

Intelligent Energy  Europe



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Deliverable D.3.6

List of Educational Materials for Training Energy Auditors

2007

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## **1 Objectives of this Deliverable**

It is a main objective of RURASU to prepare the ground for the successful implementation of EPBD in Europe. One main prerequisite for this is to have a sufficient amount of professionals who are able to help owners, tenants and residents to cope with the requirements of the new legislation. This is the reason why RURASU implements at least two training courses for professionals in Task 3.6. For these training courses it is very important that they use high quality training materials. To evaluate its quality and also to give other DASUs the possibility to optimise their training materials, Deliverable 3.6 asks for a list of educational material from every single DASU.

## **2 Working Methodology**

The work – and this report – is structured along the four individual DASUs. Through a joint template every DASU was requested to elaborate portraits of their education material along the same criteria and thus allow a good comparison between the used materials. This strive for homogenous structures is limited through the individual peculiarities of every DASU. The German DASU e.g. works completely with materials that were prepared by the DASU. For this reason a survey like for the other DASUs was not possible. Instead a sample of the EPBD related publication is included as Annex to this report.

### 3 Training Materials in Greek DASU

Number	Country	Author	Title	English Translation of the Title	Publication Year	Form (paper, electronic)	Brief Abstract of the main content
1	Greece	Papadopoulos A.M., Oxizidis S., Papathanasiou L.	Developing a new library of materials and structural elements for the simulative evaluation of buildings' energy performance	Developing a new library of materials and structural elements for the simulative evaluation of buildings' energy performance	2007 (in press)	paper	Contemporary building energy simulation programs are not only used by researchers but are also common tools in the hands of engineers and architects. Most of them are using databases of materials and structural elements, with characteristics originating from the country or the broader region where the specific program was developed. Thus, often the particularities met in other countries are not considered. Such a database of materials and constructions systematically used in the Greek building sector was developed for use with the simulation program EnergyPlus, which has become quite popular over the last years. In order to determine the applicability of the database, the energy behavior of a typical multistory, multifamily building was simulated, having the exact materials and structural elements and patterns used in Greece. Furthermore, different thicknesses of insulation were simulated, corresponding to local climatic conditions and, even more important, to different dates of the building's construction.
2	Greece	Papadopoulos A.M.	Energy cost and its impact on regulating the buildings' energy behaviour	Energy cost and its impact on regulating the buildings' energy behaviour	2007 (in press)	paper	The necessity to improve the buildings' energy behaviour was born out of the price shock caused by the oil crises in the 1970's. The respond was expressed by national legislative acts regulating the demand for heating and ventilation. The results were important, though not always without side-effects, for example in the field of indoor air quality. Furthermore, economic and environmental considerations played an important role in determining the policies applied, the latter particularly in the 1990's and as a result of the Kyoto and Montreal protocols. Finally, new problems, like the increasing demand for air-conditioning and its impact on the national electricity systems began to influence the way in which a building's energy behaviour is considered. The enforcement of the European Directive on the Energy Performance of Buildings (2002/91/EC) seems to provide for the first time an integrated regulatory tool, enabling the simultaneous consideration of the energy, environmental and economic parameters of building's design. Its
3	Greece	Papakostas K.T., Papadopoulos A.M. and Vlahakis I.	Optimization of thermal protection in residential buildings using the variable base degree days method, Int. Journal of Sustainable Energy, Vol. 24, 1, 19 - 32	Optimization of thermal protection in residential buildings using the variable base degree days method, Int. Journal of Sustainable Energy, Vol. 24, 1, 19 - 32		paper	The optimal degree of thermal protection depends on technical and economic criteria. It is determined by considering the heating and cooling demand of the building and also the feasibility of the investment needed to achieve the aimed degree of thermal protection of the building's shell. As all these parameters vary with respect to climatic conditions, the fluctuation of cost factors, and the actual way in which buildings are designed and constructed, the determination of an optimal thermal protection is always subject to discussion. A way of approaching this problem is discussed in this paper. The building's heating demand was determined by applying the DIN 4701 method, whilst its cooling demand according to the CLTD/CLF ASHRAE method. The actual energy consumption arising, in order to cope with these demands, was determined by applying the variable base degree-days method. In order to evaluate the feasibility of the suggested thermal protection, two microeconomic methods were applied, namely the Net Present Value and Depreciated Payback Period. The whole methodology was used to assess a typical Greek single family residential building under varying clim

