Detailed analysis of electricity consumption in tertiary buildings as a basis for energy efficiency policies

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Abstract
Electricity consumption in the tertiary sector is still increasing – by 3 % per year between 1995 and 2005 in the EU-25 countries – and a further increase is expected of more than 2 % per year over the next 15 years. The tertiary sector includes companies and institutions of public and private services with very heterogeneous economic and energy-related characteristics. A study of the current state of data in the tertiary sector in European countries revealed that the availability of disaggregated data on electricity consumption and its use by purpose (lighting, office equipment, ventilation, air conditioning, etc.) is poor. Building managers and decision-makers are not well enough informed about the electricity consumption structure and electricity-saving potentials.

EL-TERTIARY develops a harmonised methodology for monitoring electricity consumption and applies it in more than 100 cases in 12 EU countries. Implications for dissemination and energy efficiency policies will be derived. It is regarded as important to have an exchange of experiences on these issues within the scientific community and with actors and decision-makers in order to develop efficient instruments for practical use. EL-TERTIARY is an EU Intelligent Energy project under Key Action 4 "Energy efficient equipment and products".

Introduction
The tertiary sector is a heterogeneous area. It includes subsectors such as all kinds of public and private offices, hotels, restaurants, shops, supermarkets, schools, universities, kindergartens, hospitals, swimming pools and various other services. Many types of buildings are represented which vary with regard to size, technical standard, building age, etc. A common characteristic is that energy costs absorb only a small part of the total budget or income of the companies and institutions in this sector. For this reason, energy saving is not commonly a financial or management priority in the tertiary sector.

Existing studies found multiple types of significant barriers to energy efficiency improvements (e.g. Sorrell et al. 2004; de Canio et al. 1998; de Groot et al. 2001 and other numerous studies since the 1980s). They are mainly caused by socio-economic framework conditions in the sector, but also market failures, transaction costs, or imperfect information as well as market barriers on the supply side. Especially public organisations and companies which are not profit-oriented are characterised by a high level of barriers (Schleich/Gruber 2007). One of the main important barriers is the lack of information about the patterns of energy consumption. This is partially due to missing metering devices and partially to organisational deficiencies such as failing to clearly assign the responsibilities for energy management and energy costs. Transaction costs including the costs of collecting, assessing and applying information on energy savings potentials, investments and organisational measures, as well as the costs of negotiations with potential suppliers, consultants or installers are prohibitive. Another problem is the shared responsibility between different departments, e.g. operating and purchasing departments. There is also a lack of sufficient market structures and access to energy service companies, energy consultancies, energy agencies, etc. Finally the end-users, i. e. the employees who do not pay the energy costs, are not usually motivated to save energy.

Electricity continues to gain an increasing share of final energy use in all countries, despite its use placing an extra burden on the energy economy and the environment. Electricity, which accounted for 36 % in 2000, is expected to have a share of more than 47 % of energy consumption in the tertiary sector by 2030 (EU DG TREN 2003). This long-term development makes it necessary to initiate increased measures to save electricity and to use it efficiently. Southern EU countries tend to show a much higher increase in electricity consumption and an alarming occurrence of summer peaks with precarious impacts on the stability of electricity grids.

For example, one study found that the cooled area in EU-15 countries, a large share of which comprises tertiary sector offices and trade buildings, increased by more than 100 % between 1990 and 2000 and a further increase of 150 % is expected by 2020 (Adnot et al. 2003). For many building managers, electricity consumption is a difficult area in which to identify saving potentials due to the complexity of end-uses which are mainly crosscutting technologies such as lighting, office equipment, information and communication, hot water production, ventilation, air conditioning, electric motors (pumps, elevators), and electric heating. A sector-specific use is cooling and freezing, e. g. in supermarkets, hotels, and restaurants. Experiences of consultants show that they were able to find high potentials for efficient electricity use in most companies and buildings (Jochem/Gruber 2005). The data situation on the stock and electricity consumption of buildings in the tertiary sector is still insufficient even in Germany, where surveys on this issue were conducted for many years (Jochem/Gruber 1990). In Switzerland, a study analysed building and organisational characteristics, energy-relevant decisions and the development of the electricity consumption in 100 office buildings over a decade. Among others, it revealed that the increasing efficiency of equipment was compensated by a more intensive use of equipment and new installations, e.g. IT infrastructure or air-conditioning (Weber 2000). The electricity consumption structure is expected to change considerably over time due to technological developments and the purchase and use of appliances.

