The Hochschule Zittau/Görlitz
Germany’s first registered environmental management (EMAS) at an institution of higher education

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Abstract Most universities still consider the principles of environmental ethics and sustainable development on an academic level addressed at specific courses of studies or as part of research. Practical approaches to encourage individuals in a university community to accept responsibility for environmental improvements are rare. Implementation and maintenance of a standard environmental management system (EMS), however, may be useful not only to improve environmental protection but also to outline a university safeguarding a vision of the future. Structured environmental management systems must provide a defined and organised approach to the relevant activities such as clearly defined policy and objectives, clear-cut responsibilities, documented systems, ongoing training, record, document control, internal audits, management reviews, and continual improvement. The Hochschule Zittau/Görlitz – University of Applied Sciences is the first German institution of its kind having in its entirety successfully undergone the full cycle of EMS requirements including validation and registration specified in the EC regulation 1836/93 (EMAS) which is the European equivalent of the international ISO 14001 standard. Particular concern is shown for active involvement and participation of students and employees during all individual phases of the environmental management system.

1. Introduction
Universities and equivalent institutions of higher education increasingly play a leading role in teaching and promoting the principles of environmental ethics and sustainable development. According to the Magna Carta of European Universities (Leal, Filho et al., 1996) they are urged to commit themselves to an ongoing process of informing, educating and mobilising their employees, students and all the relevant parts of society concerning the consequences of ecological degradation. Universities shall, therefore, incorporate an environmental perspective in all of their work.

In Germany a growing number of university level institutions are undertaking “reviews” or “audits” to assess their environmental performance by controlling the impact of their activities and services on the environment. To be more effective and in order to continuously meet legal and policy requirements, these assessments need to be conducted within a structured management system such as the European EMAS or the international ISO 14001 standards.

2. Environmental management at the Hochschule Zittau/Görlitz
The Hochschule Zittau/Görlitz – University of Applied Sciences was founded in 1992 based on a former School of Engineering for Electronics and Information Processing. The university is located in the south-eastern part of the Federal State of
Saxony right at the Polish and Czech borders, thus playing an increasingly important role in pan-European relationship. The university offers a total of 21 courses of studies (within eight faculties) such as business management, economics, mechanical and energy engineering, social sciences, ecology and environmental protection, eco-balancing and environmental law and management. Since 1992 the number of students has been continuously rising, reaching more than 3,500 in 1999.

2.1 Organisation, schedule and performance of the EM project

In a January 1995 resolution the university rectorship and senate professed themselves willing to realise fundamental principles of a sustainable economic, ecological and social development at all university levels. At first a pilot EM study was performed by students in the summer of 1997 only for parts of the university infrastructure focusing on the investigation and definition of specific indicators for consuming and affecting the natural environment. To ensure proper implementation, maintenance and improvement of the environmental management system (EMS) a working group (EM team) has been installed in October 1997 and a representative for the EM was appointed by the rectorship of the university in January 1998 (Figure 1). The EM team consists of a leader, the chancellor of the university, the representative for the EM, the representative for the maintenance of health and safety standards, the representative for environmental protection, students, staff and division representatives.

The planning and realisation of the university EMS was based on the requirements of the EC regulation 1836/93 and included the following elements:

- Environmental policy.
- Environmental examination.
- Environmental targets.

![Figure 1. University structure and organisation of the EMS](image-url)
The EMAS standard was chosen because of its even stronger requirements concerning quantification of environmental targets and publication of an environmental declaration compared to the international environmental management certification ISO 14001.

The specific university environmental policy containing ten guidelines passed the senate in May 1998 and was made public inside the university and through the Internet homepage (www.htw-zittau.de). In the frame of the first environmental check relevant aspects resulting from the university’s activities, education and research were identified on which environmental targets at each relevant function and level were established and documented. Roles, responsibilities and authorities were defined (Figure 1), documented and communicated to ensure that EMAS requirements are executed and maintained. Throughout 1998 a total of 33 EM system and compliance audits and two management reviews were performed in order to determine whether or not the environmental management system has been properly implemented. Individual steps within the EMS implementation phase are illustrated in Figure 2.
2.2 Acquisition of data

