

REPORT: AHEF TASK AZ-66

“Technical assistance in the areas of Energy Auditing and Energy Management: a) Support for preparing a curriculum of a course, and b) Proposals for development of a Master’s degree program”

Azerbaijan

INOGATE Technical Secretariat and Integrated Programme in support of the Baku Initiative and the Eastern Partnership energy objectives

Contract No 2011/278827

A project within the INOGATE Programme

Implemented by:

Ramboll Denmark A/S (lead partner)
EIR Global
The British Standards Institution
LDK Consultants S.A.
MVV decon GmbH
ICF International
Statistics Denmark
Energy Institute HrvojePožar

Document title	REPORT on AHEF TASK AZ-66 “Technical assistance in the areas of Energy Auditing and Energy Management: a) Support for preparing a curriculum of a course, and b) Proposals for development of a master’s degree program”, Azerbaijan
Document status	Final

	Name	Date
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Checked by	L. Good	October 21, 2014
Approved by		

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Abbreviations

AHEF	Ad Hoc Expert Facility
AZ	Azerbaijan
AzUAC	Azerbaijan University of Architecture and Construction
BREF	best available technology reference document
ECTS	European Credit Transfer and Accumulation System
EE	energy efficiency
EU	European Union
ITS	INOGATE Technical Secretariat
LCC	life cycle cost
PC	Partner Country
RES	renewable energy sources
SE	sustainable energy
TA	technical assistance

1. Executive Summary

This report provides an assessment of the INOGATE Technical Secretariat (ITS) Ad Hoc Expert Facility (AHEF) task (AZ-66) in terms of its delivery, results and preliminary impact. The overall objective of this AHEF was to teach new skills in sustainable energy (SE) to students and professors of the Azerbaijan technical university. This university wanted to learn about the achievements of the EU Member States in implementing EE technologies in industry and buildings and new RES technologies as well as corresponding EU SE legislation. The beneficiary of the technical assistance (TA) was the Azerbaijan University of Architecture and Construction (AzUAC).

The TA a) provided assistance to students and professors of the AzUAC to obtain new skills and knowledge of sustainable energy through the delivery of lectures, and b) supported the update and improvement of the university's SE curricula.

Within this task the ITS experts developed two pilot lectures with the following content:

- Definition & objectives of energy management
- ISO - International Organization for Standardization
- ISO 50001 - Energy Management System
- Guideline for Energy Management
- Basics of Life Cycle Cost (LCC) feasibility analysis
- Structured methodology for performing LCC analysis to develop bankable energy efficiency and renewable energy projects
- Data collection and reality checks necessary for inputting to LCC analysis
- Techniques for writing reports to convince investors of feasible projects
- Case studies of economic analysis for energy efficiency/renewable energy projects.

The two lectures were delivered with the participation of professors, PhD students, postgraduate and bachelor students. Recommendations for improvement of the current curricula were submitted to the board of the university for adoption. The adoption of the ITS recommendations in the university's teaching programme is expected by end of 2014. ITS will monitor impact based upon the baseline with the universities by year end 2014. ITS will also monitor the number of students actually trained using the ITS course materials. ITS recommends a targeted dissemination campaign of the course materials to other universities in the INOGATE Partner Countries for ensuring the widest possible impact of this AHEF action.

2. Work carried out

In December 2013, the team of experts visited the AzUAC to assess their training needs as well as to establish a baseline from which to monitor impact in the short to medium term perspective.

The experts and their topics of expertise were the following:

- | | |
|--------------|---------------------|
| Albin Zsebik | - Energy Management |
| Ali Korakan | - Energy Auditing |

The purpose of the first mission was to assess what the universities required in terms of competence development in SE that could be accommodated by the ITS.

As the objective was to improve the existing curricula, the task considered the existing curricula to be the baseline for the technical assistance.

In order to identify the curricula development needs, the ITS experts conducted interviews with relevant professors from AzUAC. The professors stated their preferences for curricula development and presented the current curricula to be improved. The ITS experts subsequently presented EU experience in sustainable energy, identified key gaps in the current Azerbaijan curricula and agreed on areas to be covered in ITS recommendations. These findings are summarized in the “review of existing curriculum” section of the Curriculum Recommendations.