In 2006, the EU Intelligent Energy project EL-TERTIARY (Monitoring Electricity Consumption in the tertiary sector) was launched under Key Action 4 "Energy efficient equipment and products". Its overall objective is to promote electricity savings and a more efficient use of electricity in the tertiary sector. Existing potentials will be identified based on reliable and detailed information on electricity consumption. The results will be used to design suitable policies and initiatives including an assessment of their impact. One of the main goals is to develop a pragmatic methodology for the empirical monitoring of electricity consumption and balancing of end-uses in tertiary buildings. This method is applied to the analysis of more than 100 tertiary buildings in twelve countries and will later be made available to the public and documented in a brochure for building managers in order to be used on a broad level. To start with, the project collected existing data in the countries involved concerning the tertiary sectors and buildings in a database and analysed methodologies used for gathering the data. This paper presents the results of the evaluation of these data and methods and briefly describes the harmonised methodology developed for the case studies.

Data collection and analysis

As a first step, available data from national studies, surveys and other sources were identified in the countries participating in the project EL-TERTIARY: Belgium, Bulgaria, the Czech Republic, France, Germany, Greece, Hungary, Italy, Latvia, the Netherlands, Portugal, and Romania. For standardisation purposes, the NACE sector classification was adopted. Buildings or companies were classified according to the closest NACE division or class. Furthermore the electricity end-use categories were defined in such a way that the data collected are comparable and can be used as an input for statistics and databases at EU level.[1] The end-uses were: lighting, air conditioning, ventilation, refrigeration, office equipment, motor systems (others than for heating, ventilation, etc.), hot water and electric heating. Some studies have more detailed information, but a subdivision was not used for reasons of comparability. More categories will be introduced into the case studies within the EL-TERTIARY project. In addition, the data and their sources are described with respect to their statistical basis. A template was developed which required input for each study considered, the sectors and subsectors analysed, the method of analysis, electricity consumption as a total and – if available – analysed per end-use listed above, surface area of the sample and other explanatory information.

Input was provided from 11 countries[2]. The studies include over 12,100 buildings across the tertiary sector. They involve samples of various sizes, ranging from case studies of single buildings to studies of thousands of similar buildings. The methods used include measurements for smaller samples and surveys for bigger ones. The following NACE sectors are represented:

50–52	Wholesale and retail trade
55	Hotels and restaurants
65–67	Financial intermediation
70–75	Real estate, renting and business activities
80	Education
85	Health and social work
90–93	Other community, social and personal service activities

The data collected were compiled into a single Excel file and analysed, depicting indicators of electricity use per category per country and sector. The main conclusions from the data analysis can be summarised as follows (Figures 1 and 2):

- The number of studies analysing all – or most – of the end-uses listed above is limited. Most studies provide the total

1. e.g. for the Odyssee-MURE project on Energy Efficiency Indicators (database of basic energy-related EU-wide data and energy-efficiency indicators) and energy saving measures (database on measures for the rational use of energy in EU countries and simulation tool for the evaluation of their impact).

2. Work is still ongoing because new studies and data sources are still being found. In addition, the collection will be completed by data from Northern European countries not represented in the project team.

