Introduction to Panel 2 Sustainable production design and supply chain initiatives

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Introduction

Compared to the research efforts in the field of energy efficiency and resource efficiency in the past, a lasting implementation of innovative concepts in this field in daily practice seems to be rather low. If the former proved to be able to obtain substantial savings of energy, reduction of emissions and saving of money, the latter, with its enormous potential, is still having a hard time.

This panel wants to show innovative examples for sustainable production, focussing on holistic approaches with regard to the whole process chain and the entire supply chain, as well as to adjacent systems like product development, production planning and distribution, and, of course, to all resource flows, e.g. energy, material or water.

This panel aims at the broadest possible presentation of industry, in particular sustainable production solutions with high effort implemented in daily practice, and looks at examples that inspire, with possible transferability to other enterprises and production sectors.

In Panel 2, we start with papers that deal with the broadening the view on energy efficiency. We then continue with examining tools for improving energy efficiency and eco-efficiency, with a special focus on information gathering and use. Finally, analyses of different scales of impact on sustainable production will be presented and discussed.

Not only energy efficiency

Narrowing the focus only on energy efficiency is enough for achieving higher results in terms of sustainability? Energy efficiency is not a stand-alone issue, but it should be complemented in a broader context. Gudbjerg et al. (2-020-14) highlight how non-energy benefits (NEBs) are traditionally not included in the economics of energy efficiency project implementation, since there is no commonly recognised method for calculating their value, thus leading to lower their acceptance. This paper presents a method for valuation of NEBs and a web-based tool for collection and visualisation of NEBs of energy efficiency projects. Khattak et al. (2-015-14) describe a jaggery production process from energy and exergy perspectives. The process was modified to improve process efficiency based on an energy analysis, but they highlight how modifications required to minimise exergy destruction differ from what is required to maximise energy efficiency. This study highlights a possibility that increasing the local system efficiency may have a negative impact on the global system's resource consumption. Khattak et al. (2-040-14) present a case study into the use of waste heat from a factory building to supplement the heating system. When analysing the energy efficiency of a factory, it is useful to consider the whole system including both the manufacturing processes and the factory building, because the latter is included due to its significant energy usage associated with production. A simulation based approach is used in which the factory heating system is compared with and without heat reuse. The results quantify and compare the changes in efficiency and resource use based on both energy analysis and exergy analysis; effectively quantifying natural resource consumption due to changes in the manufacturing system.

Tooling energy efficiency and eco-efficiency

The need of practical, still effective tools for energy efficiency and eco-efficiency is strong. Brunner et al. (2-089-14) present a comprehensive energy audit and energy management tool as well as a realization guideline for companies of the food and

beverage industry. It includes the design of the present state production process flow sheet, a mass and energy balance, the calculation of the primary energy use and CO_2 emission as well as heat integration, efficient electricity consumption and efficiency of heat and cold supply. Guidelines for the implementation of best available technologies and renewable energy sources including information on existing funding systems show potentials for improvements and tailor-made solutions for SMEs in the different subsectors in the food and beverage industry. Litos & Evans (2-064-14) review approaches on eco-efficiency in terms of tools and techniques applied so far in the literature and discusses on a tool-kit that has been developed to assess eco-efficiency and identify and prioritise actions for implementation in production facilities. This paper also provides insight and guidelines for tool developers in industry and academia who aim at helping practitioners to better visualise and rationalise improvement actions in factories.

Information for energy efficiency

Adequate level of information on energy consumption is an enabler for energy efficiency. Al-Mansour et al. (2-090-14) show how insufficient or inappropriate monitoring of energy consumption usually lead industrial companies in the wrong direction, and keep them from knowing what potential they have for profitable energy investments. The paper presents a novel concept of the context sensitive energy and environmental management system and a case study of its implementation in energy intensive industry. A concept of the tool has been developed for achieving energy savings and emissions reduction through the system of metering, monitoring and evaluation of energy, environmental and economy performance. Agha & Jenkins (2-080-14) utilise high-resolution empirical energy data of a vertical case study textile mill to estimate its overall energy use and to find out any underlying efficiency improvement opportunities and identify some actionable energy saving opportunities. The paper reveals how a more detailed energy analysis can provide much richer and actionable information than more standard energy audits and surveys, as, for any energy efficiency study, measuring the energy consumption quantitatively is the first step.

Different scales of impact

With a growing scale, three analyses are presented to appreciate the different level of impact of decisions on sustainable production. McAlister & Wood (2-072-14) evaluate the environmental impacts of 3D printing, and consider how the use of 3D printing technology in place of traditional production methods can improve the sustainability of production. They identify the key strengths and weaknesses of the technology, and suggest that despite the limitations, 3D printing will continue to sustain growth in the industrial, retail and after-market support, biomedical and low-end consumer areas. They find that use of electrical energy appears to be the largest environmental impact of 3D printers, but waste is still important, particularly as it represents a proportion of wasted energy as well as materials. Pastowski et al. (2-091-14) highlight how most strategies for increasing energy efficiency in industry and logistics are heavily based on improvements of related technologies, but organisational approaches are often overlooked. Likewise there is not much evidence on the interrelation of decisions focused on production or logistics and their effects on energy efficiency. This paper contributes help to better understand interrelated organisational variables and to design them in a way that the system-wide energy efficiency can be optimised. Three case studies cover plant-related logistics, a local production cluster and a particular branch of a global distribution network. Herbst et al. (2-066-14) present how analyses and scenarios of future industrial production, especially in the field of energy-intensive industries, can be useful for a variety of different task from policy advice to resource sustainability. This paper describes a methodology for the modelling of future steel use and production on process level as well as scrap availability linking economic and demographic information. The methodology describes a comprehensive approach to translate macroeconomic sector information into apparent and true steel use of a country and calculate its physical production of crude steel, electric steel, and oxygen steel considering structural change, prompt scrap availability, and end-of-life scrap availability.

Conclusions and key messages

This panel has covered a wide variety of topics, highlighting several opportunities for saving energy and costs, and reducing emissions. We hope this panel, having shown innovative examples for sustainable production that were put into practice, could represent a good contribution for companies to choose directions. Nonetheless, if the variety of papers presented in this panel covered several areas of interest, it is evident that more evidence is still needed to prove that potentials are substantial and, in the meanwhile, they are worth further investigation.