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BETTER BUILDING

Certifying VET teachers as Energy Saving Advisers
A transfer system into three different European societies

Modular curriculum and teaching materials – executive summary

Turkey





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The project partnership:

- IAL Emilia Romagna, Bologna, Italy (Project promoter)
- BEST Institut für berufsbezogene Weiterbildung und Personaltraining GmbH, Vienna, Austria (Coordinator)
- Fundatia Romano-Germana CPPP, Timisoara, Romania
- GLOBALTraining and Consulting, Istanbul, Turkey
- PAPILOT - Zavod za vzpodbujanje in razvijanje kvalitete življenja, Ljubljana, Slovenia
- Rogaland Kurs og Kompetansesenter, Stavanger, Norway
- Tekniker Eğitim Sağlık Kültür Vakfı (TEK-SAV), Ankara, Turkey

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Executive Summary

Abstract

The method of analysis and the general construction methods differ from one EU country to the other. These are added to the abstract.

Introduction

Turkey is spending approximately 55 billion USD for energy each year and has been buying most of the energy sources (natural gas, petrol, and coal) from other countries (mainly from Russia). Turkey has good potential for solar energy and thermal energy compared to the other European countries. There are very big problems in using the energy efficiently in houses.

“**Better Building**” educational documents can be used at training centres and vocational colleges in Turkey to train the students and people who need these environment-related skills and knowledge.

Consequently, while the Project will be transferred to Turkey the defined calculation methods, used materials and practical styles are kept one to one.

But besides this, the laws and the regulations used in Turkey at the moment have been taken into consideration.

Alternative calculation methods according to Turkish regulations were introduced. This will give us the chance of finding the most effective method of calculation, heat insulation materials and the way of application.



Curriculum

The curriculum involves many points. In Turkey, there are differences in climatic conditions and construction methods of buildings. But heat loss from buildings shows similar behaviours. That is why, with minor changes, the curriculum is taken as it is.

Thus, for the transfer of innovation we thought about and added the following:

- EU applications and the techniques are taken completely.
- The insulation materials and application styles are also taken completely, since winters in the EU are comparable. (Also to promote the materials trade).
- Turkish regulations have been added.
- Proposed and existing financial models according to Turkish situations have been added.



Training Course

Total Time: 6weeks x 30 hours per week

Schedule of periods / topics

	Topic	Total hours
1	Interactive effects between construction and environment	8
2	Legislation and regulations regarding old and new buildings.	6
3	Heat insulation, requirements and aspects.	6
4	Energy budget and convenience of living in existing buildings.	10
5	Basic knowledge of heat admission of building panels	30
6	Humidity in buildings, formation of condensate	8
7	Insulating materials regarding the thermo technical reconstruction of buildings	20
8	Technologies regarding the thermo technical reconstruction, arranged according to categories of building components	60
9	Calculate the economic feasibility of additional heat insulation	18
10	Use of solar energy	8
11	Recycling of construction waste following reconstruction measures	6
12	Communication (optional)	6
Total hours training course		180



Topic 1

Interactive effects between construction and environment

Aims	Topics of advanced training
<p>The trainee understands the influence of fuel consumption on the environment.</p> <p>The trainee knows the international efforts and proposed solutions regarding energy saving ways of construction as well as environmental protection.</p> <p>The trainee knows the possibilities users have to influence the energy consumption of buildings as well as the interactions between environmental protection and construction work.</p>	<ul style="list-style-type: none">• The situation of the world energy supply and the primary energy sources• General outline of combustibles and their influence on our climate• Necessity of conservation of energy in construction work• Possibilities of economization regarding energy consumption in old and new houses.• Systems to protect energy demands.• Energy sources and energy reserves.