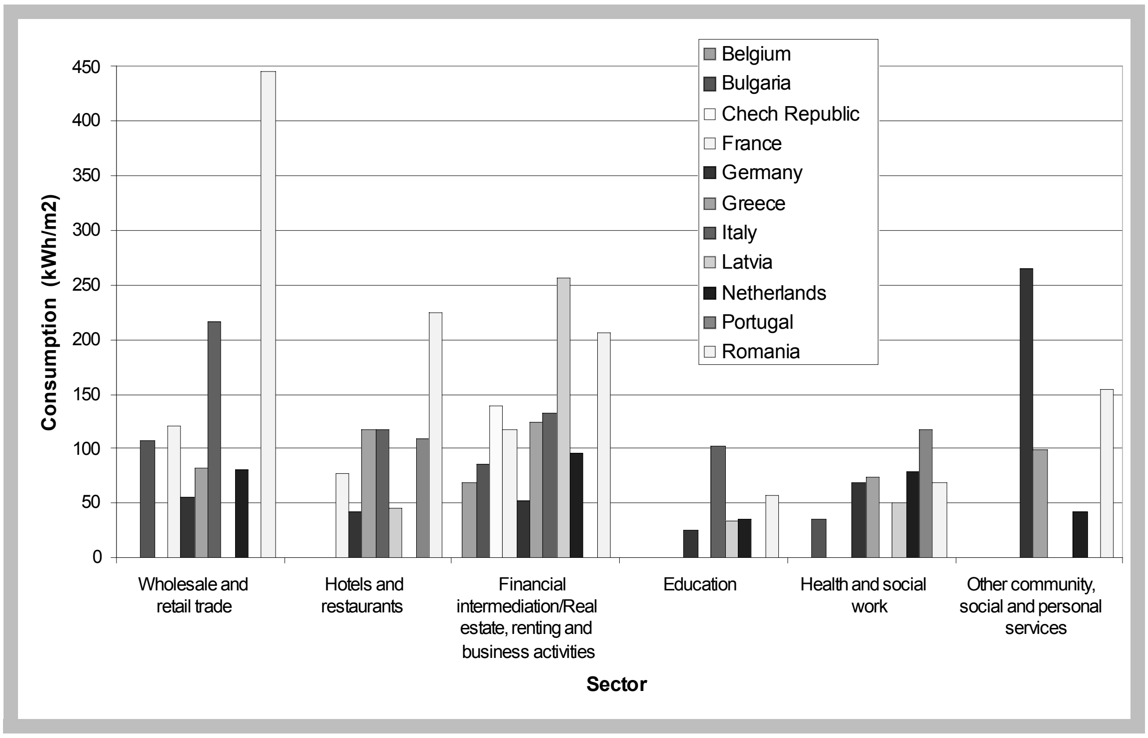

Figure 1: Analysis of European Data – Electricity consumption per sector

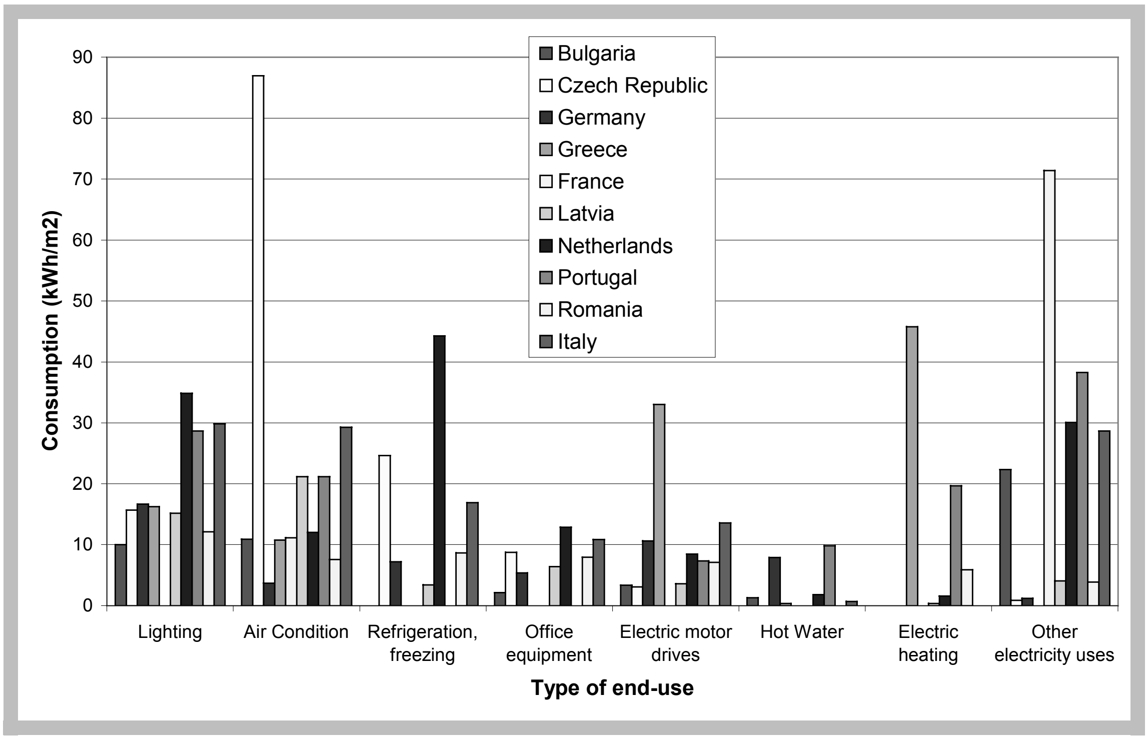

Figure 2: Analysis of European Data – Breakdown of electricity consumption per end-use

electricity consumption. Some include one or two end-uses in addition to those originally targeted.

