Industrial Energy Mapping: THERMCYC WP6

This report contains an evaluation of the potential waste heat sources in Denmark. The evaluation is based on data from Statistics Denmark on the 15 Danish sectors (the 15 sectors are grouped in five categories that have similar consumption/production patterns). Besides the 15 sectors, the accessible heat from three natural energy sources is also included in the evaluation. The quantification of the potential waste heat is based on a number of approaches such as, professional experience within Viegand Maagøe, input from project partners, theoretical calculations, case studies, input from suppliers, input from end-users etc.

It must be emphasized that the total energy consumption used in this study covers all end-users and utility companies and therefore the total energy consumption can be higher than what can be found in other statistic. By including both utility companies and end-users a double counting of net energy input can occur, if e.g. the output from the utility company is used as energy input to the end-users.

The total potential for heat recovery is calculated to 212 PJ per year (excluding natural energy sources) which correspond to 13% of the net energy input for end users and producers.

The large potential is firstly within the transport (36%), secondly within utility (28%), industry (23%), buildings (11%) and finally the construction sector where the potential is relatively small.

The potential for waste heat in the transport sector originates from exhaust gas (high temperature from 200°C to 400°C), engine and charge air cooling (low temperature below 80°C).

In the utility sector, 43 % of the waste heat originates from condensate from steam power plants which is accessible at a temperature of 20 °C. The remaining 57 % of the waste heat originates primarily from exhaust gas at temperatures from 120°C to 180 °C.

In the industrial sector 91 % of the waste heat is accessible at temperatures below 100°C. The low temperature waste heat originates mainly from condensate, condensate from steam plants which is accessible at a temperature of 20 °C. The remaining 57 % of the waste heat originates primarily from exhaust gas at temperatures from 120°C to 180 °C.

In the building sector the all the waste heat is accessible at temperatures below 100°C and originate primarily from refrigeration/cooling and exhaust from boilers.

The potential of waste heat in the construction sector is estimated to be relatively low due the fact the majority of the installations are temporary.

The potential for utilising "waste heat" from natural resources is theoretically close to infinite, but economically unfeasible. At the stage of completing the report, there has not been sufficient information to evaluate the low temperature potential that is also economically feasible, so the focus in this report is primarily regarding the temperatures from these natural resources. Solar can supply heat at temperatures up to 100°C, geothermal energy can supply heat at temperatures up to 90 °C and air/water average around 2°C during colder seasons and 17 °C in warmer seasons.

When looking across all the sectors there are two major energy sources. One of them originates from cooling/ refrigeration, condensate and various industrial processes all below 60 °C and the other major waste heat source comes in the form of exhaust gas from various comb-bustion and heating processes.