SINTEK JURNAL: Jurnal Ilmiah Teknik Mesin
ISSN: 2088-9038, e-ISSN: 2549-9645
Homepage: http://jurnal.umj.ac.id/index.php/sintek

ANALYSIS OF BOILER MACHINERY MAINTENANCE USING OEE (OVERALL EQUIPMENT EFFECTIVENESS) METHOD IN TAHU ASIN SINAR BANDUNG FACTORY

Iwan Nugraha Gusniar[1], Rio Sandy[1,*]
[1]Mechanical Engineering, Faculty of Engineering, Singaperbangsa Karawang University
Jln. HS. Ronggo Waluyo, Puseurjaya, Telukjambe Timur, Karawang, Jawa Barat 41361

[*]E-mail: 1810631150044@student.unsika.ac.id

Accepted: 21-08-2021 Revised: 26-11-2021 Approved: 01-12-2021

ABSTRACT

The boiler engine is one of the strategies in increasing the efficiency of energy use, especially in the process of making tofu, the boiler works as a chemical (potential) energy conversion engine from fuel to heat energy in the form of steam by heating the fuel for that the boiler may always operate with optimal performance. The purpose of this study is to determine the effectiveness of the boiler machine during production, the effectiveness values include availability, performance rate and quality rate, the data analysis method is carried out with the overall method of equipment effectiveness using weekly data, after doing research, the availability value is 89.7%, The value of the performance rate is 87.9%, the engine quality rate shows a result of 99.9%, and the results of the calculation of overall equipment effectiveness are 78.51%, it can be concluded that this value has not reached the standard or in other words the boiler engine needs to be reworked time management good production from time of machine operating availability (availability) as well as boiler machine performance from production (performance rate) to increase the value of overall equipment effectiveness (OEE).

keywords: boiler machine; overall equipment effectiveness; avaiability; performance rate; quality rate.

1. INTRODUCTION

Tahu asin sinar bandung is one of factory which is engaged in food production, in processing raw materials into finished goods soybeans like tofu salty require a source of heat in their production operations.

The mini boiler machine is one of the strategies in increasing the efficiency of energy used, the boiler functions as a chemical energy conversion engine (potential) from fuel into heat energy in the form of steam by heating the fuel, the boiler consists of 2 components, namely the combustion chamber as a tool to convert energy chemical energy into heat energy and an evaporator which converts combustion energy into steam potential energy.

Boilers are required to always operate generate steam in order to smooth production and for machines that require hot steam is pressurized, for the performance of the machine boiler should be noted that not decline that can cause damage (breakdown) which eventually result in loss operation time (downtime) [1] .

The problems that arise as a result of *downtime* is an effect on the delay in production , loss of time effective to produce up to affect the productivity of the company, in addition to the damage also resulted in expenditure costs be increased to repair the machine [1].

In connection with things that do Data analysis boiler machine for the production is very important to do right maintenance and prevention [2].

Research that is ever done by Fuji Sriharti (2020). With analyzing treatment machine stamping using methods TPM, PT Tri Jaya Engineering Karawang , then obtained the value of the Availability highest at 89.69%, Performance rate is 99.3% , Quality rate is the highest 99,58% and OEE amounted to 82.035% [3].

Other research also been carried out by Daeng. Analyzing the maintenance of boiler machine at PT. Dewa Rencana Perangin Angin factory using methods of OEE with the presentation of data used per month, obtained the value of OEE highest at 74.35%, the value of the Performance rate indicates a value which is perfect is 100%, availability ratio is high, namely at 75.46%. and Rate of quality in the month of April was the largest that is at 100% [1].

Based on the above research, than the author would lift study case analysis of boiler machine using methods of OEE in tahu asin sinar bandung factory with the presentation of data per weekly.

The Purpose of the research is to determine the value of the availability of the boiler machine production (availability), the performance of the boiler machine from the time of production (performance rate), quality rate of boiler machine during operation and the value of OEE.

OEE is a method of analyzing the data to determine and identify how the magnitude of the effectiveness which is owned by the equipment or machines in production at the time are really productive, to calculate the value of availability, performance rate and quality rate [2] .

This below is the standard world value of each variable.