- The energy indicators show considerable differences between countries.
- Energy consumption indicators have increased values moving from EU-15 towards EU-25 and EU-27. There seems to be, as expected, a technological gap between the "old" and the "new" EU countries. Such indicators are of course, of questionable accuracy when the building samples involved are very small.
- The definitions and the accuracy of the analysis of the end-uses treated may vary from country to country. For example, some countries or studies grouped office equipment together with electric motors and refrigeration; some regarded electric heating under ventilation, etc. There is also an open question regarding the data given for electric heating, which

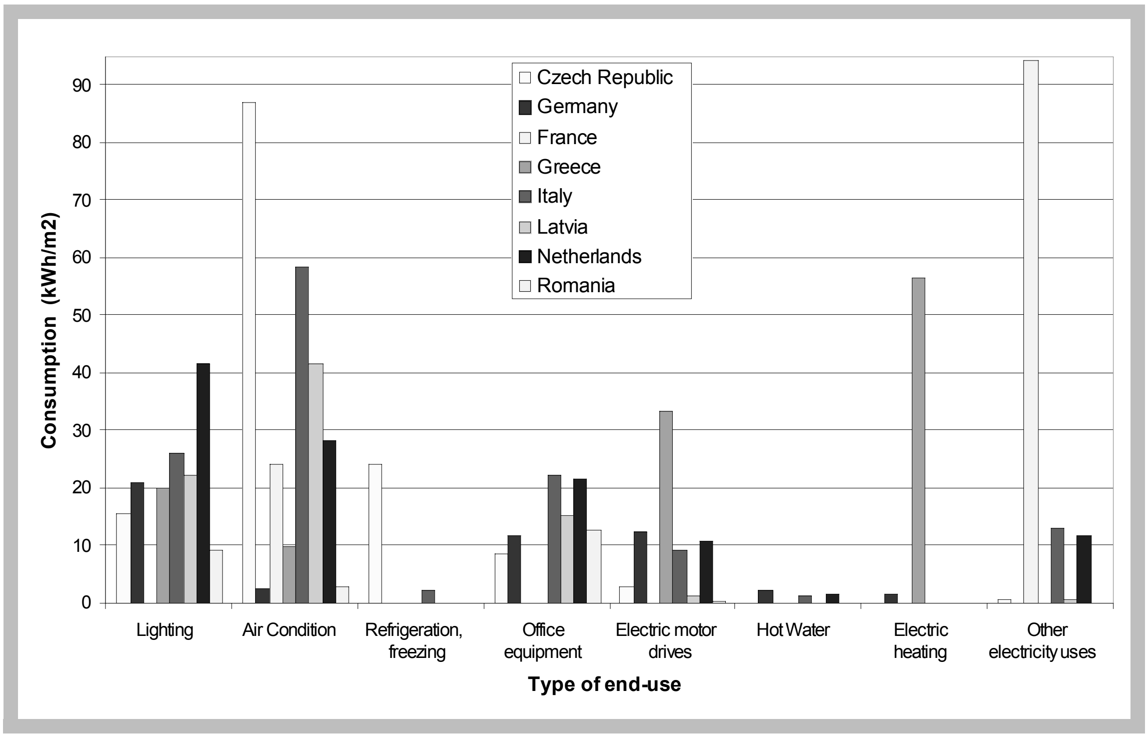

Figure 3: Electricity consumption per end-use in private offices in eight European countries

may contain heating by reversible heat pumps; this is very difficult to quantify, especially with survey techniques. Interrelations between electricity and fuel consumption still have to be analysed.

The work attempted has not been undertaken on this scale before (i. e. at EU level). Most studies analysed are of a regional or national nature. The analysis of existing data reveals that obvious problems exist. They are related to the existing studies and/or the technological status of the region, country or sample treated. The current work should be seen as the initial step in a wider attempt. More input is needed (studies, data) and is expected within the framework of the current project.

A common EU-wide understanding is necessary to help energy experts collect or produce the appropriate data and create a basis to judge their accuracy and validity. More relevant studies such as the ones to be produced by EL-TERTIARY are necessary to provide an initial basis on which future work can build. An accurate definition of the number and content of end-uses is needed to allow an EU-wide analysis on a common basis and to work towards common targets.

Quality of data and methodologies

The data sources found are mainly studies performed in the participating countries by, for instance, research institutes. In order to determine deficiencies, gaps and problems with regard to the data collected, a methodological checklist has been developed. It consists of four parts:

- Part 1 contains questions with regard to the country and the information, whether the study or data were published or are confidential, type of building and NACE code.
- Part 2 indicates the title of the study, year of publication, type of study (survey, measurement, assessment, extrapolation, etc.), number of cases, time period covered, and type of data (individual data, aggregated data or a combination).
- Part 3 is the main part of the methodological checklist. In this part, the data content is described (total electricity consumption and breakdown to different kinds of equipment or installations). For each figure, the methodology of data collection is described (measured, calculated, estimated or surveyed).
- In part 4 comments on the study are included, such as special building characteristics, availability of more detailed data, autonomous electricity production, etc.

