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Evaluation of the impact of obligatory energy audits for large companies in Germany

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1 Background

In February 2015 the German Government enacted a law which targets non-SMEs in order to implement the EU Energy Efficiency Directive of 2012 (European Commission 2013; Hirzel et al. 2016). According to the EU definition non-SMEs are companies or institutions with more than 250 employees or 50 million Euro turnover. They were obliged to complete an energy audit according to EN 16247-1 by December 2015 and then every four years. The enterprises are exempted from the energy audit obligation if they introduce a certified energy management system according to ISO 50001 or EMAS by the end of 2016.

The energy audit has to cover a minimum share of 90 % of the total energy demand of a company. If companies have a number of similar sites, e.g. supermarkets or banking subsidiaries, they can carry out a so-called multi-site audit in a representative number of sites concerning their business and energy usage profile. A subordinate authority of the Federal Ministry for Economic Affairs and Energy, BAFA (Federal Office of Economics and Export Control), verifies the implementation and can impose a penalty in case of non-compliance.

Large enterprises are also addressed by the European Emission Trading Scheme and the eco-taxation in Germany raising the fuel taxes and a tax on electricity whereby exemptions from this taxation are granted for energy intensive sectors and industries in strong international competition. In addition, some funding programs for energy-saving investments and management systems are available.

2 Objectives and Methodology

A very early evaluation of the energy audit obligation was commissioned in autumn 2016. Its aim was to determine energy savings, reduction of emissions, investment and administrative expenses for the companies as well as effects on the German energy service market due to the measure. An online survey has been carried out with 462 companies which have completed an energy audit and 403 which have introduced a certified energy or environmental management system. The quantitative impact of the law was extrapolated to all non-SMEs in Germany.

The questionnaire was very long, comprehensive and detailed. It covered issues in accordance with the information required by the Ministry and which were necessary to calculate the quantitative effects of the law. In order to receive precise data on company size and structure, energy consumption, potentials and savings the respondents from companies with energy audits were asked to extract the technical information required from the energy audit report. In case of companies with subsidiaries they had to fill in data for the whole company as well as for a single site for which they had the audit report in hand. Companies with energy management systems were also asked to select a single site and present data for this site and for the whole company.

As the total number of companies concerned is not clearly defined, statistical representativeness cannot be applied. Therefore the assessment for Germany was not based on the number of companies but on the total energy used by the non-SMEs in each sector. Many sources were used to identify the current energy end-use of non-

SMEs and their sites in Germany broken down by 24 subsectors for an assessment of the energy end-use (DESTATIS 2015/2016 and others). The bottom-up analysis for the extrapolation was based on 609 cases with complete data on measures taken and savings achieved.

3 Results

In the following a short summary of results is presented. An exhaustive overview is given in the project report, also including the effects on the energy audit market.

3.1 Compliance with the law over time

Almost all audit processes started in 2015, 41 % of the reports were delivered in December 2015, 19 % earlier. 40 % were completed only in 2016 (Figure 1).

