ANALYSIS OF PURE ARGON GAS INVENTORY CONTROL USING MATERIAL REQUIREMENT PLANNING (MRP) METHOD AT PT NOV PROFAB INDONESIA

Alfina Nur'aini

Batam State Polytechnic
International Trade Logistics
Parkway Street, Batam Centre, Batam 29461, Indonesia
E-mail: alfinanuraini36@gmail.com

Abstract

The purpose of this study is to determine the planned amount of inventory and see the level of efficiency before and after using material requirement planning (MRP) with the lot for lot (LFL) technique on pure argon gas. This study uses quantitative research with the MRP approach. Data collection is carried out by means of documentation taken from the company's historical data from 2022 - 2024. The data collected is then processed to calculate storage costs and ordering costs. The results will be used for the calculation of Material Requirement Planning (MRP). MRP calculations are used to determine the amount of gas needed and the costs incurred, as well as to compare costs before and after the implementation of MRP. The results of the study show that the use of material requirement planning (MRP) can determine the planned amount of inventory needed and has proven to be efficient in its use for gas supplies at the NOV Profab Indonesia company.

Keywords :Material Requirement Planning (MRP), Lot Sizing, Lot for Lot (LFL), efficiency

1. Introduction

Batam City has various manufacturing companies, especially in the oil and gas sector, including drilling companies and the provision of tools and equipment needed by drilling companies and oil companies. These companies compete with each other to provide equipment and oil drilling both on land and at sea. (Hidayat Rusdi, 2021).

PT NOV Profab Indonesia is one of the fabrication companies in Batam which was established in 1998, has strict standards and high specification applications such as the oil and gas industry and mineral mining. PT NOV Profab Indonesia was built with the aim of producing products with the best quality and competitive prices in order to meet the needs and desires of customers. PT NOV Profab is located in Batam City on JL. Bawal Kav V, Batu Merah - Batam Island Indonesia (PT NOV Profab, n.d.).

PT NOV Profab has one of the strategies implemented, namely by providing efficient inventory as a basis for meeting production needs and providing the resources needed to produce products on time. One form of determining production inventory is by determining the raw material for pure argon gas. (PT NOV Profab, n.d.).

Pure argon gas is used by companies as a stock of auxiliary goods, namely goods or equipment used in the production process (Noviandi, 2021). Pure argon gas is a stable and rare gas that does not easily react with other elements As a protective gas (Setiawan, 2020). Pure argon gas is one of the important elements in various industrial activities. Its need is very crucial, so companies must ensure its timely availability.

One of the problems at PT NOV Profab Indonesia is the determination of less than optimal inventory and causing stock out or shortage of pure argon gas needs so that additional orders or additional PO (Purchase Order) occur. This will hamper the manufacturing process of a product produced so that the process cannot run effectively and efficiently.

Based on the data obtained, the following is the raw material inventory available in January - December 2023.

Tabel 1. 1 Gas Order and Usage Data 2023

	Data Pemakaian Gas satu periode (Bulan)												Satuan
	1	2	3	4	5	6	7	8	9	10	11	12	
Compressed Natural Gases (CNG)	81	76	57	34	45	79	30	76	64	57	45	31	Pallet
Jumlah Pemesanan	410					250			52				
MIXED GAS, 98% AR + 2% N2	0	0	0	0	0	64	32	0	32	0	16	16	Cylinder
Jumlah Pemesanan	700												
COMPRESSED PURE ARGON	48	58	30	60	76	95	108	132	129	119	100	86	Pallet
Jumlah Pemesanan	350					350			473				
COMPRESSED N2	4	6	5	5	5	3	3	5	10	4	4	3	Pallet
Jumlah Pemesanan	28								8				
COMPRESSED OXYGEN	167	170	153	88	119	104	84	132	113	114	93	103	Pallet
Jumlah Pemesanan	1.5												
DISSOLVED ACETYLENE	24	17	16	13	22	23	30	19	24	22	15	17	Pallet
Jumlah Pemesanan	350												

(Data *Purchase Order Receiving Journal* PT NOV Profab Indonesia)

In table 1.1 above, it can be seen that the company experienced a shortage of gas raw materials in the 6th and 9th periods. In one year, the company experienced a shortage of Compressed Natural Gases (CNG), Compressed Pure Argon, and Compressed Nitrogen raw materials so that the company had to open a new PO (Purchase Order) 2 times. Pure argon and oxygen gas are the most widely used gases, but oxygen gas does not experience a stock out, while the least used gas is mixed gas , 98% AR + 2% N2. PT NOV Profab Indonesia made a single order in a large amount, causing a buildup in inventory storage. Based on the problems above, it is necessary to conduct an analysis of optimal raw material inventory control for unstable needs.

