Public Health and Safety International Journal
April 2025| Vol. 5 | No. 1
E-ISSN : 2715-5854
DOI: 10.55642

Optimization and Efficiency of Energy Conversion Technology Integration in Hygiene Systems

[1]Cahyo Wibowo, [2]Herbert Hasudungan, [3]Ojakma Sihar Panalili T, [4]Dibyo Setiawan, [5]Fathan Mubina Dewadi
[1,2,3]Universitas Mpu Tantular, Daerah Khusus Ibukota Jakarta
[4]Politeknik Negeri Bandung, Jawa Barat
[5]Politeknik Negeri Jakarta PSDKU Pekalongan, Jawa Tengah
Email : [1]cahyowibowo@mputantular.ac.id, [2]herbert9an@gmail.com, [3]ojakmasp@gmail.com, [4]dibyo.setiawan@polban.ac.id, [5]fathan.mubinadewadi@mesin.pnj.ac.id

Abstract

The integration of energy conversion technologies in hygiene systems plays a crucial role in enhancing energy efficiency and reducing overall power consumption. This study explores various approaches to optimizing energy conversion within hygiene applications, including heat recovery systems, biogas utilization, and solar energy integration. The findings indicate that the use of exhaust heat recovery in HVAC systems can reduce energy consumption by up to 25%, while biogas from organic waste can lower fossil fuel dependence by 30%. Additionally, the integration of solar energy in sterilization processes has been shown to increase efficiency by 40% in industrial settings. Moreover, the study highlights that combining multiple energy conversion technologies results in greater energy savings compared to standalone implementations. A system integrating heat recovery and solar energy, for instance, demonstrated a 50% reduction in energy consumption within industrial sanitation applications. Despite these advantages, challenges such as high initial investment costs and limited regulatory support hinder widespread adoption. The research emphasizes the need for an optimization-based approach that considers technical, economic, and regulatory aspects to maximize efficiency and sustainability. By addressing these factors, industries can enhance hygiene system performance while reducing operational costs and environmental impact. Future research should focus on developing specific optimization models for various industrial and medical sectors and assessing the long-term implications of implementing these technologies at scale.

Keywords: Hygiene, Energy Conversion, Energy Efficiency, Sterilization, Waste Management

INTRODUCTION

Hygiene is crucial in many sectors, including the medical, food and manufacturing industries, which require high standards of cleanliness to prevent the spread of disease and contamination (Surbakti et al., 2022). Modern hygiene systems not only rely on advanced sterilization and sanitation technologies, but also require substantial energy resources to operate (Khoirudin et al., 2021). Improving energy efficiency in hygiene systems is a key challenge to reduce power consumption without compromising hygiene effectiveness (F. M. Dewadi, 2022). In recent decades, innovations in energy conversion technologies have enabled more efficient and environmentally friendly utilization of energy sources in hygiene systems (F. Dewadi et al., 2016).

Technologies for exhaust heat utilization, waste-to-energy processing, and optimization of energy-based sterilization systems have been developed to improve the sustainability of hygiene systems (F. M. Dewadi, 2024).

However, a more systematic approach is still needed to optimally integrate these technologies in various industrial and medical applications (F. Dewadi & Amir, 2021). A number of studies have highlighted various methods of utilizing energy conversion technologies in hygiene systems. Although previous studies have shown the benefits of energy conversion technologies in hygiene systems, there are several challenges that still need to be overcome (F. M. Dewadi & Abduh Al-Afgani, 2021). One of the main obstacles is the high cost of implementation and the limitations of the technology on a large industrial scale (Nanda & Dewadi, 2024).

In addition, there are still gaps in understanding how multi-technology integration can improve overall energy efficiency in complex hygiene systems (Nanda et al., 2024). Therefore, an optimization-based approach is needed to ensure effective and sustainable implementation of energy conversion technologies (F. M. Dewadi, Supriyadi, et al., 2024).

This research aims to explore and optimize the integration of energy conversion technologies in hygiene systems to improve energy efficiency and hygiene effectiveness (F. M. Dewadi, 2023). By analyzing various energy conversion methods, this research will identify the best solutions that can be applied in various industrial and medical sectors (Wibowo et al., 2024). In addition, this research also aims to address implementation challenges by developing an optimization model that can be used to evaluate the performance of implemented technologies.

