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**Article**

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## KNOWLEDGE INTENSIVE BUSINESS SERVICES (KIBS) IN THE CONTEXT OF CHANGING ENERGY ECONOMICS IN GERMANY

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**Abstract**

This paper is part of a PhD project (2013-2016) researching the effects and impact of changes in the energy economics on enterprises in Romania and Germany. The project so far revealed that energy efficiency measures belong to the top activities selected by enterprises to react to these new challenges.

The main purpose of the study is to determine the role of KIBS in the currently changing German energy sector. The general context of KIBS is being presented through a literature research, including the KIBS framework in the sectors of energy efficiency, energy audit, energy management and related areas. As being top actual, this specific topic was so far not researched yet, the article covers the identified gap in literature.

The methodology used is a qualitative research focused on KIBS in the context of the changing German energy system - several experts were interviewed including academic and industry experts preparing for the German Energy Efficiency Summit (managed by the first author). Their feedback was further analyzed using the causal correlation model.

Based on the key finding that KIBS could belong to the winning sectors, the first author is in process of creating a new innovative business model for KIBS in the sector of energy services.

**Keywords:** Knowledge intensive business services (KIBS), energy economics, energy efficiency services, energy audit, energy management services, Germany

**JEL Classification:** P48, P42

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**Introduction**

In the context of a changing energy environment, enterprises have to react to the changing conditions simply in order to survive. With Germany going through a significant energy transition and other countries also being faced with their energy transition, Germany and Romania were selected for a PhD-Research project investigating in the company's reactions to the faced changes. In 2013 German and Romanian enterprises were investigated through field research on possible measures they perform to counteract the effects of the mentioned changes.

The main research questions are:

- Which is the importance of KIBS in energy audits and how are they perceived by the industry specialists?
- Which are the legal requirements and guidelines for KIBS implementation?
- Which are the advantages of KIBS versus other measuring and monitoring services?
- Which is the status of the energy efficiency measures identified during the energy audit?
- How do legal deadlines impact the demand on energy audits?

The objective of the paper is to research on the role of KIBS in the context of changing energy economics in Germany.

The results of the study were evaluated using a qualitative research methodology and then confirmed by a very strong focus on measures in energy efficiency and energy audits (details in chapter three of this article); both being segments requiring a high level of specialized skills - hence knowledge intensive business services (KIBS).

Miles (2001), Osterloh and Boos (2001) mention that KIBS cover a wide range of business areas, mostly based on highly specialized knowledge. Some of the KIBS are hereby run as special departments in organizations; however, mostly KIBS are being outsourced. Organizations prefer focusing on their core business and sourcing highly specialized services from outside (Bartussek, 2013). By that, they can focus on the areas they are specialized in. Keeping KIBS within the company requires additional effort in budget, specialized personnel and continuous focus on the development in the market (Esser and Seiter, 2015). Outsourced KIBS on the other hand are specialized on the services they provide and ensure their customers to always be up-to-date in terms of technological development as well the legal framework.

Typical traditional sectors for outsourced KIBS are information technology, business process (such as research and development), technical support services, etc. (mentioned by Bröker, 2014; Willocks and Lacity, 2006; Barthelemy and Quelin, 2006; Shah and Bandi, 2003; Howells, 2006; Chiesa, Manzini and Pizzurno, 2004). Miles et al. (1994) grouped KIBS in two sections (table no.1).

Whereas information technology services, research and development, technical engineering services as traditional KIBS were mentioned, KIBS in the field of energy did per se not exist at the time yet. Several of the mentioned KIBS however, either belong to today's KIBS in the energy sector or are based on intensive cooperation with those (both marked with “\*”).