There are several methods to determine inventory control, namely, economic order quantity (EOQ), which is to determine the most optimal purchase quantity, material requirement planning (MRP), which is to determine the planning of raw material requirements, and just in time (JIT) for on-time production (Ramadhan et al., 2023).

Based on previous research conducted Gulo et al., (2023) this MRP method helps companies to prepare the right schedule so that there are no obstacles in planning the procurement of raw materials needed for production. To overcome the above problems, the author will propose improvements to inventory control for raw material needs using the Material Requirement Planning (MRP) method. This method is suitable for the problems explained above, because it can see the forecast of raw material inventory and product components that can be managed on time, and can reduce the amount of stock out inventory. This method is used so that the production process can run smoothly according to the previously set schedule. Based on the background of the problem that has been explained, the author wants to conduct research with the title: "Analysis of Pure Argon Gas Inventory Control Using the Material Requirement Planning (MRP) Method at PT NOV Profab Indonesia ".

The purpose of this study was to determine the planned amount of pure argon gas inventory using the Material Requirement Planning (MRP) approach and to determine the level of efficiency before and after using Material Requirement Planning (MRP) in controlling pure argon gas inventory.

The problem limitation in this study was carried out at PT NOV Profab Indonesia, the object in this study is the supply and use of pure argon gas. This study will take the company's historical data regarding the supply of pure argon gas in 2022 - 2024. Data collection for the last 3 years was used because the company only used pure argon gas in 2022 and to determine the cycle of the lack of pure argon gas supply.

2. Theoritical Review

2.1 Definition and role of inventory

Inventory is material or goods that will be stored for a specific purpose, such as for use in the production process, assembly, or for resale(Aisyah Siti & Sumasto Fredy, 2020). These supplies can be in the form of raw materials, additional materials, semi-finished products, or finished products.

Inventory plays an important role in business operations which are managed in such a way that the company can avoid various possibilities that will endanger the inventory needed to manage inventory is called inventory management (Haslindah et al., 2020).

Inventory management is a method of managing inventory with the aim of being able to make the right order at the most optimal price. Inventory is the largest and most important asset of a company (Aisyah, S. & Sumasto, F., 2020).

Inventory management system is a set of provisions to determine the level of inventory that must be maintained. This method is very useful for production teams and efficient for various types of businesses..

2.2 Types of Inventory

In accordance with Haslindah et al.,

(2020)There are 5 types of inventory, namely:

a. Raw material inventory

These raw materials are supplies of raw materials that will be processed and used as basic components in the production process.

b. Product Inventory

Product inventory is in the form of materials or components purchased from other companies to form the main components and can be marketed as finished products.

c. Stock of auxiliary goods

Ancillary goods inventory is the form of goods or equipment used in the production process.

d. *Work – in – Process*

Work in Process is inventory of goods that have passed through stages in the production process but are not yet fully finished, because they are still waiting for the completion of the next stages of production, such as adding components, checking quality, or further assembly processes before they can be processed into finished products that are ready to be marketed.

e. *Finished Goods*

Finished Goods is inventory consists of goods that have been completely finished in production, where all stages of production have been passed including assembly, quality control, and packaging. In this context, these goods do not require any additional processes and are only waiting to enter the next stage, namely the shipping or distribution process according to the orders received from consumers.

2.3 Inventory Function

In accordance with Muhidin et al., (2020) Inventory has various functions that can increase flexibility in company operations. Inventory levels also allow companies to plan better and meet customer needs more efficiently, increasing customer satisfaction and increasing the company's competitiveness in the market.

The four functions of inventory are as follows:

a. Providing a variety of products to meet demand.

b. Division of several stages of a production process.