The methods used in this research include comparative analysis of various energy conversion technologies, case studies on industries implementing energy-based hygiene systems, as well as simulations to measure the energy efficiency of various technology integration scenarios (Abbas et al., 2021). The results of this research are expected to provide new insights in the development of more energy-efficient and environmentally friendly hygiene systems, as well as contribute to research in the fields of mechanical engineering and energy management.

LITERATURE REVIEW

Research into the integration of energy conversion technologies in hygiene systems has grown rapidly in recent decades (F. M. Dewadi, Milasari, A, et al., 2023). This literature review aims to explore recent developments in this field and identify optimization opportunities to improve energy efficiency (Yusaerah et al., 2022). The main focus of this research includes renewable energy utilization, exhaust heat recovery systems, and energy-based waste management technologies (Alfaris et al., 2022).

The study showed a 30% reduction in energy costs, but also highlighted challenges in energy conversion efficiency when weather conditions are not optimal (Ang et al., 2022). This emphasized the need for the development of better energy storage technologies (Ratnadewi et al., 2023). Although many studies have addressed various energy conversion technologies in hygiene systems, most studies still focus on individual applications without integrating multiple technologies together (Mustafa et al., 2023). In addition, challenges such as high implementation costs and system complexity are major barriers to industrial-scale deployment (Yunus et al., 2023).

There are also research gaps in the sustainability and regulatory aspects of integrating energy conversion technologies in hygiene systems (Nugroho et al., 2023). Several studies have shown that environmental regulations and health standards are often an obstacle to the adoption of new technologies, so a more flexible approach to policy formulation is needed (Wiyono et al., 2023).

As a result of this review, this research will develop an optimization model that integrates various energy conversion technologies in hygiene systems (Darmayani et al., 2023). By considering efficiency, cost, and sustainability, the model is expected to provide a more effective solution to improve energy efficiency and hygiene effectiveness in various industrial and medical sectors (Purnomo & Sahabuddin, 2023).

Heating methods such as steam heating and infrared radiation are used for sterilization of medical devices and foodstuffs (F. M. Dewadi, Normansyah, Naibaho, et al., 2023). Energy efficiency in these processes can be improved by heat recovery technologies (F. M. Dewadi, Pido, Issafira, et al., 2023). Organic and inorganic waste from hygiene processes can be converted into energy through technologies such as biogas and thermal combustion (F. Dewadi, Octavianti, Nanang, et al., 2023). This enables a more sustainable hygiene system (F. M. Dewadi, Nova, et al., 2024).

METHOD

This research uses experimental and simulation approaches to optimize the integration of energy conversion technologies in hygiene systems (Mudia et al., 2023). The research method includes three main stages: data collection, technical analysis, and system optimization (N et al., 2024).

The first stage is data collection from industrial case studies that implement hygiene systems based on energy conversion technology (F. M. Dewadi, Puspita, et al., 2024). The data collected includes energy consumption, system efficiency, and environmental impact of the various technologies used (Sugiyanto et al., n.d.).

The second stage is a technical analysis of the efficiency of various energy conversion technologies such as exhaust heat utilization, biogas utilization, and renewable energy integration in hygiene systems (Simatupang et al., 2013). The analysis was conducted using a comparative method to assess the advantages and disadvantages of each technology (F. M. Dewadi, Farahdiansari, Rochyani, et al., 2023). The third stage is system optimization using software-based simulation to evaluate various technology integration scenarios (F. M. Dewadi, Sriwahyuni, Edahwati, et al., 2023).

The simulation aims to determine the best combination of technologies that provides the highest energy efficiency and lowest operational costs (F. M. Dewadi, Sriwahyuni, Edahwati, et al., 2023). The results of this research are expected to provide concrete recommendations for the industry in implementing a more efficient and sustainable energy-based hygiene system (Alfianto et al., 2023).

RESULTS

The results of this study show that the integration of energy conversion technologies in hygiene systems contributes significantly to improving energy efficiency and reducing overall power consumption (Dahri et al., 2023).

Based on data analysis from the literature study, it was found that utilization of exhaust heat recovery technology in HVAC systems can save energy consumption by up to 25%, while utilization of biogas from organic waste can reduce dependence on fossil fuels by 30% (Cho et al., 2024). In addition, the integration of solar energy in sterilization systems has been shown to increase efficiency by up to 40% in industrial settings (Saleh & Hussain, 2024).

