hydrogen Economy | | **Authors:** | S. Shah, OPTIMISTIC | | **Abstract:** | **Objectives/Scope:** This paper aims to explore the strategic importance of hydrogen compression in the context of a growing hydrogen economy, with a particular focus on reciprocating compressors. It provides a technical overview of existing compression technologies, evaluates their suitability across various hydrogen applications, and addresses the performance and safety challenges involved in compressing nearly pure hydrogen for transport, storage, and end-use energy delivery. **Methods, Procedures, Process:** The approach involved a thorough literature review, analysis of real-world industrial case studies, and synthesis of data from manufacturers and experts in the field of reciprocating compressors. The study categorizes hydrogen compression needs into four primary applications—injection into transport grids, storage, fueling stations, and end-user consumption and matches each with the most suitable compressor types. Performance metrics such as flow rate, discharge pressure, CAPEX/OPEX, operational intermittency, and material resistance to hydrogen embrittlement were assessed to determine the applicability and limits of current technologies. Non-mechanical and hybrid solutions were also evaluated for emerging use cases. **Results, Observations, Conclusions:** The findings confirm that hydrogen compression is a critical enabler of the green energy transition. Reciprocating compressors, particularly non-lubricated models, are validated as versatile and robust solutions for a wide range of pressures and flow requirements—up to 400 bar in industrial applications. Diaphragm, hydraulic, and ionic compressors provide even higher discharge pressures (>700 bar) but at lower capacities, making them ideal for specific niches such as fueling stations. Screw compressors, though pressure-limited (~30 bar), remain relevant in booster applications. The study observes that not all natural gas compressor technologies can be transferred directly to hydrogen applications due to the molecule’s small size and embrittlement risk. Therefore, material science and compressor redesigns are essential. Hybrid solutions combining reciprocating and non-mechanical stages appear promising. The report concludes that collaborative system-level optimization—linking compressors with electrolyzers and storage—will maximize the efficiency and safety of future hydrogen infrastructures. **Novel/Additive Information:** This paper offers a novel systems-based analysis of hydrogen compression, presenting real industrial data points for pure hydrogen use and proposing hybrid compression architectures. It contributes new insights into integrating traditional and emerging technologies, enhancing design strategies for hydrogen infrastructure development across the energy and transport sectors. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5717-SPE | | **Title:** | Sru Operation Mode Change To Resolve Hp Steam Water Carryover Issue. | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | SRU Operation mode Change | | **Authors:** | V.K. Algule, A. Alkayyoomi, ADNOC Sour Gas | | **Abstract:** | **Objectives/Scope:** The objective is to reduce the HP steam water carryover issue from the Sulphur Recovery Unit (SRU) Waste Heat Boiler (WHB) by changing the SRU operation mode. This initiative aims to enhance operational efficiency and ensure the reliability of the waste heat boiler system **Methods, Procedures, Process:** There are four identical, parallel Claus Sulphur Recovery and Tail Gas Treating Units (0751/0752/0753/0754) designed to handle acid gas for a nominal sulphur processing capacity of almost 2,500 TPD per train. Plant throughput increased to 145% sulphur processing capacity, reaching almost 3,400 TPD per train uring the test run to increase plant capacity as part of the new OSGE Expansion project, the SRU load increased. The process data collected during the test run showed liquid carryover indications from WHB steam drum V-104/105. This was confirmed by analyzing the steam quality (STH), with special samples reporting higher phosphate (PO4) content than normal, as well as reduced superheated steam temperature in incinerator superheater coils outlet. Additionally, some integrity issues were rapidly noted in acid gas piping downstream of the ejectors as clear evidence of liquid in STH from WHBs used as motive steam for the ejectors The analysis concluded that the increase in SRU train capacity is leading to water carryover into saturated HP steam from steam drums (V-104 & V-105) due to steam drums capacity constraints. The following actions were implemented to reduce HP steam generation from SRU WHB, as shown in the image below. **SRU Operational Mode Adjustments:** To reduce the Reaction Furnace (RF) operating temperatures and the duty on the WHBs, while ensuring BTEX destruction, the following changes were made:   * Combustion air preheater outlet temperature was reduced from 230°C to 160°C. * Acid Gas preheater was completely cut off by closing the HP steam supply   A detailed action plan has been put in place to mitigate / reduce the effects of this WHBs Water Carryover issue. New dedicated and special sampling, extensive thermography surveys in acid gas piping downstream of the ejectors and operational mode adjustments were carried out as part of the short-term actions plan including eliminating Acid Gas Preheat and minimizing combustion Air Preheat while in parallel increasing SRU throughput. **Results, Observations, Conclusions:** This project has yielded positive results and conclusions as follows:   * Water carryover was significantly reduced * Plant production increased by 36 MMSCFD * HP steam consumption was reduced by 90 TPH * GHG emissions were reduced by 111,009 CO2eq tons   **Novel/Additive Information:** This method has proven effective not only in recovering and maintaining integrity but also in recovering production and optimizing energy consumption, leading to a reduced carbon footprint | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-5883-SPE | | **Title:** | Integration Of Hydraulic Power Recovery Turbine In Lube Oil Base Stock Upgradation Process | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Hydraulic Power Recovery Turbine | | **Keyword2:** | Lube Oil Base Stock Upgradation | | **Keyword3:** | Energy Recovery | | **Keyword4:** | Pelton Turbine | | **Keyword5:** | Economic Feasibility | | **Authors:** | B. Chiramel, Hindustan Petroleum Corporation Limited (HPCL) | | **Abstract:** | **Objectives/Scope:** This paper investigates the integration of a Hydraulic Power Recovery Turbine (HPRT) into the Lube Oil Base Stock Upgradation Process (LOUP) to capture high‐pressure flash energy between the High‐Temperature Separator and the Product Stripper. Objectives include developing detailed HPRT design parameters, assessing mechanical and process integration feasibility, and quantifying both energy recovery potential and economic benefits to demonstrate a rapid‐payback, energy‐efficient enhancement to refinery operations. **Methods, Procedures, Process:** The LOUP effluent was characterized by measuring flow rate (0.01667 m³/s) and pressure drop (140 bar → 7 bar). Available hydraulic power was calculated using P=Q×ΔPP = Q \times \Delta PP=Q×ΔP, and a Pelton‐type turbine was selected for its suitability to high‐head, low‐flow conditions. Key turbine design parameters—nozzle diameter, runner diameter, specific speed, and jet velocity—were derived from standard turbomachinery formulas assuming a turbine efficiency of 85%. Economic feasibility was evaluated through annual energy recovery estimates (kWh), unit energy cost savings (₹/kWh), capital expenditure, operating costs, payback period, net present value (NPV), and internal rate of return (IRR) over a 10-year project life. **Results, Observations, Conclusions:** Design calculations indicate that the HPRT can continuously recover approximately 184.7 kW, yielding 1.48 GWh of electricity annually. At a tariff of ₹8/kWh, this translates to annual savings of ₹11.8 million. With an estimated capital cost of ₹3 million and annual OPEX of ₹0.2 million, the system achieves a payback period of 0.26 years (≈3.1 months). Financial analysis yields an NPV of ₹69.4 million and an IRR exceeding 385% over the project life. Mechanical assessments confirm stable operation with an 11 mm nozzle, a 3.01 m runner diameter, and a safety margin against cavitation (NPSHA ≈1575 m). No negative impacts on process continuity or maintenance frequency were observed during simulated test runs. These findings validate HPRT integration as a technically robust, economically compelling solution for reducing energy waste in LOUP. **Novel/Additive Information:** This study presents the first end-to-end HPRT design and techno-economic analysis specifically for a refinery’s lube-oil upgradation loop. By combining rigorous mechanical design with comprehensive financial modeling, it offers a replicable model for energy recovery, advancing the state of knowledge in process optimization and sustainable refinery operations. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-6061-SPE | | **Title:** | A Deep-to-shallow Seasonal Energy Storage Strategy To Improve Geothermal Longevity In Regina, Saskatchewan | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Geothermal | | **Keyword2:** | Energy Optimization | | **Keyword3:** | Technology Advancement | | **Keyword4:** | Shallow Aquifer | | **Keyword5:** | Deadwood Formation | | **Authors:** | M. Kamali, Petroleum Technology Research Centre; A. Rangriz Shokri, University of Alberta; N. Jia, G. Zhao, University of Regina; R. Narayanasamy, Petroleum Technology Research Centre; R. Chalaturnyk, University of Alberta | | **Abstract:** | **Objectives/Scope:** Sedimentary basins, both deep and shallow, offer valuable low-carbon energy solutions by serving as significant geothermal energy sources. In cold climates like the Canadian prairie provinces, extracting geothermal energy from low-enthalpy subsurface systems provides a practical way to meet seasonal heat demands. This study focuses on optimizing geothermal energy utilization through deep-to-shallow thermal energy storage strategies, enhancing system sustainability, and supporting long-term energy security. **Methods, Procedures, Process:** In this study, we built a numerical model of three aquifers, namely Winnipeg, Deadwood, and Mannville. These formations are key geothermal resources and have provided high permeability and suitable temperatures for direct heat use since 1978. The shallower Mannville Aquifer, at around 850 m depth, consists of interbedded sandstone and shale with regional groundwater flow. Two doublet systems are incorporated to evaluate deep-to-shallow aquifer thermal energy transfer. Seasonal energy demand is evaluated using data from a University of Regina residential facility. The methodology involves simulating fluid flow, heat transfer, and aquifer interactions to optimize extraction rates while minimizing thermal breakthroughs. **Results, Observations, Conclusions:** Numerical simulations indicate that integrating a deep-to-shallow thermal energy storage approach significantly enhances geothermal system efficiency. The highest cumulative production rate from both aquifers was set at 2400 m³/day. During low-energy demand periods, deep geothermal well production could be reduced to a constant rate of 1000 m³/day, with excess energy stored by injecting it into the shallower geothermal reservoir. Storing excess energy from deep aquifers in the shallower Mannville aquifer during low-demand periods slows thermal depletion of the deep reservoir, preserving higher temperatures for extended use. Observations show that seasonal energy storage improves temperature stability, reduces thermal breakthroughs, and optimizes extraction rates. Additionally, findings emphasize the importance of managing production patterns to align with seasonal heat demand, ensuring long-term sustainability. The study concludes that implementing Aquifer Thermal Energy Storage (ATES) enhances geothermal system longevity, increases energy efficiency, and provides a sustainable solution for regions like Saskatchewan. Overall, the deep-to-shallow thermal exchange method offers an effective strategy for optimizing geothermal energy utilization while improving thermal stability in subsurface reservoirs. **Novel/Additive Information:** Our modeling approach assesses the novel deep-to-shallow geothermal storage strategy to optimize energy extraction and seasonal heat management. The results provide insights into enhancing energy efficiency, increasing geothermal system sustainability, and improving thermal storage in the shallower aquifer during low-demand months. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-6064-SPE | | **Title:** |  Operational And Strategic Gas Network Planning Amid Power Sector Variability | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Gas Production Model | | **Keyword2:** | Pressure Stability Modeling | | **Keyword3:** | Integrated Supply Chain Planning | | **Authors:** | R. Aljneibi, ADNOC | | **Abstract:** | **Objectives/Scope:** This paper introduces a Gas and Energy Master Planning framework that addresses the growing operational coupling between power demand and gas infrastructure. The objective is to develop a unified model that optimizes gas production, allocation, and routing while ensuring pressure stability and economic efficiency under varying energy demand conditions. **Methods, Procedures, Process:** The framework integrates long-term energy demand forecasts with short-term operational constraints across the gas value chain. A spreadsheet-based simulation model links feedstock characteristics to plant-level yields, pipeline transport costs, and infrastructure capacities. The optimization layer accounts for pressure constraints, flow directionality, and compressor performance across the network. Power sector demand variability—particularly from renewable energy integration—is incorporated through dynamic gas withdrawal patterns. The model jointly optimizes production volumes, processing allocation, and network routing to maximize product value while maintaining operational feasibility. Although currently deterministic, the platform is structured for future enhancement with AI-based forecasting and decision support modules. **Results, Observations, Conclusions:** Scenario analyses highlight how renewable-driven variability leads to frequent flow reversals and high-demand pressure zones, particularly in compressor-limited sections. The model identifies key segments vulnerable to congestion or instability and provides insight into optimal rerouting and allocation strategies. Results suggest that adjusting plant feed allocation and enhancing flexibility at specific junctions can significantly reduce pressure swings and improve overall system efficiency. The current model has demonstrated strong predictive accuracy in matching real-world production and demand profiles. Its outputs enable decision-makers to prioritize infrastructure reinforcements, evaluate seasonal strategies, and assess the resilience of gas networks under future energy demand profiles. **Novel/Additive Information:** This work delivers a planning-grade, integrated modeling tool that unifies production, transport, and consumption optimization across the gas network. It fills a gap between static long-term planning and short-term operational needs, offering a scalable decision-support foundation for managing coupled gas-power systems amid increasing renewable energy penetration. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-6114-SPE | | **Title:** | Steam Loss Management Programme- A Route Towards Doubling Energy Efficiency And For Industrial Decarbonization In OQ Group | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | steam | | **Keyword2:** | Energy Efficiency | | **Keyword3:** | energy management | | **Authors:** | M. Vahgjipurwala, OQ Company | | **Abstract:** | **Objectives/Scope:** OQ has embarked on an ambitious journey to meet Oman’s target to reduce emissions by 25% by 2030 and towards netzero target 2050. Its important to articulate clear plan and prioritise cost-effective energy efficient technologies to justify investment. Steam systems are key element in industries, however due to neglect and oversight these entail substantial losses. As per IEA, doubling energy efficiency is essential to meet netzero and limit global warming to 1.5°C, improving steam system performance will be crucial. **Methods, Procedures, Process:** The study begins by performing initial assessment to develop scope and key focus areas. This is followed by detailed assessment where with help of field measurements steam losses within plant are quantified. Comprehensive catalogue of steam traps is developed with RCA and plan for addressing leaks. This reduces boiler load and hence natural gas use, which translates to cost savings. Also, reduction in boiler feed water provides additional savings. Addressing steam loss is a well-established initiative paving way towards performance-based contract with guarantee savings. This provides no risk and assured method to implement savings while ensuring consistency in execution with right tools and competent personnel. Site visit during the assessment is key to success of the programme, taking measurements and inputs from operations provide deep insight into challenges being faced. While addressing steam leaks, operational issues, hammering etc., are also addressed. This also reduces safety hazard due to leaking steam traps. Case Study1: Reduction of steam venting is a quick win and can be implemented with no CAPEX. Reduction in fuel gas consumption at boiler to determine reduction in overall Energy Intensity Index (Solomon Index), by 1.1 points, and savings in $3.4Million/year. Case Study 2: Reduction of steam leaks with a performance-based contract. This will reduce EII by 3 MJ/MT, emissions by 9500tonnes/year with a simple payback of <1year. Case Study 3: Vapours from LP Condensate drum can be recovered to produce LP steam with Mechanical Vapour Recompression. This will lead to savings in natural gas and provide EI reduction of 14kWh/BOE with emission reduction of 1000tonnes/year. **Results, Observations, Conclusions:** OQ has benefitted immensely by implementing comprehensive Steam Loss Management programme providing clear pathway to achieve decarbonization targets in cost-effective manner. It further substantiates that doubling energy efficiency is practically achievable to limit global warming to 1.5°C. The case studies demonstrate that having variety of projects covering CAPEX and non-CAPEX solutions can help organizations reach their target for decarbonization. **Novel/Additive Information:** The study will provide basis for organizations to work towards comprehensive steam loss management programme addressing all aspects of the steam network, including leaks and operational issues to work out cost effective solutions for reducing carbon emissions and fast track its journey towards net-zero. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-6136-SPE | | **Title:** | In-situ Bfw Injection/washing In Cdu Pre-heat Train 3 | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | BFW Wash | | **Keyword2:** | Online water wash | | **Keyword3:** | Pre Heat Improvement | | **Authors:** | I. Khan, Indian Oil Corporation Ltd; S. GAUTAM, Indian oil corporation limited | | **Abstract:** | **Objectives/Scope:** Crude oil is preheated through a network of Pre-Heat Exchangers Train (PHT), utilizing hot product streams to heat the feed thus reducing the duty of the fired heater. But, over a period of time, heat exchanger fouling occurs reducing heat transfer efficiency & thereby increasing fired heater load. Typically, exchangers are taken offline for mechanical/chemical cleaning and may require up to a week per cleaning cycle thus adversely impacting the energy efficiency of the unit. This paper presents the conceptualization, process simulation, detail engineering & implementation of the project for the in-situ cleaning of pre heat exchanger in PHT-3 of CDU by Boiler Feed Water (BFW) injection. It’s USP is that its cleaning efficiency is almost equivalent to mechanical cleaning thus eliminating additional fuel required in fired heater during offline cleaning & saving mechanical cleaning cost, giving two fold benefits. **Methods, Procedures, Process:** In-situ cleaning primarily occurs due to the increased fluid velocity - owing to partial phase change of the injected BFW to steam creating a two-phase flow regime - thus significantly increasing the fluid velocity, increasing turbulence & creating scouring action resulting in dislodging of deposits.This is the horizontal deployment of the present principle of water/velocity steam injection in Delayed Coking Units (DCU) & Visbreaking Units (VBU). Leveraging this concept, a controlled BFW injection system was engineered and implemented at Mathura Refinery (MR) CDU. A comprehensive simulation study was carried out to evaluate the thermos-hydraulic behavior of the system during BFW washing. The study involved detailed modeling of fluid dynamics and heat transfer to ensure reliable system performance under a range of operating conditions. However, due to the high steam expansion ratio, precise control of injection rates needed to be determined as excessive vapor velocity may lead to erosion, vibration, or pressure imbalances in the associated piping & equipments. **Results, Observations, Conclusions:** So, a detailed stress analysis of the complete piping network under dual-phase flow conditions was conducted using CAESAR-II software for confirming that all calculated stresses, displacements & heater nozzle loads remained within the tolerance levels. Dynamic analysis was performed by identifying excitation frequencies, for ascertaining any potential vibration issues & remedial actions, like supports reinforcements, installation of guides & limit stops etc were implemented. This integrated analysis confirmed the structural integrity of the system, validating its operational reliability and safety even under dynamic two-phase flow conditions. **Novel/Additive Information:** A novel application of BFW injection-traditionally used in Delayed Coking and Visbreaking Units-to Crude Distillation Unit pre-heat trains. The successful implementation of this concept offer a valuable solution for refinery operations aiming to enhance energy efficiency | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-6252-SPE | | **Title:** | Esp Energy Efficiency Programme - A Case In Decarbonizing Journey For Upstream In Oman | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | ESP | | **Keyword2:** | Energy Efficiency | | **Keyword3:** | energy management | | **Authors:** | D. Al Hashar, M. Vahgjipurwala, OQ Alternative Energy | | **Abstract:** | **Objectives/Scope:** Electrical Submersible Pump (ESP) is one of popular technologies for artificial lift in oil and gas industry, however their high operating costs necessitates exploration of technologies to reduce expenses and enhance efficiency. OQ has embarked on a journey to reduce emissions by 25% by 2030 and towards net-zero by 2050. ESPs have significant contribution to emissions in upstream sector and is one of focus areas for decarbonization. It is essential to have a Energy Efficiency Programme addressing ESPs to cover all aspects of ESP operations. **Methods, Procedures, Process:** First, OQ team develop a Well Reservoir Management (WRM) workflow to determine energy intensity index for every ESP with benchmarking to identify abnormal consumption and bad actors. Root cause analysis should be performed to determine the reason for abnormal consumption and plan for appropriate corrective action. Monitoring technologies are key. Deep dive into electrical analysis could unearth efficiency opportunities, such as re-rating of motors. The workflow was linked directly as digital twins to surface network model of flowlines and trunklines, addressing backpressure and linked to emission intensity reduction per well.Second, retrofitting of Induction motors with permanent magnet motors, focusing on lowering baseline load.Our observations is discussed in high and low range of offtake and motors frequency.Third, optimizing power source option for the ESPs should be reviewed. ESPs are typically located in remote areas where providing power is challenging. Consequently, diesel generators are used which leads to high costs and emissions. Connecting ESPs to grid should be the primary option to ensure reliable power, low in cost and emissions. However, this may not always be feasible requiring the use of generators for long periods of time. Use of temporary solar panel solutions in hybrid with generators could provide a low-cost option to decarbonize the power to ESPs. **Results, Observations, Conclusions:** Life cycle benefit of the Energy Efficiency Programme was discussedin context of reduce maintenance, increased reliability, improve production while reducingenergy intensity index and emission reduction to below 10 Kg CO2/BOE. The other benefits can strengthen business case for investment and motivate operations to deliver consistent savings. It would be crucial to develop a Measurement & Verification system for all initiatives to ensure savings are qualified to management to justify investment. Also, any deviations from performance can be noticed and corrective action can be taken to ensure savings are not lost. **Novel/Additive Information:** The paper will review implementation of ESP energy efficiency programmein context of OQ upstream assets in Oman and highlight benefits and challengesencountered during execution. It will provide basis to other operators in the industry to develop and follow a similar programme to help reach their decarbonization goals. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-6440-SPE | | **Title:** | Dots Dashboard Enhance Refining Margin Through Optimizing Operation Driven By Digitalization. - Success Story | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | energy efficiency | | **Keyword2:** | digitalization | | **Keyword3:** | decision on the spot | | **Keyword4:** | heater | | **Keyword5:** | optimization | | **Authors:** | M.P. Leelamma, Abu Dhabi National Oil Company | | **Abstract:** | **Objectives/Scope:** Digitalization, big data analysis and wise utilization of Artificial Intelligence (AI) are effective tools which can optimize operating cost and overcome the sustainability challenges in the energy sector. This paper showcases the positive results of ADNOC Refining’s in-house developed digital tool called “DOTS**(D**ecision **on** **T**he **S**pot**)**Dashboard **Methods, Procedures, Process:** Refinery Technical team continuously monitor operation & energy performance and take appropriate action to ensure that process units are operating at optimum, whereas same information was found not available to the Operation Team, they control the operation. ADNOC Refining team have developed an interactive digital tool which showcases online display of most important Top Management information energy consumption, fired heater performance, energy cost ($/bl) to Operation team 24X7, 365 days. Moreover, the tool displays the energy consumption & opportunity for improvement which drives Operation Team towards Operation, Energy & sustainability excellence. AI inputs are integrated in the backend tool to augment human intelligence.The idea of developing a dashboard integrating all the key relevant information about the refinery is a very tough challenge. It requires access to different programs and critical data from several sources. Moreover, the accuracy of converting the raw data into useful information requires stringent analysis and performance checks. The first step in making this idea into reality started by understanding Operation & Technical team’s demand and expectations. Based on the continuous interaction with technical team we could formulate an initial layout of Dashboard. The dashboard was developed by fetching relevant data from Real Time database (RTDB) and LIMS, performed logic calculations, verified using conditional logics and results were displayed in an attractive platform. Dashboard is dynamic and interactive to panel engineers through different colors to take decision on the spot. **Results, Observations, Conclusions:** Dashboard access is controlled based on requirements. Dashboard is designed with soft tabs for easy navigation Dashboard is dynamic and one of the important interactive tools designed was **AI driven process heater optimization**. Subject tool dynamically calculates thermal efficiency of process heaters and compares with design efficiency and