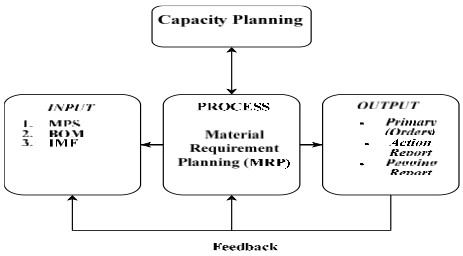
c. In order to take advantage of quantity discounts because purchasing in large quantities can reduce shipping costs.

d. Avoiding inflation and rising inventory prices can have various functions that make company operations more flexible.

2.4 *Material Requirement Planning* (MRP)

Material Requirement Planning (MRP) is a system designed to plan and schedule material requirements so that the production process can run smoothly. This system includes the stages of processing raw materials into finished products, which requires good time planning. In this process, precise rules are needed regarding when and how much material should be ordered for each item and the components needed in production (Gulo et al., 2023).

Figure 2. 1 MRP Work Process



Source: Ramadhan et al., (2023)

Input current or input used in the system *material Requirement planning* (MRP):

a. *Master Production Schedule* (MPS)

MPS is a summary of the finished product schedule for the coming period based on customer orders or demand estimates. In a production planning system, orders recorded in the Master Production are assumed to be reliable, even though they are only estimates.

b. *Bill of Material* (BOM)

BOM is a list of all materials, materials, and parts units and the quantities needed to produce a unit of

product or major components. MRP uses BOM as the basis for calculating the quantity of each material needed in each period.

c. *Inventory Master File* (IMF)

Inventory Master This is a file that contains information about the status of materials, components, subassemblies, and products that include the On-Hand, the quantity that has been allocated, the planned lead time, lot size, safety stock, lot size criteria, tolerance for waste or defective results, and various other important information related to inventory..

Basic steps of management MRP

a. *Netting* is a calculation process to determine the amount of net requirements for each period.

Net Requirement = Gross requirement – (Current inventory + scheduled reception)

b. *Lotting* clean needs the determination of the lot size that will ensure that all fitting requirements are met. Orders will be scheduled for completion at the beginning of the period in which there is a net requirement..

Lotting = Net Requirement – Quantity on Hand + *Safete Stock*

c. *Offsetting* is done to determine the ordering plan to meet net needs. The ordering plan is obtained by combining the initial availability of the desired lot size with the time capacity when the goods are ordered or produced until the goods are ready for use.

Planned Order Realease = Planned Order Delivery Date – Lead Time

d. Exploding is the process of calculating gross requirements for lower levels in a product structure and is based on the ordering plan.

Gross Requirement = Net Requirement X Quantity in BOM

To do this, it is necessary to first carry out forecasting or prediction.

Benefits MRP

The MRP method provides various benefits, including helping to improve service quality and customer satisfaction, optimizing the use of facilities and human resources, improving inventory planning and scheduling processes, and enabling companies to respond more quickly to changing market needs (Gabriel Elisabeth, 2023).

2.5 *Lot Sizing*

The lot sizing technique is a technique used to determine the size of the order quantity according to Jay Heizer (2013), MRP system is a very effective method for determining production schedules and net requirements in the production process. However, if you have net requirements, you need to make a decision about the amount to order. This decision is called lot sizing analysis technique used:

a) Lot for Lot

The Lot for Lot (LFL) method, or commonly known as the minimum inventory method, is based on the idea of having only what is needed, with the amount of inventory kept to a minimum. The amount of the order is the amount actually needed. This Lot-for-Lot results in no inventory being held back. Thus, the only cost incurred is the ordering cost. The assumption behind this method is that suppliers (either external or internal) do not require a specific lot size, with the aim that any lot size chosen will be able to be filled. The use of this technique can reduce the cost of carrying inventory for expensive items or items with low assembly costs and unsustainable needs..

b) Economic Order Quantity

According to Jay Heizer (2013) Economic Order Quantity (EOQ) is one of the oldest and most widely known inventory control techniques, this inventory control method answers

two important questions: when to order and how much to order. The EOQ mode can be applied if the following assumptions are met: demand for the product is fixed, uniform and known, the price per item of the product is fixed, the storage cost per item per year is fixed, the cost of each order is fixed, the time between ordering and receiving the items is fixed and there is no shortage.

$$EOQ = \sqrt{\frac{DS}{H}}$$

c) Periode Order Quantity

POQ is a lot size technique that places orders or quantities needed during a predetermined period. POQ is an order quantity that covers a certain demand for a certain distance. The quantity of each order is a recalculation at the time of the order and does not leave excess inventory.

$$POQ = \frac{Total\ Periode}{D/EOQ}$$

3. Research methods

This study will analyze the control of pure argon gas inventory using the MRP system. In this case, quantitative research will be used with the MRP approach.

