Energy and Exergy Analyses of the Danish Industry Sector

A detailed analysis of the Danish industry is presented in this paper using the energy and exergy methods. For the 22 most energy-intensive process industries, which represent about 80% of the total primary energy use of the industrial sector, detailed end-use models were created and analysed with data for the years 2006 and 2012. The sectoral energy and exergy losses, as well as the exergy destruction, were further established to quantify the potential for recovering and valorising heat otherwise lost. By also considering transformation processes occurring in the utility sector, the impact of using electricity and district heat in the industry is shown. The exergy efficiencies for each process industry were found to be in the range of 12% to 56% in 2012. However variations in the efficiencies within the sectors for individual process industries occur, underlining the need for detailed analyses. The exergy losses amounted to 3800 TJ for the same year. Meanwhile, the complete exergy losses, including the central production of heat and power, exceeded 8700 TJ. This analysis illustrates for the case study of Denmark how waste heat recovery potentials in the industrial sectors are found, by determining the sectors losses and exergy destruction. In addition the importance of applying a system analysis is shown, which corrects the site efficiencies for electricity and district heating use. The use of 22 industries, further highlights differences amongst industries belonging to the same sector.

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