This information is now available in a standardised format for all the studies and data sources found and registered. The data themselves are compiled in the database described above. The methodological checklists give detailed qualitative information about the data. With the help of this information it is possible to determine the quality of the data and to pinpoint gaps, deficiencies and problems with regard to the available data on the electricity usage of a total building and its installations or apparatus.

With regard to the type of study involved: 16 % were based on surveys, 12 % on measurement, 4 % on assessments, 6 % were not specified; no extrapolations were represented. The majority (62 %) used a combination of methods, consisting mainly of survey, assessment, and extrapolation (30 %); 10 % used measurement and surveys, another 10 % measurement and assessment. 34 % of the studies present aggregated data, e. g. for a whole sector, 60 % consist of data on individual buildings and 6 % of aggregated data as well as data for individual buildings.

The search for studies intended to concentrate on recent data. 66 % of the studies were performed in the period 2000–2006.

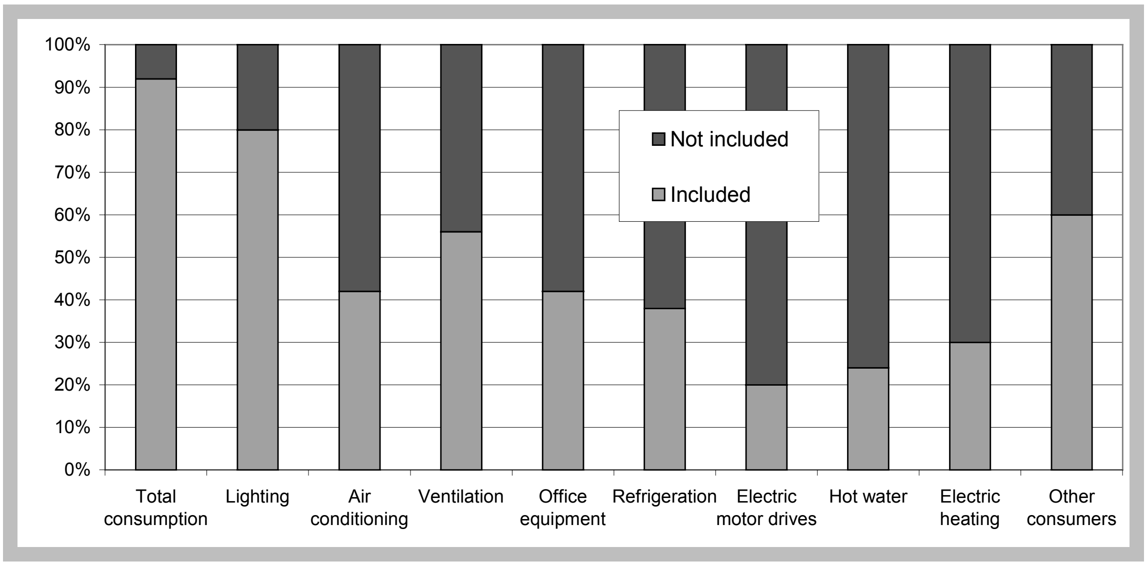

Figure 4: Percentage of studies which take into account different types of electricity end-uses

Table 1: Methods of determining the different types of electricity end-uses

	Method of determination					
	Unknown	**Measured**	**Calculated**	**Estimated**	**Surveyed**	**Combination**
Total consumption	7 %	57 %	9 %	2 %	15 %	11 %
Lighting	5 %	0 %	60 %	3 %	8 %	25 %
Air conditioning	9 %	9 %	41 %	9 %	23 %	9 %
Ventilation	4 %	11 %	33 %	30 %	11 %	11 %
Office equipment	0 %	0 %	33 %	52 %	5 %	10 %
Refrigeration	5 %	11 %	21 %	42 %	11 %	11 %
Electric motor drives	10 %	0 %	40 %	10 %	10 %	30 %
Hot water	17 %	0 %	25 %	0 %	25 %	33 %
Electric heating	20 %	0 %	20 %	0 %	27 %	33 %
Other	7 %	4 %	57 %	4 %	7 %	21 %

Earlier studies were included when more recent ones were not available in a country (18 %). In 16 % of the studies, the year of origin is not mentioned.

