

# Barriers and Solutions of TPM Implementation In PNG Distribution Company

Prof. Chintan Barelwala<sup>1</sup> Jagdish Varotaria<sup>2</sup>,

<sup>1</sup>Asst. Prof., Department of Mechanical Engineering, Gandhinagar Institute of Technology, Gujarat (India),

<sup>2</sup>P. G. Student, Department of Mechanical Engineering, Gandhinagar Institute of Technology, Gujarat (India),

---

## Abstract

Total Productive Maintenance (TPM) has been recognized as one of the significant operation strategy to regain the production losses due to equipment inefficiency. Many organizations have implemented TPM to improve their equipment efficiency and to obtain the competitive advantage in the global market in terms of cost and quality. Many companies in India are implementing TPM with great vigor to become competitive - the one most important thing in today's uncertain scenario. This paper represents different barriers of TPM implementation faced by O & M department and solutions for effective TPM implantation in Sabarmati PNG distribution Company. For a gas distribution company, SAP & ERP offers important opportunities like solving problems linked with market deregulation, correct management of processes related to gas distribution and sales, thus increasing the company's chances to win the market competition.

**Keywords:** Total Productive Maintenance, Pareto Analysis, Fishbone Diagram, ERP, SAP Systems.

---

## 1. Introduction

TPM is intended to bring both functions (production and maintenance) together by a combination of good working practice, team working, and continuous improvement. Efficiency and effectiveness of equipment plays a dominant role in modern manufacturing industry to determine the performance of the organizational production function as well as the level of success achieved in the organization. [1] The impact of equipment efficiency has become more and more critical as the widespread utilization and application of highly sophisticated and automated machines in the industry increases. The maintenance of these complicated equipment and machines thus became very crucial and costly to manufacturers. Many organizations began to realize that the continuity of this excellent performance must be supported by a strong backbone of efficient and effective equipment. [2] Traditional maintenance technicians are regarded as passive and non-productive to the current production function. Hence, implementing Total Productive Maintenance (TPM) in the manufacturing industry has emerged as an important operational strategy to overcome the production losses due to equipment inefficiency. TPM is an innovative approach, which holds the potential for enhancing the efficiency and effectiveness of production equipment by taking advantages of abilities and skills of all individuals in the organization. [3] TPM focuses on maximizing the Overall Equipment Efficiency (OEE) with involvement of each and everyone in the organization. It will not only establish a complete maintenance system, but also aims to improve the maintenance skills and knowledge among the shop floor operators. Now, TPM and its implications received prestigious worldwide recognition in achieving the ultimate *Zero Defects* and *Zero Breakdown* targets. [4]

This paper aims to assess the optimum TPM operational strategy which will increase the chances of a successful TPM implementation within a manufacturing organization in a developing country perspective. [5] At the same time, few implementation issues such as motivators, critical success factors and factors that inhibit the extent and success of TPM implementation in the PNG distribution sector will also be discussed.

## 2. A Gas Transport Application

Sabarmati Gas Ltd is Service One type of service Industry. The objective of Sabarmati Gas Ltd is to construct, operate and maintain natural gas distribution system to supply piped natural gas to various sectors i.e. Industrial, Domestic, Commercial and Transportation. Industrial demand comprises demand from small and medium scale industries.

The natural gases are a part of the mixture (salt water, gas and condensate - crude oil) which is extracted using wells from ores. After making the extraction from probe production, the mixture goes through a mixing line separation in a park where the liquid is separated from the gas. Afterwards, the gases get separated into high-pressure gas and low pressure gas. The next step is for the low pressure gas to pass through to the compressing station, where the pressure is raised to the accepted level because it must be reintroduced into the main pipe, which in turn goes into the measurement and control station. Here, the delivery parameters will be recorded, amounts to be shipped will be checked, and then the gas will be taken by the national gas transportation network. The resulting liquid from the separation station will go to a central park where it will be submitted to a new separation, the final results of all operations being gas, salt water and condensate. The gases will be again separated to high and low pressure gases:

- Low pressure gas will be sent to a compressor station, where, using specific processes, its pressure will be increased up to the allowed value in order to pass it to the network distribution;
- High pressure gas will be sent into the treatment plant gas where it will be divided in two: one part will go to gasoline plant (where for example the hydrocarbons will be removed from the gas) and another part will go to drying (where the water will be extracted from the gas).