3.1 Research Object

The object of this research will focus on the process of controlling pure argon gas inventory using the Material Requirement Planning (MRP) method and see how efficient the use of this method is in controlling pure argon gas inventory.

3.2 Sampling Technique

a. Population

Population is a group of people, events or anything that is studied. The author uses data on the level of inventory of pure argon gas at PT NOV Profab Indonesia as the population of this study.

b. Sample

This study uses sample data on pure argon gas usage in 2022 – 2024.

3.3 Data collection technique

This research method uses analysis to see the control of pure argon gas so as not to disrupt the production process due to a lack of pure argon gas. The data collection technique in this study is direct interviews with several related parties at PT NOV Profab Indonesia such as warehouse supervisors, logistics admins, procurement parties to obtain detailed information about pure argon gas inventory. Documentation or records connected to pure argon gas inventory management which include purchase records, gas usage data from the previous period, monthly inventory reports, and gas demand reports by production.

4. Research Result

4.1 Data collection

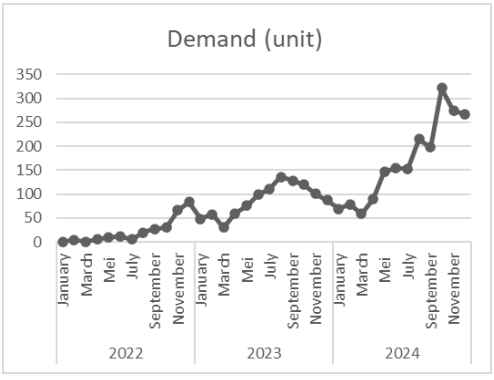
The data collected for this study is based on the amount of demand for pure argon gas from 2022 to 2024. The data that will be taken and processed in this study in a monthly period for one year. Pure argon gas data at PT NOV Profab Indonesia is as follows:

a. Unit prise of *pure* argon gas is Rp187.000,- / Pallet

b. *Lead Time* 7 day/order

The following is the author attachment of pure argon gas demand data in tabular form for 2022 - 2024.

Figure 4. 1 Demand data graph for 2022 - 2024



Based on the graph in Figure 4.1 above, it can be seen that the demand for the use of pure argon gas is unstable from year to year to month because the company only started using this gas in 2022.

4.2 Data processing

Data processing carried out in this study is based on the results of the data collection above, the author uses the Material Requirement Planning method in accordance with the formulation of the problem, namely to plan inventory and to see the level of efficiency of using the MRP method.

Table 4. 2 Interview result data

Name	Price Detail
1 Pallet Gas *Pure* Argon	Rp187.000,-
Shipping Cost for 1 Order	Rp500.000,-
1 minute Call Cost	RP500,-
Paper and printing costs	RP37.000,-
Internet Costs	Rp60.000.000,-
Land Cost/Meter	Rp138.000,-
Electricity cost	Rp750.000.000.-
Damage Costs	Rp561.000,-
Note	
Internet charges 5%	
Phone Charges take 10 minutes	
Land required for gas storage is 576M2. Storage costs for pure argon gas are charged at 15% of the total land.	

(Source : Interview Results)

Table 4.2 is information from the results of interviews conducted by the author during the internship. The author conducted interviews with several sources, the information from the table above was obtained by the author from the third source, namely the procurement department. Furthermore, the author processed the data from the information as follows:

a) Order Costing

Ordering costs are the total costs incurred to bring in goods from suppliers. These costs are the costs for each purchase such as shipping costs, telephone costs, employee costs, paper costs, printing costs, and internet costs.

Shipping cost

Shipping costs are costs incurred due to shipping from suppliers to PT NOV Profab. As seen from table 4.2, the company spends shipping costs per order of Rp500,000, - this cost includes loading and unloading of pure argon gas.

Telephone charges

Telephone costs arise due to the existence of telephone communication between suppliers and consumers for the ordering process. Referred to table 4.2, this cost requires 10 minutes of calling time/1 order with a required rate of Rp500/minute.

Total Phone Cost = Rp500 X 10 Minute

Total Phone Cost = Rp5.000,-/Order

Employee costs

Employee costs arise because the company must pay the workforce that prepares, sends letters, sends emails, and needs in ordering. The following is a table of employee costs in ordering activities.

