http://jurnal.yudharta.ac.id/v2/index.php/jkie

Journal Knowledge Industrial Engineering

E-ISSN: 2541-4461 | P-ISSN: 2460-0113

Analysis of Significant Energy Use in Tire Company using Pareto Diagram

Kamaluddin[a], Irwan Budiman[b], Anita Christine Sembiring[c]

[a,b,c] Department of Industrial Engineering, Universitas Prima Indonesia, Medan, Indonesia

[a]Corresponding Autor: chowkamal98@gmail.com

Article Info

Article history

Received : June 17, 2022

Revised : July 25, 2022

Accepted : August 14, 2022

Published : August 30, 2022

Keywords:

Significant Energy Use

Pareto Diagram

Tire Company

ISO 50001

A B S T R A C T

Through Government Regulation No. 70 of 2009 concerning Energy Conservation, the government has made it mandatory for large energy users, namely users who use energy equal to or more than 6000 tons of oil equivalent per year, are required to carry out energy conservation or energy management activities. In research on the object of research, which is a tire company, the company is one of the industries that use energy of more than 6000 tons of oil equivalent per year and is one of the industries that directly have an impact on national energy supply. Realizing the impact of the availability and increase in energy prices, especially for industry, companies are required to take appropriate and wise actions in consuming energy through energy conservation and saving programs. The implementation of Energy Management seen in the company is still combined with the existing functional organizational structure so that the control function becomes weak. The importance of setting priorities in implementing energy conservation, using the 20/80 Pareto diagram method will provide more precise targeting in achieving energy efficiency. Priority selection will provide considerable potential for improving energy performance, in addition to prioritizing will make the organization more effective and efficient.

DOI: https://doi.org/10.35891/v9i2.3252

1. Introduction

Energy has become the main human need to carry out almost all activities, especially industrial activities. Along with the increasing national development, economy and industrial development, it will directly have an impact on increasing energy users. Meanwhile, the current supply of energy is still very dependent on fossil fuels, especially oil fuels, while oil reserves are running low. On the other hand, the price of energy, especially the price of fuel, is increasing. The high use of fossil fuels in Indonesia is strongly influenced by the level of inefficient use in all sectors. This is due to the low level of awareness of most Indonesian people in managing energy use which is still classified as wasteful, so energy savings are needed for energy users. This step was chosen to improve the national economy, because the higher the price of oil in the international market, the heavier the burden of subsidies that must be borne by the government.

The tire company that is the object of research is one of the industries that directly have an impact on national energy supply. Realizing the impact of the availability and increase in energy prices, especially for industry, companies need to take appropriate and wise actions in consuming energy

through energy conservation and saving programs. The implementation of the Energy Management System in the company still uses the existing functional organizational structure so that its control is felt to be less effective. The importance of setting priorities in implementing energy conservation will offer considerable potential for improving energy performance, in addition to setting priorities will make the organization more effective and efficient.

Research by Deny Satyagraha, Syamsir Abduh and Ishak Kasim (2020) Energy Management in Industry: Optimization of the Utility Side of the Tire Industry, Trisakti University. (Preliminary Energy Audit) by making direct measurements, calculating the load deviation between the actual energy consumption report and the load nameplate, calculating the Energy Consumption Intensity (IKE) value and its trend, simulating recommendation steps, determining energy baseline and strategic steps for energy management actions that adopt ISO 50001. The level of energy use can be optimized by implementing the recommended steps so that PT. For Indonesian tires, Plant X will save 38,918.92 USD or IDR 575,986,400 every year with a Break Event Point (BEP) of around 29 months. Therefore, the company that is the object of research will be prioritized for decision making using the Pareto Diagram. This research will be an illustration of providing a focus on the implementation of ISO 50001:2018 in the company so that it is more effective and efficient in preparing an audit plan that aims to map energy use, evaluate energy use and determine strategic steps for energy optimization.

2. Literature Review

Refers to the ISO (The International Organization for Standardization) Standard, which is the International Organization for Standardization which sets international standards in the industrial and commercial fields of the world where the purpose of its formation is to increase trade between countries in the world. ISO 50001:2018 is a standard used to manage energy performance including energy efficiency and consumption, using a Management System model with a PDCA (Plan, Do, Check, Action) cycle approach for continuous improvement.

