WASTE HEAT RECOVERY: POTENTIAL, POLICY CHALLENGES AND TECHNOLOGY CHOICES

Sanne Lemmens, University of Antwerp, +3232654897, sanne.lemmens@uantwerpen.be

Overview

The industry sector in the European Union (EU) is responsible for about 20% of primary energy use. Significant efforts have been made to improve the efficiency of the sector's energy use, but there remains room for improvement (EC, 2011). Enhancing energy efficiency is a major contributor to lowering the intensity of energy use. These demand-side efforts are indispensable in transitioning to a more streamlined energy sector. One approach gaining increased attention is the recovery of industrial waste heat – heat that is unavoidably produced by some processes and that has no in-process use. [2] Recovering this waste heat may still give it a useful destination in secondary processes and is therefore said to improve an industrial plant's energy efficiency. Waste heat could be valorized for differing end-uses using several techniques. Potential end-uses exist in heat supply (for processes, to district heating systems or to buildings), electricity generation (for on-site or off-site use) or cogeneration. In practice, applications are influenced by technical challenges, economic considerations and policy settings. Knowing the policy context and the technical possibilities, it is of interest to investigate how the economic dimension steers for certain solutions. The question is how to valorize this waste heat in a manner that is both energetically and economically interesting.

Methods

This research starts by exploring theory and literature findings to come to a solid definition of energy efficiency and understand barriers in practice. The European Union recently published its Energy Efficiency Directive to overcome the energy efficiency gap by action on several fronts. Second, it is investigated what measures exist to enhance energy efficiency, more specifically within the industry sector. In the remainder of the wok the scope narrows to waste heat recuperation as a measure to improve industrial energy efficiency. Finally, various end-use possibilities for industrial waste heat are discussed, with a perspective on the economic aspects rather than the technical details.

Results

Waste heat recovery is a measure with significant potential to enhance the industry's overall energy efficiency. Recovering residual heat streams allows for useful application in a secondary system. The end-use options include heat utilization, electricity generation and combined heat and power production. The overarching benefit of industrial waste heat utilization is an improved employment of energy sources. Putting discarded residual heat to use implies an enhanced utilization of the energy source used as primary input for the system. At the same time it may (partly) offset energy generation with alternative energy sources because less energy input is required for this secondary process.

Conclusions

This paper draws a definition of the concept energy efficiency and discusses various options to improve energy efficiency, specifically in the industry sector. The potential of waste heat recovery is further explained and the possibilities for useful application of residual heat are delineated. The choice for one end-use system or another depends first of all on the technical and practical possibilities: characteristics of the waste heat, heat requirement in a nearby process, proximity of nearby process, heat demand in on-site building. These practical aspects delineate the scope of the possibilities. The final decision is commonly made regarding economic trade-offs. This qualitative assessment is a preliminary step in complementing the technical research in the field with an economic viewpoint.

References

[1] EC, 2011. COM/2011/0109. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Energy Efficiency Plan 2011. European Commission, Brussels, 08/3/2011.

[2] Bendig, M., Maréchal, F., Favrat, D., 2013, Defining "Waste Heat" for industrial processes, Applied Thermal Engineering 61: 134-142.