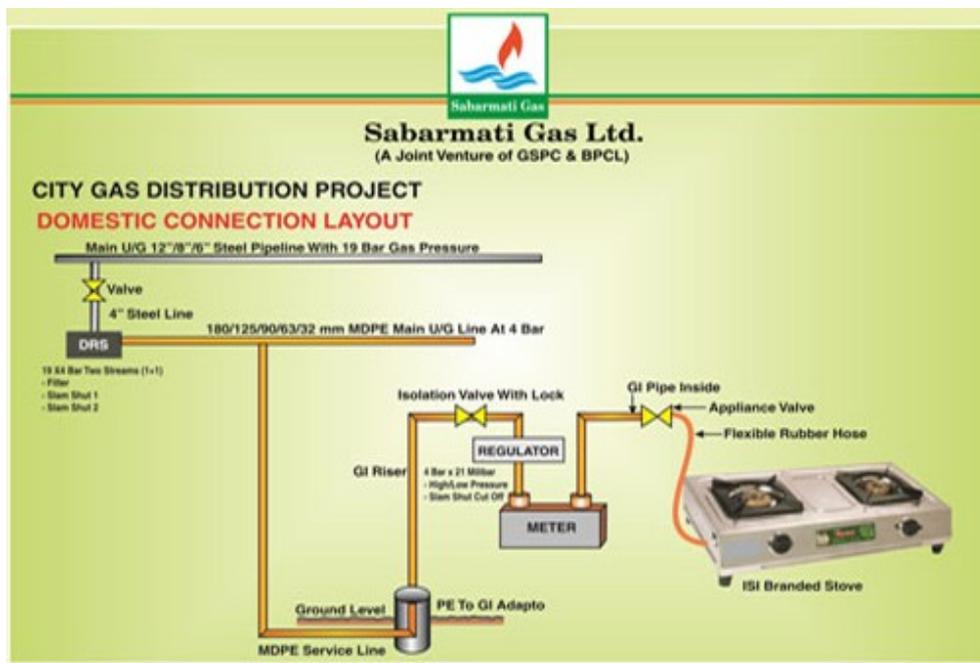


Fig.1. PNG Domestic Connection layout.

The gases then go to the measurement and control gas station and then to the national transportation network. Salt water will be used later for local injection into existing wells. There are two types of injection: technological injection (in oil layer directly) or residual injection (injecting water into a dead layer or into a defused probe). Condensation (crude oil) will go into a central warehouse, where it will be treated for impurities and water. After that it will be sent through a specialized network to a refinery. [9]

**3. Problem Statement**

Introducing TPM in a PNG distribution industry is still considered a major challenge due to several non-conductive environments in the adoption and implementation process. Lack of commitment and leadership from top management has always been discussed as one of the main factors that inhibit the implementation of TPM. On the other hand, resistance from the employee involved in the TPM program is also regarded as another major reason that explains why TPM fails in many local organizations. [6] Employees refused to endure extra maintenance responsibilities without any rewards, recognition or compensation. The following major challenges were there in front of us:-

Leakage Problems

To establish Quality Systems

Maintaining the health of the equipments

Customer's demand

### 3.1 Challenges of Maintenance Function

Operation and Maintenance department found some service related problems in routine work like,

- Daily complaints ratio very High
- Time duration in solving each complaint is more as compare guideline
- Alteration and modification work of domestic customers not satisfactory
- Alteration pending more then 3-4 months which not followed standard guideline
- Billing not proper as well as bill distribution problematic.
- Standard guide line not followed in Complaint solving, time duration and proper way

To overcome above challenges, TPM deployment played a critical role in improving people capability in an accelerated manner.

