FORECASTING SALES OF PREMIUM OIL FUEL, PERTALITE, PERTAMAX, PERTAMAX TURBO AND BIO SOLAR USING THE METHOD EXPONENTIAL MOVING AVERAGE (EMA) (CASE STUDY: KLAMPIS GAS STATION SURABAYA)

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ABSTRACK

Along with the development and progress of current technology, fuel oil is one of the basic needs for both industry and transportation, demands will this fuel service becomes very important, and pertamina as the material provider fuel oil, must be able to guarantee the availability and smoothness of fuel products oil. The purpose of this study is to predict the amount of premium sales, pertalite, bio solar, Pertamax, and Pertamax turbo at Klampis Surabaya gas station for 2018 by using the forecasting method Exponential Moving Average (EMA). Based on the results data processing carried out it can be concluded that the forecasting method that period 30 days are more accurate in predicting Premium, Pertalite, and Bio Solar 2018. And the 365 day period more accurate in predicting Pertamax, and Pertamax Turbo. Based on comparison of values MSE with MAPE, it can be concluded that using the MSE method to find values more good errors in this study. Based on the comparison of MSE values with MAPE, it can be concluded that using the MSE method to find better error valuesin this research.

Keywords: *Forecasting, Exponential Moving Average (EMA)*

1. INTRODUCTION

With development and technological progress, fuel oil (BBM) is a basic requirement in industry as well as in fields transportation that is increasingly having days the level of demand is increasing because of machines it requires fuel oil, to meet achievement of uniform fuel needs in various sectors. There are five types of BBM which is located in Surabaya Klampis gas station i. e. Premium, Pertalite, Pertamax, Pertamax Turbo, and Solar. Sales at the Klampis gas station Surabaya based on availability fuel oil supplies. If depleted inventory of consumers will switch to another gas station. But the problems are often occurs at lampis Surabaya gas station is often experiencing shortages of stock fuel oil. Then for resolve the problem the considered necessary to forecast forecasting sales of five fuels the oil in the Klampis gas station for the next few periods. Things that often happen with mistakesin forecasting is if the amount of production is produced too a lot while demand is small it will cause harm to the company and vice versa if demand is high while production a little disappointment will arise from consumer so that cause the company lost its customers. Method Exponential Moving Average used to make many trading strategies and use on many technical indicators. Where in it, the advantages of this strategy depend directly on period timed, used for moving from one time period to another the other. Based on the explanation that has been discussed, then in the final project proposal This research was conducted for forecasting Premium fuel oil sales, Pertalite, Pertamax, Pertamax Turbo, and Bio Solar at Surabaya Klampis gas station using method Exponential Moving Average (EMA).

2. METHODOLOGY

This research was divided into 6 stages, i.e. Requirement analysis, system design, Implementation, system testing, maintenance, Report writing. Need analysis On this Step author do data collection by taking it at a gas station Klampis Surabaya. From the process data that has been obtained will be analyzed.

a. Analysis System Design
   At this stage the writer perform data collection by picking up at the gas station Klampis Surabaya. From the process data that has been obtained will be analyzed.
b. System Design
   Author in This stage do design design system uses *Data Flow Diagram* and *Flow chart System.*
c. Implementation
   On this step author doing data translation or solving problems that are has been designed inward programming language. Language programming used is Java and uses compiler NetBeans IDE 8.0.2System Testing.
d. Testing
   This stage the author did testing is done with use *Mean square error* testing and *The mean absolute procentage error* to see the error rate.
e. Maintenance
   In This stages author To do *Maintenance* that done if there is *variable* new that added so that will done change on The system
f. Writing Report
   This stage the author makes report start from introduction until closing.

3. SYSTEM ANALYSIS AND DESCISSION DESIGN

Sales at the Klampis gas station Surabaya based on availability fuel oil supplies. When consumers run out of inventory will switch to another gas station. But the problem that often occurs in Klampis Surabaya gas stations are frequent experiencing a shortage of material stock burn oil. Then to overcome these problems are deemed necessary do forecasting forecasting sale of five fuel oils in the Klampis gas station for some period to come with use method *Exponential Moving Average.* The first step is to Determine constants, initial values previous ema, and specify data lastly, then count up forecasting by formula *exponential moving average.* For more details can be seen in the.
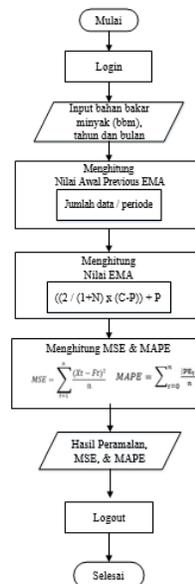
following 3.1 FlowChart Design System