Table 1. The value standard world of overall equipment effectiveness

OEE Factor	World Standard
Availability	90%
Performance	95%
Quality	99.9%
OEE	85%

Availability (AV)

To determine the value of the Availability used equation as follows :

$$\text{AV} = \frac{Running\ time - planned\ downtime - days}{Running\ time - planneed\ downtime} \times 100\% \quad (1)$$

Performance Rate (PF)

The data needed to calculate the performance rate is the operation time data per week, from the actual production data per week, and the ideal cycle time of the product [4]. To calculation of performance rate that is used is the data as follows:

$$PF = \frac{production\ number\ x\ ideal\ cycle\ time}{operation\ time\ effective} X100\% \quad (2)$$

Quality rate (QR)

The data used to calculate the quality rate is data on the total number of production in one week and reject data [4]. Data products that qualify for testing quality without do repair up first and immediately able to enter into the process further [5]. using the following equations:

$$QR = \frac{total\ production - reject}{total\ production} X100\% \quad (3)$$

Overall Equipment Effectiveness (OEE)

The relationship of the three components that called the value of the effectiveness of the production on the machine boiler [4]. can be use the formula below:

$$OEE = \text{Availability(\%)xPerformance rate(\%)} \text{ x Quality rate (\%)} \quad (4)$$

2. METHODS

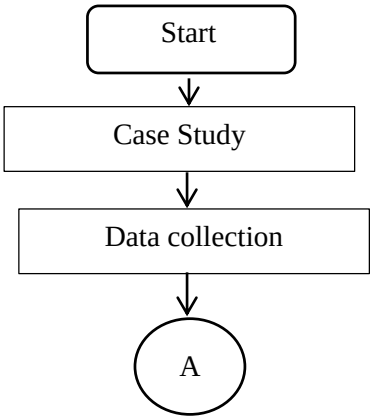
The methods of taking data is do in Tahu Asin Sinar Bandung Factory were is in Gg. Cibuntu, Sarimulya, Kec. Kotabaru, District Karawang, Jawa Barat 41374, Indonesia, Cikampek by using three methods, namely:

Observation, A method of collecting data is done by way of observations in the field are directly.

Interview, A method of collecting data by asking directly to the parties who are involved in operating the machine boiler as boiler operators.

Literature study, Is a method of collecting data by looking for references containing studies and theories related to existing problems.

The meode in the study were used as shown in the figure 1.



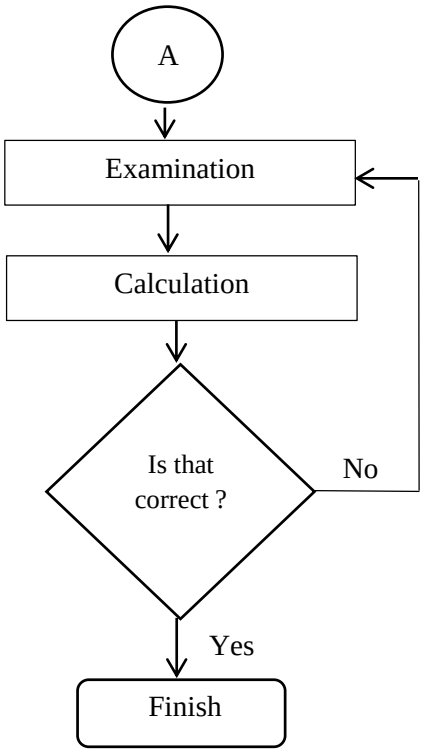


Figure 1. Method Of Research

3. RESULTS AND DISCUSSION

For calculation of overall equipment effectiveness) Taking data in Tahu Asin Sinar Bandung Factory are based of data production in May 2021.

Availability (AV)