## 4. Research Methodology

Total Productive Maintenance is a structured equipment-centric continuous improvement process that strives to optimize production effectiveness by identifying and eliminating equipment and production efficiency losses throughout the production system life cycle through active team based participation of employees across all levels of the operational hierarchy. A structured survey approach has been used as the research strategy in this study to find out different problem in PNG distribution industry. Total Productive Maintenance (TPM) is a maintenance program, which involves a newly defined concept for maintaining plants and equipment. TPM focuses on maximizing the overall equipment efficiency with involvement of each and everyone in the organization. [7]

TPM and its implications received prestigious worldwide recognition in achieving the ultimate Zero Defects and Zero breakdown targets. TPM starts with 5S. TPM based on kaizen. Kaizen means Kai means change and Zen means good (for the better). Kaizen introduced the idea that employee expertise generates improvement. Which should be taking place all the time in every process involving every one- top management supervisors and workers? "Kaizen is a process oriented approach where efforts for process improvement are properly rewarded. It is a people oriented approach which promotes discipline participation and involvement, skill development, morale, motivation and communication. Achieve and sustain zero losses with respect to minor stops, measurement and adjustment defects and unavoidable downtimes. [8]

### 5.1 Impact Factor for Implementation of TPM

1. Leadership qualities, management improvement participation.
2. Organizational infrastructure.
3. Culture of collaboration and co-operation.
4. Linking TPM to business strategy & Linking TPM to Quality.
5. Project prioritization and selection Employee Training& Understanding of TPM methodology.
6. Linking TPM to Customers & employees & to create empowerment and authority at all levels.

## 5. Analysis of the Problem:

After analysis by Fishbone diagram and Pareto charts, it is found that which type of complaint comes maximum, and after that causes of that complaint is summarized by site visit, past data, visiting and taking review of customers and discussion

with technicians and shift supervisors who work there from several years.

It is observed that among different types of daily complaints some of the complaints ratio very high. First customer care executive was directly forward complaint to O&M department and Technician visit site and check about leakage. After discussion and analysis found solution if we can find leakage without visit to customer or only visit that complaint where chances of leakage high.

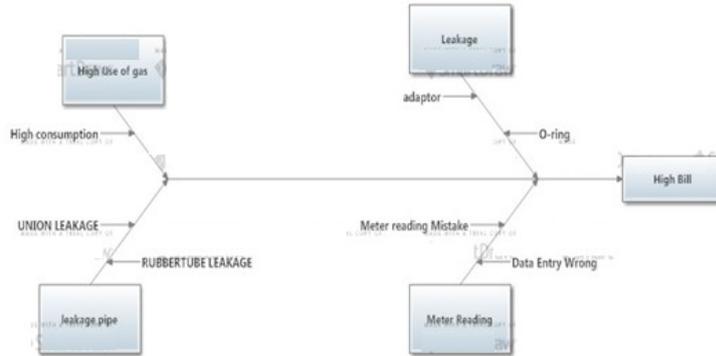


Fig. 2. Fishbone diagram of high bill complaints.

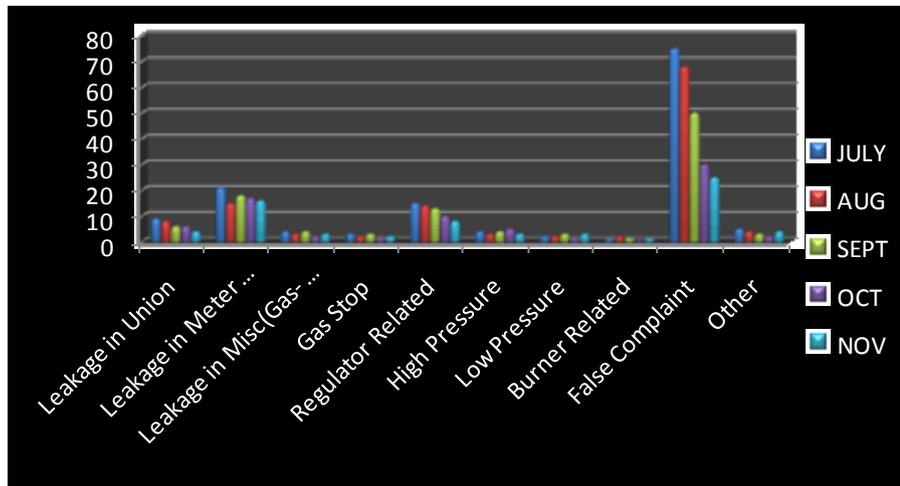


Fig. 3. Pareto chart analysis from July-2013 to Nov-2013 Domestic Complaints.