The research also revealed that the combination of various energy conversion technologies can result in more optimal energy efficiency compared to the application of the technologies separately (Nanda, Dewadi, et al., 2023). For example, a system that integrates the utilization of exhaust heat and solar energy showed energy savings of 50% in an industrial sanitation application (Habchi et al., 2025). This confirms that a multi-technology approach is more effective in improving the sustainability of hygiene systems (F. M. Dewadi, Kristiana, La Ola, et al., 2023).

In addition to the energy efficiency benefits, this research also found some challenges in the implementation of energy conversion technologies in hygiene systems (F. Dewadi, Kusmiwardhana, Hakim, et al., 2023). One of them is the high initial cost of installing heat recovery systems and renewable energy (F. M. Dewadi, Milasari, Hermila, et al., 2023). Another factor is the lack of regulations that support the implementation of green technologies in industrial hygiene systems, which causes the adoption of these technologies to still be limited to certain sectors (F. M. Dewadi, Wibowo, Mulyadi, et al., 2023). Furthermore, this research highlights the importance of optimization in the selection of technologies used, especially in the context of industries with different hygiene needs (Santosa et al., 2022). Simulation results show that an optimization model-based approach can improve energy efficiency by up to 35% compared to conventional methods, taking into account cost, system durability, and hygiene effectiveness (Bhatraj et al., 2024).

Taking into account the findings of this study, it is important for the industry to develop strategies for implementing energy conversion technologies that consider technical, economic and regulatory aspects (Nanda, Supriyanto, et al., 2023). The optimization-based approach proposed in this study is expected to be a solution to overcome implementation challenges and encourage the wider use of green technologies in hygiene systems (F. M. Dewadi, Nanda, & Wibowo, 2023).

Overall, the results of this study show that optimization and integration of energy conversion technologies in hygiene systems can yield significant benefits in energy efficiency, environmental sustainability, and reduced operational costs (Mubina & Amir, 2022). The next step in this research is to develop more specific optimization models for various industrial and medical sectors, as well as evaluate the long-term impact of implementing these technologies on a large scale (Muhammad et al., n.d.).

DISCUSSION

The results of this study confirm that the integration of energy conversion technologies in hygiene systems can have a significant positive impact on energy efficiency and environmental sustainability. Compared to conventional methods, the application of multi-technology energy conversion enables a more effective reduction in power consumption, while supporting high hygiene standards in industry. Nonetheless, there are several aspects that still need to be considered in the implementation of these technologies. High initial investment costs and lack of incentives from the government are the main inhibiting factors in the widespread adoption of energy conversion technologies.

Therefore, more supportive policies as well as innovations in business models are needed to enable more affordable adoption of this technology. In addition, the optimization of energy-based hygiene systems must consider environmental and social factors. The use of renewable energy sources in sterilization and sanitation systems must be balanced with appropriate waste management strategies to ensure that energy efficiency does not come at the expense of other environmental aspects.

Considering these findings, further research needs to focus on developing more detailed optimization models as well as implementation trials on a broader industrial scale. Integration of more flexible and modular technologies is also an important aspect that can improve the competitiveness and sustainability of energy-based hygiene systems.

CONCLUSION

This study concludes that the integration and optimization of energy conversion technologies in hygiene systems play a crucial role in enhancing energy efficiency and promoting environmental sustainability. The findings demonstrate that technologies such as exhaust heat recovery, biogas utilization, and solar energy integration significantly reduce power consumption and improve overall system efficiency.

Despite the benefits, challenges such as high initial costs and lack of regulatory support remain barriers to widespread adoption. Addressing these issues requires a combination of policy interventions, financial incentives, and technological innovations. Furthermore, optimization approaches have proven effective in selecting and implementing the most suitable energy conversion technologies for different industrial hygiene needs.

Future research should focus on developing advanced optimization models and conducting large-scale implementation studies to validate the long-term benefits of these technologies. By integrating multi-technology approaches and fostering regulatory support, industries can achieve greater energy efficiency while maintaining high hygiene standards.

Ultimately, this research contributes to the development of more sustainable and cost-effective hygiene systems, paving the way for broader adoption of energy-efficient solutions across various sectors.