Table 4. 3 Employee Costs

Batam UMK Salary 2024	Rp4.989.600,-
One Day Working Hours	8 hours/day
Work in 1 Month	22 Days
Phone Time, Print, etc.	1/2 hour (30 minutes)

8 (1 Working day) x 22 day = 176 hour / month.

Rp4.989.600,- (UMK) / 176 hour (month) = Rp28.350,- (hour).

Rp28.350,- x 0,5 = Rp14.175,- (30 minute).

So, the cost required for labor for all ordering needs, takes 30 minutes at a cost of Rp. 14,175,-/Order

Paper and printing costs

The cost of paper and printing arises due to the use of paper and the cost of printer ink. This cost uses 4 sheets of paper with a total cost of Rp37,000,-/Order

Internet costs

In table 4.2, it can be seen that the monthly internet cost is Rp60,000,000,- the internet cost incurred for sending emails to gas suppliers is charged at 5% of the total monthly cost. The following is the calculation of the internet cost for sending emails to suppliers:

Internet costs = 5 x Rp60.000.000,-

$$= \frac{100}{6} \times Rp3.000.000,-$$

Internet costs = Rp500.000,-/Month

So, the total internet cost for ordering all gas is IDR 3,000,000,- for the total internet cost specifically for pure argon gas is IDR 500,000,-/Month

b) Determine Strorage Cost

Storage costs arise due to costs incurred in the process of storing materials, finished products, and semi-finished products. The costs incurred include land rental costs, employee costs, damage costs, electricity costs, and others.

Warehouse rental fee

The cost of renting a warehouse during the storage period of pure argon gas is Rp138,000,-/M^2. Storage of pure argon gas requires an area of 576M^2. The cost charged by the company for renting pure argon gas land is 15% of the total cost.

Land lease = Rental expenses x Monthly land rent

$$\text{Land lease} = \frac{15}{100} \times Rp138.000,-$$

$$= Rp20.700,-$$

Land lease = Rp20.700,- x 576M^2

= Rp11.923.200,-/Month

Damage costs

This cost arises for costs if damage or defects occur during the storage of pure argon gas. The company assumes a cost of Rp561,000,-/month.

Employee costs

This employee cost arises to pay for labor in the field or warehouse. For this cost, the company has assumed a 20% charge on the storage cost of pure argon gas.

Employee cost = Rp4.989.600,-

Employee cost = Percentage of cost burden x UMK

$$\text{Employee cost} = \frac{20}{100} \times Rp4.989.600,-$$

= Rp997.920,-/Month

Electricity costs

This electricity cost arises for lighting needs and others. This electricity cost is charged at Rp. 750,000,000,-/month, which is 1% of the total cost.

Electricity cost = Percentage of cost burden x 1 month electricity costs

$$\text{Electricity cost} = \frac{1}{100} \times Rp750.000.000,-$$

$$= \frac{Rp7.500.000,-}{6}$$

Electricity cost = Rp1.250.000,-

So, the total electricity cost for the entire gas storage cost is IDR 7,500,000,- and the total storage cost for pure argon gas is IDR 1,250,000,-/Month

4.3 Company policy

Determine inventory costs

Total inventory for pure argon gas needs in 2022 in units of 262 Pallets, in 2023 as many as 1054 pallets, and in 2024 as many as 2026 pallets. The frequency of orders in 2022 is 6 orders, while in 2023 as many as 3 orders, and in 2024 as many as 2 orders. The following is a calculation to determine inventory costs.

Total Cost = Storage Cost + Ordering Cost

Purchase cost

Purchase of pure argon gas in pallet units for Rp. 187,000,-

Purchase cost in 2022

262 pallet x Rp187.000,- = Rp48.994.000,-

Purchase cost in 2023

1054 pallet x Rp187.000,- = Rp197.098.000,-

Purchase cost in 2024

2026 pallet x Rp187.000,- = Rp378.862.000,-

Booking fee

Order costs include shipping costs, telephone costs, employee costs, paper and printing costs, internet costs. Here is the calculation for order costs.