4	Greece	Hellenic National Statistical Service	Statistical Index – Census of Buildings' Inventory	Statistical Index – Census of Buildings' Inventory	2001	data	
5	Greece	Papadopoulos A.M.	Solar Thermal Technologies for Buildings - The state of the art, (Santamouris M. ed) Active Solar Heating and Cooling of Buildings: Perspectives for the coming decade, James and James, London	Solar Thermal Technologies for Buildings - The state of the art, (Santamouris M. ed) Active Solar Heating and Cooling of Buildings: Perspectives for the coming decade, James and James, London	2003	book	Almost thirty years after the first oil crisis, the technical and socio-economic background for renewable energy sources (RES) systems in the building sector is certainly quite different to that of the mid-seventies. Within this rather short time frame active solar systems (ASS) became the most widespread, and certainly the most well-known type of RES system. They are by now a commonly accepted solution for covering specific energy demands, both in the perception of the final consumer, as well as an example of a highly developed demonstration instrument for the scientific progress in the field of thermal processing. These developments were assisted, to a large extent, by national and international policies, as well as by a public interest for energy conservation and for the reduction of running costs in the residential and tertiary sector. Still, the development of the branch in the 1990's seems to move in two different directions. Some types of ASS, like the flat-plate collectors for domestic hot water (DHW) production, have evolved to
6	Greece	Crawley, D.B., L.K. Lawrie, C.O. Pedersen, R.J. Liesen, D.E. Fisher, R.K. Strand, R.D. Taylor, R.C. Winkelmann, W.F. Buhl, Y.J. Huang, A.E. Erdem	ENERGYPLUS, A New-Generation Building Energy Simulation Program, Proceedings of Building Simulation '99, Vol. 1. pp. 81-88	ENERGYPLUS, A New-Generation Building Energy Simulation Program, Proceedings of Building Simulation '99, Vol. 1. pp. 81-88	1999	book	
7	Greece	Mihalakakou G., M. Santamouris and A. Tsagrassoulis	On the energy consumption in residential buildings, Energy and Buildings, Vol. 34, 7, p.727-736	On the energy consumption in residential buildings, Energy and Buildings, Vol. 34, 7, p.727-736	2002	paper	A neural network approach is used in the present study for modelling and estimating the energy consumption time series for a residential building in Athens, using as inputs several climatic parameters.
8	Greece	Balaras C. A., Droutsas K., Argiriou A. A. and Asimakopoulos D. N.	Potential for energy conservation in apartment buildings, Energy and Buildings, Vol.31, 2, p. 143-154	Potential for energy conservation in apartment buildings, Energy and Buildings, Vol.31, 2, p. 143-154	2000	paper	The hourly values of the energy consumption, for heating and cooling the building, are estimated for several years using feed forward backpropagation neural networks. Various neural network architectures are designed and trained for the output estimation, which is the building's energy consumption. The results are tested with extensive sets of non-training measurements and it is found that they correspond well with the actual values.
9	Greece	Hellenic Ministry of Environment, Planning and Public Works	Thermal Insulation Code for Buildings, Decree-Law 1/6/1979, The Hellenic Official Gazette, 362D, 1979	Thermal Insulation Code for Buildings, Decree-Law 1/6/1979, The Hellenic Official Gazette, 362D, 1979	1979	law	Furthermore, "multi-lag" output predictions of ambient air temperature and total solar radiation are used as inputs to the neural network models for modelling and predicting the future values of energy consumption with sufficient accuracy.
10	Greece	Papadopoulos A.M., Theodosiou T. and Karatzas K.	Feasibility of energy saving renovation measures in urban buildings: The impact of energy prices and the acceptable pay back time criterion, Energy and Buildings, Vol. 34, 455-466	Feasibility of energy saving renovation measures in urban buildings: The impact of energy prices and the acceptable pay back time criterion, Energy and Buildings, Vol. 34, 455-466	2002	paper	The energy renovation of existing buildings is an important tool for the reduction of energy consumption in the building sector, the improvement of prevailing indoor thermal comfort conditions and also for the improvement of environmental conditions in urban areas. At the same time, it is a technical, economic and social problem, due to the way in which many cities have been built and the restrictions imposed by economic constraints that tantalise most countries in South-Eastern Europe, and also Greece. It applies particularly in Northern Greece, with its cold and prolonged heating season, where a series of studies was carried out since 1994 to approach the problem and develop viable proposals. Public and mixed-use buildings form a significant part of the building stock and are therefore a primary candidate for energy saving measures, especially as they also play the role of a 'pilot-demonstrator' for the private owned buildings. However, due to the low energy prices that prevailed over the last ten years, and as energy saving