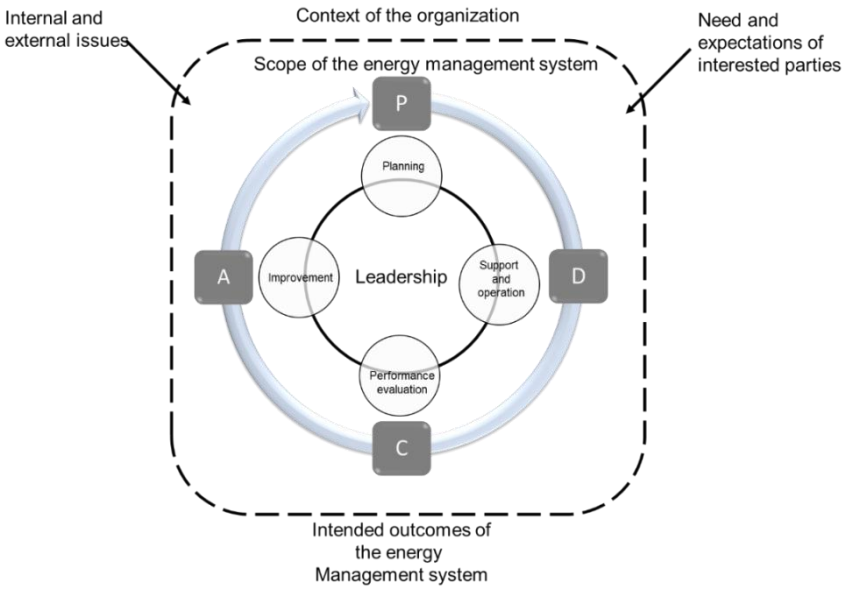


Figure 1. ISO 50001:2018 PDCA Cycle

In Figure 1 ISO 50001:2018 PDCA Cycle can be explained, among others:

Plan : Understand organizational context, establish energy policy and energy management team, consider actions to address risks and opportunities, conduct energy reviews, identify significant energy uses (SEUs) and establish energy performance indicators (EnPIs), energy

baselines (EnBs), goals and targets energy, and action plans required to deliver results that will improve energy performance in accordance with the organization's energy policy.

Do : Implement action plans, operational and maintenance controls, and communications, ensuring competence and considering energy performance in design and procurement.

Check : Monitor, measure, analyze, evaluate, audit and conduct management reviews of energy performance and energy management systems.

Action : Take action to address non-conformities and continuously improve energy performance and energy management systems.

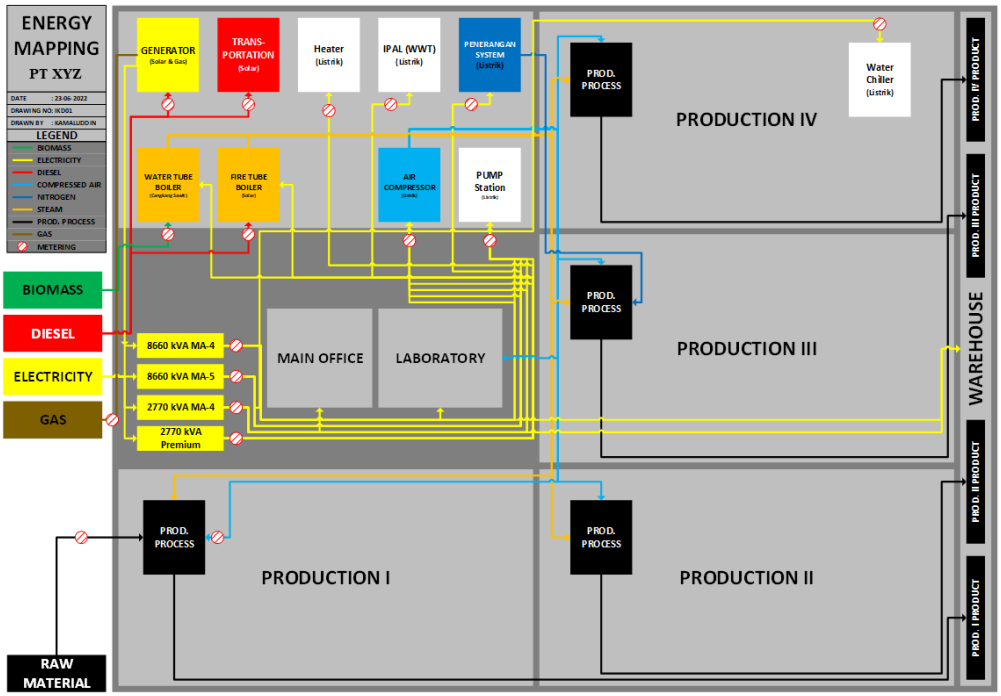
3. Methodology

This study of Significant Energy Use in the manufacturing industry was carried out by collecting primary data, observations of measurements in the field and data on energy consumption in the past. Based on the analysis and the type of data used, this research includes nominal quantitative research methods, for the data to be collected, can be calculated, measured and described using numbers. The nominal quantitative methodology is based on primary data which is used as input for the calculation of energy consumption for each energy consumption equipment. The research starts from data collection (energy mapping, types of energy, energy equipment, and energy metering) followed by data processing (data grouping, energy users and energy types, calculating the consumption of each energy user, conversion in the same energy unit, data processing using Pareto diagrams) then the data is analyzed by categorizing the significance of energy users with the Pareto concept and ends with drawing conclusions and suggestions.