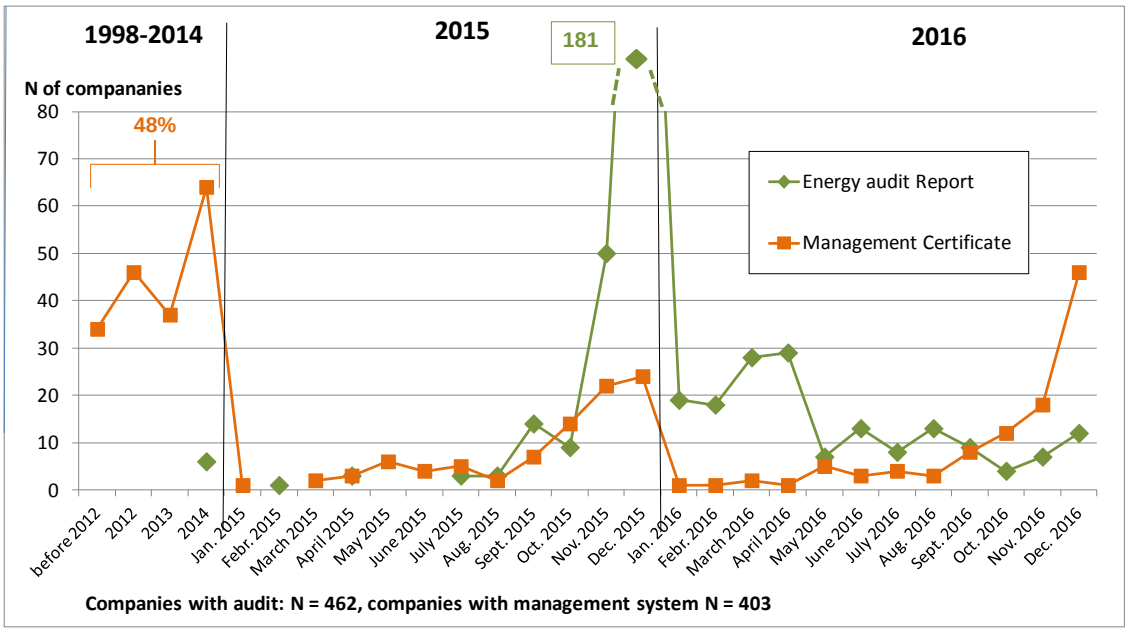

Figure 1. Fulfilment of the audit obligation over time

About half of the companies opting for the alternative solution had already introduced the management system before the law came into force. This means that the reason for introduction was not the law but mainly the eco tax exemption; the earlier they introduced the management system and the higher their energy intensity the more important was the tax exemption as a reason. Generally, energy-intensive companies, e.g. energy suppliers, paper, chemistry, glass, metal or plastics industries, and other manufacturing industries are more represented among the companies which chose the management option whereas construction, trade, hospitals and the service sector account for a higher share of those with energy audits.

94 % of the audit companies would hardly have completed an energy audit to the same extent and at the same time without a legal obligation to do so, whereas almost half of

the companies having introduced a management system in 2015 or 2016 would have done it in any case (Figure 3).

3.2 Performance of audits in companies choosing the audit option

With respect to quality the respondents were asked about the process of consulting. Many but not all quality criteria were met. Many consultants did not take economic viability criteria into account sufficiently. Most of them only mention the pay-back period, but did not calculate a rate of return. Further criteria such as the analysis of complete systems, proof of reliability and validity, a clear breakdown of energy used, clear report on calculation methods and assumptions as well as a list of saving potentials were given in most cases. Generally, with regard to almost all criteria internal energy audits – which account for 12 % of all audits – perform better than audits done by an external consultant.

98 % of the respondents confirmed that the auditor made recommendations for energy-saving measures, but not always appropriate ones. In the opinion of 40 % they were directly implementable, further 53 % said they were partially applicable und 7 % considered them to be useless. Implementation plans were provided in 64 % of the companies.

Finally, the audit reports often covered only part of the elements specified in the reference standard. Almost all reports covered a summary, recommendations for measures and a documentation of the auditing process (80 up to 86 %). Two thirds cover documentation and analysis of the present energy status and quantified saving potentials. 58 % describe the background. Only 36 % mention possibilities to receive subsidies, 29 % make suggestions for recording savings achieved, and 21 % describe possible interactions between measures. The analysis of selected audit reports by the evaluators revealed a similar result: Very few reports comply completely with all the criteria listed in EN 16247-1.

Nevertheless the respondents were very or quite satisfied with the audits including the reports. 73 % would recommend other companies to complete and energy audit, and 83 % would recommend their auditor. Various criteria were used to evaluate the satisfaction; two criteria did not score well: the cost-benefit relation and the own time spent for the audit which was rated too high.

