Improving Gas Pipeline Sustainability Through Benchmarking: A Business Case

Abstract:
To align with national targets set by their governments, pipeline operators will require a roadmap to attain their net zero goals well in advance of the specified date. To achieve these goals, all players in the energy value chain, including pipeline operators, will need to effect major changes in a relatively short period of time. Details of how gas pipeline operators can drive sustainable changes in their organisations through benchmarking will be presented in this paper. To drive this change, there must be a fundamental understanding of the business model of a gas pipeline operator and the limitations of sustainable practice in this context. The following areas are considered critical when driving pipeline sustainability:

- Strategic repositioning to develop a roadmap for achieving Net Zero.
- Development of a new gas market for Hydrogen & Biomethane.
- Implementation of new policies to reduce greenhouse gas emissions.
- Highly effective leak detection & repair processes.
- A digitalisation capability that supports new practices to realise sustainability.

Emerging practices providing a platform for sustainability within pipeline operations will be outlined for each of the above areas, with examples of how benchmarking has been used to accelerate this process. The value of performance measurement and peer group benchmarking in enabling operators realise their sustainability agendas for the mutual benefit of all players in the energy value chain will be considered.

Introduction:
To align with national targets set by their governments, pipeline operators will require a roadmap to attain their net zero goals well in advance of the specified date. To achieve these goals, all players in the energy value chain, including pipeline operators, will need to effect major changes in a relatively short period of time. Details of how gas pipeline operators can drive sustainable changes in their organisations through benchmarking will be presented in this paper. To drive this change, there must be a fundamental understanding of the business model of a gas pipeline operator and the limitations of sustainable practice in this context. The following areas are considered critical when driving pipeline sustainability:

1. Gas Pipeline Sustainability & Challenges
2. Best Practices of European Gas Transmission System Operators
3. Case Study: Indian Gas Pipeline Operator

Sustainability in Pipeline Operations & Challenges:
The following areas are considered critical when driving pipeline sustainability.

Corporate Governance
Strong corporate governance will be required to not just develop a roadmap but manage the activities required to achieve sustainable operations. Many pipeline operators within Europe have started to adopt Environmental, Social, and Corporate Governance (ESG), by taking previous Environmental specialists from traditional Health, Safety and Environment departments and incorporating this function into a new organisation structure. This promotes sustainability at a corporate level within the organisation and keeps the focus on progress with ESG investments and day-to-day activities which will drive change.

New Gas Market for Hydrogen & Biomethane
Initiatives around the world aim to reduce dependence on imported fossil fuels and feedstock. Within Europe a project known as the Hydrogen Backbone will link Hydrogen producers with key industrial and domestic infrastructure to supply carbon free energy. Operators are still awaiting the final vision of the EU parliament on the future of hydrogen gas to decarbonise energy. The hydrogen backbone is a major project that will require cooperation to deliver the objectives. Incentives will be required to help Gas Transmission System Operators (TSOs) prepare for a decarbonised future.

Gas Distribution System Operators (DSOs) are leading the way on biomethane injection to the networks due to the ease of injecting small volumes at lower pressures compared to pressures required to directly inject into a TSOs pipeline system. More incentives are required, such as those available in Denmark which is currently leading the way in terms of biomethane injection into their systems. Subsidies provided through tariffs was the initial mechanism to drive fast growth in this area with a 10-year period of duration.[1] It

also requires close cooperation with TSOs to have the facility to reverse flow gas from DSOs in summer when domestic demand is low. In addition, there can still be issues with permitted water and oxygen content between different pressure classes of system which inhibits wider adoption until Network codes are more aligned.

New Policies to Reduce Greenhouse Gas Emissions

There are several key initiatives across Europe to tackle the effects of climate change and drive operators towards decarbonisation. One such example is new legislation, EU Article (2019/942) will force companies to carry out routine leak detection and repair (LDAR) programs and repair any leaks of 500ppm and above within 5 days or 1 month if additional maintenance planning is required to access the failed equipment.[2]

Frameworks for measuring and monitoring emissions have also been introduced to help drive improvements in data reporting. The Oil and Gas Methane Partnership (OGMP), a UN driven initiative, will require operators to implement new techniques for in-field monitoring of emissions to satisfy the reporting requirements within the framework.[3] More details on how European operators are adopting this framework are covered later in this paper.