To calculate the availability required running time is the time of production without expensive downtime that occurs [6]. in the factory knew salty ray duo is operate the machine 10 hours of work during the 7 days, Having obtained the value of running time each week and or the planned time in Friday during 1.5 hours, then the availability calculation can be done, For example, the calculation of availability y ang used is the data in the first week, to enter a value as follows:

$$\text{AV} = \frac{Running\ time - planed\ downtime - days}{Running\ time - planned\ downtime} \times 100\%$$

$$= \frac{70 - 1{,}5 - 7}{70 - 1{,}5} X100\%$$

$$= 89{,}7\%$$

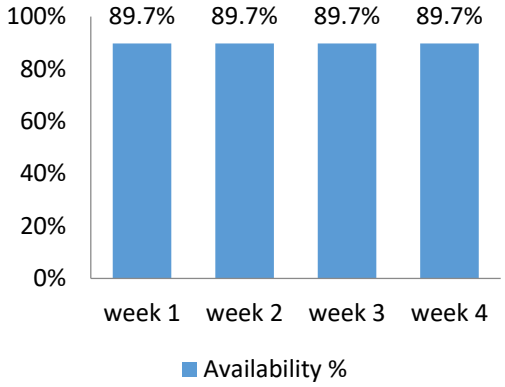


Figure 1. Diagram results of calculations availability

From the results of table calculation at the top in get grades *availability* average is in under standard OEE is 89.7% as shown in Table 1 standar world of OEE is at least 90 %. factors that affect the availability value are the obstacles to the production process [10]. Both in terms of humans and machines [9].

Performance rate (FR)

The data needed to calculate the performance rate is the data operation time (time operating effectively) [7]. As long as the running time per week is over 70 hours of operation per week, the data of actual production per week amounted to 44590 , and the time cycle of the ideal product for 0.00138 hours, For example, the calculation of performance rate used data in the first week with entering the values as follows:

$$PF = \frac{production\ number\ x\ ideal\ cycle\ time}{operation\ time\ effective} X100\%$$

$$= \frac{44590\ x\ 0{,}00138}{70} X100\%$$

$$= 87{,}9\ \%$$

The result of the calculation of performance rate is 87.9% in other words, as the figure 3 shows, value is not ideal, based on a standard OEE for performace rate is 95%.

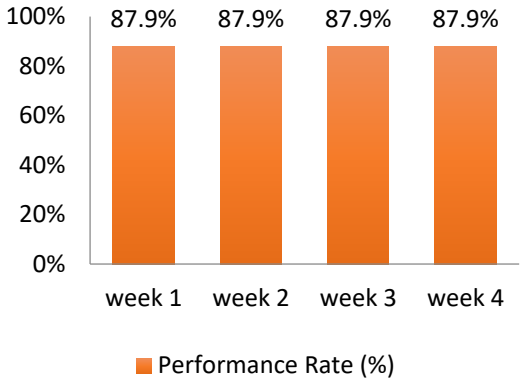


Figure 2. Diagram of performance rate calculation results

Quality Rate (QR)

The data used to calculate the quality rate is the data amount of the total production in one week and the data reject [8]. For example, calculation of quality rate used data in the first week, to enter the value as follows:

$$QR = \frac{total\ production - reject}{total\ production} X100\%$$

$$= \frac{44590-34}{44590} X100\%$$

$$= 99{,}92\%$$

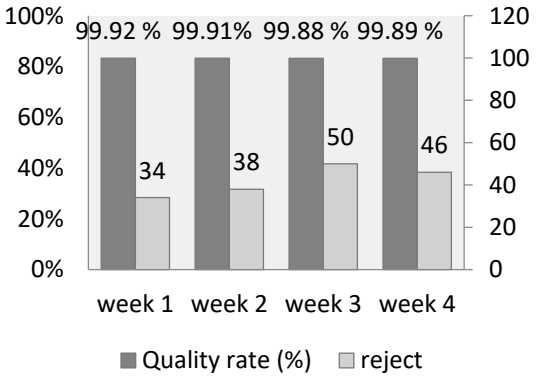


Figure 3. Diagram from the calculation of the quality rate

The result of the calculation of quality rate for boiler machine are worth 99.9%, and the value of OEE is according to standard of the world, that is 99.9%, , as the figure 4 shows.