3.3 Qualitative impacts of energy audits

70 to 80 % of the respondents agree that the energy audit played an important role because it made a contribution e.g. through analyzing the energy demand thoroughly, evaluating possible energy saving measures, confirming own considerations or pointing out the economic viability of measures (Figure 2).

For almost 60 % was important, that they received information on energy saving potentials for the first time. An indication for a continuous impulse is that 50 % of the respondents “now attach greater importance to energy efficiency in general”, a statement agreed by 80 % of the companies with management system.

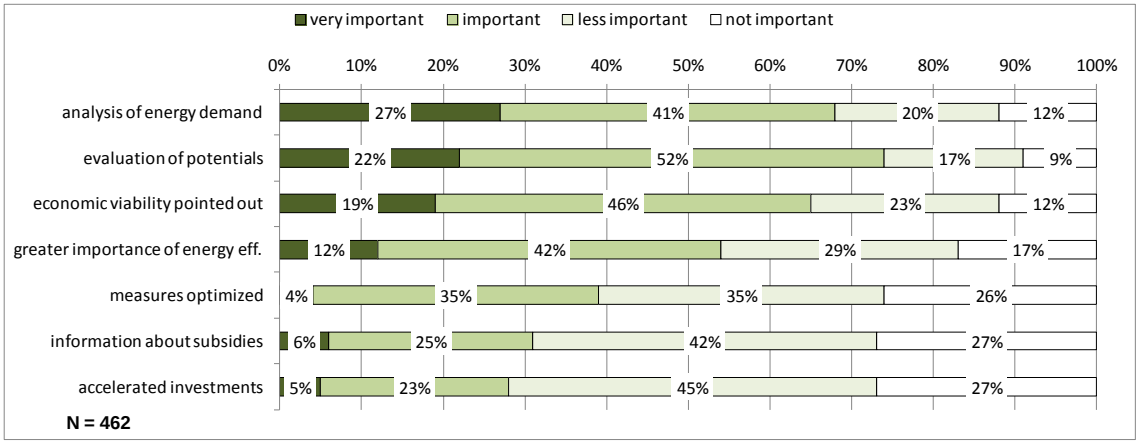

Figure 2. Qualitative impacts of energy audits

3.4 Energy Efficiency Measures Taken

A crucial question of the study was the measures undertaken as a result of the audit or the management system respectively. Figure 3 shows for companies with audit which percentage of the companies surveyed mentioned recommended, implemented and firmly planned measures in defined areas, such as room heating, process heat, etc. Planned measures were included because the evaluation took place at a very early stage. The planning of larger investments in energy-saving measures often depends on reinvestment cycles of two or more years.

