

Curriculum for the Seminar

**"Energy Efficient Construction
and Application of Renewable
Energies"**

**for Small and Medium-Sized
Enterprises**

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This training course was developed by the QUICK Project Partners: Chamber of Crafts in Hamburg, ZEWU - Centre for Energy, Water and Environmental Technology, and tested in practice on 6-8 June 2011 in Brest/Belarus with 68 participants (Instructors: Ingrid Krumnow, Graduate Engineer Architect, Energy Consultant, Hamburg, Germany; Maritta Antoniazzi, Graduate Engineer Architect, Energy Consultant, Hamburg, Germany; Viktor Vladimirovich Tour, Department of Construction Technology and Building Materials, Brest State Technical University, Belarus; Yuri Matveev, Innovation Enterprise Alternative, Brest, Belarus).

1. Introduction

Energy saving is a MUST for each country and every community. For new buildings, efforts are made through the statutory requirements to improve the construction standards relating to energy. In particular, retrofitting should be applied in the existing buildings, and thus also the application of renewable energies.

This Seminar is addressed to small and medium-sized enterprises which would like to get an overview of

- energy-efficient modernisation of buildings

and

- the use of renewable energies.

1.1 Target group

Managers and decision makers from small and medium-sized enterprises (SMEs)

1.2 Instructors

The Seminar has two technical focal points which should be covered by the instructors in terms of content with sound knowledge in theory and practice. This includes adequate knowledge of the relevant country-specific designs and requirements. In addition, there are methodological skills which are required, such as delivering presentations, working in groups and conducting discussions. Working on the topic "Optimised Construction and Calculation of our Model House" is supported by the energy advisory programme EVA 2010. The instructor should have already worked with this programme or familiarised themselves with it. Since the programme is available only in German, students do not have to enter much data. Therefore, a data set entitled "Project Brest" has been provided.

Additionally, an instructor should be provided for this Seminar who knows the market situation of the country, can inform the participants about the legal framework and can possibly report on the existing financial support measures.

1.3 Duration

The Seminar is divided into 21 teaching units (45 minutes each) and can be carried out in two days. As a further variant, the course will be conducted in three modules which include 6 / 8 / 7 teaching units.

1.4 Implementation

1.4.1 Technical Equipment

The correct implementation of the Seminar requires

- Instructor's PC with a beamer
- Stable Internet connection
- Blackboard
- Flip chart

Group work requires the availability of a computer for each participant group (every 4 participants). Moreover, it is also helpful if the students have a calculator.

1.4.2 Methodological Remarks

Das Seminar is to be understood as an overview of information, which presents the relationship between energy efficient construction / modernisation and the application of renewable energies. The focus is on information exchange and reflection whether the applications presented here could be adopted as market opportunities, both for application in the participants' own countries and other European countries. Therefore, the time data is to be understood as reference values and should depend on the interest of each participant group.

2. Seminar Concept

Introduction

The Seminar begins with an overview of the teaching units, getting to know each other and getting the motivation to participate in the Seminar.

2.1 Teaching Unit 1

Teaching Unit 1: Availability of Fuels, Projections and Overview / Energy Saving Measures

Slide set: Teaching Unit 1/ 30 slides

Topics

Key topic 1.1: Fossil Fuels and their Development (Slides 1- 6)

Key topic 1.2: Greenhouse Effect and Consequences of Global Warming (Slides 7 - 15)

Key topic 1.3: Energy Saving, Efficient Energy Use,
Economic Application of Renewable Energies
Legal Framework of the EU (Slides 16 - 30)

Learning Objectives for Teaching Unit 1

The Participants

...are informed on the state of the world's energy consumption and the finiteness of fossil resources

...get an overview of the effects of combustion and its impact on the Earth system

... get an overview of the economics of various measures

...are provided with ideas in their own field (private / business) how to save energy, use it more efficiently and to consider renewable energies.

Form of Instruction

Lecture on the basis of the set of slides, discussion on the basis of the presented contents

Duration

2 teaching units, including the introduction (90 minutes)

2.2 Teaching Unit 2

Teaching Unit 2: Insulation Standards in the EU and Different Insulating Materials

Slide set: Insulating Materials / 31 Slides

Topics

Key topic 2.1: Energy Consumption in the Household (Slides 31- 35)

Key topic 2.2: Digression on Physics (Slides 36 - 39)

Key topic 2.3: Insulating Materials and their Properties (Slides 40 - 52)

Key topic 2.4: Application Examples of Various Insulating Materials (Slides 53 - 61)

Learning Objectives for Teaching Unit 2

The Participants

...should recognise which consumers are significant to energy consumption in the household

...are taught how the insulating effect of a material is obtained and how it can be measured in order to be able to undertake classification.