In order to find out which gaps, deficiencies and problems exist in the current data file, quantitative and descriptive statistics were used to analyse the methodological checklists. Earlier it was determined how to judge the quality of the data. For this judgement the following guidelines are followed. The quality of data is determined by looking at the way the data was gathered. Data gathered with the help of measurement is considered to have a good quality. When the data is not measured but, instead, calculated, the quality of the data is of a lesser level, because of the possible flaws that could exist in the calculation. Data which is estimated is of a somewhat lesser quality then data about the electricity usage of an installation which has been calculated. Finally, the data about the electricity usage which has been gathered with the help of surveys is of the least quality.

It has been analysed in how many studies the electricity usage of a building and of the various end-uses has been taken into account. Furthermore, it has been analysed per type of energy consumer how the data has been gathered. With these analyses is it possible to draw conclusions with regard to the quality of the data, the gaps, deficiencies and problems. One of the results is shown in Figure 4.

As can be seen in Figure 4, a lot of data already exist on the total electricity consumption of buildings in the tertiary sector and there is some more insight into electricity consumption for lighting and ventilation. The other installations in a building have not often been taken into account in the studies found. Table 1 shows the distribution of the ways in which the electricity consumption is determined for the different types of end-uses and the buildings.

Looking at these results it can be said that there exist some gaps and deficiencies in the data found. The first gap or deficiency that can be mentioned is the lack of data with regard to the energy usage of equipment and installations gathered with the help of measurement. Another gap or deficiency is the poverty or lack of information about part of the end-uses. There is a great spread in available information. With regard to the data found on total electricity consumption of various buildings in the tertiary sector the quality is fairly high. The data about the energy usage of the different types of equipment and installations in buildings in the tertiary sector is of a lesser quality because in most cases it is calculated.

With regard to the electricity usage of some types of systems a lot of information is already available: lighting (80 % of the studies found), ventilation (56 %), air conditioning (42 %), and office equipment (42 %). About other installations little information was found. It concerns the following types of systems: refrigeration (38 % of the found studies), electric heating (30 %), hot water production (24 %), and electric motor drives (20 %). With regard to the quality of the data about the electricity usage of the refrigeration, electric motor drives, and the hot water there is a great variety in methods used and the few number of studies in which these usages were mentioned.

The conclusion from these findings is not necessarily that EL-TERTIARY has to focus the attention to these types of end-uses. It is possible that these types of installations do not play an important role in determining the total electricity consumption of the different types of buildings within the tertiary sector.

In general most data on end-uses were calculated except office equipment and refrigeration, where values were mainly estimated. Measured data are rare; they are available for ventilation, refrigeration, and air conditioning only. A combination of methods was used mainly for electric motor drives, hot water, and electric heating.

The EL-TERTIARY project focuses not only on metering electricity consumption but also on the determination of electricity balances of tertiary buildings. Often lighting, ventilation and air conditioning are the three most important energy users with regard to the total electricity consumption of a building. When taking into consideration the way in which the data is gathered with regard to these electricity users in most cases the electricity usage has been calculated so far. With regard to the different types of lighting, ventilation and air conditioning, a lot of research has already been performed by the manufacturers of these systems. Besides that, it is difficult to get a good insight in the electricity consumption of the different types of, for instance, lighting, because of the great diversity in available types on the market. For these reasons, not only metering but also the determination of the consumption of these systems with the help of standard calculation will be a relevant method in the case studies, e.g. based on the nominal power of the system as stated by the manufacturer and the hours of usage (for instance stated by the Building Management System).

Development of a monitoring methodology

A key outcome of the EL-TERTIARY project is a database with a set of data of electricity consumption and end-uses in types of buildings and subsectors in the tertiary sector and a harmonised methodology for electricity metering and analysis, which has been tested in at least 100 selected typical buildings. The results will be made available for stakeholders and interested building owners, managers and planners, help them to find the electricity-saving potentials in their premises, to make the relevant investments and to encourage the users regarding energy-saving behaviour.

Creating a methodology to meter electricity consumption in the tertiary sector has to take into account several specific aspects of this sector:

- a high diversity of building types, systems, usages, etc.
- different climatic regions and weather conditions
- the dependency on access to the building and cooperation with building owners, facilities managers, etc.
- the fact that electricity can harm seriously and that metering of many devices in buildings have to carried out by professional electricians

The methodology developed by IGS defines a practical and adequate way to cover the large variety of buildings, standards, electric devices and metering possibilities. It uses a top-down approach for the analysis of electricity consumption of buildings. The method allows a structured way of documentation and gives options for electricity metering and calculation. In 2007, a web-based version for the documentation of the buildings and metering results will be provided.