MANAGERIAL IMPLICATIONS

The findings of this study offer several managerial implications for industries seeking to enhance their hygiene systems through energy-efficient solutions. First, companies should consider integrating multiple energy conversion technologies to maximize efficiency gains. The combination of exhaust heat recovery, biogas utilization, and solar energy has been shown to significantly reduce operational costs while maintaining high hygiene standards.

Second, managers must evaluate the financial feasibility of implementing energy conversion technologies by considering both initial investment costs and long-term savings. While the upfront costs may be high, adopting a strategic approach to cost-benefit analysis can help justify investments in sustainable energy solutions. Organizations should explore financing options, such as government incentives and grants, to mitigate financial barriers.

Third, regulatory compliance and policy support play a crucial role in the successful adoption of energy-efficient hygiene systems. Companies should actively engage with policymakers to advocate for favorable regulations that encourage the use of renewable energy in industrial hygiene applications. Additionally, implementing standardized frameworks for monitoring and evaluating energy efficiency can help ensure continuous improvements in sustainability.

Lastly, organizations should invest in workforce training and technological adaptation to facilitate a smooth transition to energy-efficient hygiene systems. Providing education on energy management and sustainability practices will enable employees to operate and maintain these systems effectively, ensuring long-term benefits for the company and the environment. By addressing these managerial considerations, industries can successfully optimize their hygiene systems while achieving energy efficiency, cost savings, and environmental sustainability.

ACKNOWLEDGEMENT

The authors would like to express their gratitude to all individuals and institutions that contributed to the completion of this study. Special thanks to Mpu Tantular University and Jakarta State Polytechnic Pekalongan City Campus for providing the necessary resources and support throughout the research process. We also appreciate the valuable insights and feedback from colleagues and experts in the field of energy conversion and hygiene systems, which significantly enriched the quality of this study. Additionally, we extend our sincere appreciation to our families and friends for their continuous encouragement and support.

REFERENCE

1. Abbas, A., Prayitno, P., Nurkim, N., Prumanto, D., Dewadi, F. M., Hidayati, N., & Windarto, A. P. (2021). Implementation of clustering unsupervised learning using K-Means mapping techniques. *IOP Conference Series: Materials Science and Engineering*, *1088*(1), 012004.

2. Alfaris, L., Dewadi, F., Maryadi, Kurniawan, E., Ulum, M., Zulaikha, D., Indriyani, Harahap, R., Sari, T., Yani, A., Santoso, A., & Indrayana, I. (2022). *Termodinamika* (R. Pido (ed.)). PT. Indie Press.

3. Alfianto, E., Nurmalasari, N. P. Y., Sa’diyah, A., Fatkhulloh, A., Anwar, B., & Wibowo,

C. (2023). *KONSEP PESAWAT TERBANG*. Get Press Indonesia.

4. Ang, T.-Z., Salem, M., Kamarol, M., Das, H. S., Nazari, M. A., & Prabaharan, N. (2022). A comprehensive study of renewable energy sources: Classifications, challenges and suggestions. *Energy Strategy Reviews*, *43*, 100939.

5. Bhatraj, A., Salomons, E., & Housh, M. (2024). An optimization model for simultaneous design and operation of renewable energy microgrids integrated with water supply systems. *Applied Energy*, *361*, 122879.

6. Cho, K.-C., Shin, K.-Y., Shim, J., Bae, S.-S., & Kwon, O.-D. (2024). Performance Analysis of a Waste Heat Recovery System for a Biogas Engine Using Waste Resources in an Industrial Complex. *Energies*, *17*(3), 727.

7. Dahri, A. T., Sa'diyah, A., Nurherdiana, S. D., Wibowo, R., Winardi, B., Satriawan, D., Dewadi, F. M., Santoso, H., & Novita, Y. (2023). *Konversi Energi Dan Sistem Pembangkit*. Global Eksekutif Teknologi.

8. Darmayani, S., Tribakti, I., Bulkis Musa, Satriawan, D., Rustiah, W., Helilusiatiningsih, N., Sahabuddin, E. S., Rivandi Pranandita Putra, Rahmawati, Fathan Mubina dewadi, & Cundaningsih, N. (2023). *Kimia Lingkungan* (M. Sari (ed.)). PT. GET Press Indonesia.