Form of Instruction

Lecture on the basis of the set of slides, discussion of the presented contents, description of real product examples, clarification of application examples

Duration

4 teaching units (180 minutes)

2.3 Teaching Unit 3

Teaching Unit 3: Determining the Final Energy Demand on the Basis of a Model House

Slide set: Determining the Final Energy Demand/ 21 Slides

Topics

Key topic 3.1: Energy Demand of Existing / Renovated Buildings (Slides 62)

Key topic 3.2: Model House Building Envelope (Slides 63 - 65)

Key topic 3.3: Calculation of the U-Value (Slides 66 - 70)

Key topic 3.4: Model House Energy Losses (Slides 71 - 78)

Key topic 3.5: Model House Emissions (Slides 79 - 82)

Learning Objectives for Teaching Unit 3

The Participants

...should recognise which savings potential is available in an average building from the 1960s and a building renovated according to the energy saving regulations / construction policy

...should recognise how the U-value is composed and how it affects the energy balance

...learn to assess what emissions are created with different insulation standards, and how they are changing.

Form of Instruction

Lecture on the basis of the available set of slides and the accompanying calculation in the Energy Consulting Programme EVA 2010. This programme is available as a 30-day trial version and the Model House Brest is provided as a project, also with the presented variants. Discussion on the presented content. Participants can create their own variants.

Note

The Programme EVA 2010 (German) can be downloaded as a 30-day trial version, from the Leuchter company in the download area from www.leuchter.de. The programme is in accordance with DIN 18599 for residential and non-residential buildings (in the programme it is possible to select the German and the English version)

Duration

2 teaching units (90 minutes)

2.4 Teaching Unit 4.1

Teaching Unit 4.1: Optimised Construction in the Planning

Slide set: Optimised Construction in the Planning, Building Envelope/ 25 Slides

Topics

Key topic 4.1.1: Identification of Weak Points by means of Thermography (Slides 83 -89)

Key topic 4.1.2: Identification of Weak Points with the Blower Door Test (Slides 90 - 99)

Key topic 4.1.3: Typical Thermal Bridges (Slides 92 - 94)

Key topic 4.1.4: Wind Density Level (Slides 95)

Key topic 4.1.5: Optimised Insulation (Slides 96 - 107)

Learning Objectives for Teaching Unit 4.1

The Participants

...should learn the possible applications of thermography.

...should learn the application possibilities of the Blower Door measurement of finding leaks in the building envelope as well as quality assurance.

...learn to recognise what typical thermal bridges are present in a building.

...should understand why the air density envelope is important and where it is places.

...learn about the application of optimised insulation.

Form of Instruction

Lecture based on the set of slides and the discussion go the applicability of the presented techniques of quality assurance. Alternatively, you can work with the worksheets to determine the U-values.

Duration

2 teaching units (90 minutes)

2.5 Teaching Unit 4.2

Teaching Unit 4.2: Optimised Construction, Heating Technology

Slide set: Teaching Unit 4.2 Optimised Construction / 18 slides

Topics

Key topic 4.2.1: Overview of Conventional Heating Systems (Slides 108)

Key topic 4.2.2: Condensing boilers (Slides 109 - 111)

Key topic 4.2.3: Water Heating (Slides 112 - 115)

Key topic 4.2.4: Control Technology – Thermostats, Pumps,
Hydraulic Balancing (Slides 116 - 119)

Key topic 4.2.5: Heating Surfaces (Slides 120 - 122)

Key topic 4.2.6: Ventilation Systems (Slides 123 - 125)

Learning Objectives for Teaching Unit 4.2

The Participants

...should understand the available, conventional heating and control technology.

...should understand why an efficient ventilation system is important in an efficient house and how it can be installed.

Form of Instruction

Lecture based on the set of slides and the discussion go the applicability of the presented techniques.