**Table no 1: Grouping of KIBS**

| <b>KIBS group 1</b>        | <b>KIBS group 2</b>                             |
|----------------------------|---|
| *Management consultancies  | *Information Technology services (IT)           |
| *Environmental services    | *Technology intensive business process services |
| *Legal services            | *Financial services                             |
| Accounting and Bookkeeping | *Research and development services (R&D)        |
| Marketing services         | *Telecommunication services                     |
| Human Resource services    | *Technical engineering services                 |
| Public Relations services  |   |

*Source: Based on Miles et al., 1994, pp. 19-24*

The article starts by showing an overview on the energy consultation services in Germany including auditing, management systems and contracting. The second chapter focuses on the European Energy Efficiency Directive in Germany for SMEs (Small and Medium Sized Enterprises) and non-SMEs. Chapter three researches the demand for energy audits in the context of the changes of the energy-efficiency-law in Germany and includes interviews with 153 energy experts and concerned KIBS.

This papers aims at continuing the authors' study on environmental sustainability and business adaptation strategies as a results of the changes in energy economics in Germany. The authors aim to bring a significant contribution by developing a new innovative business model for KIBS in the sector of energy services combining them with meaningful additional services.

### **1. Energy Consultation Services in Germany**

The complex legal structure in today's energy economics requires intensive management consulting as well as precise legal advice. Several law offices today are specialized in the field of energy production, power plant approval process (here especially in the sectors of wind and solar energy) and the complex sector of energy contracting.

On the other hand, with the growing number of decentralized renewable energy plants, the grid management and operation process became more and more complex. Consequently, the complicated structures to keep the power system stable require a well-developed software and hardware frame which only highly specialized KIBS are in a position to take care of. Additionally, decentralized solar power plants require specific alarm systems to avoid illegal access to the area and theft of the valuable components, which includes also telecommunication services. The third element for KIBS in this context is in specialized tools and software to ensuring grid stability through protecting from cyber-attacks (Hohan, Pirnea and Weber, 2014).

In literature two attributes differentiating KIBS from other services are mentioned: intangibility and interaction (considered by Den Hertog, 2000; Miozzo and Grimshaw, 2005; Miozzo and Grimshaw, 2006; Leiponen, 2005; Leiponen 2006; Grimshaw and Miozzo, 2006). Intangibility hereby refers to the evaluation process of the services provided by KIBS. As there is no objective way in this process, both the KIBS service providers as well as the service receiver need to develop a high level of trust and goodwill. Interaction on the other hand describes the

dependency and the need for close cooperation between the KIBS service provider and service receiver during the definition process of the service product (Kohleick, 2008).

In the context of outsourcing KIBS, according to Cuganesan, Rooney and Silvi (2006) and Barthemely (2003) refer to the potential success of the outsourced business service as well as to the risk to fail. The risk for failure hereby is higher, if the benefit for the outsourcing organization is bigger than for the KIBS. Deloitte Consulting (2005), Outsourcing Times (2005) and Preston (2004) suggest that around 50% of the outsourced KIBS ended early with some of them being insourced again.

In Germany Energy Efficiency Consultation Services are available for several years already, focusing on mainly two target sectors: buildings (residential and non-residential) and cross-sectional technologies. Also the customer group split into two sections: private households and enterprises (figure no. 1).