Topic 2

Legislation and regulations regarding old and new buildings

Aims	Topics of advanced training
<p>The trainee should get an overview on legislation, standards and regulations of construction and building utilization regarding energy consumption. The trainee needs to be able to implement them in concrete schemes.</p> <p>The trainee knows the national regulations and the guidelines of the EU regarding energy consumption of buildings.</p>	<ul style="list-style-type: none"> • Legal regulations regarding the national strategy concerning energy saving measures and energy enhancement efficiency especially in the domain of construction. • Legal regulations regarding planning, authorization and implementation of building measures. • Legal regulations regarding energy related building reconstruction measures (Thermo technical reconstruction of buildings) • Legal regulations regarding responsibilities and benefits of reconstruction measures of buildings. • Institutions that are responsible for energy enhancement efficiency. • Vocational training in the area of energy/thermo technique (existing vocations): <ul style="list-style-type: none"> • In the vocational school system • In adult education • In the university system • In other areas



Topic 3

Heat insulation, requirements and aspects

Aims	Topics of advanced training
<p>The trainee knows the accentuation of requirements regarding heat insulation especially in residential buildings.</p> <p>The trainee knows and uses the term heat insulation in connection with energy efficient construction.</p>	<ul style="list-style-type: none"> • Optimized convenience in living by reaching the right concentration of air humidity. • Heat exchange between human and environment • Progress regarding heat insulation measures on a European level. • Construction solutions regarding outer shells • Requirements and perspectives in the domain of heat insulation.

Topic 4

Energy budget and convenience of living in existing buildings, importance in the domain of construction physics

Aims	Topics of advanced training
<p>The trainee is to know the relationship between convenient heat levels in living space and the parameters of climate of the surrounding environment.</p> <p>The trainee should be able to specify and explain the parameters of heat conditions in living spaces.</p> <p>The trainee should be able to</p>	<ul style="list-style-type: none"> • Thermal balance of human beings • Convenience of living and respective parameters, air temperature, surface temperature, relative humidity, airflow velocity, air renewal ratio. • Parameter of climate regarding the building and the outside climate: alignment of buildings, sunshine, main wind direction, air temperature. • Application of different systems of energy supply and impact on energy



<p>give advice regarding the variety of supplies of energy and their efficient use.</p>	<p>demand.</p> <ul style="list-style-type: none">• Measuring system and exerciser for energy consumption.
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Topic 5

Basic knowledge of heat admission of building panels

Aims	Topics of advanced training
<p>The trainee should be able to explain the heat admission of building panels.</p> <p>The trainee should be able to accurately classify a building in the climatic conditions of the surrounding area.</p> <p>The trainee understands the term thermal balance and is able to conduct the calculation of thermal balance of a building.</p> <p>The trainee can determine the factors which are responsible for a reduction of energy demands and step towards energy saving.</p>	<ul style="list-style-type: none"> • Basic concepts of the subject of building materials: <ul style="list-style-type: none"> • Heat transmission through conduction. • Heat transmission through convection • Heat transmission through radiation • Climatic requirements of calculation: <ul style="list-style-type: none"> • Classification of area according to climatic conditions for summer and winter • Equivalent calculation temperature • Thermal balance in residential buildings <ul style="list-style-type: none"> • Calculation methods, performing of • Calculation methods and exercises. • Heat losses, heat demands • Heat requirements per hour regarding one heated room: <ul style="list-style-type: none"> • Heat loss through heat outlets/cold bridges • Heat loss through airing • Heat requirements for hot water • Factors affecting the thermal balance of buildings.



Topic 6

Humidity in buildings, formation of condensate

Aims	Topics of advances training
<p>The trainee knows the terms air humidity and building material humidity and is able to identify the respective effects on buildings as well as the thermal pre-conditions of the buildings.</p> <p>The trainee knows the causes of formation of condensate and can recommend measures of prevention for the resulting phenomenon.</p>	<ul style="list-style-type: none">• Absolute humidity moisture saturation, relative humidity, vapor pressure, dew point, condensate.• Humidity of building materials: Hygroscopic humidity, balanced humidity, critical humidity of building materials.• Migration of steam: Resistance to steam diffusion, Resistance to steam percolation, condensate on surfaces and in building parts.• Building measures against condensate water:<ul style="list-style-type: none">• Moisture barrier• Aerating rooms the right way.• Right room temperature• Reduce sources of moisture formation.• Breathable plaster.