11	Greece	Santamouris M., Kapsis K., Korres D., Livada I., Pavlou C. and Assimakopoulos M.N.	On the relation between the energy and social characteristics of the residential sector, Energy and Buildings	On the relation between the energy and social characteristics of the residential sector, Energy and Buildings	2007 (in press)	paper	Social, financial, energy and technical data from about 1110 households have been collected during 2004 in the major Athens area. The sample has been divided in seven income groups and a detailed analysis has been performed. Important conclusions have been drawn regarding the quality of households, the operational conditions and the energy spent per income group. Low income people are more likely to be living in old buildings with poor envelope conditions. The cost per person and unit area is much higher for the low income group for both heating and electricity. Fuel poverty is quite high, especially when the actual oil prices are considered.
12	Greece	Hellenic Ministry of Environment, Planning and Public Works	Technical regulation of distributing the heating costs of central heating installations, The Hellenic Official Gazette, 631D	Technical regulation of distributing the heating costs of central heating installations, The Hellenic Official Gazette, 631D	1985	technical regulation	
13	Greece	Technical Chamber of Greece	Technical Directive 2427/83	Technical Directive 2427/83	1983	law	
14	Greece	Power Public Corporation, www.dei.gr	-	-	2006	site	
15	Greece	National Observatory of Athens	Greece - National Inventory Report 1990-2003, <a href="http://www.climate.noa.gr/Reports/Sub_2005">http://www.climate.noa.gr/Reports/Sub_2005</a>	Greece - National Inventory Report 1990-2003, <a href="http://www.climate.noa.gr/Reports/Sub_2005">http://www.climate.noa.gr/Reports/Sub_2005</a>	2005	report	
16		Jäger-Waldau A. and Ossenbrink H.	Progress of electricity from biomass, wind and photovoltaics in the European Union, Renewable and Sustainable Energy Reviews, Volume, 2004, 8, Issue 2., p.157-182	Progress of electricity from biomass, wind and photovoltaics in the European Union, Renewable and Sustainable Energy Reviews, Volume, 2004, 8, Issue 2., p.157-182	2004	paper	Photovoltaics and renewable energies are growing at much faster pace than the rest of the economy in Europe and worldwide. This and the dramatic oil price increases in 2005 have led to remarkable re-evaluation of the renewable energy sector by politics and financing institutions. Despite the fact that there are still discrepancies between the European Union and the USA, as to how to deal with climate change, renewable energies will play an important role for the implementation of the Kyoto Protocol and the worldwide introduction of tradable Green Certificates. Apart from the electricity sector, renewable energy sources for the generation of heat and the use of environment friendly biofuels for the transport sector will become more and more important in the future.
17		Kaltschmitt M., Streicher W., Wiese A.	Renewable Energy. Technological Foundations, Economical and Environmental Aspects', Springer Verlag, Berlin, p.339-343.	Renewable Energy. Technological Foundations, Economical and Environmental Aspects', Springer Verlag, Berlin, p.339-343.	1997	book	
18	Greece	Official Gazette of the Hellenic Government	Regulation for the Provisions of Production and Procurement Licenses (Vol. B 1498/08.12.2000	Regulation for the Provisions of Production and Procurement Licenses (Vol. B 1498/08.12.2000	2000	regulation	
19	Greece	Papadopoulos A.M. and Kaltschmitt M.	Sustainable energy project for the economic development of remote and isolated island communities, Proceedings of the Altener 2000 Conference, 23-25 October, p.293-296.	Sustainable energy project for the economic development of remote and isolated island communities, Proceedings of the Altener 2000 Conference, 23-25 October, p.293-296.	2000	Proceedings of the Altener 2000 Conference	Smaller isolated communities, be it on the islands of the Dodecanese or in the mountainous areas of Pieria-Greece, are characterised by a small population, depending financially on tourism and agriculture, and by their remoteness. These conditions make their energy provision difficult and expensive. Still, there is a considerable potential of renewable energy sources, mainly wind, solar and geothermal energy and, to a smaller degree, biomass. In this paper are presented the preliminary results of an ALTENER project aiming at the utilisation of these resources in a way that will support the development of the local communities, sustaining at the same time the unique features of the region. The results presented focus on the existing energy provision scheme and the exploitable RES potential, indicating some of the possible solutions, which are to be determined as the project reaches its completion.
20	Greece	Boulazis N., Glinou G., Papachristou D., Papadopoulos M.	Perspectives for the development of RES in Greece, RENES Conference, p.13	Perspectives for the development of RES in Greece, RENES Conference, p.13	2005	paper	

