Energy efficiency of industrial motor driven systems

Annegret-Cl. Agricola
German Energy-Agency, Head of Division Energy efficiency in the Electricity Sector
Chausseestr. 128 a
D-10115 Berlin, Germany
agricola@dena.de

Jörg Köhl
German Energy-Agency, Project manager
Division Energy efficiency in the Electricity Sector
Chausseestr. 128 a
D-10115 Berlin, Germany
koehl@dena.de

Keywords

Energy efficiency in industry and trade, motor driven systems, advisory campaign, Motor Challenge Programme

Abstract

Numerous studies demonstrate that measures to improve energy efficiency of industrial motor driven systems are insufficiently implemented by industrial enterprises - in spite of their huge technical and economic saving potential. In the framework of the SAVE programme, the European Commission has developed a broad range of tools targeted on overcoming barriers to implement efficiency measures. While these tools have demonstrated their value individually, they have not gained their existing potential yet.
In Germany, a nationwide initiative, borne by public authorities, private institutions and manufacturers, was set up in order to decisively open up the market for energy efficient techniques, by integrating information and existing assistance tools. The advisory campaign comprises:

- Development of easy adjustable applications, which simplify the design and implementation of innovative solutions in various facilities.
- Executive consultancy addressing technical and commercial staff, as well as upper management in industrial enterprises, in order to motivate decision makers not only to consider the reduction of energy consumption but also to start realizing measures. Advice on concomitant opportunities of financing measures is given too.

Thus industrial system users are guided to optimize the energy efficiency of motor driven pump-, ventilation- and compressed air systems.

Experience gained in a previous campaign, concentrating on the same target group in Germany, shows that the end-user orientated advisory service has the desired effect on market growth. The latest concerted initiative, which concentrates on decision makers, aims at addressing a majority of small and medium-sized enterprises in Germany. Current customer feedback is consistently positive.

Introduction

With the objectives for a world-wide reduction of greenhouse gases, specified in the Kyoto protocol of the United Nations, the European Union committed itself to reduce the average CO_2-emissions from 2008 to 2012 by 8% referring to the level in 1990. Multiple strategies and measures must be implemented in order to achieve this goal. The final energy consumption in the sectors industry and trade has to be reduced.

Within those sectors, one third of the final energy consumption concerns applications that transform electrical energy in per case required energy forms. In the year 2000 the industry sector exclusively used about 951 TWh electrical energy in the European Union (EU 15), corresponding to 37% of the entire consumption. In the Federal Republic of Germany the sector has a similar relevance. In 2002 nearly 209 TWh of electrical energy were used in the industry sector. About 65% of this consumption accounts for motor driven systems.

Although energy efficiency of industrial electricity applications has been brought up for discussion often, current statistics suggest that the largest part of existing reduction-potential is not used yet (see Figure 1).

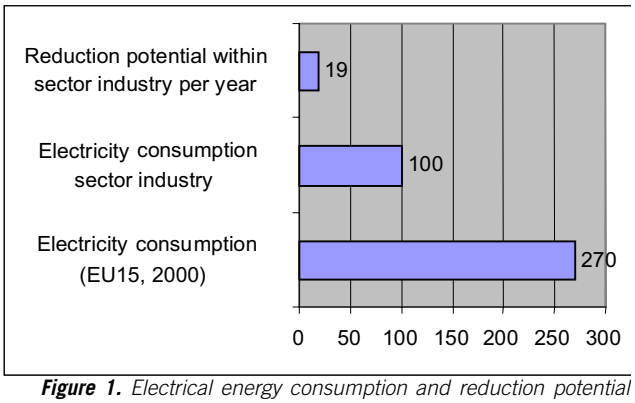

Figure 1. *Electrical energy consumption and reduction potential within European Union (EU 15), as percentage of industrial consumption, in 2000.*

Energy saving potentials in industrial enterprises

Numerous studies[1] document substantial economic cost- and energy-saving potentials, which can be harvested by process-optimization during planning, installation and operation of electrical driven applications. Apart from the use of energy-efficient technical components, like high-efficient electrical motors or frequency converters, an integrated view of the overall system with substantial cost savings to be achieved could also increase energy efficiency.

