Masterarbeit

Load-shifting potential through demand-side-management (DSM) in the industrial sector

The German energy transition (Energiewende) requires the integration of large amounts of fluctuating, heterogeneously-spatially-distributed electricity into the energy system. There are several approaches to achieving this, namely electricity network and/or storage expansion, flexible electricity generation and demand side management (DSM). DSM refers to a range of approaches aiming at better managing the demand side in end-use sectors. Of particular relevance for the integration of renewable electricity is load shifting, because it enables those loads (or parts thereof) that are flexible to be temporally adjusted according to the prevailing generation profile. Hence balancing power can be provided by industrial process, positive in the case that the load of the process is reduced and negative in the case that it is increased.

As a large energy consumer, accounting for about 30% of national final energy demand and 20% of CO\textsubscript{2} emissions, the industrial sector seems to represent a promising area for load-shifting. Indeed, several studies and authors have examined the potential within this sector. However, the majority of studies are based on a top-down approach and do not all consider the potential for both positive and negative balancing power. Furthermore, they generally employ a crude resolution to investigate individual industrial sectors and cross-cutting technologies, which are not verified by detailed bottom-up analyses.

Hence the objective of this Master’s thesis is to determine the potential for load-shifting in the German industrial sector (or selected subsectors, see below) based on detailed bottom-up approaches. The specific aims of the thesis are:

1. To provide an overview and critical discussion of the existing literature in this area.
2. Based on the results of 1., to select suitable industrial subsectors (e.g. those promising a large potential) to investigate in detail.
3. To carry out an industrial survey together with IREES (see below) and develop a bottom-up methodology, based on the energy flows and load profiles of individual industrial processes, to estimate the load shifting potential
4. An optional but desirable extension includes a consideration of the physical location of the plants/processes identified in 3., and therefore the derivation of generalized conclusions about the implications for the electricity network(s).
5. To carry out an economical assessment and/or optimization of the studied industrial processes and thus determine the additional associated economic costs and benefits.

The thesis is available immediately and will be supervised by the IIP and IREES (http://www.irees.de), which is providing access to its industrial networks. It should be written in English but a good knowledge of German is essential. For further information and to make and application please contact:

Dr. Russell McKenna
Email: mckenna@kit.edu