Introduction to Panel 5
Energy efficiency in industry

Panel leader: **Silvia Rezessy**
European Commission, DG Joint Research Centre
Silvia.Rezessy@ec.europa.eu

Panel leader: **Barbara Schlomann**
Fraunhofer Institut System- und Innovationsforschung, Germany
Barbara.Schlomann@isi.fraunhofer.de

Introduction

Technologies and practices related to core processes, auxiliary activities and cross-cutting technologies in all industrial sectors offer numerous opportunities to improve energy efficiency with the aim of cutting energy costs, improving productivity, meeting environmental obligations and building a green corporate image.

The panel on energy efficiency in industry has welcomed papers describing how existing potential can be harnessed, whether through the development and application of new technologies, better management of energy or influence of national and international programmes. The panel on energy efficiency in industry thus offers opportunities to learn about a wide variety of cutting-edge energy technologies, measures, programmes, and management strategies that reduce energy costs, improve energy reliability, lower energy price volatility, and enhance industrial productivity.

Papers on the following topics were encouraged:

- Policies and measures to improve energy efficiency in industry, such as emissions trading, voluntary agreements, standards or specific approaches for industrial SMEs.
- Innovative technologies and management practices to improve energy efficiency in industry.
- Top-down and bottom-up modelling approaches to analyse the impact of energy prices, environmental taxation or structural changes on industrial energy consumption
- Following a peer-review process, a total of 22 papers and 3 posters were accepted in the panel, which cover the above topics.

Improving energy efficiency in energy-intensive industries

In paper 5042 Thollander and Ottosen analyze the presence of long-term energy strategies in the Swedish pulp and paper industry. The results of their survey on energy management practices in 40 Swedish mills show that more than 20% of the studied mills lack a long-term energy strategy, and that less than half of the studied mills had an energy strategy of at least five years. They demonstrate the importance of the implementation of long-term energy strategies in this energy intensive industry.

In paper 5269 Stenqvist and Nilsson provide a process and impact evaluation of a Swedish tax rebate program for industrial energy efficiency. The implementation of Directive 2003/96/EC introduced taxation on electricity for industrial consumers in Sweden, allowing tax exemption for energy intensive industries if they entered an agreement on energy efficiency, which requires participants to do energy audits, implement energy management systems and make profitable investments. The program has been hailed as a major success. The paper evaluates under what conditions the program meets stated objectives.

Paper 5100 Helgerud and Sandbakk analyse twelve industrial sub-sectors of the Norwegian food and drink industry with regard to their implementation of energy saving measures and quantifies the accumulated energy saving potential corresponding to certain investment cost levels. The authors estimate a 20% economic profitable energy saving potential in the food and drink sector in Norway provided that the industry accepts investment measures with pay-back up to 2 years.

Standards and market transformation

In paper 5134 Brunner and Borg report on experiences of an electric motor systems market transformation program between 2005 and 2009, providing guidance through conflicts of various industry groups and competing standards and their impact on slowing energy efficiency market development. They summarise lessons learned and draw conclusions for other mass produced electric equipments.

In paper 5140 Tiedemann and Sulyma report on the process, market and impact evaluation of an industrial market transformation program at a major North American utility. They state that the program has been successful in building a high level of knowledge of and interest in energy efficient technologies and in encouraging energy efficiency investments. Major energy efficiency opportunities include appropriate motor sizing and heat recovery for compression, appropriate motor sizing and adjustable speed drives for fans, adjustable speed drives and pipe sizing for pumps, appropriate motor sizing and power factor correction for processes, and T5 lamps and electronic ballasts for lighting.

In paper 5389 Jardot et al discuss possible cost degression effects for energy efficient technologies by economies of scale and experience taking electric motors as a case study. Cost degression aspects are already quite well analyzed for renewable energy technologies, but much less well documented for energy efficient technologies. By analyzing the detailed structure of the (gross) production value for energy efficient electric motors it was possible to identify cost degression in the reference category amounting to approximately 20% between 1995 and 2006 corresponding to a learning rate of around 9%.

Policy instruments to improve energy efficiency

In paper 5052 Oikonomou et al show the effects of supplier obligations and white certificates in two oligopolistic market models: Cournot and the Stackelberg model, testing their theoretical findings with data from the oligopolistic market in Italy. They show that a leader company can serve the main part of electricity and energy efficiency projects, through financing them with white certificates, while the residual demand is more expensive and must be covered at a high cost from follower companies.

Gaudioso et al provide estimates in paper 5073 of the abatement that has taken place in Italy in the first implementation period (2005-2007) of the EU ETS. The analysis shows CO_2 emission trends at sectoral level and applies indicators to demonstrate changes in production and consumption patterns.

In paper 5250 Price et al evaluate the program design and initial results of the Top-1000 Energy-Consuming Enterprises program in China, which was modelled after a voluntary agreement pilot project with two steel mills in Shandong Province designed based on lessons from the Netherlands Long-Term Agreements and the UK Climate Change Agreements. The paper guides the reader towards understanding the possible implications of its success in terms of energy and carbon dioxide emissions reductions and recommends future program modifications based on international experience with similar target-setting agreement programs.

Improving energy efficiency in companies

In paper 5092 Levacher et al propose new solutions on industrial processes in order to harness the potential energy savings in industry by using Best Available Technologies (BATs). These include electrical BATs, process analysis by new methods of energy integration including the energy value (quality of the energy used) for sectors which have never been explored before, recovering and valorising energy losses and energy inside waste and co-products.