2.1 Examination of the Azerbaijan accreditation system and requirements

The Azerbaijan accreditation system meets the requirements of the European Credit Transfer and Accumulation System (ECTS). Credits are allocated to entire qualifications or study programs as well as to their educational components, e.g. specialization modules, courses, dissertation work, company training, continuing education, work placements and laboratory work. The number of credits ascribed to each component is weighted according to the workload that students face in order to achieve the learning outcomes.

2.2 The current status of teaching energy management at the Azerbaijan University of Architecture and Construction (AzUAC)

The energy management course at AzUAC is based on the curriculum of the Energy Management (Buildings) MSc. It was developed by the TEMPUS project No CD_JEP-25043-2004 (AzB) and financed by the EU.

2.3 Analyzing the current AzUAC curriculum of energy auditing and the development of proposals

Development of the existing curriculum was coordinated by Prof. Dr. Talebi-Daryani Reza, Fachhochschule Köln (Cologne University of Applied Sciences). The curriculum was up to date until 2008, but since then there have been significant developments in technical possibilities, information technology and management tools. To be compatible with basic requirements of energy management systems and considering their continuous improvement, it seemed necessary to develop a state-of-the-art curriculum.

2.4 Ideas for a MSc programme in management and auditing

Based on a discussion with beneficiaries, ITS recommended three versions for the development of the existing curriculum.

The beneficiaries agreed that the existing accredited Energy Management (Buildings) MSc curriculum (EnMB program) was a good starting point for the development of recommendations.

The objective of the new study programme is

- to prepare students for energy audit and building certification.
- to enable students to develop a good understanding and thorough insight into all important aspects of energy auditing, energy control and the general issue of energy management.

The aim of the programme is to provide students with the expertise to:

- analyze and evaluate the operation and the performance of buildings and industrial facilities;

- to apply energy efficiency technology; and
- to critically analyze and describe the global behavior of integrated thermal systems, such as buildings.

The students should also be able to prepare:

- building energy ratings (BER) according to the EU Directive on the energy performance of buildings;
- fill out BER certificates in a prescribed form; and
- prepare energy audits of and reports on non-residential, communal and industrial buildings.

Finally, students should also be able to estimate and critically evaluate possible solutions in the energy-technology and energy-management fields.

The recommendations to further develop the existing Energy Management (Buildings) (EnMB) programme, are outlined in the following three versions.

Version 1: -

The title and the base subjects of the EnMB programme will not change. Instead:

1. The content of some basic and selected subjects of the existing curriculum of the Energy Management (Buildings), EnMB programme will change with the overall goal to prepare students for energy audit and building certification.
2. Students in the frame of the 1st and 2nd project work will practice energy auditing of residential, communal and industrial buildings.

Version 2:

In the title of the existing EnMB programme the “Buildings” written in brackets will be changed to “Auditing” and the content of some basic and selected subjects of the EnMB programme will change. Therefore:

1. Selected subjects of the Energy Management (**Auditing**), EnMA programme will focus on preparing students for energy audit and building certification.

2. Students in the frame of the 1st and 2nd project work will practice the energy audit of residential, communal and industrial buildings.

Version 3:

The study programme and curriculum will have a new name: **Energy Auditing and Energy Management**, EnAM, and some base subjects of the EnMB programme will be replaced by new subjects. Therefore:

1. Basic and selected subjects of the curricula of the EnAM program will focus on preparing students for energy audit and building certification.
2. Students in the frame of the 1st and 2nd project work will practice energy audit of residential, communal and industrial buildings.

Versions 1 and 2 do not need accreditation and can be declared ready for the autumn semester 2014, whereas version 3 requires accreditation.

The beneficiaries selected the recommendations from Version 1.

2.5 Development of an MSc programme in energy efficiency and energy auditing for AzUAC.

As an outcome of the programme, students should be able to estimate and critically evaluate possible solutions in the building energy-technology and energy-management fields. Upon completion of the MSc program, students will be familiar with:

- the development of building technology from traditional construction to zero energy buildings;
- the development of building automation and information technology from pneumatic control to cloud computing; and
- the conversion of building construction and automation to 'bright green building' concepts.