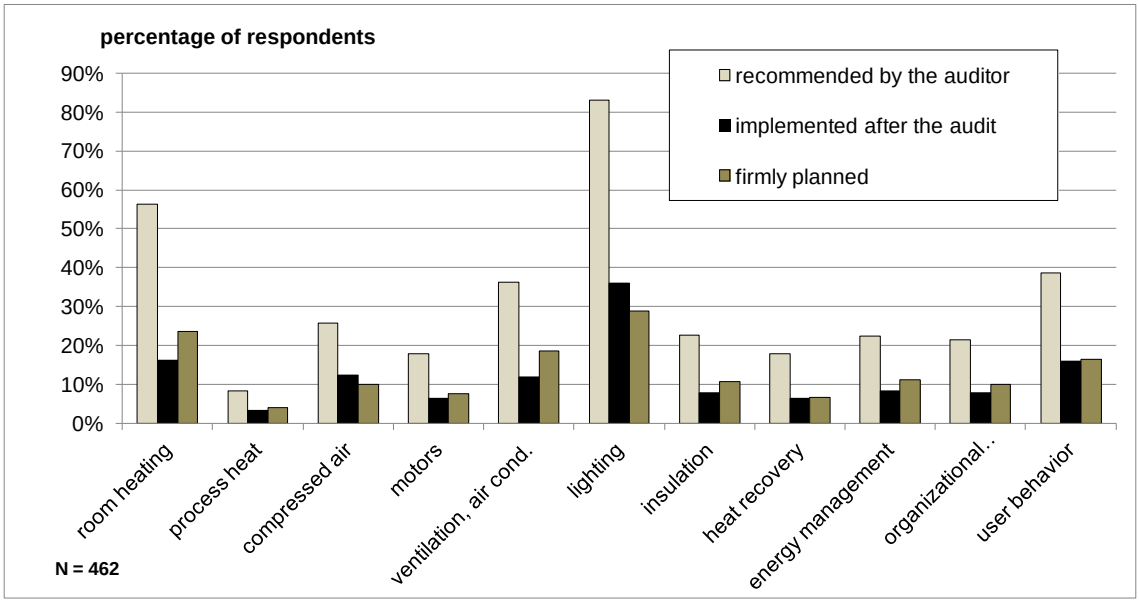

Figure 2. Qualitative impacts of energy audits

The focus of measures recommended and taken is lighting, followed by ventilation/air condition, room heating and user behavior. Companies with management system also mention lighting most frequently, but for them process-oriented measures, e.g. in the

area of compressed air, motors, heat recovery and process heat, are much more relevant than for audit companies.

3.5 Extrapolation for all non-SMEs in Germany

The companies of which data were gathered in the survey altogether cover about 5.5 % of the total energy end-use of non-SMEs (52 TWh or 187 PJ). For the calculation of the quantitative impact two types of data were used: the saving potentials identified by auditors or within the management system, and the actually implemented or firmly planned measures.

The total energy end-use of non-SMEs concerned by the audit obligation can be estimated to amount to 3.373 PJ per year, of which one third is electricity and two thirds fuels – without vehicle fuels because there are no data available for non-SMEs.

In sum, the potential is about 3.9 % of the energy used per year, and savings of 3.4 % of the energy used are or will be achieved. This would suggest that a large part of the potential is put into practice. Taking into account an autonomous technical progress (ca. 1 %/a) and an impact of other policy instruments, energy savings of 14 PJ will be achieved by 2020 or even 30 PJ if effects of a further audit are included (Table 1).

Table 1. Extrapolation of the results to German non-SMEs

	2016 – 2020 5 years	2016 – 2020 4 years and next audit 2019
Savings (PJ) ./. autonomous progress (ca. 1 %/a)	113.06 84.32	145.90 84.32
Result	28.74	61.58
Effects of other policies (./. 50 %)	14.37	30.79
Final savings (end of 2020)	14.37	30.79

The expectations of the German Government associated with the audit law – energy savings of 50.5 PJ by 2020 (Federal Ministry for Economic Affairs and Energy 2014) – would then be fulfilled between about 30 and 60 %. The latter figure includes effects of further audits in 2019 and increasing saving activities due to the fact that in the short time the law could not be fully effective.

4 Conclusion

The audit obligation led to significant effects. Many companies would not have carried out an audit without the law. Audits or the introduction of a management system also have a sustainable impact in terms of strategic importance of energy efficiency and priority setting.

Although most companies were satisfied with the audit, there are some doubts about the quality of the performance of the audit and the reports, e.g. in the profitability analysis. Cursory inspections instead of detailed examination may be one reason for the relatively low energy saving potential identified. Even in energy intensive production

sites the focus was lead on crosscutting technologies. Larger saving potentials would be found in the replacement or optimization of production and process technologies or in the logistics division. It must be taken into account that the energy audit law created a high demand for energy consultants: several ten thousand audits had to be made in a very short time of nine months. Efforts should be made to equalize the demand for consulting services to avoid that a similar situation occurs after four years when the next audits are scheduled.

For many companies in the service sector or administration services, sales offices or very small subsidiaries the effort for the audit is very high compared to the results. The evaluation team suggested the introduction of a lower limit of the yearly energy consumption for the audit obligation – e.g. 100,000 kWh as used in Denmark (Dandanell 2014) – instead of the number of employees or turnover as criterion for companies concerned.

5 References

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