In paper 5321 Schweiger et al present the EINSTEIN methodology for thermal energy audit, which focuses on industries with a high thermal energy (heat and cold) demand in low and medium temperature ranges up to 400°C, such as food and beverage industry, metal surface treatment, wood processing industry and many other industrial sectors (paper, chemical, pharmaceutical, textile, etc.). Even if the EINSTEIN methodology is focused on industrial heat and cold demand, a big part of the developed methodology can also be applied to other medium and large scale consumers of heat and cold.

Waldmann and Keuc in paper 5349 present a new approach targeted at SMEs and involving communication-based services that empower companies to build their knowledge on their energy consumption patterns and changes therein. Based on an energy management information system, energy data is collected from the energy supplier though remote data acquisition and analysed in the energy management information system, providing the management of SMEs with monthly reports containing key developments of energy consumption through personalised e-mails.

In paper 5178 Tanida gives an overview of the efforts in a developing country like Thailand to improve energy efficiency in industry, taking the example of retailers in Bangkok. The paper focuses on environmental management aiming to ensure triple benefits (minimizing resource use, economic benefits, and the abatement of CO2 emissions) based on the management system by AEON, which is one of the biggest Japanese retailers.

Modelling industrial energy consumption I

In paper 5276 Blanc and Callonec study the efficiency of a carbon tax in the French industrial sector and assess the likelihood of industrialists shifting from one energy source to another due to a change in the relative prices of different energy sources and of improving energy efficiency. They conclude that with price variations of the magnitude that was observed between 1986 and 2004 industrial companies were much more likely to improve the energy efficiency of their equipment and processes than to shift energy sources in response to a given increase in prices. The study also gives information about the speed at which the industrial sector adapt to variations in prices.

Using Irish industry as a case study, in paper 5148 Cahill and Ó Gallachóir examine the effectiveness of ODEX in measuring true energy efficiency improvements in the sector. To determine its accuracy, ODEX is subjected to a series of index number tests commonly used in index number theory and is compared to an index of energy intensity at constant structure. The extent to which the value yielded by the index depends on the level of dis-aggregation is investigated, and the validity

of making cross-country comparisons using ODEX values is challenged.

In paper 5173 Hita et al use the TIMES models to assess the response of industry to environmental constraint. It calculates the best economical choices for technology adoption in the large energy consuming industries. The authors identify for each large energy consuming industrial branch, and for different carbon constraint, the best technologies, or optimisations to reduce production cost. The potential for improving the energy efficiency of industrial cross-cutting technologies is calculated.

Improving the energy efficiency of industrial cross-cutting technologies

In paper 5045 Irrek et al analyses the technical and economic energy efficiency potentials of distribution transformers in industry and commerce in the EU-27. Based on this, strategies, policies and measures are identified on European, national and company level that can support the realisation of energy saving potentials (e.g. mandatory standards, information and training, labelling, and a calculation tool).

In paper 5129 Dupont and Sapora show the sizeable heat demand reduction potential in French industry, taking as example heat pump systems. The paper also highlights several barriers that might slower the spread of such systems and reduce their potential. The authors indicate that cost-effectiveness of the heat recovery by heat pump systems is a key uncertainty.

Anglani and Benzi present in paper 5241 a simplified procedure for using a bottom-up methodology for reporting the energy savings from use of variable speed drives for air compressors, compared to fixed speed motors, with a load-unload technique. Potentials and drawbacks of a simplified assessment procedure are analysed and projections of potential savings in the Italian industry are presented.

Modelling industrial energy consumption II

Fleiter et al present in paper 5376 a critical assessment of the concept of conservation supply curves (CSCs). The construction of CSCs is subject to several methodological issues that have an enormous effect on the slope and position of the final curve. The analysis of these methodological issues has been conducted by constructing a CSC for the European industry.

In paper 5237 Algehed et al lay out an approach that combines top-down and bottom-up models used to analyse the influence of specific policies on energy efficiency and carbon dioxide emissions in industry. Results obtained from the bottom-up model are used as input data for the top down model by soft linking the two models. They present a case study of the EU pulp and paper industry using the combined top-down and bottom-up approach and conclude that the joint approach gives a better understanding of the industrial system studied than if using the models separately.

In paper 5153 Ó Gallachóir and Cahill propose an improved method of modelling plant energy demand that introduces standard productivity Key Performance Indicators (KPIs) into top-down models of energy consumption in manufacturing plants. The model demonstrates the relationship between energy consumption and productivity, and standard metrics for productivity and quality can help identify the areas of manufacturing activity that offer the most potential for improved energy efficiency. The paper concludes that policies and measures that focus on energy consumption alone, will have limited success in improving the energy efficiency of industry. Policies and measures that promote greater productivity and improved quality of process and product may have a greater influence on the energy efficiency of the industrial sector.

Posters

Panel 5 has accepted 3 contributions to the poster session. Paper 5012 by Bongardt and Eichhorst presents experiences from adopting voluntary agreements in Chinese state-owned enterprises. Paper 5025 by Lezsovitz presents the advantages and disadvantages of multiple disk type turbines for the realization of co-generation in small and medium scale heat supply systems. Paper 5105 by Riviere et al presents an energy efficiency assessment tool based on Process Energy and Exergy Analysis method (PEEA). Directly derived from an application of the PEEA method introduced by Abou Khalil et al in 2008, a scanning and auditing tool for industrial plants is presented, which aims at identifying within the industrial plant, customized and pertinent process energy efficiency improvements, while quantifying the potential energy savings as well as payback time for investments.