Furthermore, students should be able to prepare building auditing reports and building certifications (Fig. 1.).

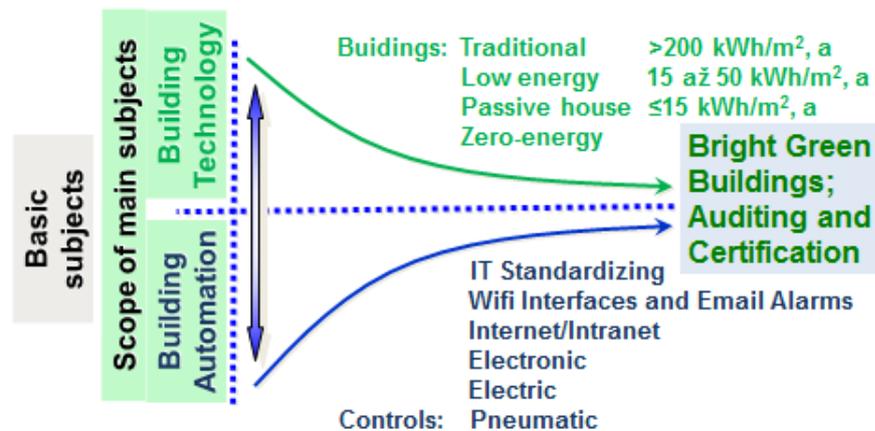


Fig. 1. The scope of subjects and learning outcomes

The programme has been summarized in the MSc programme Course Book (Kurs Kitabçası) called “Energy Management (and Auditing) in Buildings (Binalarda Enerji Məcəmmenti (və Audit)). (See course book on website.)

In April, 2014, the team returned to Azerbaijan. The purpose of the 2nd mission was to present the results and fine tune them to the identified needs. During this mission, a series of 2 pilot lectures were delivered on site with the support of the ITS experts. (See lectures on website.) Twenty two people attended the energy auditing lecture, and 30 attended the energy management lecture. (See participant lists on website.)

The purpose was to ensure that the beneficiaries were in a position to deliver the courses and field questions from students on the course materials. The results of this exercise are presented in Chapter 3.

The final training materials and notes for delivery were handed over to the beneficiaries for uptake in the fall semesters. All the links to the materials are included in the Annex 1.

3. Results and impact so far

During the delivery of the pilot lecture, the beneficiaries and the ITS experts had the opportunity to review the strengths and weaknesses of each of the course materials. A summary of these discussions and conclusions reached for each of the parts of the course lecture series is presented below.

3.1 Pilot lecture on energy management

Since the beneficiaries were not familiar with the Energy Management System standard (ISO 50001), a pilot lecture on energy management was developed with the following content:

- **Definition & Objectives** of Energy Management
- **ISO** - International Organization for Standardization
- **ISO 50001** - Energy Management System
- **Guideline** for Energy Management

3.2 Supervision of the lecture by the AzUAC professors

During the second visit of the ITS expert team, the pilot lecture was introduced and discussed with professors of the AzUAC (see Figure 2). The following day, a pilot lecture was delivered to students by the professors of the University (see Figure and Figure)



Figure 2, AzUAC discussion of pilot lecture



Figure 3. Delivery of pilot lecture



Figure 4. Pilot lecture audience

3.3 Development of a syllabus for three one semester courses, for the MSc program

This is a totally new course for the university and covers the following subjects.

- Energy management
- Energy auditing
- Certification of energy performance of buildings

3.4 Pilot lecture on energy auditing

Within the context of the energy auditing course, a pilot lecture has been developed to teach financial analysis of energy efficiency and renewable energy sources projects.

- One of the main barriers in developing and implementing energy efficiency (EE) and renewable energy (RE) projects is finance.
- The financial sector has its own special language. Engineers and architects need to learn and speak this language in order to be able to communicate better and to engage with decision makers and financiers.
- Life cycle cost analysis is a universally accepted method for calculating the feasibility of projects and for developing bankable projects.
- The pilot lecture aims to deliver a practical method for engineers and architects to develop bankable renewable energy and energy efficiency projects.

Case studies enhance the understanding of the student. The lecture bridges the gap between academia and industry. It covers the following subjects.