The EL-TERTIARY method combines audit and metering strategies to reduce the effort for data collection. This approach will be supported by an ergonomic and self explaining web-based user interface. The underlying database structure allows the use of collected data for other applications thereby increasing the value of the initial energy audit and metering. The target is to provide a tool that delivers high quality data being used by semi-professionals and that creates a more sustainable database for buildings.

The methodology is tested within the project and later intended to be used by a multiple number of persons: professionals, engineers, maintenance staff, etc. To make sure not to get lost in the details of a building concept the top-down-approach defines some practical general application rules:

- Documentation should always be done first and metering second. Good documentation of a system provides more information than an imprecise metering.
- The auditor should first enter the information he can get easily. He should not waste too much time on single items of information. Easy metering tasks should be done first, in order not to waste time on difficult metering approaches.
- Photos taken of the building, of rooms and systems and of the metering setup can help later understanding and evaluation.
- The auditor should stick to the methodology and especially to the documentation rules because otherwise a common evaluation is not possible.
- Electricity can harm seriously. Therefore the auditor has to follow instructions for the metering device used. Some work must be carried out by professional electricians only.

The number of aspects that can be described in a building is extremely large. In order to include as many of them as possible the methodology covers all relevant systems and practical technical descriptions. It is important that not all of this information has to be provided to obtain a good result.

Metering the energy consumption is rather worthless if the building itself and its systems are not properly described. Therefore it is necessary to analyse each building first and to set up a metering concept before the auditor actually starts the metering. The EL-TERTIARY methodology is based on existing methods[3] and defines some additional procedures and rules for their application. The procedure comprises six steps:

1. Getting started
2. Auditing the building
3. Auditing the systems
4. Metering
5. Calculation of energy consumption
6. Database input

The steps should be followed one after the other to implement the top-down approach. A priority list will be prepared for data collection: minimum (necessary), important (very useful), detail (nice to have).

Step 1: Getting started

Working on a building starts with the registration of the person or institution that will carry out the metering and by creating a new building in the web portal (online April 2007). All information on the building and all metering results will be saved with reference to the building.

Step 2: Auditing the building

Auditing is the starting point for the metering of each building. It provides the necessary information on type, use, size etc. to classify and compare the building and the metered data. The web tool asks for general information on the building like location, type of use, floor area, energy consumption stated in bills, operating hours of equipment, etc. Auditors should collect as much information as possible using the following sources: owner of the building, facility manager, on-sight analysis, and publications or any other source.

Auditors should always start with information that can be received easily. It is usually not effective to spend much time on single items that are difficult to find out. For many systems the web-tool offers choices for types of rooms or systems. The auditor should always select the one that best fits the building even if it is not a perfect answer.

Step 3: Auditing the systems

The next level of documentation for each building is the auditing of individual systems. The auditor should enter as many different systems as possible starting with the ones that are typical for the building and easy to be described such as the lighting system in a classroom or the ventilation system of an office building. The information should be fairly easy be collected by looking through plans and by on-sight analysis:

- **Total energy consumption and electricity consumption.** Information on the overall energy consumption of the building is essential. Usually existing data of annual values for consumption can be used. In many cases it might be possible to collect monthly data or even trend data (energy supplying companies often have 15-minutes readings of meter consumption and peak demand).
- **Electricity consumption of building sections.** There are often already metering devices installed in buildings for billing of building sections like retail stores. They are usually read by facility managers (monthly or annually). The auditor should try to get this information and describe the part of the building that is supplied by the metered system.
- **Lighting.** The auditor should try to identify typical rooms or parts of the building (office room, class room, hotel guest room, etc.) and describe the room and its lighting system. Since it is usually difficult to meter the electricity consumption of a lighting system it is important to describe the room in which it is installed, the way it is operated and used to estimate the annual hours of usage.
- **Ventilation and air conditioning systems.** The auditor should try to identify the most important systems and document the key aspects as defined in the web tool. In addition it is important to clarify the way the system is operated especially the time schedule.
- **Cooling.** The auditor should try to identify the most important systems and document the key aspects as defined in the web tool. In addition it is important to clarify the way the system is operated, i.e. the rooms that are provided with cooling, the target room temperatures, etc. In many cases this will be the only information on cooling systems since metering is difficult.
- **Pumps.** The consumption of pumps depends strongly on the state of the hydronic system they are part of. Therefore the type of pump and the system to which it belongs (heating, cooling, water supply, etc.) should be noted.
- **Equipment.** The web tool offers a list of devices to choose from. Auditors should pick the device that best fits the different types of equipment of the building in typical rooms.[4]

Additional specific issues refer to installations in special buildings, e.g. office buildings (equipment), schools (kitchen, cafeteria, etc.), hotels (refrigeration, wellness area), restaurants and supermarkets (refrigeration), hospitals (laundry).