Today's final electricity consumption of all existing electrical driven applications in industry could be reduced by suitable optimization measures and investments with almost 20%. That means, within the European Union about 181 TWh could be saved per year. Only related to pump-systems the energy-saving potential is approximately 46 TWh. On the assumption of an electricity tariff of 8 Eurocent/kWh a cost-saving potential of annually 3.7 Billion Euro results.

The disclosure of existing saving potentials and the implementation of energy-efficiency-measures are determined by the national framework (laws, regulations, support measures), the basic economic conditions of the enterprises (electricity tariffs, capital availability etc.) and the operational conditions. Cost-efficiency of optimized systems usually translates in terms of reduced operating- and electricity-costs during the period of operation. Often financing offers and services are necessary for the implementation of energy saving measures, apart from an increase in the technical planning know-how. If these financing offers are missing, expedient measures are not realized, despite of recognized chances. There are a number of other obstacles in enterprises, which restrict the use of existing potentials. Examples are:

Technical obstacles

For instance the complexity of combined systems could lead to operational staff not being able to appraise effects of optimization measures in other places. Furthermore, due to missing measuring-instruments allocation problems exists concerning the correlation of consumption to consumption generating aggregates. Last but not least the calculated plant availability could decrease by using the most energy-efficient solution. An example is the replacement of a butterfly valve regulation by a frequency converter, which has a higher risk of default.

Economic obstacles

In enterprises the energy costs are mostly underestimated in comparison to total manufacturing costs. Moreover, lack of capital or validating investment measures only by means of the payback period, and not on basis of return on investment, could be the crucial factor for enterprises not to realize possible measures.

Organizational obstacles

Distributed or unclear competencies, as well as lack of time of responsible persons, are common reasons for not recognizing and using energy-saving potentials. In addition, internal cost calculation systems, which cannot make an allocation of the costs to the cost causers, cannot assign benefits to the relevant initiators.

The obstacles mentioned can be diminished by a holistic view and analysis of the energy using systems, by optimization of the organizational structures and by the dismantling of information deficits. Therefore campaigns, which diminish information deficits and convince industrial management to act, can make a contribution to the awareness of energy efficiency potentials and can be motivating for the realization of reasonable measures. The market for energy-efficient techniques is stimulated positively by such campaigns.

Campaign "energy efficient systems in industry and trade" started in 2004

In 2004 the Deutsche Energie-Agentur GmbH (dena – the German Energy Agency for energy efficiency and renewable energies) together with the sections "pumps + systems" and "compressors, compressed air and vacuum technology" of Verband Deutscher Maschinen- und Anlagenbau[2] initiated a country wide information and motivation campaign in order to decisively open up the market for energy efficient techniques by integrating information and existing assistance tools. The campaign addresses itself to enterprises in all industrial sectors, with focus on small and medium-sized enterprises. One previous campaign concentrating on the same target group in Germany, namely "Druckluft Effizient", aimed at optimizing compressed air systems. Experiences made in this context showed that end-user orientated advisory service had the desired effect of market growth.

"Druckluft Effizient" has produced a lot of helpful information material. A measurement campaign did not only reveal huge saving potentials but also motivated the companies to exploit them. This campaign also generated positive market effects for energy-efficient technologies. Over 200 enterprises in Germany profited directly from the

1. E.g.: German ministry of economics: research project 19/98
2. VDMA – the German Engineering Federation is a network of around 3 000 engineering industry companies in Europe

Figure 2. *Private and public project partners.*

provided information. On the average, 240 MWh electricity consumption was saved in each analyzed enterprise per annum.