- Basics of life cycle cost (LCC) feasibility analysis
- Structured methodology for performing LCC analysis to develop bankable energy efficiency and renewable energy projects
- Data collection and reality checks necessary for inputting to LCC analysis
- Techniques for writing reports to convince investors of feasible projects
- Case studies of economic analysis for energy efficiency/renewable energy projects

3.5 Supervision of the lecture by the AzUAC professors

AzUAC professors delivered the pilot lecture under ITS supervision. The photos below show delivery of the lecture.



Figure 5. Delivery of pilot lecture by AzUAC professors



Figure 6. Prof. Nurmammad Mamedov



Figure 7. Delivery of pilot lecture by AzUAC professor

3.6 Roll-out of courses

The piloting of the lectures during the second mission by the experts to Azerbaijan was an opportunity to provide lecturers and students with exposure to the material. The feedback was very positive, and the professors showed a strong commitment to utilise the material and integrate it into their curriculum. See “Letter from Beneficiary” in Annex 3.

The university has committed to use the training materials and incorporating them as part of the standard curricula for masters courses (see Annex 3 for letter).

4. Conclusions and recommendations

The original university curricula, developed over a generation ago, did not focus enough on SE, because SE principals were not very important then. As a result, engineers of that time did not care about wasting energy. They used inefficient technologies, and the whole economy was energy intensive. Now, as a result of this task, the engineering curricula have been updated to become "SE oriented." By using these materials, universities can train engineers in a more sustainable way of thinking.

Projects developed by today's students and future engineers will be subject to the SE principals and will be SE oriented. This process, inexorably, will create demand for policy makers to improve the SE business environment and SE policy. At the same time, universities also train future executives, managers, decision makers and policy makers. With a sustainable way of thinking, these are exactly the people who will bear new ideas and direct society to improve the SE business environment.

The coming academic years will show how useful and helpful the new curricula are for future engineers. A positive teaching experience might motivate other universities to apply to the Ministry of Education and Science to include ITS lectures in their curricula, too.

While the main recommendations on how to best use the lecture materials are included in the Annex, a key recommendation for wider regional impact of these materials is set out below.

The training materials developed by the ITS for these universities are highly replicable by other universities across the INOGATE Partner Countries. The ITS recommends some minor resources are allocated to a dedicated “campaign” of sending these materials to targeted universities to ensure the maximum uptake of these materials. For example, the Ilia University in Tbilisi, one of the leading universities in Georgia, is planning to develop a Master's programme on energy and

sustainable development. Preliminary talks between the ITS and the university have resulted in a keen interest by the university to receive the materials from the ITS which they will adapt for integration at their own cost. The dissemination campaign of these lectures materials should be completed in the fall of 2014.

Annex 1: Training Materials

All training materials and related documents are uploaded on the INOGATE website:

<http://web.inogate.org/activities/311?lang=en>

The training materials posted on the website include:

- Energy management lecture
- Energy auditing lecture
- Course book (AzUAC document in Azerbaijani language with INOGATE English curriculum additions interspersed in red highlight throughout text.)

Annex 2: Letter from Beneficiary

(Received 30 Jun 2014)

Dear Ali,

I apologize for my late response I was very busy.

We have already sent you the lecture concepts which we revised for the two courses prepared for Energy Management (Buildings) Masters program.

1. Energy Audit and building certification.
2. Energy Management

Both of these courses will be taught in Masters program. Both course will be used in the Masters program we have prepared together. Additionally, some of the concepts from these courses are planned to be included in other courses which are taught in the faculty.

I would like to specify that the concept you have prepared are strongly required for the construction sector in Azerbaijan. This is because we are expecting the “Law of Energy Efficiency” in Azerbaijan shortly to be passed. The draft of the law has been prepared (I was involved in preparation of this law) and submitted to other organs for the procedures to be completed. For this reason, shortly energy audit and certification of all new and existing buildings, regulations for energy management will be required in Azerbaijan.

Master student taking the courses in the new, prepared format with enhanced knowledge will increase their productivity after they graduate.

In the view of the aforesaid we should continue our cooperation in the future.

Sincerely,

Nurməmməd Memmedov