The first environmental check considered a time period of three years (1995-1997). Data on the university’s energy and water consumption and emissions were separately captured for the two locations Zittau and Görlitz and were evaluated by internal and external comparison and the generation of specific environmental codes. A more differentiated view of the specific situation of individual departments and faculties was achieved by the performance of a relatively large number (total 33) of EM system and compliance audits. Experience shows that mistakes and organisational problems are likely to appear in surveys for specific information which are carried out voluntarily with the help of pre-fixed questionnaires and check-lists:

- Questions are partly misinterpreted (either deliberately or unintentionally) by the people asked.
- Answering the questions is felt to be additional, annoying work.
- That is the reason why complexes of questions are not answered or are not answered properly.
- Questionnaires are handed back after hesitating a long time, so that it is difficult to meet deadlines.
- Specific surveys of the environmental protection (within a company or university) are often classified as being not yet pressing or important.
- Analysing the questionnaires (check-lists) leads to additional mistakes.

Taking this background into consideration new practicable approaches to minimise potential mistakes in carrying out the surveys were sought. Personal, on-the-spot talks were carried out on the basis of prepared, computer-aided questions (using a laptop) in order to minimise misinterpretation, delays and incomplete answers.

Another important criterion for personal questioning is improving the acceptance and motivation of the people asked by active involvement which leads to a “multiplying effect” in making the Environmental Management System known within the university.

2.3 Results

The goal of the first environmental check was to assess the current state of the university’s environmental performance as a basis for the analysis of weak points and for the definition of objectives and targets in order to meet the guidelines of the environmental policy.

The energy situation. The first environmental check in the framework of the university EM focused on capturing the specific consumption of energy and water in the individual buildings. This area provides a high environmental relevance with large capacities for economising and improvement. In the energy sector the following facts can be reported, using the evaluation of consumption values and comparing them to values outside the university.
The value for the consumption of heating energy in the Hochschule Zittau/GoÈrlitz, as shown in Figure 3, is considerably higher than the average value in German Schools of Engineering (ages, 1997). This result is due to the numerous building and reconstruction activities and due partly to old and not sufficiently insulated buildings. Some construction work resulting in cutting the heating energy consumption has already been carried out or will be carried out in the next few years.

Comparing the values for the consumption of electrical energy in the Hochschule Zittau/GoÈrlitz to average values of German Schools of Engineering (ages, 1997) results again in higher consumption (see Figure 4).

The consumption values indicate an urgent need for activities in the field of energy management. Apart from construction and technical activities which have partly been started, first of all a change in behaviour of the students and employees in dealing with energy are the focus of attention in order to reduce the energy consumption.

The CO₂-situation. The combustion of fossil photosynthetic fuel (mineral oil, rock coal, lignite, natural gas) generates CO₂. As about 85 per cent of this type of fuel was used to meet Germany’s demand for primary energy in 1997 (Energiedaten ’97/’98, BMWi), large amounts of the climatically harmful gas CO₂ are released. The emission of CO₂ in Germany amounted to nearly 900 million tons in 1997 (Umweltbundesamt, ESSO Energieprognose 1997). Traffic and transportation, the third-largest source of CO₂ emission, has to be taken into consideration as well. It is the aim of the Federal Republic of Germany to reduce the CO₂ emission for 1990 by 25 per cent by the year 2005. This target can only be achieved, if all areas in the commercial sectors and society will be
actively involved. Thus, one of the main tasks in the environmental management of the Hochschule Zittau/Görlitz is to reduce the CO$_2$ emission related to traffic and energy consumption.

To evaluate the effects on the environment the university’s CO$_2$ emission was examined, considering the emissions as a result of energy and area consumption and of the volume of traffic. The examination was carried out on the basis of the municipal energy mix (see Figure 5).

The higher emissions for 1996 are a result of the increased demand for heating and electrical energy due to a higher amount of students enrolled. The larger number of students resulted in a higher volume of traffic which consequently caused higher CO$_2$ emission. To complete the values of CO$_2$ emission the generation of CO$_2$ by the students’ and employees’ breathing was

**Figure 4.** Specific electric-energy consumption (kW/m$^2$*a) of the University of Applied Science Zittau/Görlitz compared with average values of German Schools of Engineering (ages, 1997).