Duration

2 teaching units (90 minutes)

2.6 Teaching Unit 5

Teaching Unit 5: Overview of the Various Forms of Renewable Energies and their Technical Implementation

Slide set 5 / 45 Slides

Topics

Key topic 5.1: Definition and Classification of Renewable Energies (Slides 126-130)

Key topic 5.2: Solar Energy (Slides 131 - 145)

Key topic 5.3: Biomass (Slides 146 - 151)

Key topic 5.4: Biogas and Biofuels (Slides 152 - 155)

Key topic 5.5: Heat Pumps (Slides 156 - 161)

Key topic 5.7: Cogeneration Plants (Slides 162 - 165)

Key topic 5.8: Wind Energy, Hydroelectric Power (Slides 166 - 167)

Key topic 5.9: Market Opportunities for Renewable Energies (Slides 168 - 170)

Learning Objectives for Teaching Unit 5

The Participants

....recognise the diversity of products and application areas of renewable energies

... examine to what extent the application is available in their country

....consider what it takes to provide applications on your own

Form of Instruction

Lecture on the basis of the set of slides and a discussion of the presented contents on the basis of guiding questions and query cards

- What is the situation in your own country / environment?
- What needs to be established in order to implement renewable energies?
- Where do the participants see which technological possibilities?

Duration

3 teaching units (135 minutes)

2.7 Teaching Unit 6

Teaching Unit 6: Situation in the Country

Here the instructor should provide knowledge concerning the respective country.

Topics

Key topic 6.1: Market Situation on Site

Key topic 6.2: Legal Framework

Key topic 6.3: Funding

Learning Objectives for Teaching Unit 6

The Participants

....learn the latest information on the situation in their own country

Duration

1-2 teaching units (45 – 90 minutes)

2.8 Teaching Unit 7

Teaching Unit 7: Presentation of a Near-Zero Energy House and Application of Renewable Energies

Slide set: Near-Zero Energy House/ 15 Slides

Topics

Key topic 7.1: Considerations to the Overall Concept (Slides 171 - 172)

Key topic 7.2: Optimisation of the Components / Comparison of Variants (Slides 173 - 177)

Key topic 7.3: Presentation of a Near-Zero Energy House d (slides 178)

Key topic 7.4: Energy Savings in Comparison (slides 179 - 182)

Key topic 7.5: Emissions (slides 183 - 186)

Learning Objectives for Teaching Unit 7

The Participants

....recognise in group work, what influence a new insulation standard has on the energy balance.

... recognise in group work, what influence heat preparation has on the energy balance.

.... recognise in group work, how the pollutant emissions change according to the variants.

Form of Instruction

Lecture based on the set of slides. Creation of predefined variants with the EVA 2010 Programme in group work.

Tasks in group work (about 4 persons in each group)

How the respective variant changes

the final energy demand?

1. the primary energy demand?
2. the pollution emission levels?

- Group 1: Variant "Roof Insulation + Condensing + Solar"
- Group 2: Variant "No Insulation + Geothermal Heat"
- Group 3: Variant "Combined Variants + Geothermal Heat"
- Group 4: Variant "Exterior Wall Insulation + Roof Insulation"

Duration

2 teaching units (90 minutes)

2.9 Teaching Unit 8

Teaching Unit 8: Project presentation

Form of Instruction

Presentation of the results from working groups on a flip chart.

Tasks in group work (about 4 persons in each group)

How the respective variant changes

1. the final energy demand?
2. the primary energy demand?
3. the pollution emission levels?

- Group 1: Variant "Roof Insulation + Condensing + Solar"
- Group 2: Variant "No Insulation + Geothermal Heat"
- Group 3: Variant "Combined Variants + Geothermal Heat"
- Group 4: Variant "Exterior Wall Insulation + Roof Insulation"

Learning Objectives for Teaching Unit 8

The Participants should be able to evaluate different solutions with their advantages and disadvantages.

Duration

1 teaching unit (45 minutes) in total for all 4 groups.

2.10 Teaching Unit 9

Teaching Unit 9: Summary and Conclusion

Form of Instruction

- Providing the teaching units in flip chart 1 and presentation of a summarising overview.
- Clarification of the remaining questions from the participants – What was missing?; How can we implement the contents as a professional perspective?
- Flip chart 2 – revealing the opinion section
- Participants stick 3 points on the flip chart with the question: "What did I like the most?"
- Participants stick 1 point in the opinion section with the question "How did I like the"?

Duration

1 teaching unit (45 minutes)

3. Certificate

The participants receive a certificate upon completion of the seminar, in which the training contents (key topics) are listed and signed by the training centre (Chamber of Crafts) and the Hanseatic Parliament. The certificate contains possibly the INTERREG Disclaimer.