4. Results and Discussion

Energy Mapping

Energy consumption data collection on energy consumption equipment based on the metering system can be seen from Figure 3. Energy Mapping



Picture: 3. Energy Mapping

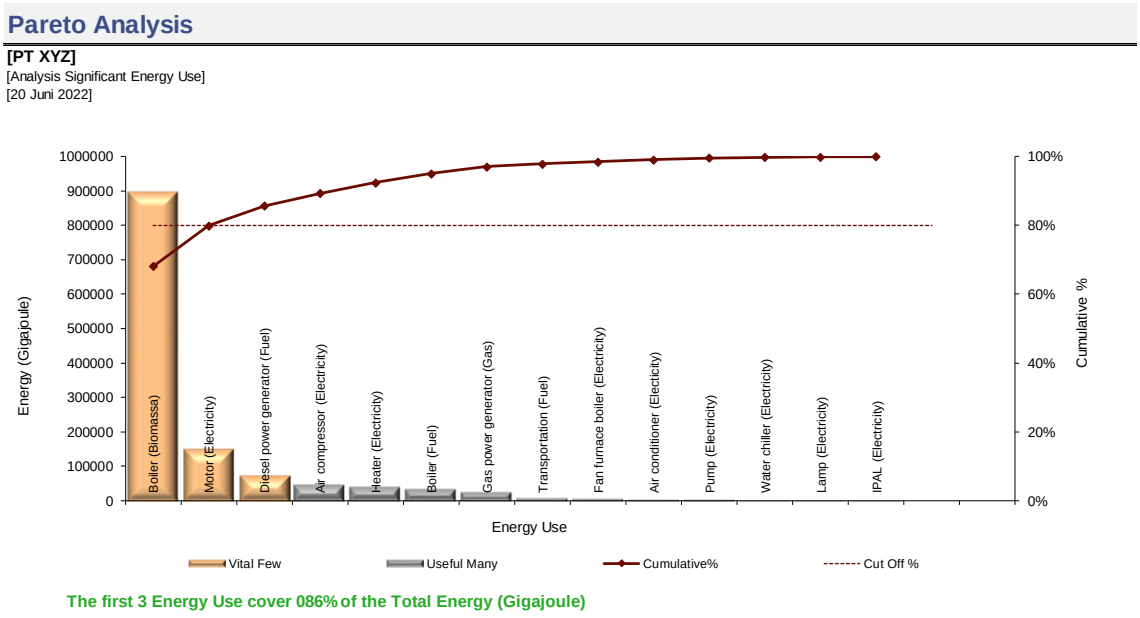
Data collection

Data collection is done through computerize on the data system, total energy consumption in 2021.

Tabel 1. Konsumsi energy

Energu use	Type energy	Original unit	G. Joule	Usage Percentage	Kum (%)
Boiler (Biomassa)	Palm shells	53,270,149 kg	894,938	68.1	68.1
Motor (Electricity)	PLN electricity	43,000,000 kwh	154,800	11.8	79.9
Power Generator (Fuel)	biodiesel	2,024,664 liter	76,800	5.8	85.7
Air Compressor (Electricity)	PLN electricity	13,156,667 kwh	76,734	3.6	89.3
Heater	PLN electricity	11,400,000 kwh	47,364	3.1	92.4
Boiler (Fuel)	Biodiesel	907,017 liter	41,040	2.6	95.0
Power Generator	Natural gas	705,881 m3	34,376	2.0	97.0
Transportation	Biodiesel	300,270 liter	11,380	0.9	97.9
Boiler (Fan Furnace)	PLN electricity	2,196,944 kwh	7,909	0.6	98.5
AC	PLN electricity	2,120,000 kwh	7,632	0.6	99.1
Pump	PLN electricity	1,826,111 kwh	6,574	0.5	99.6
Water Chiller	PLN electricity	500,278 kwh	1,801	0.1	99.7
Lighting	PLN electricity	500,000 kwh	1,800	0.1	99.8
IPAL	PLN electricity	420,000 kwh	1,512	0.1	99.9
		Total	**1,314,186**		

Based on the table data above, a Pareto diagram can be made, as shown in Figure 4. Pareto Analysis 20/80.



