BAB V
KESIMPULAN

Studi literatur yang dilakukan bertujuan untuk melihat perbedaan strategi penerapan simbiosis industri dalam upaya mitigasi emisi $CO_{2.}$ Perbandingan dilakukan untuk melihat persamaan dan perbedaan dari strategi penerapan simbiosis industri. Untuk persamaan dari ketiga kasus sehubungan dengan simbiosis industri yaitu penerapan simbiosis industri yang berupa pertukaran limbah guna menfefisienkan proses dan mengurangi emisi. Persamaan lainnya yang ditemukan bahwa penggunaan energi dan pemilihan bahan bakar menjadi masalah umum yang ditemui sehingga bahan bakar alternatif menjadi tantangan pada setiap subjek penerapan simbiosis industri. Untuk perbedaan dalam penerapan strategi simbiosis industri sendiri berdasarkan ketiga industri tersebut adalah cakupan penerapannya. Terdapat penerapan simbiosis industri hanya pada proses produksi saja namun terdapat pula hingga cakupan transportasi. Perbedaan lainnya yang ditemui yaitu penerapan simbiosis industri yang tidak terbatas pada pertukaran limbah antar industri namun juga dapat dilakukan dengan memanfaatkan teknologi sehingga cara ini dapat menjadi jalan keluar untuk melakukan simbiosis industri di mana pun industri tersebut berada. Namun, kendala biaya menjadi masalah. Pasalnya, investasi teknologi juga tidak murah dan belum tentu sesuai dengan keuntungan yang perusahaan dapatkan. Adapun dengan dilakukannya studi literatur ini diharapkan dapat menambah wawasan dalam penerapan simbiosis industri.

DAFTAR PUSTAKA

Referensi Utama

Hashimoto, S., Fujita, T., Geng, Y., & Nagasawa, E. (2010). Realizing CO_2 emission reduction through industrial symbiosis: A cement production case study for Kawasaki. *Resources, Conservation and Recycling,* 54(10), 704-710. doi:10.1016/j.resconrec.2009.11.013.

Yu, J., & Wang, K. (2011). Study on Characteristics of Steel Slag for CO_2 Capture. *Energy & Fuels*, 25(11), 5483-5492.

Zhang, G., Zhao, P., Xu, Y., & Zhang, Y. (2017). Characteristics of Pressure Drop of Charred Layer in Coke Dry Quenching over Coke Oven Gas. *Energy & Fuels*, 31(4), 4548–4555. doi:10.1021/acs.energyfuels.6b03286.

Referensi Pendukung

Achmad, Rukaesih. 2004. *Kimia Lingkungan*. Yogyakarta : Andi *Publishing*.

Bains, P., Psarras, P., & Wilcox, J. (2017). CO_2 capture from the industry sector. *Progress in Energy and Combustion Science,* 63, 146–172.

Chang, E., Wang, Y.C., Pan, S.Y., Chen, Y.H. and Chiang, P.C. (2012). CO_2 Capture by Using Blended Hydraulic Slag Cement via a Slurry Reactor. *Aerosol Air Qual*, 12(6), 1433-1443.

Daellenbach, H.G., & McNickle, D.G. 2015. *Management science: Decision making through systems thinking*. New York: PALGRAVE MACMILLAN.

Daigo, I., Matsuno, Y., & Adachi, Y. (2010). Substance flow analysis of chromium and nickel in the material flow of stainless steel in Japan. *Resources, Conservation and Recycling*, 54(11), 851–863.

Dong, L., Fujita, T., Zhang, H., Dai, M., Fujii, M., Ohnishi, S., Liu, Z. (2013). Promoting low-carbon city through industrial symbiosis: A case in China by applying HPIMO mod*el. Energy Policy*, 61, 864 - 873. doi:10.1016/j.enpol.2013.06.084.