**Source:** ages (1997)

**Figure 5.** Specific CO$_2$-emissions (t/a)
included in the examination as well (approximately 113 tons per annum). The following comparison is to illustrate the scale of CO₂ emission of the Hochschule Zittau/Görlitz. To compensate for the university’s CO₂ emission photosynthesis would have demanded approximately 1,600 tons of wood for 1995 and approximately 1,800 tons of wood for 1996. For 1996 this would mean: 515 birches; 1,116 cherry trees or 900 poplars.

All their life long, these trees would have fixed the amount of CO₂ in their wood which was produced only within one year at the university’s location in Zittau.

The water situation. Types of water considered are drinking water, used water and sewage. Laboratories also use particularly pure types of water (de-ionised, distilled) which are not taken into account. To compare the university’s situation of water consumption with the outside, again specific values were taken. It is not easy, however, to compare our university with other universities or institutions on the basis of the data and information provided. Students cannot be assigned to an individual building. An exact analysis and spotting of the weak points is made more difficult by a lack of sufficient numbers of water meters in the buildings as well as in the departments concerned. Comparative values were used for the external comparison (see Figure 6).

To compare the consumption of the university’s buildings at the Zittau location, the water consumption was applied to the area. In 1996 the overall water consumption rose with an increasing overall area. In 1997 the water consumption fell with a decreasing overall area. Apart from increasing and decreasing areas, construction and maintenance first of all of the sanitary facilities lead to fluctuating water consumption.

The results with external institutions provide good and very good values for the water consumption in the Hochschule Zittau/Görlitz. In the period 1995 to 1997, the characteristic values for the water consumption per student show an

![Figure 6. Water consumption (m³) per total number of students](image-url)
overall decreasing trend despite increasing numbers of students. (The slight increase in water consumption for 1996 is due to reconstruction and construction works.)

The environmental programme and declaration. The environmental programme is documented in the EM handbook which is an integral part of the intranet published and updated administration handbook of the university. Environmental objectives and targets are, therefore, accessible to every member of staff with the measures being binding.

All verified information relevant to the environment is summarised and published in the Environmental Declaration 1998 (Hochschule Zittau/Görlitz, 1999a) which is available to the public.

EMS validation and registration. The EMS has been examined and evaluated by an external certification organisation (DQS, Frankfurt) in December 1998 and was registered under Nace-code 80 by the Industrial Chamber of Commerce (IHK), Dresden, in March 1999 (Reg. Nº DE-S-144-00018/19).

2.4 Involvement of students

Tell them, and they will forget,
Demonstrate, and they will remember,
Involve them, and they will understand
(Epigraph to the 2nd European Conference of Sustainable Cities and Towns, Lisbon, 1996).

One of the guidelines of the environmental policy of the Hochschule Zittau/Görlitz requires protection and preservation of the natural environment as the fundamental principles and a basis for life. This shall be achieved by qualifying and enabling both students and staff to play an active role in a continuous process of improving the environmental performance of the university and, thus, to promote their potential of creativity and innovation. An average of 30-40 “Ecology and Environmental Protection” students per year participate in all steps of the university EMS by carrying out either practical training or reference work and projects which have become an integral part of the curriculum. About three or four students each year are given the opportunity to assist in the project in a funded 20 hours/month contract. Some of the tasks in which students assist are:

- acquisition and determination of the university’s specific energy and water consumption using defined environmental measures and codes;
- acquisition and determination of the university’s specific waste production and emissions as a basis for the preparation, maintenance and application of an administrative disposal guideline;
- estimation of the CO₂-reduction potential which may result from landscaping based on the stock-taking and evaluation of the university’s sites and properties;
• traffic census for the campus and neighbouring areas as a basis for estimating the CO₂-reduction potential which may occur from reducing motorised mobility of staff and students;
• development and optimising EMS check lists for individual departments and faculties;
• participation in and implementation of EM system and compliance audits.

In addition the Hochschule Zittau/Görlitz tried to promote the creative potential of students by having them involved in the preparation and organisation of an international workshop on “Environmental management for public authorities and institutions” which was carried out in June 1998 (Hochschule Zittau/Görlitz, 1999b). Students took the chance for oral presentations of their work. Impressions of this workshop can be found on the Internet (www.htw-zittau.de).

So far, experience at the Hochschule Zittau/Görlitz indicates that active involvement of the students creates an improved identification with “their” university and simultaneously conveys skills and capabilities with “consummate ease” that may significantly enhance their professional career prospects (Frankfurter Rundschau, 1999).