It is implemented after study and analysis of leakage complaints that when customer calling for high bill, customer care executive fellow ask for meter reading is proper or not. If Meter reading is ok then customer can easily check after use of gas at night time. If same meter reading customer noted at morning than chances of leakage very less. After analysis of manpower availability and work time noticed that shift schedule need to be change and prepared new shift schedule. Most of complaints come in between time 9AM to 5PM hence emergency complaints may come anytime but its frequency as compare routine complaints is less.

5.1 Use of CAD/CAM integrated ERP and SAP Systems

Driving business at a beginner stage in the industry with a small consumer base and partial geographical spread seems to be a smooth ride for many. Thereafter, phased business expansion for CGD companies always becomes complex and unwieldy, and influenced by many operational, economical and geopolitical factors, such as available gas supply, availability of national grid, existing operations stability, organization effectiveness while managing growing consumer services, available pipeline network and new consumer demand in awarded geographical areas. While addressing these challenges and risks associated with supply, consumer, infrastructure, and regulations, CGD operating companies need to

ensure complete visibility, control and effectiveness in their operations. In order to overcome these challenges associated with the operating environment and achieve faster time to market, ensure higher asset utilizations, mitigate risk and uncertainties in operations, and deliver best consumer services, there is strong need of strategic and differentiated approach while selecting right enterprise resource planning (ERP) solution for it.[6]

Current advances in information technology and, in particular, computer-aided design/computer-aided manufacturing (CAD/CAM) and enterprise resources planning (ERP) systems, have led organisations to undertake significant investments in these systems. Next generation manufacturers require both systems to maintain or gain a competitive advantage, reduce risks and improve productivity and viability. In addition, recent attention to the implementation of CAD/CAM systems highlights their important role in automating complex design and next generation manufacturing processes. In the next millennium more manufacturers are likely to implement CAD/CAM and ERP systems and hence issues in the integration of CAD/CAM with ERP systems must become a major concern. [9]

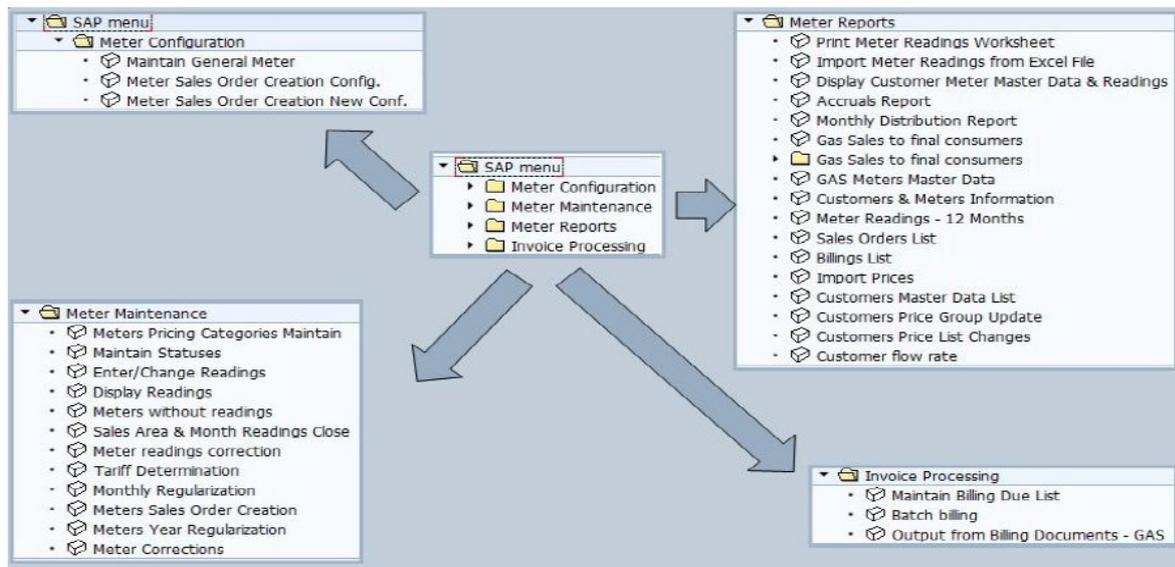


Fig.4. SAP Application Menu.