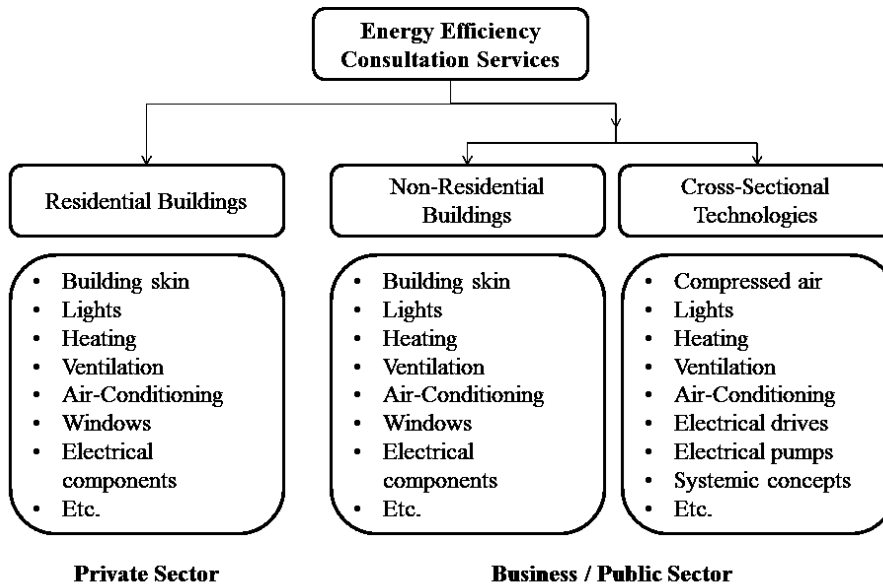


Figure no. 1: Energy Efficiency Consultation Services in Germany (author’s design)

For the Consulting Sector focusing on energy efficiency activities consequently three areas of business activities with specific requirements resulted from this constellation.

Based on the different requirements to be fulfilled for each of the pillars, three areas of business activities with specific requirements resulted in this context. Public buildings for instance serve as working places and therefore need to fulfill besides the energy efficiency policy also additional requirements such as industrial safety regulations and for example workstation requirements in terms of light intensity and quality.

With the installation of the *National Energy Efficiency-Action Plan (NEEAP) 2014*, the German government implemented the European Energy Efficiency directive (2012/27/EU). The market for KIBS in the area of energy services in Germany consequently was newly structured. This new structure supported a further manifold, transparent and competitive

development of the energy services sector. The energy service sector hereby is being composed by several main segments (BMW<sub>i</sub>, 2014):

- Energy audits / energy consultancies
- Energy management services
- Contracting services

In addition, there is a much wider network of specialized services (KIBS) connected to the aforementioned sectors for example:

- Facility management
- Software development
- Monitoring, measuring and metering services
- Communication technology
- Network engineering
- Insulation services for buildings

All these services by themselves require their own specific set of knowledge and can only survive in cooperation and coexistence.

### **1.1. Energy audits / Energy consultancies**

In Germany there is no central register for consultation services. Instead there is a variety of databases where energy consultants and auditors can register. Some of these databases focus on certain sectors such as buildings or industry, others combine several. This is a challenge for the customer in the process of identifying a qualified energy efficiency expert. With the implementation of the EU Energy Efficiency Directive, the databases operated by BAFA and dena (both being German authorities in charge of managing the energy audit process) became the main sources of information now. Energy consultants and auditors registered in these databases had to proof a defined set of qualification and knowledge. In addition, according to the EU Energy Efficiency Directive, only these auditors are eligible to apply for governmental subsidies to financially support energy efficiency measures of their customers (BAFA, 2015b).

An energy audit hereby is defined as a systematic process to collect information of the actual energy consumption profile of buildings, industry processes and/or industry sites, to quantify potential economic energy efficiency measures and to summarize the findings in a specific report (BMW<sub>i</sub>, 2014). Energy audits are also mandatory requirement prior installing energy management systems. Details for energy audits are defined in the DIN EN 16247-1.

Prognos, Ifeu and HRW (2013) suggest that the market of energy consulting service providers in Germany is dominated by small enterprises (75% of which with up to five employees). The latest research indicates that around 370.000 to 410.000 energy consultations were performed 2011 in Germany with an estimated turnover between 264 and 457 Mio. Euro (BMW<sub>i</sub>, 2014). The number of subsidized energy audits however was with 19.271 in the same year much lower, with a decreasing trend. With 95% the majority of the energy audits were performed in the building sector, only 5% in the industry (BMW<sub>i</sub>,

2014). KIBS specialized on energy audits in buildings however face a very competitive price market and struggle making any profit.

### **1.2 Energy management services**

Energy management services in Germany follow the definition of the industry norm ISO EN DIN 50001. This sector comprises energy management systems for buildings as well as for production processes, combination of both, registration and evaluation of energy consumption data, software development, consulting, concept development, and installation of energy management systems as well as certifications (Prognos, Ifeu and HRW, 2013). A research quantified the number of 3.240 certified energy management systems by March 2014 in Germany, which is about 1% of the enterprises registered in Germany at the same time (BMW, 2014).