The new campaign "Energy efficient systems in industry and trade" supplies adequate information and consulting offers to the target group and it develops accompanying press and public relations. Furthermore, it aims to motivate decision makers in industry and trade to realize energy-efficient measures. Special attention of the campaign is given to directly address end-users. For users of motor driven systems (decision makers with economic responsibility, plant engineers and technicians) as well as for plant planners, different offers are developed and country wide communicated. Managers are informed about economic energy-saving potentials including financing services (e.g. performance contracting). Plant engineers can receive assistance for the realization of measures to increase the energy efficiency.

The project is accompanied by a professional marketing strategy in the public area. Financing is organized as a public private partnership in equal parts of public and private means. The project is supported by the Federal Ministry of Economics and Labour (BMWA) in Germany. The campaign will also be linked to the European Motor Challenge Programme, which has officially been launched in February 2003 by the European Commission. The Motor Challenge Programme aims at accelerating the improvements of motor driven systems (pumps, compressors, fans, drives) on a voluntary basis. So far several well known companies assist the programme.

Via the internet-site, which is permanently updated during the campaign process, information that already is available is communicated. It is supplemented by extra information meeting specific users demand. The Website is promoted by press and public relation of the campaign.

The realization of energy efficiency measures will be activated by the offer of a modular advisory service (see Figure 3). A number of about 100 initial consultancies are supplemented by a fixed number of detailed technical-economical energy saving analyses. Implementation consultancy is offered to those enterprises, which received an energy saving analysis, and for whom efficiency measures under the economic point of view would make sense, but which nevertheless would not arrange measure realization. It addresses technical and commercial decision makers and focuses on

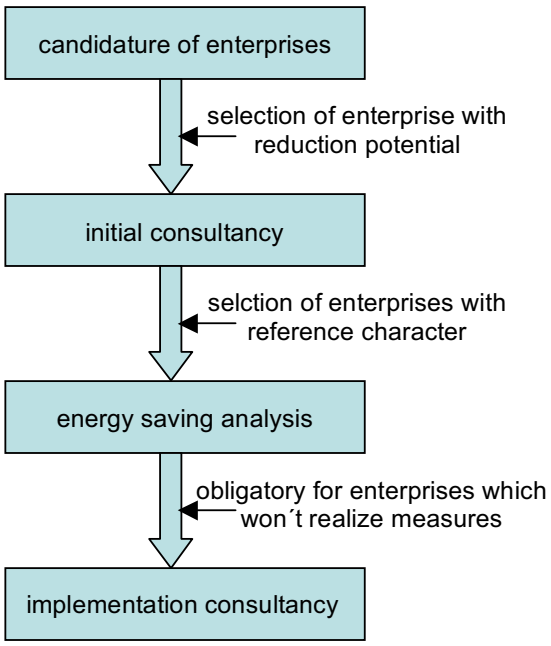

Figure 3. *Consulting modules.*

financing and official promotion possibilities for the proposed measures.

The modules 'initial consultancy', 'energy saving analysis' and 'implementation consultancy' are central activities of the campaign and at the same time occasions for a campaign-referred public relation. Successful energy efficiency projects with high practical relevance (Best Practice) are communicated with priority in order to motivate other users to imitate arrangements and proceeding. At the beginning of the campaign pump- and drive systems will be in the focus of the activities. In the course of the campaign-process further systems as fans and compressors and their drives will be addressed.

Time schedule

The campaign "energy efficient systems in industry and trade" started on December, 13th, 2004 in the framework of a first press conference. The country wide initiative was presented by BMWA, VDMA and dena. More than 15 representatives of press organisations visited the event. At the same time, the Website of the campaign was launched at www.system-energieeffizienz.de.

Following the project presentation, a number of about 50 companies and institutions asked for more information and advisory service. With the beginning of springtime, consultants will start with the on site appointments. The project is planned for a three year period up to the end of 2007. The actions done so far will be continued and expanded in the future.