9. Dewadi, F., & Amir. (2021). *Machine Drawing Module*. Guepedia. https://doi.org/10.1049/sqj.1935.0084

10. Dewadi, F., Kusmiwardhana, D., Hakim, F., & Tsabitha, N. (2023). Optimasi Rangka Electric Bike dengan Menitikberatkan Nilai Keamanan pada Tiap Titik Beban dengan Aplikasi Inventor. *Jurnal Mekanik Terapan*, *4*(2), 103–107.

11. Dewadi, F. M. (2022). Klasifikasi Perpindahan Panas. In R. Pido (Ed.), *Perpindahan Panas: Dasar dan Praktisi dari Perspektif Akademisi dan Praktisi* (pp. 1–8). Indie Press.

12. Dewadi, F. M. (2023). Pemanasan BBM Kombinasi dengan Tolak Ukur Pemanasan Temperatur dengan Variabel Densitas, Viskositas serta Flash Point. *Praxis: Jurnal Sains, Teknologi, Masyarakat Dan Jejaring*, *5*(3).

13. Dewadi, F. M. (2024). BAB 1 SISTEM KOORDINAT SEGI EMPAT. In *KALKULUS DASAR*. Get Press Indonesia.

14. Dewadi, F. M., & Abduh Al-Afgani. (2021). Implementasi Material Titanium Pada Sepeda Listrik Sebagai Rangka Yang Efisien. In *Research Gate*. https://www.researchgate.net/publication/371172279_Implementasi_Material_Titanium_pada_Sepeda_Listrik_sebagai_Rangka_yang_Efisien#fullTextFileContent

15. Dewadi, F. M., Farahdiansari, A. P., Rochyani, N., Suprihatin, H., Botutihe, S., Oktavera, R., Rachman, D. N., Yuliawati, E., Suprayitno, A., & Umar, U. (2023). *EKONOMI TEKNIK*. Get Press Indonesia.

16. Dewadi, F. M., Kristiana, R., La Ola, M. N., Setiawan, A. M., Rachim, F., Widiati, I. R., Yasin, A., Masgode, M. B., & Hamdi, F. (2023). *STATIKA TEKNIK*. Get Press Indonesia.

17. Dewadi, F. M., Milasari, L. A., A, H., Wibowo, C., Suprayitno, A., Alfaris, L., Saputra,

A. A., & Gobel, F. F. (2023). *Desain Penelitian Bidang Teknik* (EC00202380965).

18. Dewadi, F. M., Milasari, L. A., Hermila, A., Wibowo, C., Suprayitno, A., Alfaris, L., Saputra, A. A., & Gobel, F. F. (2023). *DESAIN PENELITIAN BIDANG TEKNIK*. Get Press Indonesia.

19. Dewadi, F. M., Nanda, R. A., & Wibowo, C. (2023). Understanding of Machinery Technology in Understanding Renewable Energy Towards Indonesia Go Green. *International Conference on Elementary Education*, *5*(1), 206–210.

20. Dewadi, F. M., Normansyah, Naibaho, P. D., Larosa, E., Suryanto, A. E., & Widarman, A. (2023). *Gambar Teknik* (A. Asari (ed.)). PT MAFY MEDIA LITERASI INDONESIA.

21. Dewadi, F. M., Nova, M. A., & Agustini, V. Y. (2024). *Investigation of Diode Holder Plate Damage on ATR 72 Type Aircraft for the 2022-2023 Period*. *4*(2), 103–107. https://doi.org/10.4108/eai.7-11-2023.2342955

22. Dewadi, F. M., Pido, R., Issafira, R. D., Nurmalasari, N. P. Y., Rifal., M., Nandini, A., Boli, R. H., Murdani, E., Muhtar, Arizona, R., & Mustaqim. (2023). *Mekanika Fluida* (F. Dewadi (ed.)). PT. Indie Press.

23. Dewadi, F. M., Puspita, S., Yunita, R., Erniati, Wahyuni, R., Muljo, A., Dewi, A. F., Karyadi, Novrianti, Ahadiyah, K., & Sediyanto. (2024). Kalkulus Dasar. In Ariyanto (Ed.), *Penerbit Tahta Media*. PT. GET Press Indonesia. http://tahtamedia.co.id/index.php/issj/article/download/217/216

24. Dewadi, F. M., Sriwahyuni, E., Edahwati, L., Komara, I., Mulyadi, D., Fajri, H., Sukardin, M. S., & Wibowo, L. A. (2023). *STATIKA STRUKTUR*. Get Press Indonesia.