Digitalisation Capability to Support New Practices in Sustainability

Operators are adopting a digitalisation capability that supports new practices to realise sustainability. This is not just achieved through software solutions to help implement new reporting frameworks, but also through incorporation of data science principles at gas pipeline operators. This will require additional staffing with relevant skills for both data science and data architecture design.

The challenges facing gas pipeline operators can therefore be summarised into three key areas to decarbonise operations:

- Methane Emissions Reduction
- Biomethane Injection
- Hydrogen Networks

An individual operator cannot deliver the ambitions of a country to reach Net Zero. Therefore, best practice sharing and networking between TSOs and other key energy intense industries is required to achieve effective decarbonisation of energy.

Best Practices in Methane Emissions Strategy

European Operators using our benchmarking forums have been discussing the implementation of Best Available Techniques (BAT) to measure and manage methane emissions. Some of the key activities in this area include:

- Periodic leak detection and repair campaigns (LDAR).
- Venting minimisation in compressor start/stop operational strategies.
- Preferential use of electrically operated or air operated valves and pumps compared to traditional natural gas actuated devices.

Gas TSOs also have ongoing R&D initiatives, with various entities such as the European Gas Research Group (GERG) to investigate the optimal technological solutions for in-field assessment of both bottom up and top-down measurement of methane emissions.[4]

Operators in Europe are also actively participating in trade associations, to increase knowledge and meet their commitments though:

- Gas Infrastructure Europe (GIE)
- MARCOGAZ
- The European Network of Transmission System Operators for Gas (ENTSOG)
- Oil & Gas Methane Partnership v2.0 (OGMP)

<u>OGMP v2.0 – Methane Emissions Reporting</u>

OGMP v2.0 framework is a comprehensive measurement structure to obtain a complete account of methane emissions at source reporting levels. More than 80 companies are involved at present with a mixture of:

- Upstream, midstream, and downstream operators
- Public, private, national and international Oil & Gas companies
- Operating Oil & Gas assets in over more than 30 countries

Partners of OGMP 2.0 include the UN Environmental Programme, EU, Environmental Defence Fund, and Climate & Clean Air Coalition. There is ongoing development of OGMP 2.0 compliance regarding:

- Commitment to implement robust measurement, reporting & verification system (MRV) to improve data transparency and accuracy.
- Platform for sharing experiences and knowledge.
- Setting ambitious goals in parallel with mitigation strategies.

Obtaining methane emissions data with both a bottom up and top-down approach is essential to attain level 5 which recognises the maturity of emissions inventory management. The levels within the framework are shown in Figure 1:

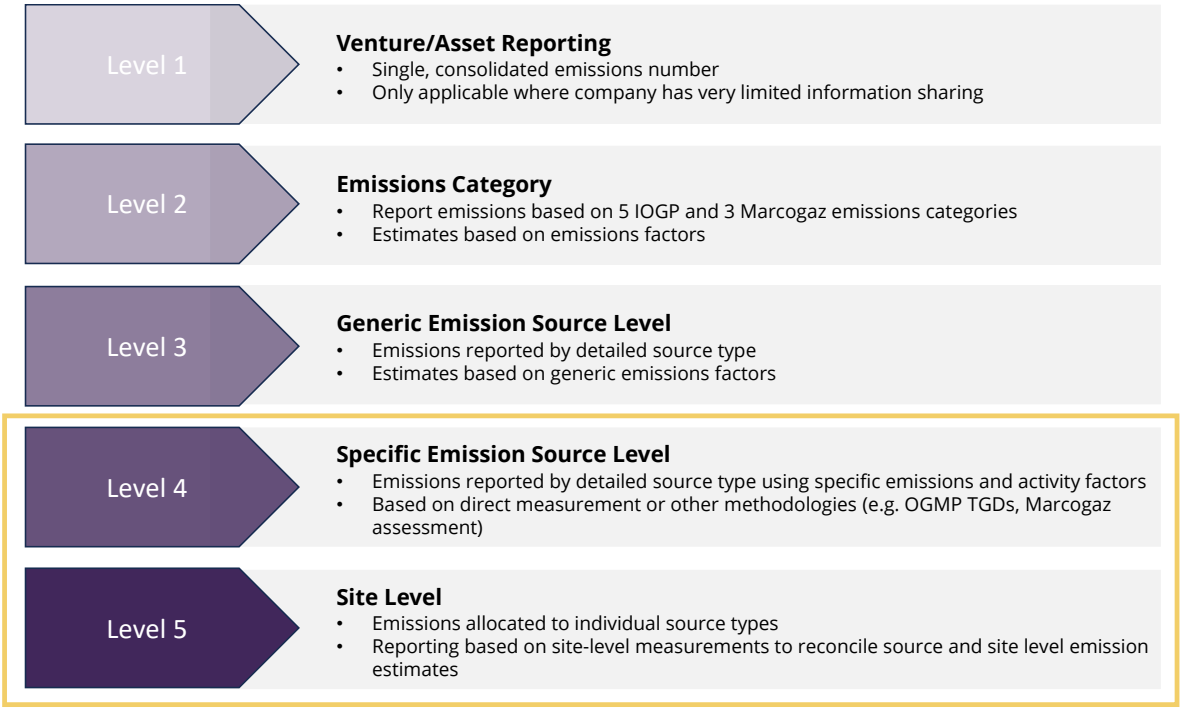

Figure 1: OGMP framework reporting levels.

Site Level Emissions Measurements

This is currently conducted by operators using aerial inspection campaigns. It is commonplace to use helicopter surveillance along the right of way and over installations for gas leak detection using ALMA (Aerial Laser Methane Assessment). This technology can help with rapid identification of critical points on where to focus ground investigations for sources of emissions. Data from the survey can typically be integrated into Maintenance Management tools to create an inventory of measured emission levels.

Gas Leak Detection

Following aerial inspection campaigns, it is recommended to reconcile ALMA data with in-field measurements. Typical "Bottom up" approaches involve use of drone technology and Optical Gas Imaging (OGI) camera surveys. OGI results give estimated values for concentration of methane in ppm which can be translated into an estimated leak rate in m^3 per hour using the EPA21 standard.[5]

Best Practices in Energy Efficiency:
Another area linked to a pipeline operator's carbon footprint is the energy intensity of gas operations. Based on a recent Juran Benchmarking survey of European Gas TSOs, all operators are committed to reducing energy intensity with the following goals:

- Targets to 2030 are around a 30% reduction in energy consumption.
- Targets to 2050 are typically a 50% reduction in energy consumption.

Most companies are linking energy efficiency with carbon footprint reduction strategies that include:

- Sourcing green certified imported electricity.
- Conversion to an electric vehicle fleet where practicable.
- Reduction of Scope 3 emissions through the supply chain, procuring green manufactured materials for example.
- Reduction in domestic energy consumption at offices.

There is currently a mixture of companies using primary (Scope 1) & final (Scope 1 & 2) energy consumption values when calculating efficiency. Companies are also reporting consumption at different levels within their asset base, the majority (60%) report this at an installation level at present:

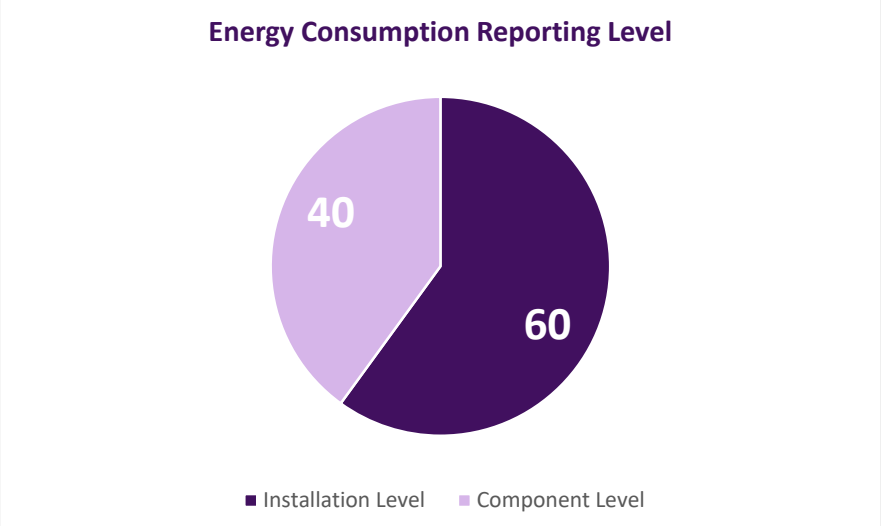

Figure 2: Energy Consumption reporting levels at Gas Pipeline Operators

The main problem facing all companies in Europe is balancing targets against changes in the security of the gas supply. Gas flows have changed significantly with the reduction of Russian gas supplied by pipeline. Targets are therefore hard to achieve versus a baseline set in previous years with a notably different flow regime brought on by increased importation of LNG injected into the local gas transmission grids.

Energy Efficiency – ISO 50001

Most European operators are certified to this standard or are working towards certification. The main benefit is that it provides a framework for monitoring of energy consumption. This helps to prioritise the energy efficiency projects which will result in the greatest impact to performance. Some examples from the European Operators of projects undertaken to reduce energy consumption include:

- Energy efficiency performance of buildings, vehicles and lighting.
- Reduction of setpoint temperatures at gas receiving stations.
- Installing higher efficiency heating systems.
- Changing hot stand-by to cold stand-by of heating systems in summer.
- Adjustment of feedback loops.
- Trigeneration from existing processes.
- Use of turbo expanders.
- Use of frequency inverters.
- Energy efficiency communication campaigns.
- Gas network efficiency operation tools.
- Use of external studies by specialists.

Operators, however, are not currently financially incentivised by their governments to invest in energy efficiency projects. Therefore, selection of projects to be carried forward will be those which result in the biggest impact to energy cost reduction, to maximise return on investment. Increasing the price of carbon credits is one action legislators could take so that certain projects that are currently not financially viable then become more attractive for operators to implement.

Case Study - Indian Pipeline Operator:

Juran Benchmarking has recently worked with a Gas Pipeline Operator in India to determine sustainability performance against a Global peer group of Transmission System Operators. Through benchmarking, opportunities were identified to improve energy efficiency related to Compressor Unit operations. Improving Compressor Unit energy efficiency would also support the company's drive to reduce CO_2 emissions.

The operator developed an action plan to reduce energy consumption and decarbonisation of its activities based on the findings of the sustainability benchmark:

Energy Efficiency – Proposed Actions

- Use of Turboexpanders for energy recovery.
- Mapping of compression process to improve the overall energy efficiency of the compressor fleet.
- Investigate options for waste heat recovery.

Decarbonisation – Proposed Actions

- Investigate the feasibility of adopting electric vehicles.
- Review options and feasibility to use motorising turbines and solar panels to generate electricity onsite.
- Injection of 5% hydrogen into fuel gas lines for gas turbine compressor units.

The operator is currently assessing the feasibility and costs/benefit analysis of each solution proposed.

Conclusion:

Gas Pipeline Sustainability poses many challenges and requires peer group performance measurement & technical collaboration. Best Practices can only be adopted through correct assessment of available technologies and adopting robust sustainability frameworks. Using benchmarking to conduct a gap analysis gives focus to operators and helps target sustainability initiatives which bring maximum value.

In this way Pipeline Operators can play their part in supporting their national governments to achieve Net Zero in their countries.

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