Picture: 4. *Pareto Analysis 20/80*

From the results of the Pareto diagram, it can be concluded that there are the first 3 Energy use cover 86% of the total energy, namely biomass energy (palm shells) consuming 894,938 Gigajoules (68.1%), Motor with the type of electrical energy sourced from PLN consumes total energy is 154,800 Gigajoules (11.8%), Diesel Power generator with the type of diesel fuel energy consumes 76,734 Gigajoules (5.8%).

5. Conclusion

With the use of the Pareto diagram concept, the main priority proposal for resource allocation in conservation or energy efficiency in the application of the Energy Management System is obtained where the boiler with the type of biomass energy (palm shell) consumes 894,938 Gigajoules (68.1%), mMotor with the type of electrical energy sourced from PLN consumes a total energy of 154,800 Gigajoules (11.8%), and a diesel power generator with the type of diesel fuel energy consumes 76,734

Gigajoules (5.8%). So it is recommended to prepare an audit plan that aims to map energy use, evaluate energy use and determine strategic steps for energy optimization of Boilers, Motors and Diesel Power Generators.

Acknowledgements

I thank God Almighty for His blessings and grace, I was able to finish this journal on time. I also want to thank all stakeholders at Prima Indonesia University. Don't forget to say a big thank you to Mr. D.T as CEO who allowed me to do this research in his company with great support both morally and morally.

References

Aguirre, F., Villalobos, R.J., Phelan, P.E., Pacheco, R., 2010. Assessing the relative efficiency of energy use among similar manufacturing industries. Int. J. energy Res. 477–488.

Akalyadevi.K, Antony Crispin Sweety. C, Sudamani Ramaswamy A. R. (2020) SPHERİCAL BİPOLAR FUZZY GRAPH, International Journal of Creative Research Thoughts (IJCRT), ISSN:2320-2882, Volume.8, Issue 6, pp.4317-4327.

Albert Thumann, Terry Niehus, and William J. Younger, Handbook of energy audits, 9th edition. Indian Trail, Lilburn, GA: The Fairmont Press, Inc, 2013.

Andersson, E.; Arfwidsson, O.; Thollander, P. Benchmarking energy performance of industrial small and medium-sized enterprises using an energy efficiency index: Results based on an energy audit policy program. J. Clean. Prod. 2018, 182, 883–895.

Badan Standardisasi Nasional (BSN), "Standar Nasional Indonesia (SNI) ISO 50001:2012 Sistem manajemen energi – Persyaratan dengan pedoman penggunaan." 2012.

C. Paunescu and L. Blid, "Effective energy planning for improving the enterprise's energy performance", Management and Marketing Challenges for the Knowledge Society, Vol. 11, No. 3, pp. 513-531, 2016.

Danandeh Mehr, A., Kahya, E., 2017. A Pareto-optimal moving average multi gene multi-gene genetic programming model for daily streamflow prediction. J. Hydrol. 549, 603–615.

Danandeh Mehr, A., Nourani, V., 2017. A Pareto-optimal moving average-multi gene multi-gene genetic programming model for rainfall-runoff modelling. Environ. Modell. Softw. 92, 239–251.

Deny Satyagraha, Syamsir Abduh and Ishak Kasim (2020) Manajemen Energi di Industri: Optimasi Sisi Utiliti pada Industri Ban, Universitas Trisakti.

Government Regulation of the Republic of Indonesia. 2007 Regulation of Energy No.30

Government Regulation of the Republic of Indonesia. 2019 Regulation of Energy Conservation No. 70.

IEC 50001:2018, "Energy management system: Requirements with guidance for use". International Standard, Publication Date: Aug. 2018, Edition 2, 30 pages, 2018.

IEC 50006:2014, "Measuring energy performance using energy baselines (EnB) and energy performance indicators (EnPI): General principles and guidance". International Standard, Publication Date: Dec. 2014, Edition 1, 33 pages, 2014.

IEA (International Energy Agency). Energy and Climate Change; World Energy Outlook Special Report; IEA: Paris, France, 2015.

IEA (International Energy Agency). Tracking Clean Energy Progress; IEA: Paris, France, 2017.

Minister of Energy and Mineral Resources of the Republic of Indonesia. 2012 Regulation of Energy Management No. 14.

Riahi-Madvar, H., Dehghani, M., Seifi, A., Singh, V.P., 2019. Pareto optimal multigene multi-gene genetic programming for prediction of longitudinal dispersion coefficient. Water Resour. Manage. 33 (3), 905–921.

Zhang, T., Georgiopoulos, M., Anagnostopoulos, G.C., 2017. Pareto-optimal model selection via SPRINT-race. IEEE Trans. Cybern. 48 (2), 596–610.