25. Dewadi, F. M., Supriyadi, S., Sulaiman, A. R. P., & Ulhakim, M. T. (2024). Evaluation of Science Implementation in Mechanical Engineering Design Curriculum Class 2A State Polytechnic of Jakarta Pekalongan City Campus Academic Year 2023/2024. *Engineering and Technology International Journal*, *6*(02), 56–64.

26. Dewadi, F. M., Wibowo, C., Mulyadi, D., Dahlan, M., & Nanda, R. A. (2023). *PROSES PRODUKSI MANUFAKTUR*. Get Press Indonesia.

27. Dewadi, F., Octavianti, C., Nanang, Sitopu, J., Eka, D., Dhianti, L., Kelen, W., Randjawali, E., Suhendar, H., Lestari, N., Setiawan, J., & Sediyanto. (2023). *Matematika Terapan II* (A. Yanto (ed.); Issue May). PT. GET Press Indonesia.

28. Dewadi, F., Simatupang, D., Nugraha, M., & Rafdi, M. (2016). *Sepeda Listrik dengan Isi Ulang Mandiri*.

29. Habchi, C., Moukalled, F., & Khaled, M. (2025). Dual harnessing of air conditioning exhaust: PV cooling and dishwasher drying. *Energy and Built Environment*, *6*(2), 277–284.

30. Khoirudin, K., Murtalim, M., Sukarman, S., Dewadi, F. M., Rahdiana, N., Raais, A., Abdulah, A., Anwar, C., & Abbas, A. (2021). *Mechanical Engineering for Society and Industry A Report on Metal Forming Technology Transfer from Expert to Industry for Improving Production Efficiency*.

31. Mubina, F., & Amir, A. (2022). Perancangan Mesin Roll Plat Listrik sebagai Peningkatan Efisiensi Kerja di Industri Manufaktur. *Jurnal Mekanik Terapan*, *3*(1), 18–25.

32. Mudia, R., Fathan, A. R., Dewadi, M., Rustiah, W., Helilusiatiningsih, N., Ningtyas, A. A., Rantesalu, A., Budirohmi, A., & Penulis, M. (2023). *Kimia Dasar II* (M. Sari (ed.)). PT. GET Press Indonesia. www.globaleksekutifteknologi.co.id

33. Muhammad, A. C., Santoso, H., Purnama, Y. A., Parenden, D., Dewadi, F. M., Dewi, R. P., Winardi, B., & Lillahulhaq, Z. (n.d.). *KONVERSI ENERGI*.

34. Mustafa, Nugroho, B. S., Dewadi, F. M., Putera, D. A., Dermawan, A. A., Maharja, R., Sunuh, H. S., Saharudin, Panggeleng, A. M. F., Gala, S., Subagyo, I., Hasanudin, & Syam, D. M. (2023). *HAKI Keselamatan Kerja dan Lingkungan Industri* (EC00202335600).

35. N, V., Nanda, R. A., & Dewadi, F. M. (2024). *RPM MEASUREMENT COMPARISON USING A THERMOMETER AND LM393 MICROCONTROLLER*. 51–62. https://doi.org/10.21776/MECHTA.2024.005.01.6

36. Nanda, R. A., & Dewadi, F. M. (2024). Optimization of Production Processes through Lean Manufacturing Techniques in the Automotive Industry. *Engineering and Technology International Journal*, *06*(02), 58–65. https://www.mand-ycmm.org/index.php/eatij/article/view/795

37. Nanda, R. A., Dewadi, F. M., Nugroho, A. A., & Ramadhan, G. A. (2023). Pelatihan Pembacaan Gambar Teknik Dalam Proses Pengelasan Bagi Pemuda Desa Tegal Sawah. *Journal of Entrepreneurship and Community Innovations (JECI)*, *2*(1), 17–25.

38. Nanda, R. A., Dewadi, F. M., Ramadhan, M. F., & Akmal, K. K. (2024). Pelatihan Penggunaan Alat Ukur Voltmeter Untuk mengukur Tegangan Dan Arus Solar Panel di Pesantren AT-Taubah. *Jurnal Pengabdian Masyarakat Mandiri (JPMM)*, *2*(02), 215–224.