Topic 7

Insulating materials regarding the thermo technical reconstruction of buildings

Aims	Topics of advanced training
<p>The trainee should be able to describe the characteristics of building materials and their respective use in reconstructing buildings.</p> <p>The trainee knows and is able to assess criteria for choosing building materials.</p> <p>The trainee knows the legal regulations regarding the use of building materials as well as the most important characteristics of these building materials.</p> <p>The trainee should be able to choose optimal building materials and take ecological aspects into account. The trainee should avoid or minimize contaminated building materials in the planning stage.</p>	<ul style="list-style-type: none"> • Physical characteristics of insulating materials: the term insulating materials, specific heat capacity, heat passage. • Organic substances: cohesive fiber materials or non-fiber materials, artificial polymer materials. <ul style="list-style-type: none"> • Discourse of insulation materials • Inorganic materials • Cohesive cellulose • Non-reinforced gas aerated concrete elements; Technical characteristics, delivery and storage <ul style="list-style-type: none"> • Reinforced gas aerated concrete elements: technical characteristics, delivery and storage. • Granulate and concrete with granulate • Mineral wool and products made out of mineral wool • Glass wool and products made out of glass wool • Organic materials: artificial polymer material, polyester, polyurethane foam, etc. <ul style="list-style-type: none"> • Regulations regarding use of building materials • Criteria regarding the use of insulation materials • Criteria for selection of insulating materials – properties in demand: -



	<ul style="list-style-type: none">• Resisting heat and cold• Resisting moisture• Resisting fire, moisture barrier• Protection against parasites• Enquiries regarding insulation capacity of building elements: resisting heat passage, thermal stability, resisting steam diffusion, resisting air flow
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Topic 8

Technologies regarding the thermo technical reconstruction, arranged according to categories of building components

Aims	Topics of advanced training
<p>The trainee knows the laws, standards and regulations regarding the design and implementation of restoration measures on buildings.</p> <p>The trainee should be able to recommend the best possible solution for a thermo technical reconstruction depending on the kind of/ state of outer shell.</p> <p>The trainee should be able to recommend the best possible solutions for a thermo technical reconstruction of the roof, depending on kind of/ state of roof.</p> <p>The trainee should be able to recommend the best possible solutions for a thermo technical reconstruction of the ceilings, depending on kind of/ state of ceilings.</p> <p>The trainee should be able to recommend the best possible solutions for a thermo technical</p>	<ul style="list-style-type: none"> • Thermo technical reconstruction of walls: walls made with pre-cast concrete slabs, small concrete brick stones, bricks, wood structure with insulation, clay-state bricks. • Inside insulation of walls: possibilities, advantages, disadvantages: <ul style="list-style-type: none"> • Added application of insulating layer. • Added insulation by beam filling • Additional insulation with plaster • Outside insulation of walls: possibilities, advantages, disadvantages: <ul style="list-style-type: none"> • Insulation protected by slabs • Upgraded insulation • Preparation of insulating plaster • Preparation of double wall with insulation filling • Thermo technical reconstruction of roofs: thermo technical reconstruction of roofs with truss <ul style="list-style-type: none"> • Insulation below the ceiling • Insulation above the ceiling • Insulation below the roof covering. • Reconstruction of flat roofs • Substitution of the whole roof up to the ceiling with a better and more efficient



<p>reconstruction of the outside windows and doors, depending on the kind of/ state of windows and doors.</p>	<p>structure</p> <ul style="list-style-type: none">• Substitution of insulation, the protective layer and the blocking.• Increase the thermal transfer resistance by applying a new insulation layer• Produce a roof with truss, including lightweight roofing, with added insulation of the old structure, or reconstruction following old example with ceiling below the attic. <ul style="list-style-type: none">• Thermo technical reconstruction of ceilings made of wood and concrete.<ul style="list-style-type: none">• Thermo technical reconstruction of ceilings below a heated attic• Thermo technical reconstruction of ceilings above heated rooms• Thermo technical reconstruction of ceilings above ground.• Thermo technical reconstruction of windows: possibilities, advantages, disadvantages<ul style="list-style-type: none">• Installation of a insulated window (Type Thermo pan)
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Topic 9

Calculate the economic feasibility of additional heat insulation

Aims	Topics of advanced training
<p>By calculating the trainee should be able to demonstrate certain advantages of a thermo technical reconstruction.</p>	<ul style="list-style-type: none"> • Calculation of economic advantages due to using additional insulation. • Calculation of costs for additional insulation. • Calculation of economic feasibility regarding added insulation.