2.5 Communication

Internal communication at the Hochschule Zittau/Görlitz aims at informing on the state-of-the-art of the EMS as well as continuously optimising and adapting the management system to varying conditions. For this purpose an interactive exchange of views on environmental performance is sought within the university and with comparable institutions outside the university. To integrate as many staff and students as possible into the EM process a number of events are used as a platform for information and motivation, e.g.

• meetings of the senate;
• assembly of personnel;
• faculty colloquia.

External communication on the university EM is considered by means of electronic publication (Internet), workshops open to the public, newspaper articles, and publication and distribution of the annual EM declaration (Hochschule Zittau/Görlitz, 1999a, 1999b).

2.6 Greening the curricula

Since 1994 the Hochschule Zittau/Görlitz is offering a full graduated eight semester course of study on “Ecology and Environmental Protection” finishing with a diploma grade (Dipl.-Ing. (FH)). Currently more than 350 students from all over Germany have chosen this course of study and so far about 80 students have successfully finished.

Environmental protection and basic ecological issues are addressed in numerous courses of studies and are integrated into the university’s education and training programme (greening the curriculum) (Geesteranus, 1998).
Specific courses and additional project work are offered on eco-balancing, environmental management and environmental law. Much of the curriculum is concerned with environmental topics such as alternative energy, natural resources conservation, energy efficiency, treatment of water and air pollution, waste minimising strategies, and recycling techniques.

3. Environmental management at universities: duties, expectations, benefits

In Germany 35 university level institutions are currently concerned with EM according to either the European EMAS-standard or the DIN EN ISO 14001 (Albrecht, 1999). Some of them have already reached a high level of environmental performance such as the Fachhochschule Furtwangen, most are in the state of planning and realising certain elements of EM standards. What are the reasons why 10 per cent of all German universities intend to participate in EMS? Expected benefits are certainly about legal requirements such as the Good Laboratory Praxis (GLP) or the development of cost reducing potentials by increasing energy and resources efficiency. In addition, universities in particular may be stimulated to implement an EMS because of:

- their social responsibility for the preservation and protection of the natural environment;
- their specific model function in society,
- expected improvement in image and prestige; and
- obvious advantages in competition for clients, i.e. the students.

Duties, expectations and benefits that are linked to the implementation of EMS at university level are described in the following paragraphs.

3.1 Research and development

The fact that particularly developing countries and fast-developing countries in Asia and Latin America are in considerably increasing demand for energy and resources results in a large amount of unsolved problems in supply and distribution, which are to be solved with intensive support of the universities. It is first and foremost the task of universities with EM as they are considered a role model.

According to international surveys (BP, World Bank, UN) (RWE, 1998), the specific consumption of primary energy in 1996 amounted world-wide to approximately 12 billion tons SKE (Steinkohle-Einheiten = Rock Coal Units, 1 RCU = 29.3MJ) with a world population of 5.8 billion. Different scenarios agree in their assumption that the world population will rise to 7.9 billion by the year 2020 and the consumption of primary energy will increase to 16.7 to 18 billion tons SKE (Rock Coal Units) (RWE, 1998). Secured reserves of fossil resources amounted to approximately 940 billion SKE at the end of 1995. Taking these figures into consideration, resources in mineral oil will run out in
approximately 40-60 years and resources in natural gas in about 60-80 years (considering today’s extraction techniques). These facts require urgent activity in the energy sector.

The Hochschule Zittau/Görlitz is actively involved in the following research areas:

- New and alternative sources of energy.
- Energy techniques.
- Techniques for emission reduction.
- Chemistry in power plants.
- Efficient use of energy.
- Efficient use of resources.

Further areas of action and research related to the environment in the Hochschule Zittau/Görlitz are: the protection of species and biotopes, protection of the climate, prevention of soil, ground water and air pollution, environmental engineering, waste reduction and recycling, treatment of waste and sewage, reducing harmful substances, ecological construction.