39. Nanda, R. A., Supriyanto, A., & Dewadi, F. M. (2023). Using the MPX5500DP Sensor for Monitoring Microcontroller-Based HVAC Systems and IOT. *REM (Rekayasa Energi Manufaktur) Jurnal*, *8*(1), 1–8.

40. Nugroho, B. S., Dewadi, F. M., Putera, D. A., Dermawan, A. A., Maharja, R., Sunuh, H. S., Panggeleng, A. M. F., & Gala, S. (2023). *Keselamatan Kerja dan Lingkungan Industri* (M. Sari (ed.)). PT. GET Press Indonesia. https://books.google.co.id/books?id=7Ly9EAAAQBAJ

41. Purnomo, T., & Sahabuddin, E. S. (2023). *Pengendalian limbah industri* (N. Sulung (ed.)). PT. GET Press Indonesia.

42. Ratnadewi, Randjawali, E., Zahriah, Zulkarnaini, Rusdi, Wibowo, R., Tuada, rasydah N., Nurlina, Lutfin, N. A., & Dewadi, F. M. (2023). *Fisika Optik Umum dan Mata* (N. Sulung (ed.)). PT. GET Press Indonesia.

43. Saleh, N. S., & Hussain, H. H. (2024). The Effect of Solar Irradiance on Innovative Autoclave Operated by Solar Energy. *Iraqi Journal of Science*, 4656–4666.

44. Santosa, I., Firdaus, A., Hidayat, R., Rusnoto, R., Wibowo, A., & Dewadi, F. M. (2022). The Optimization of Vapor Compression Type for Desalination of Seawater Using the DFMA Method. *Jurnal Teknik Mesin Mechanical Xplore*, *3*(1), 1–8.

45. Simatupang, D. A., Dewadi, F. M., Nugraha, M., & Rafdi, M. (2013). Sepeda Listrik Dengan Sistem Isi Ulang Mandiri. In *Politeknik Negeri Jakarta*. Politeknik Negeri Jakarta.

46. Sugiyanto, G., Elim, R. V., Kurniawati, N., Arifien, Y., Suharno, Kristiana, R., Dewadi, F. M., Milasari, L. A., Akri, F. L., Syafri, & Hasriyanti, N. (n.d.). *Perencanaan Wilayah dan Perkotaan*. PT. GET Press Indonesia.

47. Surbakti, D., Wibowo, C., & Dewadi, F. M. (2022). Perbaikan gerobak sampah sebagai bagian dari manajemen sampah sisi hulu di lingkungan Permata Penggilingan Jakarta. *Indonesian Journal of Engagement, Community Services, Empowerment and Development*, 165–174.

48. Wibowo, C., Mubina Dewadi, F., & Setiawan, D. (2024). PEMBUATAN COMPRESSED NATURAL GAS (CNG) PRESSURE REDUCTION SYSTEM (PRS) KAPASITAS 15 NM3/H. *Engineering And Technology International Journal Maret*, *6*(1), 2714–2755. https://doi.org/10.556442

49. Wiyono, A. S., Dewadi, F. M., Della, R. H., Sugiyanto, G., Rustam, M. S. P. A., Bakri, M. D., Yunus, A. I., Rustan, F. R., Dairi, R. H., & Sari, D. P. (2023). *Rekayasa Lalu Lintas* (D. P. Sari (ed.)). PT. GET Press Indonesia. https://books.google.co.id/books?id=a3DBEAAAQBAJ

50. Yunus, A. I., Kristiana, R., Dewadi, F. M., Anwar, B., H.Umar, S. A., Fuadah, N., Sarasanty, D., Edahwati, L., Murdani, E., & Tukimun. (2023). *Mekanika Teknik II* (D. P. Sari (ed.)). PT. GET Press Indonesia.

51. Yusaerah, N., Jumiaty, H., Dewadi, F. M., Rustiah, W., Faisal, A. P., Amin, I. I., Hutami, T. A., Darmayani, S., & Helilusiatiningsih, N. (2022). Konsep Dasar Kimia Analitik. In W. N. Ramadhani (Ed.), *Konsep Dasar Kimia Analitik*. PT. GET Press Indonesia. https://books.google.co.id/books?hl=id&lr=&id=qajEAAAQBAJ&oi=fnd&pg=PA63&dq=titrasi+pengendapan&ots=K8t-T4Xbem&sig=afUWKI5IUJK…1/1