Huang, C.-L., Vause, J., Ma, H.-W., & Yu, C.-P. (2012). Using material/substance flow analysis to support sustainable development assessment: A literature review and outlook. *Resources, Conservation and Recycling,* 68, 104–116.

Ibrahim, T. K., Rahman, M. M., & Abdalla, A. N. (2011). Gas Turbine Configuration for Improving the performance of Combined Cycle Power Plant. *Procedia Engineering,* 15, 4216–4223. doi:10.1016/j.proeng.2011.08.791.

Ismail, Yunita. (2020). Kajian Penerapan Simbiosis Industri Pada Rantai Pasok Otomotif. *Jurnal Ilmu Lingkungan*, 18(1), 146-152.

Kaviri, A. G., Jaafar, M. N. M., Lazim, T. M., & Barzegaravval, H. (2013). Exergoenvironmental optimization of Heat Recovery Steam Generators in combined cycle power plant through energy and exergy analysis. *Energy Conversion and Management*, 67, 27–33.

Latuconsina, Husein. 2010. Dampak Pemanasan Global Terhadap Ekosistem Pesisir Dan Lautan. *Jurnal Ilmiah agribisnis dan Perikanan,* 3(1), 30-37.

Martono, Nanang. 2010. Metode Penelitian Kuantitatif: Analisis isi dan Analisis Data Sekunder. Jakarta: PT. Raja Gradindo Persada.

Mathieux, F., & Brissaud, D. (2010). End-of-life product-specific material flow analysis. Application to aluminum coming from end-of-life commercial vehicles in Europe. *Resources, Conservation and Recycling*, 55(2), 92–105. doi:10.1016/j.resconrec.2010.07.006.

Neves, A., Godina, R., G. Azevedo, S., Pimentel, C., & C.O. Matias, J. (2019a). The Potential of Industrial Symbiosis: Case Analysis and Main Drivers and Barriers to Its Implementation. *Sustainability*, 11(24), 70-95. doi:10.3390/su11247095.

Peng, J., Lu, L., & Yang, H. (2013). Review on life cycle assessment of energy payback and greenhouse gas emission of solar photovoltaic systems. *Renewable and Sustainable Energy Reviews*, 19,255-274.

Piña, W. H. A., & Martínez, C. I. P. (2014). Urban material flow analysis: An approach for Bogotá, Colombia. *Ecological Indicators*, 42, 32–42. doi:10.1016/j.ecolind.2013.10.035.

Pratama, R., & Parinduri L. (2019). Penanggulangan Pemanasan Global. *Buletin Utama Teknik*, 15(1), 91-95.

Rakhmawati, D.A., & Navastara, A.M. (2013). Prioritas Faktor Pengembangan Kawasan Industri Gula Toelangan Melalui Pendekatan Konsep Simbiosis Industri. *Jurnal Teknik POMITS*, 2(1), 1-5.

Rochat, D., Binder, C. R., Diaz, J., & Jolliet, O. (2013). Combining Material Flow Analysis, Life Cycle Assessment, and Multiattribute Utility Theory. *Journal of Industrial Ecology*, 17(5), 642-655. doi: 10.1111/jiec.12025.

Sajwani, A. & Nielsen, Y. (2017). The Application of The Environmental Management System at The Aluminum Industry In UAE. *International Journal of GEOMATE*, 12(30), 1-10.

Santoso, H., Susanty, A., & Putriasih, J. (2014). Rekayasa Ekologi Industri dalam Mendukung Pembangunan Agro Eco-Industrial Park Skala Pedesaan. *Jurnal Teknik Industri Universitas Diponegoro*, 9(2), 117-124.

Sebastián, F., Royo, J., & Gómez, M. (2011). Cofiring versus biomass-fired power plants: GHG (Greenhouse Gases) emissions savings comparison by means of LCA (Life Cycle Assessment) methodology. *Energy*, 36(4), 2029–2037. doi:10.1016/j.energy.2010.06.003.