Topic 10

Use of solar energy

Aims	Topics of advanced training
<p>The trainee is to know the influence of the climatic conditions of the location and the orientation of buildings on their thermo technical performance.</p> <p>Already during the planning stages, the trainee should learn that the right choice of geometrical design of buildings, the size and orientation of windows and the kind of building materials which were chosen can be essential for reaching convenience of living.</p>	<ul style="list-style-type: none"> • Site analysis for existing and future buildings. • Consideration of local climatic conditions • Geometrical design of building • Windbreak measures, effects of sun and shade • Orientation of interior rooms according to cardinal points • Heat insulation of outer shell of a building, avoiding thermal bridges. • Window area and the orientation regarding an ideal use of sun energy and illumination. • Heat storage in building materials • Utilization of ecological building materials.



Topic 11

Recycling of construction waste following reconstruction measures

Aims	Topics of advanced training
<p>The trainee is to know the legal regulations of transportation requirements and storage of construction waste in regard to the environment.</p> <p>The trainee should have knowledge about the recycling of building waste originating from construction work.</p>	<ul style="list-style-type: none">• Selection of building materials in classes according to type and recycling opportunities• Disposal of building and construction waste and storage in landfills• Measures for the protection of the environment.

Guidelines

This is a very useful table or chart for the algorithm of the job. So there is almost no gap in the process. Every thing is controlled step by step. So without any change it is fully adapted.



Annexes

Annex 1 Information from the owners of prefabricated buildings

According to materials used and the climatic conditions the heat loss of buildings changes (Page 26). Calculation methods used in the project are accepted and additional methods are added (Turkish standards)

Annex 2 Data Processing

The data to be used in the calculation differs according to the position of the country. So the solar map of Turkey and the thermal areas of Turkey are added (page 38 to 49). Turkey is divided into three thermal areas. Each location has to concern this division in their calculations. Thermal transfer coefficients are given for Turkey (page 50). Different isolation materials and accordingly different isolation coefficients are used (page 53).

Annex 3 Outer isolation of the surfaces practical example

The practical example is similar to Turkey for new methods of isolations. In the past this was not the case. People were using sandwich wall and no more isolation. Plus, the panels are fixed to the wall by screws.

Annex 4 Materials and solutions for thermal rehabilitations of Buildings

There are various materials used in new isolation techniques in Turkey. There are some firms for these materials. Some of them are fabricated in Turkey but mostly imported from EU countries.



Annex 5 Laws and measures for old and new prefabricated buildings

The construction measures related to isolation is added here. It is published for the first time in 2000 and continuously renewed. As it is known, Turkey had a great earthquake in 1999. After this, the construction measures are much more strictly applied.

Annex 6 Recycling of the materials after renovation of buildings

In Turkey, recycling is not very often done. The waste materials after construction are dumped to empty areas of the municipality. Recycling ways and the tables are very good for the Turkish situation.

Annex 7 New energy sources

Solar energy is much more important for Turkey. The south, south east and western parts of Turkey are good areas of solar energy. Even the middle and east Anatolia get effective solar energy. Thus, for hot water in houses solar heat installations can be used. For commercial and government buildings solar cells can be used for daily lightening.

Geothermal hot water resources are substantial in the western and central part of Turkey. Even a complete village can be heated cheaply.



Wind energy is also another source for Turkey. Currently the areas of effective wind flow are being defined in Turkey and firms are motivated to make energy investment. Turkey is growing very fast and energy demand is increasing.

Annex 8 Finance models

Proposed and existing financial models according to the Turkish situation have been added.

Annex 9 Project partners

New partners and their logos are added as usual.



Conclusion

This Project is an excellent one and can be applied to all other countries even all over the world where energy saving is urgent. Especially in Turkey people are lacking knowledge about energy saving and environmental protection. There are regulations but the creation of a good "CONSTRUCTION CULTURE OF BUILDING AND HEAT INSULATION" or a "CULTURE of ENVIRONMENTALLY FRIENDLY BUILDINGS" is much more important than the regulations. So the most important innovation transfer must lie in these cultural changes.

Consequently, while the Project is transferred to Turkey, the defined calculation methods, used materials and practical styles are kept one to one. But besides this, the laws and the regulations used in Turkey at the moment have been taken into consideration and alternative calculation methods according to Turkish regulations are introduced. This will give us the chance of finding the most effective method of calculation, heat insulation materials and the way of application.

To sum up, the most important result of this transfer of innovation Project will be a transfer of the "CULTURE of CONSTRUCTION" and "CULTURE of ENVIRONMENTAL PROTECTION."





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