Booking fee

2022 booking fees

The ordering frequency in 2022 is 6 orders, here is the calculation of the ordering costs:

Order Cost = Shipping cost + Telephone cost + Employee cost + Paper and printing cost + Internet cost

Order Cost = Rp500.000 (6) + Rp5.000 (6) + Rp14.175 (6) + Rp37.000 (6) + Rp500.000 (12)

=Rp9.337.050,-

2023 booking fees

The frequency of orders in 2023 is 3 orders, the following is the calculation of the order costs:

Order Cost = Shipping cost + Telephone cost + Employee cost + Paper and printing cost + Internet cost

Order Cost = Rp500.000 (3) + Rp5.000 (3) + Rp14.175 (3) + Rp37.000 (3) + Rp500.000 (12)

= Rp7.668.525,-

2024 booking fees

The frequency of orders in 2024 is 2x orders, the following is the calculation of the order costs:

Order Cost = Shipping cost + Telephone cost + Employee cost + Paper and printing cost + Internet cost

Order Cost = Rp500.000 (2) + Rp5.000 (2) + Rp14.175 (2) + Rp37.000 (2) + Rp500.000 (12)

= Rp7.112.350,-

Storage costs

Storage costs include warehouse rental costs, damage costs, employee costs, electricity costs. Here is the calculation for storage costs:

Storage costs = Rp11.923.200,- (12) + Rp561.000,-(12) + Rp997.920,- (12) + Rp1.250.000,- (12) = Rp176.785.440,-

Total inventory cost

In inventory management, there are several types of costs that must be taken into account. All of these costs include the Total Inventory Cost (TIC/TC). This cost is calculated using a specific formula that covers all matters relating to the management of stock of goods (Putera et al., 2021).

Total Cost = Storage Cost + Ordering Cost

TC Year 2022

Rp9.337.050,- + Rp176.785.440,-

= Rp186.122.490,-

TC Year 2023

Rp7.668.525,-+ Rp176.785.440,-

= Rp184.453.965,-

TC Year 2024

Rp7.112.350,- + Rp176.785.440,-

= Rp183.897.790,-

Lead time

Company has been processing the delivery of ordered gas for 7 days after ordering, meaning the lead time for ordering pure argon gas is 7 days..

4.4 Forecasting

The demand forecasting results are obtained by processing demand data in the previous period that has been collected. The data collected starts from 2022 to 2024. The forecasting results can be seen in the following table:

Table 4. 4 2025 quantity forecast data

Year	Month	Demand (Unit)
2022	January	0
	February	4
	March	0
	April	6
	May	9
	June	12

	July	5
	August	20
	September	27
	October	30
	November	66
	December	83
2023	January	48
	February	58
	March	30
	April	60
	May	76
	June	99
	July	111
	August	136
	September	128
	October	120
	November	101
	December	87
2024	Januari	69
	February	79
	March	59
	April	90
	May	147
	June	154
	July	153
	August	215
	September	198
	October	321
	November	274
	December	267
2025	January	218
	February	225
	March	232
	April	238
	May	245
	June	252
	July	259
	August	266
	September	272
	October	279
	November	286
	December	293

It can be seen in table 4.4 the demand forecast in 2025 from January to December the result is no more than 300 pallets per month. This result is obtained using the linear forecast function formula.

4.5 *Material Requirement Planning* (MRP)

NOV Profab Indonesia Company previously used the gas inventory method by ordering gas as much as the amount of gas used last year by adding 10% of the inventory as their safety stock. The Lot for Lot method is used in this study because this method is known as a method that determines inventory according to what is needed only and this method is a method whose orders are adjusted to needs so that it does not produce inventory costs that are stored (Saputra et al., 2023).

Table 4. 5 MRP year 2024

Material Requirement Planning (MRP)				
Lot for Lot (LFL)				
Month Period				
Lead Time 7 Days				
	Dec-24			
	Week 1	Week 2	Week 3	Week 4
Gross requirement				
Scheduled Reception				
Quantitiy On Hand 0				
Net Requirement				
Order Acceptance Plan				
Planned Order				218

In the table above, the MRP table in December 2024 is used for ordering plans in the last week so that receipts are in accordance with the first week of January 2025.

Table 4. 6 MRP Table for Janury

Material Requirement Planning (MRP)				
Lot for Lot (LFL)				
Month Period				
Lead Time 7 Days				
	January			
	Week 1	Week 2	Week 3	Week 4
Gross requirement				
Scheduled Reception				
Quantitiy On Hand 0				
Net Requirement				
Order Acceptance Plan	218			
Planned Order				225

Based on table 4.4, the estimated gas demand in January is 218. This order was made in the last week of December 2024 so that the order was received right in January in the first week because the waiting time for the order is one week.