### **1.3 Contracting**

According to DIN 8930-5, contracting is defined as the areal and temporal defined transfer of duties on energy allocation and supply to a third party, dealing on its own account. Hereby four types of energy contracting are differentiated (BMW, 2014):

- **Energy Supply Contracting:** the contractor plans, builds, funds and operates a site to produce energy. The contracting partner receives the energy at predefined conditions.
- **Energy Saving Contracting:** the contractor plans, funds, executes and operates measures on energy efficiency. The contracting partner benefits through proportionate contribution on the saved energy cost.
- **Operating Management Contracting:** the contractor operates already existing energy production.
- **Financing Contracting:** the contractor plans, funds and builds a production site for energy and benefits through the provided financial service. The contracting partner operates the system.

According to VfW (2015), Energy Efficiency Contracting was with a share of 84% the mostly contracting setup used in Germany in 2014. With growth rates of 8 to 14%, contracting belongs to growing business models in the energy services sector in Germany (Prognos, Ifeu and HRW, 2013; VfW, 2014).

## **2. European Energy Efficiency Directive in Germany**

For the industry, the implementation of the European Energy Efficiency Directive (2012/27/EU) in Germany followed a two-step approach differentiating SMEs and non-SMEs.

In October 2014 the Directive for Energy Efficiency Consulting for SMEs was officially approved and became effective January 2015. This concept picked up and improved the previously available program for SMEs including the level of financial support of 80% of the consulting fee. Besides the general framework for these energy audits, the directive also

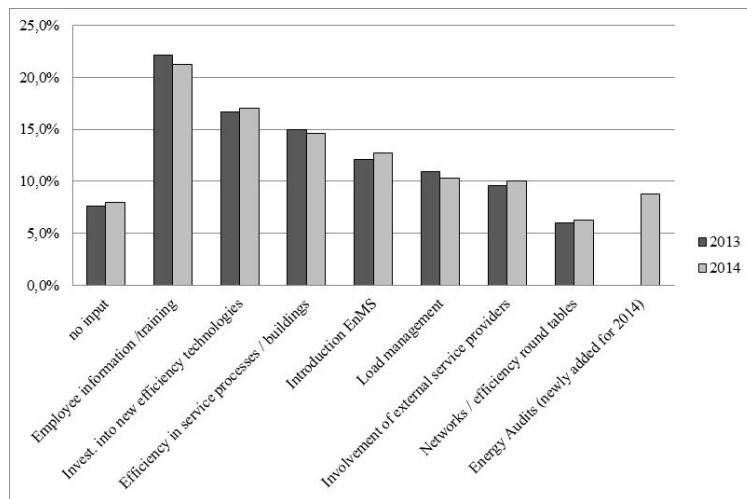
clearly defined the necessary qualification for consultants. The consultants need to register with the responsible authority and proof their skill level through diplomas as well as a professional work history and experience confirmed by relevant reference projects throughout the last three years (BMW, 2014 a; BAFA, 2015).

For non-SMEs, the novel of the EDL-G (German law for energy services) became effective in April 2015. It defines the framework as well as qualification requirements for energy audits in non-SMEs in Germany (BAFA, 2015a). Per law, all concerned enterprises have to successfully perform an energy audit latest by December 5<sup>th</sup>, 2015 (BAFA, 2015b) to be renewed every four years.

**3. Market evaluation in Germany**

Along with the implementation of the EDL-G in Germany, KIBS being operating in the area of energy audits currently experience a boom. This could be confirmed during the fore mentioned data evaluation in the author’s PhD-research project concerning the effects of changes in the energy economics to enterprises.

In the studies by Weber (2015) and Weber, Olaru and Surugiu (2015), the evaluation through quantitative research of 2.394 questionnaires in 2013 and 2.194 in 2014 in Germany (figure no. 2) showed that energy efficiency measures and as such energy management systems and energy audits are important strategies performed by the enterprises generally.