Step 4: Metering

Different kinds of metering procedures can be carried out:

- use of energy bills
- use of energy consumption trends (e.g. 15-minutes values)
- use of other existing data (building management system, energy reports, etc.)
- long-term metering for dynamic systems (at least 9 months including summer, e.g. cooling)
- short-term metering for cyclic systems (at least a day or a week, e.g. lighting)

3. e.g. General Information Leaflet (GIP) 65 (UK), SIA 380/4 (Switzerland), LEE (Germany), IPMVP – International Measurement and Verification Protocol (USA), VDI 3807 (Germany)

4. An overview of metering devices can be found within the REMODECE project (Residential Monitoring to Decrease Energy Use and Carbon Emissions in Europe).

- "spot" metering for constant or "on/off" systems (metering of momentary loads, e.g. for ventilation)

In addition to metering electricity consumption directly it can be useful to apply devices that only meter the running hours of a system. A number of devices exist, e.g. for metering the time in which a lighting system (light sensor) or a pump (magnetic sensor) is turned on/off.

The metering strategy should be applied that will provide the best quality within the time frame and the financial budget of the auditing procedure. Metering of electricity has to be carried out by professional electricians.

If possible the weather conditions during the metering period should be documented, especially for spot and short term metering. This includes the general weather conditions while metering and during the last week before the metering and specific information such as air temperature, relative humidity, and sun radiation.

Step 5: Calculation of energy consumption
Since it will not be possible in most cases to meter a whole year in order to record the annual consumption it will be necessary to meter during a shorter period and calculate the annual consumption afterwards. The following simple ways to calculate the annual consumption [kWh/a] for rooms or systems can be used:

1. constant demand [kW] * annual operation hours [h/a]
2. consumption of metered cycle [kWh/cycle] * number of this cycle per year [t/a]
3. consumption of metered time period [kWh/t] * number of this time period per year [t/a]

Option 1 should be used for constant systems with constant demand that are either turned on or off (spot metering). Option 2 should be used for cyclic and option 3 for dynamic systems. The auditor has to make sure that the metering period covers at least one whole cycle (for example one week). Dynamic systems should be metered either at different times (weather conditions) or continuously for a period of 6 month or more.

Step 6: Database input
All information can be entered in the web portal. Photos and additional documents like energy bills, hand written notes, etc. can be uploaded. Information on buildings, rooms, systems, and metering results is stored in a database that allows an analysis on different levels. Therefore it is possible to compare whole buildings as well as the efficiency of lighting in a room as well as the state of the art of single devices. That makes the methodology powerful even if only selected information is gathered for individual buildings. The web-portal offers a top-down approach for energy analysis with easy to use applications that will allow many different persons to carry out an energy audit in their building in an effective and efficient way.

Further perspectives

The collection and analysis of data on electricity consumption per end-use in European countries showed that there still are considerable gaps and difficulties for an international comparison. There are several projects within the Intelligent Energy Europe programme just completed or still ongoing which provide additional data.[5] Their results will be included in the EL-TERTIARY database and the overview on methodologies used. The quantitative documentation and the qualitative descriptions of available studies in a standardised format are available for the public and will help other researchers and actors to receive a deeper insight into electricity consumption in tertiary buildings. The results produced by projects, such as the current one, should be widely disseminated to be used as guideline for fieldwork results, as guidance to experts doing studies, and to statistics personnel collecting and exploiting results of such studies. Wide dissemination will help in improving accuracy and coherence of results of forthcoming work.

The audit methodology developed in the project is a practical guideline for building managers as well as energy consultants, energy service companies (ESCOs), energy agencies, associations of end-user target groups (industrial associations, municipal networks, etc.), and equipment manufacturers, importers, distributors and vendors. The results of the case studies in 100 tertiary buildings are stored in a database which will be available for the public.

The disaggregation of end-uses and benchmarking are important outcomes of the project. The owners and managers of buildings have to disaggregate the electricity demand to make proper decisions and the public policy makers have to understand the size of each segment of energy use to tailor the actions to the potentials. This will be possible thanks to the reliable database of electricity consumption in types of buildings in the tertiary sector and with the help of harmonised methodologies tested in a sufficient number and variety of buildings.

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