Table 4. 7 MRP Table for February

Material Requirement Planning (MRP)					
Lot for Lot (LFL)					
Month Period					
Lead Time 7 Days					
		February			
		Week 1	Week 2	Week 3	Week 4
Gross requirement					
Scheduled Reception					
Quantitiy On Hand	0				
Net Requirement					
Order Acceptance Plan		225			
Planned Order					232

Based on table 4.4, the estimated gas demand in February is 225. This is the same as the orders in the previous month, namely orders are made in the last week before entering the new month.

Table 4. 8 MRP Table for March

Material Requirement Planning (MRP)					
Lot for Lot (LFL)					
Month Period					
Lead Time 7 Days					
		March			
		Week 1	Week 2	Week 3	Week 4
Gross requirement					
Scheduled Reception					
Quantitiy On Hand	0				
Net Requirement					
Order Acceptance Plan		232			
Planned Order					238

Based on table 4.4, the estimated gas demand in March is 232.

Table 4. 9 MRP Table for April

Material Requirement Planning (MRP)					
Lot for Lot (LFL)					
Month Period					
Lead Time 7 Days					
		April			
		Week 1	Week 2	Week 3	Week 4
Gross requirement					
Scheduled Reception					
Quantitiy On Hand	0				
Net Requirement					
Order Acceptance Plan		238			
Planned Order					245

Based on table 4.4, the estimated gas demand in April is 238.

Table 4. 10 MRP Table for May

Material Requirement Planning (MRP)					
Lot for Lot (LFL)					
Month Period					
Lead Time 7 Days					
		May			
		Week 1	Week 2	Week 3	Week 4
Gross requirement					
Scheduled Reception					
Quantitiy On Hand	0				
Net Requirement					
Order Acceptance Plan		245			
Planned Order					252

Based on table 4.4, the estimated gas demand in May is 245.

Table 4. 11 MRP Table for June

Material Requirement Planning (MRP)					
Lot for Lot (LFL)					
Month Period					
Lead Time 7 Days					
		June			
		Week 1	Week 2	Week 3	Week 4
Gross requirement					
Scheduled Reception					
Quantitiy On Hand	0				
Net Requirement					
Order Acceptance Plan		252			
Planned Order					259

Based on table 4.4, the estimated gas demand in June is 252.

Table 4. 12 MRP Table for July

Material Requirement Planning (MRP)					
Lot for Lot (LFL)					
Month Period					
Lead Time 7 Days					
		July			
		Week 1	Week 2	Week 3	Week 4
Gross requirement					
Scheduled Reception					
Quantitiy On Hand	0				
Net Requirement					
Order Acceptance Plan		259			
Planned Order					266

Based on table 4.4, the estimated gas demand in July is 259.

Table 4. 13 MRP Table for August

Material Requirement Planning (MRP)					
Lot for Lot (LFL)					
Month Period					
Lead Time 7 Days					
		August			
		Week 1	Week 2	Week 3	Week 4
Gross requirement					
Scheduled Reception					
Quantitiy On Hand	0				
Net Requirement					
Order Acceptance Plan		265			
Planned Order					272

Based on table 4.4, the estimated gas demand in August is 265.

Table 4. 14 MRP Table for September

Material Requirement Planning (MRP)					
Lot for Lot (LFL)					
Month Period					
Lead Time 7 Days					
		September			
		Week 1	Week 2	Week 3	Week 4
Gross requirement					
Scheduled Reception					
Quantitiy On Hand	0				
Net Requirement					
Order Acceptance Plan		272			
Planned Order					279

Based on table 4.4, the estimated gas demand in September is 272.

Table 4. 15 MRP Table for October

Material Requirement Planning (MRP)					
Lot for Lot (LFL)					
Month Period					
Lead Time 7 Days					
		October			
		Week 1	Week 2	Week 3	Week 4
Gross requirement					
Scheduled Reception					
Quantitiy On Hand	0				
Net Requirement					
Order Acceptance Plan		279			
Planned Order					286

Based on table 4.4, the estimated gas demand in October is 279.