**Figure no. 2: Energy Efficiency Consultation Services in Germany**

*Source: Weber, Olaru and Surugiu, 2015*

Reacting to the before mentioned changes to the energy-efficiency-law in Germany, energy audits were added to the 2014 questionnaires only. Even not all concerned enterprises were aware of these changes yet the importance of energy audits was with almost 10% relatively high. The evaluation of the 2015 questionnaires most probably will show a higher value here; the data evaluation is ongoing while this paper is been written.



Change management strategies and innovation in key performance indicators hereby are supportive elements (Weber, Bodemann and Hohan, 2014; Sandru et al. 2014).

### 3.1. Methodology

In order to deep-dive the question which role KIBS are playing in the context of changing energy economics in Germany, the methodology of qualitative research through unstructured interviews was used. 153 energy experts and concerned KIBS were interviewed focusing on the challenges and opportunities KIBS experience or are expected to experience as a result from the changing energy economic system in Germany. The following focus groups were interviewed:

- Members of the German Energy Auditor Network Association,
- Exhibiting KIBS at the Frankfurt energy efficiency fair 2015,
- Participants of seminars & inhouse trainings related to energy efficiency topics,
- Academic and industry experts in preparation for the German Energy Efficiency Summit 2015.

**German Energy Auditor Network Association:** around 700 members, 40 of which are specialized in the industry energy efficiency sector were interviewed during their meeting of members in July 2015.

**Exhibiting KIBSs at the Frankfurt energy efficiency fair:** During the energy efficiency fair in Frankfurt (September 2015) the same topic of business outlook was discussed and evaluated with 45 exhibitors in the sector of special energy services as well as with several visitors of the fair. During the fair, specific congress sections related to the topics of energy management, energy efficiency, efficiency in the industry and energy efficiency in buildings were organized. 20 expert presentations and discussions were followed and conclusions related to the topic of investigation were analyzed.

**Participants of seminars & inhouse trainings related to energy efficiency topics:** Interviews with 56 participants of more than a dozen seminars & inhouse trainings provided additional feedback and data on the subject of discussion.

**Academic and industry experts in preparation for the German Energy Efficiency Summit 2015:** A fourth source of information and data which was evaluated was the development phase for the German Energy Efficiency Summit. Being commissioned with the concept development and the acquisition of the key expert speakers for the mentioned summit, the author spent many hours discussing potential top topics and potential trends of the market development with 12 Professors and industry experts prior and after the effective date of the EDL-G law in Germany.

The authors prepared the questionnaire for the interviews in order to test the following hypotheses:

- *The changes in the German energy sector will lead to a high number of auditors specializing in KIBS.*
- *After the deadline for performing the energy audits the demand for monitoring and metering services will increase, while the demand for energy audits will slow down.*

- As no guidelines are available from the authorities, tools for audit reports are already available in order to create law compliant audit reports. Companies have already started implementing the measures recommended by these reports.

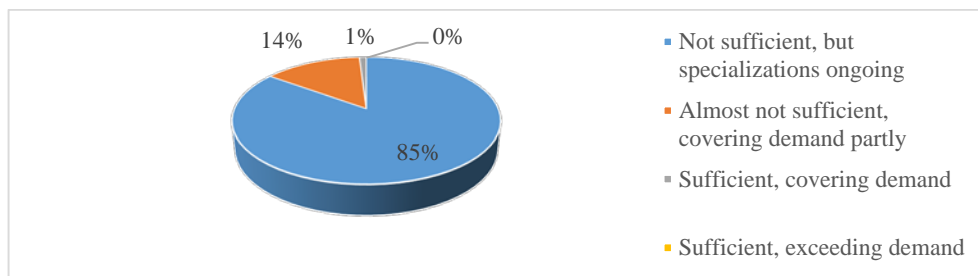
- The new German regulations will lead to a very competitive market for KIBS energy audit services.