Performance Management is a data from all the maintenance work that was carried out. It will be extracted from the SAP system and stored in the SAP Business Warehouse (BW) for analysis and reporting. Performance Management is aims to enable the users to generate accurate reports to analyze the efficiency and effectiveness of their maintenance work. It is also to provide Operations Unit with a feedback mechanism to track their progress towards best practice. The application related to the gas transport and distribution management, inside a large Gas Distribution Company could be developed using Sap environment [10].

**6. Comparison between before and after implementation of TPM:**

There are two types of benefits we can get through implementation of TPM in PNG Distribution Company:

<i>Direct Benefits of TPM</i>	<i>Indirect Benefits of TPM</i>
➤ Overall Equipment Efficiency is improved.	➤ Confidence level of employees increases.
➤ Customer complaints reduced.	➤ A clean, neat and attractive work place.
➤ Reduction in the maintenance cost by 30%.	➤ Favorable change in the attitude of the operators.
➤ Satisfying the customer’s needs by 100 % & reduced accidents.	

### 6.1 Comparative performance of a distribution Line:

After implementation of TPM there are several benefits found in company and customer side. Before complaints of customer were not solved day by day but after implement it is possible to solve it day by day practice. Customers most of complaints regarding bill can be solved on effective way and false complaints can be reduced.

We noted the specific changes in number of reduction in particular area of gas distribution line are as mentioned below:

Major Problems	Before TPM	Changes After TPM
Leakage in Union	9	4
Leakage in Meter Adaptor	21	16
Leakage in Misc (Gas-Tap, TF etc)	4	3
Gas Stop	3	2
Regulator Related	15	8
High Pressure	4	3
Low Pressure	2	3
Burner Related	1	1
False Complaint	75	25
Other	5	4

*Table-I Comparative performance of a distribution Line.*

## 7. Conclusion

The fundamental objective of this paper has been to presents a novel methodology for the implementation of the Total Productive Maintenance (TPM) program in the PNG distribution industry. During research in GSPC gas distribution company we have compare before implementing TPM and after implementing TPM data and distort major problems by TPM based corrective action plan we have reduce 80% problems analyzed by pareto chart. Today, in our company, we are able to reduce breakdowns, improve quality issues, eliminate rework, suggest cost reductions and are part of the solution. As a result of these studies, not only increases the effectiveness of the gas distribution system but also increases the effectiveness of the entire organization through mandatory participation and continuously improves efficiency, delivery, health, safety and morale of the employees. Meanwhile, we had good cost savings and improvement in company culture.

## 9. References

- [1] McGraw-Hill.Ames, V. A. (1996). Implementing the Complete TPM Process. SEMATECH TPM/OEE Case Study Workshop, Tempe, AZ, SEMATECH.Ames, V. A. (2003). TPM Interview.
- [2] P.S. Ahuja, Pankaj Kumar, "A case study of total productive maintenance implementation at precision tube mills", Journal of Quality in Maintenance Engineering, Vol. 15 Iss: 3 pp. 241 - 258, 2009.
- [3] Prof. A.Bangar<sup>1</sup>, Hemlata sahu<sup>2</sup>, Jagmohan batham<sup>3</sup> (2013), Improving Overall Equipment Effectiveness by Implementing Total Productive Maintenance in Auto, *International Journal of Emerging Technology and Advanced Engineering*, 3(6), 590-594.
- [4]Fang, L. C. (2000). Implementing TPM in Plant Maintenance: Some Organisational Barriers, *International Journal of Quality & Reliability Management*, 17(9), 1003-1016.
- [5] Olayiinka S. ohunakin "TPM Implementation in a Beverage industry: A case study" Journal of Engineering and applied science 7(2):128-133, 2012
- [6] Banta, V.C. ; Cojocar, D. (2013), Development Center Tool a software application for change request management, System Theory, Control and Computing (ICSTCC), 17th International Conference, IEEE, 42-47.
- [7] Shimbun, N. K. (1995). TPM Case Studies, Portland OR: Productivity Press.
- [8] M. Mahajan, Industrial Engineering and Production Management, Dhanpat Rai & Co., 2012.
- [9] [http://www.ace.ucv.ro/analele/2012\\_vol2/01\\_Banta\\_Viorel.pdf](http://www.ace.ucv.ro/analele/2012_vol2/01_Banta_Viorel.pdf)
- [10] <http://www.informationweek.in/informationweek/news-analysis/176274/selecting-erp-city-gas-distribution-business>