3.1 Exponential Moving Average (EMA)

Exponential Moving Average usual also known by Exponentially Weighted Moving Average or ordinary abbreviated as EMA. EMA is a type moving average that adds weighting in the calculation of closing price movements. For long time span used weighting is getting smaller. More and more short span of time used, increasingly weighted application of usage this exponential moving average (EMA) to provide the most recent average grade from a security. Exponential indicator moving average (EMA) reduces the effect lagging which usually occurs in simple moving average (High school) with give weighting to the current price of the mass price then, therefore exponential moving average (EMA) moves faster compared to simple moving average (SMA). Formula for calculating indicators exponential moving average (EMA) is as follows:

$$EMA = (\frac{2}{1+N} \times (C-P)) + P$$

Where: C = Last sale per month

P = Exponential Moving Average Previous Period

N = Exponential Moving Period Average used Use EMA to read a trend can be seen in Table 3.1

Table 3.1 EMA position and its meaning

No.	EMA Position	Mean
1	EMA Below Standart Price	Bullish Condition / Up Trend
2	EMA Above Standart Price	Bearish Condition / Down Trend

3.2 MSE and MAPE

3.2.1 MSE

The way that is often used to evaluating the results of forecasting, namely with the Mean Squared Error (MSE) method.By using MSE, that error there shows how big the difference between the estimation results and the results will be estimated. As for a given the equation for calculating MSE formula :

$$MSE = \sum_{t=1}^{n} \frac{e_t{}^2}{n}$$

Where

et = periode error = Xt -Ft
Xt = actual data t period
Ft = forcasting result t period
n = amount of data

3.2.2   MAPE

A model has performance very good if the value of MAPE is at under 10%, and has a performance good if the MAPE value is in between 10% and 20% . The equation is given to calculate MAPE, namely:

$$MAPE = \sum_{t=0}^{n} \frac{|PE_t|}{n}$$

Where :

PEt = Precentage Error $= \frac{e_t}{X_t}$ x 100

et = Period Error = Xt -Ft
Xt = actual data t period
Ft = forcasting result t period
n = number of data

4. TESTING AND RESULT

Experiments carried out are forecasting process on year 2018. From Table 4.1 obtained forecasting results 30, 90, and 365 days Table 4.1 Forecasting Results 30, 90, 365 Days

Table 4.1 Forecasting Results 30, 90, 365 Days

BBM	30	MSE	MAPE
PREMIUM	143.992	0,143	8,363
BIO SOLAR	68.770	0,011	3,663
PERTALITE	247.869	0,156	4,461
PERTAMAX	96.542	0,320	19,718
PX TURBO	16.382	0,026	41,359

BBM	90	MSE	MAPE
PREMIUM	431.963	22,466	38,700
BIO SOLAR	206.306	0,382	17,473
PERTALITE	743.594	3,921	28,719
PERTAMAX	289.621	0,297	16,902
PX TURBO	49.141	0,013	25,750

BBM	365	MSE	MAPE
PREMIUM	1.751.829	11,973	32,991
BIO SOLAR	836.681	0,264	15,181
PERTALITE	3.015.667	2,727	22,777
PERTAMAX	1.174.563	0,107	8,569
PX TURBO	199.283	0,005	12,524

From the table of forecasting results obtained can be concluded that a more accurate 30 day period in Forecast Premium, Pertalite, and Bio Solar 2018. And the 365 day period more accurate in predicting Pertamax, and Pertamax Turbo. Based on comparison of MSE values with MAPE, it can be concluded that using the MSE method to find better error values in this research. using method *Exponential Moving Average* for reference accuracy of forecasting processes.

5. CONCLUSION

There are Conclusions obtained at this research is:

a. Forecasting results from each - each year fuel oil on 2018 Klampis Surabaya gas station:
- Premium: 2,757,620.20 Liters
- Pertalite: 990,225.43 Liters
- Bio Solar: 2,527,899.71 Liters
- Pertamax: 1,156,439.83 Liters
- Pertamax Turbo: 186,293.13 Liters

b. System implementation yields prediction of the amount of material sales burn premium oil, pertalite, bio solar, Pertamax, and Pertamax turbo at Klampis Surabaya gas station.

c. System implementation usingMethod *Exponential Moving Average* can run well For predicted total sales of fuel oil.

d. From the table of forecasting results obtained can be concluded that a more accurate 30 day period in predict Premium, Pertalite, and Bio Solar 2018. And the period 365 days more accurate inside predicted Pertamax, and Pertamax Turbo. Based on comparison of MSE values with MAPE, it can be concluded that using the MSE method for look for error values better in this research.

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