In order to identify interactions of the individual factors investigated in the interviews, correlations were analyzed. As causal models represent the correlation respectively the assumptions of cause-and-effect chains (Gabler, 2014), the correlations between cause (changes in the energy economics) and reaction (situation of the KIBS) were substantiated using causal relations and verifications resulting in positive and negative findings.

### 3.2. Results

The evaluation of the main questions during the interviews, information and data collected added up to the key findings are listed below.

*Question 1: Are there enough specialists to cover the increased demand for KIBS energy audits? (see figure no. 3)*



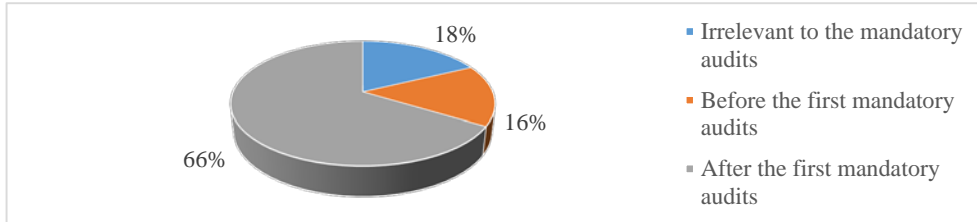
**Figure no. 3: Level of specialization versus the demand for KIBS energy auditors**

**Result 1:** Given the implementation of the EDL-G law in April 2015 and the before mentioned legal deadline for the concerned enterprises, an enormous shortage of qualified and permitted energy auditors (KIBS) could be experienced in the market. This however resulted in a tremendous increase in business opportunities for KIBS being active in the sector of energy audits.

**Result 2:** KIBS offering training and education services experience currently a boom, especially in the process of qualifying auditors for the admission into the aforementioned energy expert databases, which is mandatory in order to be eligible to perform the “BAFA” energy audits. Especially KIBS specialized on energy efficiency on buildings are expanding their qualifications, intending to escape the very price sensitive market environment of the building sector by developing a new segment of operation in the industry sector.

With both results being positive for the KIBS energy services, **the first hypothesis is valid.**

*Question 2: When will the demand for monitoring and metering services increase significantly? (see figure no. 4)*

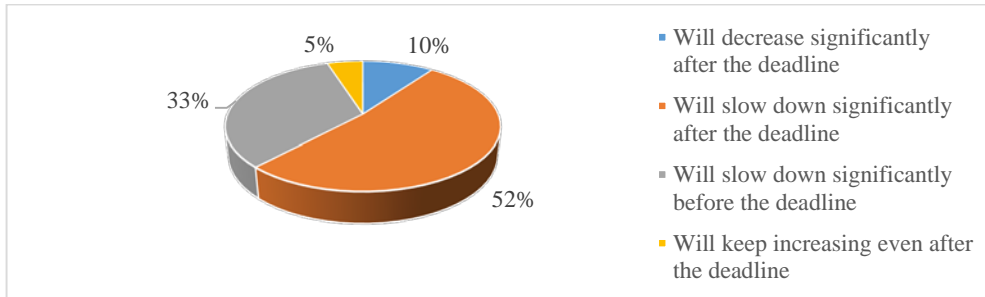


**Figure no. 4: Timeline for the increasing demand for monitoring and metering services**

**Result:** KIBS being specialized in metering, measuring and monitoring do only experience a small boom right now. The law recommends documented, ideally measures energy consumption data as basis for the audit (BAFA, 2015b). Due to the pressure in the market prior to the deadline on December 5<sup>th</sup>, energy consumption data alternatively to measuring can also be calculated using acknowledged mathematical methodologies; hence measuring is not a must right now. Given the situation in the energy audit market prior the deadline, the majority of auditors focuses on the alternate methodology of calculating and very rarely measure energy consumptions. The majority of interviewees expect the boom for monitoring and metering services to start once the first mandatory energy audits are finalized. This trend will then be based on the indication that the next energy audits (mandatory in four years) will have to be based on mainly measured energy consumption data with calculated data being the exception.