3.2 University responsibility for sustainable development and community outreach

In eastern Germany about one third of young citizens aged 18 to 22 vote either extremely right or extremely left and another approximately 25 per cent do not vote at all (Hochschule Zittau/Görlitz, 1999b). This indicates that nearly every second East German in the age range between 18 and 22 obviously avoids integration as a full and self-responsible member of a democratic society. One of the reasons for this dangerous non-conformity behaviour may be the high rate of unemployment (locally up to even more than 30 per cent) which turns out to be the major problem particularly for young people. Another reason may be attributed to the loss of orientation which for many East Germans became a serious problem after reunification.

If we define the term environmental management in a broad sense, not only reduced to the performance of physical operations in order to fulfil the requirements according to EM standards, then we will rather end up aiming at the development of a sustainable society as a whole, starting at its weakest links. The specific East German situation demands university outreach efforts to initiate and establish actions for alternatives and options particularly for disoriented and unemployed young people. Examples may occur in several areas of university education and research and may be realised through joint projects with local communities, social societies and local industry:

- Prevention of youth crime, a still unsolved but urgent problem (not only for the East German society).
- Environmental training outside the campus, e.g. constructing demonstration plants for alternative energy generation in schools.
Supporting local communities, schools, public authority institutions, etc. on implementing and improving EMS.

Joint actions and research co-operations with local industry on environmental, social and economically benefiting projects such as the establishment of energy, waste and emission reducing strategies and earth-bound energy use or seasonal energy storage.

Much of the above may be carried out in the overall frame of Local Agenda 21 (LA 21) activities. But little will be achieved without considering three key problems. These are:

1. Communication barriers
2. Motivation barriers
3. Acceptance barriers.

Environmental management in its broader sense, therefore, has to deal with the establishment of strategies for structured environmental communication, information and training, thus to improve motivation and acceptance of individual protagonists and interested parties. This task bears a potential of scientific research for both the social and natural sciences. We at the Hochschule Zittau/Görlitz have started practice-oriented projects and diploma dissertations on the support of Local Agenda 21 processes in the frame of a contractual partnership with neighbouring communities (Community of Markersdorf, City of Görlitz). So far about ten individual projects on specific LA 21 topics have been realised or are currently performed.

3.3 Image of universities
A future student selects his university not only based on an obvious and expected quality of education and research but more and more based on criteria such as scientific flexibility, practice-orientation, applicability, and topicality. A university with an innovatory EM demonstrates a voluntary continuous process of learning, development and adaptability.

For the Hochschule Zittau/Görlitz the EM emphasises the ecological focus in teaching and research established at the university’s foundation. Apart from the course of studies, Ecology and Environmental Protection, a large amount of lectures and other events in other courses of studies as well as several research projects deal with ecological and economic problems. The Hochschule Zittau/Görlitz is among the few universities in Germany which offer the combination of courses, Environmental Management, Environmental Law and Eco-balancing.

3.4 Future orientation of universities
What are the future requirements and expectations of all those involved with or connected to the universities? On the one hand, the government and society more and more require broader competition between universities on the national as well as international level and evaluation of research and teaching based on objective, scientifically firm and generally accepted quality criteria (which can up to now only be provided in fragments). On the other hand, the
ability of universities to prosper in the future has to be evaluated alongside the fact of whether they meet the requirements (regarding contents, quality and organisation of teaching and research) of the clients, i.e. the students, but also of the commercial sector as future employers. Assessment criteria not only are to be the specialist, user-oriented knowledge acquired during the course of study but to an increasing degree also must impart the abilities to be creative, motivated, communicative and involved as well as intellectually flexible. All these abilities will considerably improve the career prospects of students.

The university of the future must not look upon itself as a one-way container with intellectual contents in imparting academic knowledge in research and teaching, but has to form a bridge for living contacts paving the way for graduates to their future employment. Such a bridge can be the early active involvement of the students in creative processes at the university such as the maintenance of an EMS.

Management instruments such as EMS or quality management systems (QMS) support the ongoing process of self-evaluation by their requirements for internal and external transparency, for periodic system evaluation and adaptation. These processes within a university not only include a periodic check and evaluation of a system's functionality, organisational structure, internal and external communication and documentation. To a great extent these management instruments also consider the examination of teaching and research regarding their incorporating and updating technical, economic, ecological as well as social and scientific approaches to be connected with the requirement for sustainable development. University-based Environment Management Systems to a great extent support the university's flexibility in the administrative and scientific function, the topicality, creativity and innovations as key determinants for an ability to prosper in the future.

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