Table 4. 16 MRP Table for November

Material Requirement Planning (MRP)					
Lot for Lot (LFL)					
Month Period					
Lead Time 7 Days					
		November			
		Week 1	Week 2	Week 3	Week 4
Gross requirement					
Scheduled Reception					
Quantitiy On Hand	0				
Net Requirement					
Order Acceptance Plan		286			
Planned Order					293

Based on table 4.4, the estimated gas demand in November is 286.

Table 4. 17 MRP Table for December

Material Requirement Planning (MRP)					
Lot for Lot (LFL)					
Month Period					
Lead Time 7 Days					
		December			
		Week 1	Week 2	Week 3	Week 4
Gross requirement					
Scheduled Reception					
Quantitiy On Hand	0				
Net Requirement					
Order Acceptance Plan		293			
Planned Order					

Based on table 4.4, the estimated gas demand in December is 293.

Total *cost* = Storage costs + Booking fee

(0 x Rp176.785.440,-) + (12 + Rp1.056.175,-)

= 0 + Rp12.674.100,-

= Rp12.674.100,-

4.6 Price Comparison

Price comparison is used to see how efficient inventory prices are before and after using Material Requirement Planning (MRP).

Table 4. 18 Inventory price comparison

Year	Total Inventory Cost	Order Frequency
2022	Rp186.122.490,-	6x
2023	Rp184.453.965,-	3x
2024	Rp183.897.790,-	2x
2025	Rp12.674.100,-	12x

Judging from table 4.7 above, the comparison of inventory prices from 2022-2024 shows that the total costs incurred are very large with a low ordering frequency, in contrast to the total inventory costs in 2025, which are lower than the previous year but the ordering frequency is high. This is because MRP with the LFL method has a work system that orders goods according to needs only.

The use of MRP with the lot for lot method has a positive impact on the company because it does not need to pay additional costs such as storage costs. The frequency of orders for inventory costs is fixed because this material is not affected by vendor rules, especially regarding shipping costs. So, no matter how much gas is ordered by the company, the cost will remain the same. The use of MRP can help companies save more on raw material costs, because this system can manage stock better, manage production properly, manage raw materials efficiently, and determine the right ordering frequency (Maesaroh & Yulia, 2022).

Table 4. 19 Purchase Price Comparison

Year	Unit	Purchase Price
2022	262 Pallet	Rp48.994.000,-
2023	1054 Pallet	Rp197.098.000,-
2024	2026 Pallet	Rp378.862.000,-
2025	3065 Pallet	Rp573.155.000,-

From the table above, it can be seen that the purchase price of pure argon gas from 2022 to 2025 continues to rise because the need is also increasing. Therefore, the cost of purchasing this gas can change, depending on the demand from the field/project.

5. Conclusion and Suggestions

5.1 Conclusion

In accordance with the objectives of this study, it is to determine the planned amount of Pure Argon Gas inventory using the Material Requirement Planning (MRP) approach and to determine the level of efficiency before and after using Material Requirement Planning (MRP) in controlling Pure Argon Gas inventory.

Based on historical data on the use and inventory costs of pure argon gas at PT NOV Profab Indonesia from 2022 to 2024, it can be seen that the amount of usage continues to increase every year, the company faces high storage costs. This has an impact on the high total inventory costs.

The application of the Material Requirement Planning (MRP) method using Lot for Lot (LFL) for inventory planning in 2025, the total inventory cost decreased significantly to IDR 170,696,400,- with an ordering frequency of 48 times for the need for 2,878 pallets of pure argon gas.

These results can be concluded that the application of the MRP method using LFL has proven to be efficient and is able to optimize inventory management, so that it is in accordance with the research objectives.

The limitation of this study lies in the limited information on prices, because actual price data is not allowed to be disseminated. Therefore, the validity and completeness of the data are highly dependent on the information provided by the company. This study only looks at the comparison of prices before and after the use of MRP to see the level of efficiency of MRP use.

The implication of this finding is that companies can reduce wasteful inventory costs, minimize the risk of running out of stock, and optimize the production process with more timely and appropriate ordering.

5.2 Suggestion

Based on the attached conclusions, the researcher will provide suggestions for companies that are expected to be used as material for inventory management considerations to determine pure argon gas inventory. Companies should try to implement gas inventory and gas ordering using the Material Requirement Planning (MRP) method with Lot for Lot (LFL) to find out the planned amount of inventory to minimize inventory costs so as to avoid waste on inventory costs.

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