*Question 3: Which is the forecasted trend of the demand for energy audits?*

More than half of the interviewees answered that the demand for energy audits will slow down significantly after the official deadline of December 5<sup>th</sup>, while one third consider it will slow down even before the mentioned deadline (see figure no. 5).



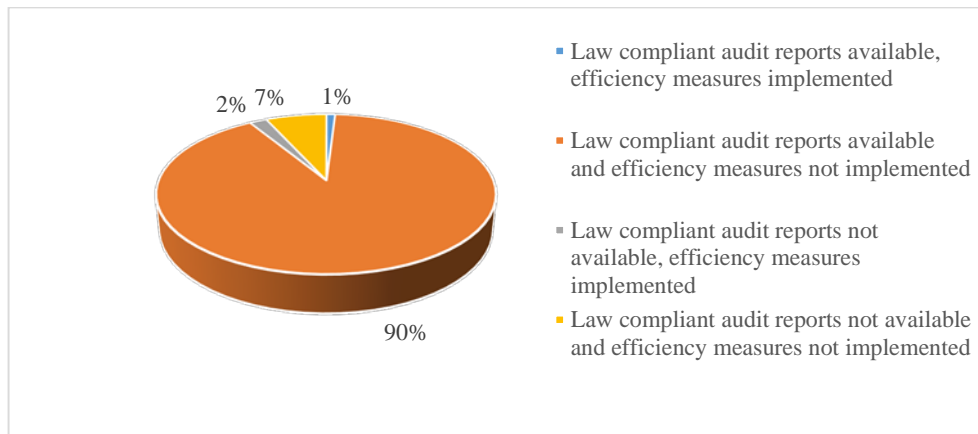
**Figure no. 5: Forecasted demand trend for energy audits**

**Result 1:** After the mentioned deadline of December 5<sup>th</sup>, the demand for energy audits according to the EDL-G is expected to slow down drastically. Only once according to the law the next energy audits will have to be performed four years after the first audit, the market is expected to again see a strong but short-time boom. Consequently, KIBS focused on energy audits are faced with a dangerous four year seasonal effect; a period being too long for a business to survive without forecasted activities.

**Result 2:** For educational activities, this slow down trend can be experienced already two months prior the mentioned legal deadline on December 5<sup>th</sup>, 2015. This effect is due to the fact, that an average energy audit takes minimum around one to two weeks and the auditors need to be qualified and registered prior to that. In addition, the acquisition process can only start after successful registration of the auditor, hence the qualification needs to be finalized around one to two months prior the deadline. Given the unequal relation between the large number of enterprises to be audited and the small number of available auditors, also “last minute” auditors will be able to find business.

*The demand slowing down after the deadline is definitely a disadvantage for KIBS services. The results for Questions no. 2 and 3 make the second hypothesis valid.*

*Question 4: What is the status of auditing reports and measures regarding law compliance? (see figure no. 6)*



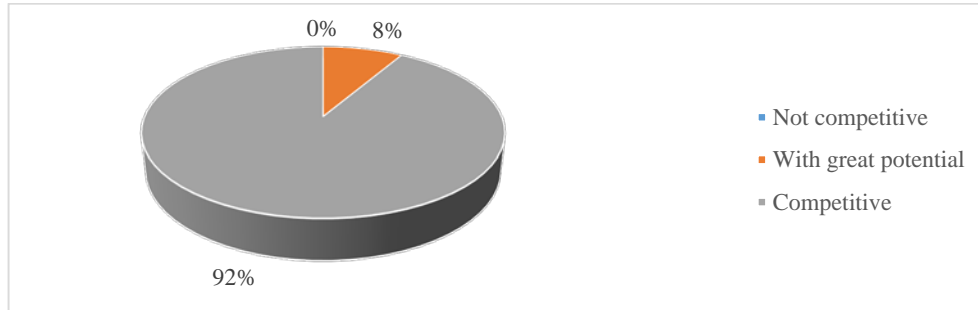
**Figure no. 6: Status of auditing reports and energy efficiency measures**