Siregar, Erwin. (2007). Industri Besi dan Logam Merupakan Sumber Emisi Gas CO2, *Majalah Ilmiah Pengkajian Industri*, 1(3), 82-91.

Stanisavljevic, N., & Brunner, P. H. (2014). Combination of material flow analysis and substance flow analysis: A powerful approach for decision support in waste management. *Waste Management & Research*, 32(8), 733–744. doi: 10.1177/0734242X14543552.

Stolyarova, Elena. (2013). Carbon Dioxide Emissions, economic growth and energy mix: empirical evidence from 93 countries. *Conference: EcoMod*, 1-19.

Sudarman, Sutradharma Tj., Ananta, Peter., Suryadi, William., Tat. Ong Po. & Gunawan, Tresno. (2011). Pemanasan Global Solusi dan Peluang Bisnis. Jakarta: PT. Gramedia.

Sun, K., Tseng, C.-T., Shan-Hill Wong, D., Shieh, S.-S., Jang, S.-S., Kang, J.-L., & Hsieh, W.-D. (2015). Model predictive control for improving waste heat recovery in coke dry quenching processes. *Energy*, 80, 275–283. doi:10.1016/j.energy.2014.11.070.

Sutanhaji, A.T., Anugroho, F., & Ramadhina, P.G. (2018). Pemetaan Distribusi Emisi Gas Karbon Dioksida (CO_2) dengan Sistem Informasi Geografis (SIG) pada Kota Blitar. *Jurnal Sumberdaya alam dan lingkungan*, 5(1), 34-42.

Ulhasanah, N., & Goto, N. (2012). Preliminary Design of Eco-City by Using Industrial Symbiosis and Waste Co-Processing Based on MFA, LCA, and MFCA of Cement Industry in Indonesia. *International Journal of Environmental Science and Development*, 3(6), 553-561. doi: 10.7763/IJESD.2012.V3.285.

Wahrlich, J., & Simioni, F. J. (2019). Industrial symbiosis in the forestry sector: A case study in southern Brazil. *Journal of Industrial Ecology.*1-13. doi:10.1111/jiec.12927.

Wang, J. G., Wang, Y., Yao, Y., Yang, B. H., & Ma, S. W. (2019). Stacked autoencoder for operation prediction of coke dry quenching process. *Control Engineering Practice*, 88, 110–118. doi:10.1016/j.conengprac.2019.04.007.

Winkler, H., Hughes, A., Marquard, A., Haw, M., & Merven, B. (2011). South Africa’s greenhouse gas emissions under business-as-usual: The technical basis of “Growth without Constraints” in the Long-Term Mitigation Scenarios. *Energy Policy,* 39(10), 5818–5828. doi:10.1016/j.enpol.2011.06.009.

Worldometer, (2016). CO2 Emissions. Retrieved from www.worldometers.com.

Wuryandari, A., & Akmaliyah, M. (2016). Game Interaktif Mencegah Terjadinya Pemanasan Global Untuk Anak. *Jurnal SIMETRIS*, 7(1), 311-320.

Yellishetty, M., & Mudd, G. M. (2014). Substance flow analysis of steel and long term sustainability of iron ore resources in Australia, Brazil, China and India. *Journal of Cleaner Production*, 84, 400–410. doi: 10.1016/j.jclepro.2014.02.046.

Zhang, H., Dong, L., Li, H., Chen, B., Tang, Q., & Fujita, T. (2013). Investigation of the residual heat recovery and carbon emission mitigation potential in a Chinese steelmaking plant: A hybrid material/energy flow analysis case study. *Sustainable Energy Technologies and Assessments*, 2, 67–80.

Zhou, N., Fridley, D., Khanna, N.Z., Ke, J., McNeil, M., Levine, M., (2012). China's energy and emissions outlook to 2050: perspectives from bottom-up energy end-use model. *Energy Policy*, 53, 51-62.