Overall Equipment Effectiveness (OEE)

Having obtained the value of availability in diagram 2, the performance rate in diagram 3, and quality rate on the diagram 4 in every week, and then do the calculation of overall equipment effectiveness, For example, the calculation of Overall Equipment Effectiveness used data in the first week, to enter its value as follows:

$OEE =$
Availability rate(%) x Performance rate(%) x Quality rate (%)
$OEE = 0{,}897 \text{ x } 0{,}879 \text{ x } 0{,}9992$
$= 78{,}78\%$

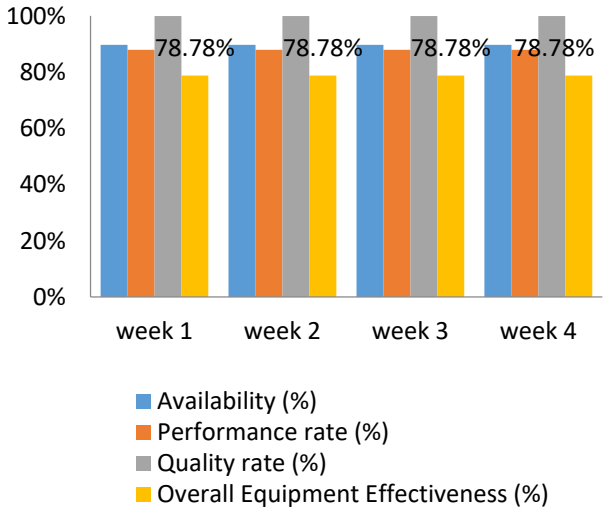


Figure 4. Diagram of the calculation of Overall Equipment Effectiveness

The results of the calculation of the average Overall Equipment Effectiveness for the boiler machine is 78.51 % and has not reached the OEE value standard as can be seen in Table 1 of the OEE World Standard, , as the figure 5 shows.

4. CONCLUSION

Based on the discussion above, the conclusion that can be drawn is Rated availability of 89.7% data every week, it is not in accordance with Table 1 standard world of OEE, with the minimum value is 90%. The ups and downs of the availability value of the boiler machine are caused by the amount of available production time.

The value of performance rate have not reached the standard value of OEE Because the fuels being used in large scale machinery that is operating 10 hours for 7 days. The boiler machine quality rate shows good results, which is 99.9% in accordance with the OEE standard value, this depends on the reject that occurs.

OEE calculation result is 78.51%, this value is not according the standards of world, that is 85%, things that impact on the results Effectiveness is the value of performance rate and the value of availability are not yet meet the standards, with other words the boilers machine are less effective in doing production, but on terms of quality already meet the standard, but necessary do back management of the time of production to increase the value of availability and performance rate.

REFERENCES

[1] Yudi Daeng Polewangi, Et Al. "Analysis Of Boiler Maintenance System At PT. Dewa Perangin-Angin," Ready Star, Pp. 161-165

[2] Mohamad Nafis, Et Al. Analysis Of The Calculation Of The Overall Equipment Effectiveness (OEE) Value On The Wrapping Machine At The Biscuit And Wafer Company PT. UNIMOS. 1-15.

[3] Umi Hanifah, Nd (2019). Performance Of A 3-Pass Mini Boiler Fueled By Wood Pellets And Coconut Shell Biomass. Agritech, 200-206.

[4] Sriharti, Fuji. (2020) . " Analysis Of Treatment Machine Stamping CSI With Methods TPM (Total Productive Maintenance) At Tri Jaya Engineering Karawang". Karawang: Singaperbangsa Karawang University

[5] Hamim Rachman, Ak (2017). Proposed Maintenance Of The Boiler System Using The Reliability Centered Maintenance (RCM) Method. Journal Of Industrial Engineering, 18 (1), 86-93.

[6] N. Noor Ahmadi, "Maintenance Analysis Of Blow Mold Machine With RCM Method At PT. CCAI," Journal Of Industrial System Optimization, Vol. 16, No. 2, Pp. 167-176, 2017.

[7] Sandy Dwiseputra Panda, Hs (2014). Preventive Maintenance Design On Corrugating Machine And Flexo Machine In PT. Surindo Teguh Gemilang. Scientific Journal Of Widya Teknik, 33-38.
[8] Firman, G. (2019). Analyst Of Machine Performance Improvement With Total Productive Maintenance (TPM) On Boiler Machine Of PT. Nusantara VI Plantation Business Unit Rimbo Dua Tebo-Jambi. Journal Of Business Management Studies, 55-60.
[9] Indra Hermawan, WJ (2017). Mixing Machine Maintenance Overview At Mawi Bread Ud. Journal Of Technology, 117-128.
[10] Hariyanto, Et Al. (2017). Analyzis Preventive Maintenance Sistem With Modularity Design In. Surya P Won . Unique Teak, 24-31.