**Result 1:** Both, the energy efficiency Directive for SMEs as well as the EDL-G law prescribe an audit report which needs to follow specific requirements. As the authorities do not provide any sample report for the auditors as a guideline, there is huge uncertainty among the energy auditors on design and content to finally be accepted by the controlling authorities. In case of failure, the report will have to be adapted requiring additional effort not being considered in the price build-up. This business opportunity was tackled by four KIBS in Germany. They developed special tools creating automated audit reports. The four concepts were evaluated by the author focusing on price-value-relationship, accessibility of the providers in case of questions, customer service and importantly compliance with the report requirements given by the authorities. In summary, there was only one provider providing a sample report free of charge – all others insisted upon signing a deal prior getting the product to know. The same provider offering the sample report free of charge developed its tool with the assistance of experienced energy auditors and provides now as the only provider also a certificate confirming law compliance by an independent party acknowledged by the authority. In addition the tool is user friendly designed and easy to understand. This tool will on one hand ensure the audit report being law compliant; on the other hand due to the standardized and automated concept it will help the auditors to save a lot of valuable time.

**Result 2:** Whereas energy efficiency activities currently focus on the audit process, the implementation of identified energy efficiency measures is so far not directed. However, discussions with several professors and industry experts in this sector revealed, that the current stage of the EDL-G in Germany is expected to be the first step only. Shortly after the deadline an alignment of the law is expected to come, forcing identified energy efficiency measures to be implemented to some extent. This would follow a similar development as experienced during the construction of today’s energy management system setup.

Both results are considered positive for energy audit services. *However, the third hypothesis is considered only partly valid because energy efficiency measures are so far not directed and not implemented.*

*Question 5: How would you define the KIBS energy services market? (see figure no. 7)*



**Figure no. 7: Characterization of the KIBS energy audits market**

**Result 1:** Many of the measuring and monitoring services offered currently however are similar in content and functionality, ending up in a relatively competitive market situation. KIBS being specialized on innovative concepts of measuring, monitoring and calculating energy consumption data however are booming already prior the mentioned deadline, as they offer additional features and services.

**Result 2:** With the sector of renewable energies developing rapidly, also KIBS focusing on cyber security for energy power plants currently are booming.

*The results of Question no. 5 show that the authors’ last hypothesis is valid.*

Generally, it has to be noted that the collected feedback did not differ from the group of interviewees; hence the findings are independent from the source group. Furthermore, a clear trend could be explored in the market: KIBS specialized not only on one single business pillar but a meaningful set of services will belong to the long-term, others to the short-term winners. Latter ones are expected to be challenged after the mentioned EDL-G deadline, in case they won’t change strategy.

**Conclusions**

As laid out by literature, KIBS, being characterized as knowledge intensive business services, are facing specific business environments. Especially in the energy service sector, major system changes can be experienced in general. In Germany, the changes were pushed by the implementation of the Directive for energy efficiency audits for SMEs (October 2014) as well as the effective date of the EDL-G law in April 2015.

On one hand, these system changes provide major business opportunities for KIBS specialized in energy services such as energy audits and energy management systems, and also related specialized supporting services in the areas of telecommunication, monitoring & metering, IT-services, educational services, etc.

On the other hand, there are also unwished by-products in this process. These are driven by the fact that most of the mentioned opportunities are short term. A series of interviews and discussions with academic as well as industry experts on the subject confirmed, that some of the opportunities are expected to drop after the legal deadline in Germany on December 5<sup>th</sup>, others will arise after the mentioned deadline.

The German Energy Efficiency Summit (managed by the first author) will take place just prior the given deadline and is targeted to addressing these topics. With a focus on sharing experiences and learning as well as discussing the outlook for energy efficiency activities and businesses the takeaways of the event certainly will assist enterprises including KIBS during the planning process of their future business strategies.

Based on the findings of the performed research, the first author is in process of developing and designing a new innovative business model. This model will focus on the favored findings and avoid the unwished for KIBS in the sector of energy services combining them with meaningful additional services. The concept of this model is going to be published in a later article.

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