the performance is displayed through color. Performance status of each significant energy user is displayed as **OPT**-Optimum or **OFI**- Opportunity for Improvement. Once you click on the deviation (OFI) it will display the reason for deviation and step by step action required to enhance efficiency. This tool is continuously enhancing refinery margin and reduce CO2 emission. **Novel/Additive Information:** Enabling the right information at the figure tip of decision makers will help them to take right decision at the right time is the novelty and such tool is not available in any of the other ADNOC Operating Companies | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-6459-SPE | | **Title:** | Making Sense Of Causation Complexity In Capital Projects - Findings From Global Research | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Capital Project | | **Keyword2:** | Risk | | **Keyword3:** | Complexity | | **Authors:** | T. Hunt, HKA Global Ltd | | **Abstract:** | **Objectives/Scope:** Whilst those who draft construction and engineering contracts in the oil and gas sector may well intend that the contract should define the allocation of risk between the contracting parties, the potential effects of those recognised risks, should they materialise, will frequently be far greater than the contract draftsman, or even perhaps the contract signatories, can envisage from the comfort of their pre-construction viewpoint. **Methods, Procedures, Process:** HKA’s CRUX integrated research program provides insights into the causes of claims and disputes arising from major capital projects around the world. CRUX Insight identifies the most common and recurring causes of these claims and disputes. It delves into the underlying factors and suggests steps to mitigate risks and reduce uncertainty. HKA’s research indicates that each project typically involves an average of 13 interrelated causation factors. As information systems have advanced, the illusion of control has also increased. Disputes often reveal flawed record-keeping and a compromised situational awareness due to poor information flow. **Results, Observations, Conclusions:** Major project delivery complexity is often underestimated, and whilst disputes are not inevitable, they are commonplace given today’s sizable and geographically distributed supply chains and can be said to be a litmus test of the health of the industry. The findings of the 2024 CRUX Insight Report will be presented, focusing on the oil and gas sector and identifying areas for industry focus to help avoid cost and schedule overruns on future major capital projects. **Novel/Additive Information:** This paper will allow attendees to gain insight and learn from expert analysis of over 2,000 projects worldwide, with actionable steps to pre-empt problems. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-6469-SPE | | **Title:** | Innovative Practical Approach In Developing Adnoc Refining Energy Efficiency Improvement Roadmap | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Energy efficiency | | **Keyword2:** | Improvement Roadmap | | **Keyword3:** | Innovative | | **Keyword4:** | Practical Approach | | **Keyword5:** | optimization | | **Authors:** | M.P. Leelamma, Abu Dhabi National Oil Company | | **Abstract:** | **Objectives/Scope:** This paper sheds light on a successful model in which the industry operators, experts and technology providers would partner to achieve global, national and corporate Net Zero emissions targets. Such exchange of knowledge and experience acts as a catalyst towards Net Zero goal achievement. **Methods, Procedures, Process:** ADNOC Refining (AR) intends to play a significant contribution in achieving ADNOC’s Net Zero goal by 2045. Energy efficiency is a cornerstone element in AR’s decarbonization journey. AR is ISO 50001:2018 Energy Management System certified. Further to its several internal initiatives, AR has partnered with KBC Process Technology applying its Strategic Energy Review (SER) systematic program in defining AR’s energy efficiency improvement roadmap. Almost 50 of AR and KBC subject matter experts collaborated to execute the program effectively. More than 100 reports, presentations, implementation plan and SORs have been issued in a span of 9 months. **Results, Observations, Conclusions:** ADNOC Refining (AR) intends to play a significant contribution in achieving ADNOC’s Net Zero goal by 2045. Energy efficiency is a cornerstone element in AR’s decarbonization journey. AR is ISO 50001:2018 Energy Management System certified. Further to its several internal initiatives, AR has partnered with KBC Process Technology applying its Strategic Energy Review (SER) systematic program in defining AR’s energy efficiency improvement roadmap. Almost 50 of AR and KBC subject matter experts collaborated to execute the program effectively. More than 100 reports, presentations, implementation plan and SORs have been issued in a span of 9 months.**Define stage:** Collected baseline data and conducted round table discussions and mechanical walkthrough onsite to develop an understanding of RRI/RRII configuration, operating conditions and limitations for the baseline period.**Discover stage:** Applied innovative BT benchmarking and gap analysis technology and developed utility models for both sites utilizing KBC’s Petro-SIM software allowing rigorous calculations of energy economics for each opportunity. Initial improvement ideas were identified and screened along with all AR stakeholders.**Develop stage:** Developed further the shortlisted opportunities and presented the “marginal” benefits for all opportunities in the below roadmap. **Deliver stage:** Implemented the major portion of the identified quick win opportunities leading to significant energy and emissions reduction realization. **Novel/Additive Information:** Meeting Decarbonization targets cost effectively starts with minimizing current assets footprint via addressing the three key elements of Energy (Supply - Demand - Heat Integration). The above comprehensive SER program has unfolded full RRI/RRII roadmap towards achieving ~13% energy efficiency improvement. Significant tangible quick win savings were achieved and demonstrated during the study leading to AR achieving two months of return on investment on this innovative program. Identified capital investment projects are fed to the pool of AR initiatives and are being taken-up by AR Engineering Team to perform Basic Design/ FEED studies. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-7477-SPE | | **Title:** | Closing The Gap Between Data And Decisions - Fast Modeling For Pipeline Gas Quality Optimization | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Compositional Tracking | | **Keyword2:** | Gas Quality Optimization | | **Authors:** | G. Zangl, D. Gavric, C. Amudo, MudoZangl Ltd. | | **Abstract:** | **Objectives/Scope:** With the advancement of digitalization and widespread access to real-time data, vast amounts of operational data are now available—awaiting transformation into actionable insights. In many cases, the pace of data acquisition exceeds the computational speed of conventional first-principles models. Yet, these physics-based models remain essential for turning data into reliable information, particularly because they generalize well across a wide range of operating conditions and perform robustly in data-scarce environments—unlike many machine learning approaches. In the context of flow assurance and gas pipeline monitoring, traditional first-principles simulations can become computationally intensive and may exceed practical decision-making timeframes. To address this, we introduce a fast and lightweight mathematical model for tracking gas compositions across pipeline networks. This approach enables real-time monitoring and optimization of gas blending from multiple sources, with the goal of stabilizing feed-gas composition for processing plants. In the short term, this allows operators to run gas plants closer to their optimal operating conditions. In the long term, it supports strategic blending of diverse gas sources—including lower-quality streams like sour gas—without the need for additional processing infrastructure such as CO₂ strippers. **Methods, Procedures, Process:** Our model is based on a one-dimensional Eulerian-Lagrangian particle tracking framework, where individual fluid particles carry evolving properties such as composition, temperature, and pressure as they move with the local flow velocity. To simulate mixing at junctions, we incorporate a stochastic node-based mixing algorithm, enabling accurate modelling of blend behaviours in pipeline networks. The method can be executed explicitly in pure downstream networks and can be applied with ODE-based solvers in distributed network topologies. **Results, Observations, Conclusions:** The explicit version of our algorithm completes full-network calculations in just a few seconds, making it well-suited for near real-time deployment. It also enables forward prediction of transient gas compositions at critical endpoints, providing early warnings of potential off-spec gas arrivals. The calculation of operator reaction times, upstream blending ratios can be adjusted proactively to mitigate or prevent off-spec gas situations at the endpoint before they can reach downstream facilities. In this paper we provide real field data of a calibrated model and some examples of the impact on operations. **Novel/Additive Information:** While the Eulerian-Lagrangian Method (ELM) was formalized in the early 1990s for solving advection-diffusion equations, it has seen limited adoption in the oil and gas industry. However, we view it as a highly suitable and purpose-driven approach—particularly relevant today as operational environments demand faster decision-making cycles. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-7478-SPE | | **Title:** | Faster, Safer, Smarter: E-coiled Tubing Deployment For Mplt In Onshore Haliba Wells | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | eCoil | | **Keyword2:** | Well delivery | | **Keyword3:** | efficiency | | **Keyword4:** | suitability | | **Keyword5:** | MPLT | | **Authors:** | N. Alhosani, A. Prasetyo, S. Alyafei, H. Alshehhi, ADNOC Onshore; H. Bakri, Al Dhafra Petroleum | | **Abstract:** | **Objectives/Scope:** **This study aims to evaluate the operational efficiency, safety, cost savings, and data quality of using e-coiled tubing (e-CT) for multi-production logging tests (MPLT) compared to conventional coiled tubing with memory tools. Focused on onshore wells in the Haliba field, the study specifically assesses the number of wells completed within one month using each method. The goal is to identify a more efficient, cost-effective, and safer approach to multi-zone reservoir evaluation.** **Methods, Procedures, Process:** **The study compares MPLT operations using e-coiled tubing and traditional memory logging in multiple Haliba field wells. E-CT, equipped with embedded conductors for real-time data transmission, was deployed to reduce intervention time and enhance data accuracy. Key performance indicators included total wells completed within one month, operational time per well, cost per run, tool deployment frequency, and HSE exposure. Comparative analysis was performed using operational logs, crew activity records, and cost reports. The study also assessed tool efficiency, data quality, and decision-making speed during MPLT to determine the practical advantages of e-CT over traditional methods.**  **Results, Observations, Conclusions:** **Field operations in the Haliba field revealed that the use of e-coiled tubing for MPLT significantly improved operational efficiency, safety, and cost-effectiveness. E-CT enabled real-time data acquisition, which reduced the need for multiple runs and allowed for immediate adjustments during logging. This not only improved the accuracy of zone-specific production profiling but also led to faster well turnover. Compared to conventional memory logging, where each run required tool retrieval for data analysis, e-CT reduced rig-up/down time and total job duration by approximately 30-40%. The reduced intervention time and fewer trips resulted in substantial cost savings per well. In terms of monthly performance, the team was able to complete up to 40% more wells using e-CT compared to memory-based methods, translating into better asset utilization and project delivery rates. In addition, physical involvement of personnel was significantly minimized, lowering the risk of HSE incidents and improving overall job safety. These findings demonstrate that e-coiled tubing provides a reliable, efficient, and safer alternative for conducting MPLT in onshore fields, particularly when operational timelines and budgets are constrained** **Novel/Additive Information:** **This study introduces the novel metric of monthly well completion rate to quantify operational efficiency—showing a marked increase in the number of wells logged with e-coiled tubing in a fixed timeframe. The ability to complete more wells safely and at lower cost is a strategic advantage in fields like Haliba, where project schedules are tight and multi-zone productivity evaluation is essential for informed reservoir management..** | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-7678-SPE | | **Title:** | Condensate Hydrotreating Units Energy Optimization | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Condensate Hydrotreating | | **Keyword2:** | Energy Optimization | | **Keyword3:** | Heater Optimization | | **Authors:** | S. Alhallaq, J. Kaleem, ADNOC Sour Gas | | **Abstract:** | **Objectives/Scope:** The primary objective of this paper is to present the initiative completed to optimize energy consumption in Condensate Hydrotreating Units (CDHT). The focus is on reducing fuel gas usage by improving heat recovery and adjusting reactor operating conditions without compromising product quality or equipment integrity. **Methods, Procedures, Process:** Two main strategies were implemented:   1. **Enhanced Heat Recovery**:    * Lowered the outlet temperature setpoint of Hot Feed/Effluent Exchangers from 210°C to 195°C in 5°C daily increments.    * This adjustment increased heat recovery from reactor effluent, reducing the load on the Reactor Feed Heater. 2. **Reactor Inlet Temperature Optimization**:    * Reactor Inlet Temperature (RIT) was reduced to as low as 260°C, leveraging the margin between actual and allowable sulphur content in the product.    * Adjustments were made gradually while monitoring sulphur levels via lab and online analyzers.   Supporting actions included lab analysis of feed nitrogen and chloride content to calculate NH₄Cl sublimation temperature, ensuring safe operation during exchanger temperature adjustments. **Results, Observations, Conclusions:**   * **Fuel Gas Savings**: Estimated reduction of 100-150 Nm³/h in fuel gas consumption across both units. * **Operational Stability**: No adverse effects on product quality or equipment fouling were observed due to proactive wash water injection and monitoring. * **Process Control**: The changes were implemented in coordination with operations and monitored over a three-month period to validate effectiveness.   **Novel/Additive Information:**   * The approach combined process engineering with real-time lab data to safely push operational boundaries. * Use of NH₄Cl sublimation temperature calculations based on actual feed composition allowed for more aggressive heat recovery without risking exchanger fouling.   The initiative demonstrated a replicable model for energy optimization in similar hydroprocessing units. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-7768-SPE | | **Title:** | Adopting Energy Efficiency Best Practices Through Iso 50001 Energy Management System To Enable Decarbonization Roadmap Across Midstream Organization In Oman | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | energy | | **Keyword2:** | Efficiency | | **Keyword3:** | midstream | | **Keyword4:** | system | | **Keyword5:** | management | | **Authors:** | S.M. Al Aisari, shinoona.alaisari@oq.com | | **Abstract:** | **Objectives/Scope:** To adopt the Omani 2050 vision of achieving net zero emission, OQ prioritises reducing energy intensity and lowering CO₂ emissions across its operations. OQGN is a subsidiary of the OQ SAOC Group owned by the Oman Investment Authority (OIA) and is standing at the forefront of Oman’s energy sector. OQ Gas Network (OQGN) is the exclusive owner and operator of the country’s natural gas transmission network. OQGN’s vision is to be the national champion of energy infrastructure through innovative and sustainable solutions and its mission is to transport energy in a reliable, efficient, safe, and sustainable way. Through its environmental stewardship practices and decarbonization initiatives, OQGN is actively working to enable Oman’s energy transition and support the nation’s 2040 Vision ambitions and 2050 Net Zero target. **Methods, Procedures, Process:** To achieve its vision and mission, OQGN took the decision to implement ISO 50001 as a platform to develop the required action plans, processes and documentations needed to elevate its energy performance, minimize its operational costs and minimize its impact on the surrounding environment. This journey was part of OQGN’s decarbonization strategy and aligns with Oman vision for net zero. OQGN integrated energy policy along with its sustainability policy that is mainly focusing on Energy Management and ESG. The energy policy ensures that energy use remains an integral part of OQGN’s decision making and that it will continually strive to reduce the energy intensity of its operations. OQGN Enabled regular monitoring of energy consumption, identified bad actors and acted for improvements. Furthermore, OQGN has started its energy efficiency strategy roadmap on future Capex energy efficiency projects that would help reduce its energy intensity. OQGN also launched three decarbonization action plans including energy efficiency, innovation, and electrification.  Process Optimization and Energy Efficiency, including pilot gas flare reduction, heater optimization, integrating efficient lighting standard requirements in new projects and enhancing maintenance practices in its compressor stations.  Data and Innovation, including leveraging AI to automate energy consumption monitoring, which helps OQGN better manage and reduce its energy use.  Clean Energy and Electrification, Installation of solar panels that provide electricity for remote 8 new Block Valve Stations, and ongoing studies to explore the electrification of compressors and heaters.  **Results, Observations, Conclusions:** Through the adoption of ISO 50001 and the implementation of energy efficiency projects, OQGN was able to achieve 43.9% reduction in Scope 1 and 2 emissions in 2024 and reduction in energy consumption intensity from 2.9 to 2.7 (Total direct energy GWh / throughput TWh). **Novel/Additive Information:** OQGN has pioneered best practices in the midstream industry, being one of the first to adopt this standard as part of its commitment towards decarbonization and energy efficiency. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-7798-SPE | | **Title:** | Production Of TDAE Grade Environmental Friendly Rubber Process Oils From Lube Extracts Through New Process Scheme | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | TDAE | | **Authors:** | S. Ganagalla, Hindustan Petroleum Corp. Ltd. | | **Abstract:** | **Objectives/Scope:** Rubber process oils (RPO) are utilized as raw materials in the manufacture of tire compounds and oil extended natural or synthetic rubbers. Refineries produce aromatic type process oils called Distillate Aromatic Extract (DAE) which has higher market demand. But the disadvantage with DAE type oils is its higher content of Poly Aromatic Hydrocarbons (PAH), which are carcinogenic and their use is limited in European Union based on legislations. Similar legislations are expected to follow in several countries to limit the use of PAH containing aromatic-rich lube extracts. The demand for such low PAH RPO such as Treated Residue Aromatic Extract (TRAE) and Treated Distillate Aromatic Extract (TDAE) is going to increase as per the market projections. Thus, it is imperative for refiners to develop processes to produce low PAH RPO from existing refinery streams such as lube aromatic extracts/ distillates. Due to the implementation of MARPOL specifications, several fuel oil grade streams are available in refineries for upgradation which include lube extracts and residues obtained from FCC/Solvent Deasphalting/Visbreaking processes. Objective is to convert these low vaue streams to low PAH Rubber process oils. **Methods, Procedures, Process:** There is no existing process in India for production of TDAE grade RPO. New HPCL R&D has developed a process based on re-extraction of lube oil extracts such as 500 N/ DAO extracts using a novel solvent extraction process utilizing selective solvents to extract PAH containing molecules and produce environment friendly RPO with lower PAH content (<3 wt%). The process was developed based on successful lab results using selective solvent systems, optimized process conditions and solvent compositions. **Results, Observations, Conclusions:** Based on R&D testing, commercial trials were carried out at Hindustan Petroleum Corporation Limited (HPCL) Mumbai refinery’s solvent extraction unit for producing low PAH RPO. Commercial plant trials showed that the reduction of Polycyclic aromatic content by 2-3 wt% in the raffinate stream which is used to produce low PAH RPO. Potential economic benefit of the process is estimated to be about Rs. 90 Crores/annum. **Novel/Additive Information:** HPGRDC has developed two novel processes for production of environment friendly rubber process oils based PCA selective system. First process was implemented at HPCL MR and resulted in economic benefit os Rs. 10 Cr. This process was implemented since 2020. New process of HP-TDAE grade RPO process is developed based novel solvent system and process. BDEP and FEED activities completed for HP-TDAE process. Pre-project activities at HPCL MR is in progress for setting up of demonstration plant capacity 48 KTPA. Expected economic benefit is Rs. 80 Cr per annum. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-7942-SPE | | **Title:** | Unlocking New Commercial Value From Late-life Assets - Stranded Gas & Data Centers | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Energy Transition Technologies | | **Keyword2:** | Stranded Gas Commercialization | | **Keyword3:** | Offshore Infrastructure Repurposing | | **Keyword4:** | Data Center Energy Solutions | | **Keyword5:** | ROICE Framework | | **Authors:** | R. Yabaluri, Black & Veatch | | **Abstract:** | **Objectives/Scope:** Several offshore oil & gas assets are nearing end of life. As the primary purpose of these assets is accomplished, there could be significant value unlocked from secondary uses of the infrastructure. Evolving energy supply-demand dynamics and technology advancements provide a strong case for repurposing offshore infrastructure for continued commercial purposes including stranded gas developments, data centers, CCUS, and renewables. **Methods, Procedures, Process:** During the first phase of this work, extensive studies were conducted to identify requirements for repurposing offshore infrastructure across Gulf of America for wind, hydrogen and CCUS. While technical feasibility was established across these options, continued incentives and subsidies are critical for commercialization of these concepts. As key energy players across the world are trying to strike the right balance between financial growth and environmental sustainability, gas is increasingly being accepted as the preferred energy transition fuel. There are multiple accumulations of discovered gas within or near existing offshore assets. Gas has been reinjected to maintain reservoir pressure and maximize recovery from these fields or has been deemed uneconomical due to the challenges developing and transporting smaller accumulations of gas. Existing infrastructure, gas export capacity and advancements modular and FLNG gas development technologies are providing new avenues to drive commerciality of stranded gas. Further, the rapid rise in AI/ML driven data centers is increasing the demand for power significantly and is creating significant stress on existing power grids. However, most grids around the world are not equipped to modernize and or scale-up power supply in short periods of time. Under these circumstances, delivering reliable and continuous off-grid energy sources to power data centers would be a game-changer. With these converging energy demand and gas technology trends, the ROICE framework has identified multiple options for potential commercialization of stranded gas while meeting energy demand for data centers. Some of the identified options include hub-and-spoke gas powered data center developments, offshore and/or submersible data centers, and modular gas processing facilities including FLNG. **Results, Observations, Conclusions:** In conclusion, as energy companies look at maximizing value from existing assets, the exponential demand from data centers presents a unique opportunity for to use their sub-commercial gas accumulations to power offshore data centers. This will require innovation across technical concepts, economic structures and regulations and the ROICE framework is well suited to develop a commercial roadmap for the same. **Novel/Additive Information:** ROICE, a joint industry-academia-government consortium has developed a comprehensive framework to identify and prioritize potential commercially viable solutions to extend the commercial life of offshore assets. As a part of this framework, multiple options are being evaluated across 3 key dimensions - concept innovation and design, economic modeling, and regulatory requirements - to provide a roadmap for commercialization of these assets. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-8083-SPE | | **Title:** | Refining Crude Oil Into Petroleum Products By Using Electromagnetic Radiation Waves At The Resonance Frequencies Of Petroleum Products | | **Category:** | +8.10 Energy Optimisation and Transition Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Energy Efficiency Reduction in Heat Energy by 36% | | **Keyword2:** | Reduction in Carbon Emission by 14.4% up to 40% | | **Keyword3:** | Capabilities for Offshore Refining platform | | **Keyword4:** | Reduced Construction Costs | | **Keyword5:** | Enhanced Workplace Safety | | **Authors:** | R.M. Ibrahim, PETROJET | | **Abstract:** | **Objectives/Scope:** This research aims to introduce a novel, low-emission method for refining crude oil using electromagnetic waves at the resonance frequencies of petroleum products. The objective is to identify these frequencies for naphtha, kerosene, and diesel and develop compact, modular refining units that reduce energy use, carbon emissions, and infrastructure needs. The system is designed for onshore, offshore, and regional applications, particularly in areas where traditional refining methods are impractical or inefficient. **Methods, Procedures, Process:** Petroleum products absorb electromagnetic energy at specific resonance frequencies, converting it into heat for selective evaporation, condensation, and collection. A variable frequency pulse generator (35-4400 mhz) was used to radiate electromagnetic waves naphtha, kerosene, and diesel fuel samples. Temperature sensors detected resonance peaks, and PLX-DAQ software visualized the thermal response. Resonance frequencies were confirmed as 1450 mhz for naphtha, 2000 mhz for kerosene, and 2300 mhz for diesel. Custom magnetrons emitting these frequencies are used industrially to heat and separate products in low-height horizontal modular units, ideal for offshore or mobile use, ensuring high efficiency and process verification. **Results, Observations, Conclusions:** This research confirms that directly heating petroleum products using electromagnetic waves at their resonance frequencies can reduce thermal energy use by 36% and lower CO₂ emissions by 14.4% potentially up to 40% when powered by renewable energy. Lab tests identified specific resonance frequencies for naphtha (1450 mhz), kerosene (2000 mhz), and diesel (2300 mhz). These frequencies allow selective heating and separation without traditional distillation towers. The proposed horizontal refining units are compact, modular, and low height, significantly reducing construction costs and operational risks. Their size and design make them ideal for offshore installations and mobile refining near oil extraction sites, minimizing pipeline infrastructure and transport-related emissions. The modular nature also enables scalability and customization to regional needs, especially for developing nations. Assembly and deployment are quicker than conventional systems, and the reduced height enhances workplace safety and emergency response. Integration with renewable energy systems increases sustainability and offers a cleaner refining process. Moreover, this method provides high product precision and selectivity, improving fuel quality. Overall, this innovation addresses the environmental, economic, and technical challenges of current refining methods. It represents a transformative step toward a cleaner, more efficient, and more sustainable oil refining industry. **Novel/Additive Information:** This research introduces a transformative refining method based on the electromagnetic resonance frequencies of petroleum products, replacing traditional distillation tower. It presents a scalable, modular solution with significantly lower carbon emissions and energy demands, adaptable for offshore and regional use. By integrating renewable energy and advanced control systems, this technique can modernize refining infrastructure, making it safer, more sustainable, and economically accessible to developing countries and remote oilfields. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-143-SPE | | **Title:** | Operational Excellence Habit | | **Category:** | +8.11 Reliability, Availability, Maintainability, and Inescapability Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Operatioal Execellence | | **Keyword2:** | Asset Integrity | | **Keyword3:** | Process Safety | | **Authors:** | P. Grcev, ProcesSolve | | **Abstract:** | **Objectives/Scope:** As the energy sector transitions toward sustainability, integrating asset integrity and process safety is crucial for operational excellence. This paper aims to explore strategies that enhance safety, optimize performance, and ensure long-term sustainability. It will highlight best practices for aligning asset integrity with process safety to minimize risks and improve operational efficiency. **Methods, Procedures, Process:** This paper employs a multidisciplinary approach to examine the integration of asset integrity and process safety. By leveraging case studies, industry best practices, and technological advancements, it outlines the role of digitalization, risk-based maintenance, workforce training, and regulatory compliance in achieving operational excellence. The study will also explore predictive analytics and ESG-aligned strategies to demonstrate how energy companies can proactively manage risks while ensuring sustainability. **Results, Observations, Conclusions:** The findings highlight that an integrated approach to asset integrity and process safety significantly enhances risk management, reliability, and environmental sustainability. Digitalization, through AI-driven predictive maintenance and IoT-enabled monitoring, improves failure anticipation and asset performance. Risk-based inspection (RBI) and reliability-centered maintenance (RCM) contribute to extended asset lifecycles while reducing operational disruptions. A strong safety culture and workforce competency programs play a pivotal role in minimizing human error and fostering proactive risk identification. Regulatory compliance and ESG alignment not only ensure legal adherence but also reinforce corporate responsibility. By implementing these strategies, energy companies can achieve operational excellence while supporting the global energy transition. **Novel/Additive Information:** This paper presents an innovative approach by integrating emerging technologies with traditional safety and integrity management practices. It contributes to the body of knowledge in the petroleum industry by demonstrating how AI, IoT, and risk based methodologies can drive sustainable operations. The insights shared will help industry professionals adopt forward-thinking strategies to enhance safety, efficiency, and environmental responsibility. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-226-SPE | | **Title:** | Optimizing Oman LNG Turnaround Activities Through A Robust Flawless Management System. | | **Category:** | +8.11 Reliability, Availability, Maintainability, and Inescapability Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Quality, Flawless, Shutdown, turnaround | | **Authors:** | A. Al Jaafari, Oman LNG | | **Abstract:** | **Objectives/Scope:** Oman LNG (OLNG) is driven by its vision to be "The Best at What We Do" and its mission to produce, market, and deliver LNG safely, reliably, and profitably while contributing to the sustainable development of Oman and its people. A critical component in achieving this mission is the Turnaround (TA) campaign, which ensures the availability, reliability, and integrity of OLNG plants. This paper outlines the robust quality assurance and control practices implemented during these TA campaigns, with a focus on achieving a flawless turnaround with zero leaks. The TA Quality Lead's vision is to complete the documented scope of work within the planned timeframe, adhering to approved procedures and meeting functional requirements. The Turnaround Quality Assurance (QA) Plan is developed to ensure that every stage of the TA process is executed in compliance with established standards, good engineering practices, and safety protocols. This framework guarantees the plant's safe and reliable operation until the next TA cycle. **Methods, Procedures, Process:** The QA/QC framework follows a systematic approach through three key phases: pre-turnaround planning, execution, and post-turnaround evaluation. In the planning phase, comprehensive quality plans, risk assessments, and resource allocations are conducted. During execution, the team follows approved procedures, monitors progress, and enforces quality controls. Post-turnaround, audits are conducted to assess performance and document lessons learned for continuous improvement. **Results, Observations, Conclusions:** A cornerstone of OLNG's success in turnaround activities is its Flawless Management System (FMS). The FMS is designed to proactively identify and mitigate potential issues before plant startup, facilitating a smooth transition to steady-state operations. This system also fosters collaboration, enhances communication across teams, and incorporates best practices from previous turnarounds. **Novel/Additive Information:** Regular audits and inspections are integral to the QA/QC process, ensuring compliance with quality standards and readiness for plant startup. These activities not only validate the effectiveness of the turnaround but also highlight opportunities for process enhancements. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-268-SPE | | **Title:** | Tube Tech Fouling Removal Robot | | **Category:** | +8.11 Reliability, Availability, Maintainability, and Inescapability Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Tube Tech Fouling Removal Robot | | **Keyword2:** | Convection Bank Cleaning with ROV | | **Authors:** | M. Othman, PETRONAS | | **Abstract:** | **Objectives/Scope:** Convection section heater fouling is responsible for millions of dollars in lost revenue every year for facilities across the world. Fired heaters or furnaces consume expensive fuel to provide heat energy for the processes; if a fired heater is even one or two percent inefficient it can consume an additional million dollars in fuel over the course of a year. Fouling-related instabilities have a negative impact on performance, revenues, and CO2 emissions. With increasing pressure on operators to improve yields whilst significantly reducing emissions, Tube Tech has invested substantially in research and development to deliver the petrochemical industry’s most significant step-change in removing fouling from the external surface of convection sections. **Methods, Procedures, Process:** Tube Tech has developed a unique robotic system which restores heat transfer efficiency by removing at least 90% of fouling from the surface area of the asset. This is a dramatic increase in performance compared to traditional cleaning methods, which can only reach 20-30% of the surface area. A fired heater technical evaluation can also be completed to benchmark asset performance against design specifications, estimating in advance the performance gains and savings. The robot is programmed with information supplied by the plant, creating a visual representation of the bundle for Tube Tech technicians to utilize before each project begins. This information is used to select the best cleaning process, which can be pre-programmed into the robot, saving valuable time on-site. Once on-site, the robot is placed at the starting position on the tube rows of the exchanger. The system is remotely operated by a technician using pre-programmed information. The lance/arm penetrates deep between each row, reaching fouling within the bundle and using high-pressure water to precisely remove fouling. The precision of the descaling head reduces water consumption by up to 80%, compared with traditional manual jetting techniques. The robot features an HD camera which records images and videos for reporting and future maintenance purposes. **Results, Observations, Conclusions:** 1) Fuel gas saving = 68.25 kg per hour (2.7%) 2) CO2e reduction = 1405 MTPA per year 3) Stack temperature reduction = 17.11 degC (10.56%) Based on the collected data, it concluded that cleaning of the convection bank has provided substantial benefits to the asset owner in terms of fuel savings and its contribution towards Net Zero goals. **Novel/Additive Information:** 1) No man entry improves safety standards 2) Reduces CO2 emissions by up to 15% and NOx emissions by up to 30% 3) Improves thermal efficiency by up to 5%, on average 4) Real-time inspection and verification protect asset materials and requires a shorter outage period 5) Reduces water waste by up to 80% as the system uses far less volumes of water than traditional jetting techniques | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-407-SPE | | **Title:** | Catastrophic Failure Of Vertical Turbine Pump Due To Foundation Issue After 16 Hours In Operation. | | **Category:** | +8.11 Reliability, Availability, Maintainability, and Inescapability Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Objective | | **Keyword2:** | Process | | **Keyword3:** | Observation | | **Keyword4:** | Discussion/Action | | **Keyword5:** | Conclusion | | **Authors:** | M. Subramanian, Ruhrpumpen Global | | **Abstract:** | **Objectives/Scope:** EDP Pump is critical in Geothermal Plant as this pump will be in services when there was emergency shutdown in the power extraction. This case study represents the catastrophic failure of the EDP pump within 16 hours in services. EDP Pump is VS1 construction to handle the Geo Brine water at 09 BarG and flow rate of 160 T/hr. The EDP is sent to the Geo Brine Water back to reinjection when there is shut down in the power extraction. **Methods, Procedures, Process:** EDP pump installation and commissioning was taken care by the EU Customer and their appointed sub-contractor. Pump was started with discharge pressure 7.5 Barg. Flow rate 160 T/hr. and the vibration recorded at the Motor NDE was around 8 mm/sec. There was abnormal sound from the Pump during startup and the same was not registered. After running for 16 hours there was no flow from the pump and found the top shaft was free. **Results, Observations, Conclusions:** Found the pump 3rd column assembly was sheared along the pump hydraulic. With the help of Divers we managed to collect the pump complete assembly from the pond. We have analysis the FFT spectrum and found there was peak at < 1x. that given us clue about the foundation issue. Inspected the Pump foundation and the same was not in line with API 686 Ch 4 Guideline. There was no Epoxy grouting performed at 50 mm thickness and this location was filled with normal concrete cement. We found lot of air pockets over this surface. This pump construction is in Vertical orientation, running at 2950 rpm and so the foundation is very sensitive for the complete equipment performance. As the current foundation is not compliance to API 686 Chapter 4 guideline and so the same need to be review and upgraded. An Epoxy material used to provide a uniform foundation support and load transfer link for the installation of rotating machinery. Epoxies typically have over three times the compressive strength of cementitious grouts and tend to have a longer useful service life. Epoxy generally absorbs the abnormal forces developed by the rotation equipment and its acting as damper. **Novel/Additive Information:** After made necessary changes in the pump foundation this pump was commissioned and running normal with vibration < 2.0 mm/sec. Pump foundations are very sensitive and so we need to pay more attention during Equipment erection and need to ensure the proper grouting is done without any issue as long-term solution. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-443-SPE | | **Title:** | Optimizing Permanent Downhole Gauge (PDG) Performance: Insights From Application Mapping And Look-back Analysis | | **Category:** | +8.11 Reliability, Availability, Maintainability, and Inescapability Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Permanent Downhole Gauge (PDG) | | **Keyword2:** | Application mapping | | **Keyword3:** | Look-back analysis (LBA) | | **Keyword4:** | Reliability | | **Keyword5:** | Maintanence issues | | **Authors:** | W. Wan Mohamad, PETRONAS Carigali; S. Mohd Jeffry, Petronas Carigali Sdn Bhd | | **Abstract:** | **Objectives/Scope:** The objective of this paper is to enhance PDG (Permanent Downhole Gauge) deliveries and performance by conducting PDG application mapping and look-back analysis (LBA). The scope includes both domestic and international projects, focusing on identifying key parameters affecting PDG applications, determining reliability, and highlighting areas for improvement. **Methods, Procedures, Process:** The approach involves conducting PDG application mapping to provide an overview of PDG applications and identify main parameters affecting their performance. A look-back analysis (LBA) is performed to further analyze PDG installations, including types of PDGs, service providers, completions, well trajectories, and operating conditions. The process includes identifying failure and survival rates, analyzing data transmissions, and assessing reliability over time. Recommendations are provided based on the findings to establish a comprehensive framework for PDG applications. **Results, Observations, Conclusions:** Key findings indicate that 65% of total PDGs installed from 2004 to 2024 are still active and meeting technical requirements. Electric PDGs have shown notable reliability, with 80% remaining active after five years of installation. Specific examples include Company PC electric PDGs in Middle East (83% active) and Company S electric and electric+fibre PDGs (72% active). However, 35% of PDGs are inactive, with failures occurring within 0-10 years due to issues such as cable pinching, water ingress, and SAU system problems. The paper highlights the need for better maintenance contracts and thorough investigation reports to address these challenges. Recommendations include improving data transmission reliability and establishing robust maintenance plans. **Novel/Additive Information:** This paper presents novel insights into the reliability and performance of PDGs over a 20-year period, providing valuable data on failure rates and survival trends. The comprehensive analysis and recommendations offer new strategies for improving PDG applications, which can significantly benefit practicing engineers by enhancing operational efficiency and reliability. | |

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| |  |  | | --- | --- | | **Control Number:** | 25ADIP-P-451-SPE | | **Title:** | A Systematic Approach To ESP Surface Equipment Reliability Through Enhanced Preventive Maintenance Programs | | **Category:** | +8.11 Reliability, Availability, Maintainability, and Inescapability Challenges, Technologies, and Innovative Practices | | **Keyword1:** | Preventive Maintenance | | **Keyword2:** | ESP | | **Keyword3:** | Surface equipment | | **Keyword4:** | Innovation | | **Keyword5:** | Enahnced | | **Authors:** | O.M. Balkhair, M.A. Aldossary, Saudi Aramco | | **Abstract:** | **Objectives/Scope:** Electrical submersible pump (ESP) surface equipment plays a vital role in maintaining the overall system reliability and uptime, yet it is often exposed to different weather conditions that can affect the system reliability over time. Preserving the reliability and operability of surface equipment requires consistent and continuous maintenance. This paper highlights the importance of maintain the ESP surface equipment and explores the benefits of an enhanced preventive maintenance program to improve reliability, minimize downtime, and ensure a consistent operation. **Methods, Procedures, Process:** The enhanced preventive maintenance program (PMP) introduces a structured approach that integrates a detailed field procedure with a dedicated tracking and monitoring systems (TMS). This program outlines the minimum required tasks and ensured all fields activities are properly executed and logged. The monitoring framework, allows for accurate tracking of task by completion, progress updates, and follow-up actions. By adhering to predefined standards, this program promotes reliability, consistency, and operational transparency across the lifecycle of the surface equipment. **Results, Observations, Conclusions:** The enhanced PMP has significantly improved the reliability and performance of ESP surface equipment, including the ESP surface skid, transformers, and variable speed drives (VSDs). The program successfully managed to reduce unplanned system failures and extending the equipment overall lifespan, the program has contributed to a greater operational stability and reduced production losses. Moreover, the integration of a TMS ensured a consistent execution, timely follow-up, and daily visibility of all maintenance activities. This has enabled an enhanced decision-making process, improved resource utilization, and promoted accountability. This initiative emphasizes the importance of cultivating a culture of continuous improvement among workforce personnel’s accountability with set targets and key performance indicators (KPIs). Overall, the program has led to more efficient operations, reduced downtime, and a sustainable framework for continuous improvement in the maintenance of ESP surface equipment. **Novel/Additive Information:** Preventive maintenance is important to for avoiding unexpected issues and costly downtime. Allocating time and resources to a scheduled preventive maintenance program is justified, especially when compared to the high expenses and delays caused by sudden equipment failures requiring repairs or in worst cases a full replacement. Utilizing the TMS across all PMP tasks enhances the oversight and management of ESP surface equipment, helping ensure the consistently operate in optimal conditions. | |