21	American Society of Heating, Refrigerating and Air-Conditioning Engineers, ASHRAE	ASHRAE Standart 62-1973: (1973), Standards for Natural and Mechanical Ventilation.	ASHRAE Standart 62-1973: (1973), Standards for Natural and Mechanical Ventilation.	1973	ASHRAE Standart
22	American Society of Heating, Refrigerating and Air-Conditioning Engineers, ASHRAE	ASHRAE Standart 62-1981: (1981):Ventilation for Acceptable Indoor Air Quality	ASHRAE Standart 62-1981: (1981):Ventilation for Acceptable Indoor Air Quality	1981	ASHRAE Standart
23	American Society of Heating, Refrigerating and Air-Conditioning Engineers, ASHRAE	ASHRAE Standard 62-1989: (1989), Ventilation for Acceptable Indoor Air Quality	ASHRAE Standard 62-1989: (1989), Ventilation for Acceptable Indoor Air Quality	1989	ASHRAE Standart
24	American Society of Heating, Refrigerating and Air-Conditioning Engineers, ASHRAE	ASHRAE Standard 62-1999: (1999), Ventilation for Acceptable Indoor Air Quality	ASHRAE Standard 62-1999: (1999), Ventilation for Acceptable Indoor Air Quality	1999	ASHRAE Standart
25	American Society of Heating, Refrigerating and Air-Conditioning Engineers, ASHRAE	ASHRAE Standard 62-2001: (2001), Ventilation for Acceptable Indoor Air Quality	ASHRAE Standard 62-2001: (2001), Ventilation for Acceptable Indoor Air Quality	2001	ASHRAE Standart
26	Awbi B. H	“Chapter 7 – Ventilation”, Renewable and Sustainable Energy Reviews Vol. 2, pp157-188	“Chapter 7 – Ventilation”, Renewable and Sustainable Energy Reviews Vol. 2, pp157-188	1998	book
27	Baek S., Kim Y., and Perry R	“Indoor air quality in homes, offices and restaurants in Korean urban areas-indoor/outdoor relationships”, Atmospheric Environment 31, pp529-544.	“Indoor air quality in homes, offices and restaurants in Korean urban areas-indoor/outdoor relationships”, Atmospheric Environment 31, pp529-544.	1997	book

28		Chan A. T.	“Indoor-outdoor relationships of particulate matter and nitrogen oxides under different outdoor meteorological conditions”, <i>Atmospheric Environment</i> 36, pp1543-1551.	“Indoor-outdoor relationships of particulate matter and nitrogen oxides under different outdoor meteorological conditions”, <i>Atmospheric Environment</i> 36, pp1543-1551.	2002	book
29		Danish Society of Indoor Climate	Introduction to the Principles behind the Indoor Climate Labelling	Introduction to the Principles behind the Indoor Climate Labelling	2000	
30		Demster S. J. and Chen S.	Variable air volume systems for environmental quality	Variable air volume systems for environmental quality	1996	book
31		ECA (European Collaborative Action on, “Urban Air, Indoor Environment and Human Exposure”)	Ventilation, Good Indoor Air Quality and Rational Use of Energy”, Report No 23, EUR 20741 En, Luxembourg: Office of Official Publications of the European Communities.	Ventilation, Good Indoor Air Quality and Rational Use of Energy”, Report No 23, EUR 20741 En, Luxembourg: Office of Official Publications of the European Communities.	2003	report

## 4 Training Material in Scottish DASU

No	Country	Author	Title	Publication Year	Form (paper, electronic)	Brief Abstract of the main content
1	Scotland	Dr Paul Stollard, Chief Executive, Scottish Building Standards Agency (SBSA)	Scottish Building Standards Agency Introduction	1/6/2007	Paper	Description of the national legislation that has been used to implement the EPBD in Scotland
2	Scotland	Alec Miller, SBSA	Section 1 2007 Technical handbook - Structure	1/6/2007	Paper	The detail of the changes to the legislation on building structures
3	Scotland	Steven Scott, SBSA	Section 4 2007 Technical handbook - Safety	1/6/2007	Paper	The detail of the changes to the legislation on building safety
4	Scotland	Dr Paul Stollard	Drivers for change to Section 6 Energy including the Energy Performance of EPBD	1/6/2007	Paper	Background to the implementation of the EPBD and the reasoning behind the decisions on the implementation

5	Scotland	Gavin Peart, Assistant Chief Executive, SBSA	Section 6 2007 Technical handbook – Energy	1/6/2007	Paper	Detail of complying with the EPBD and improved standards for energy efficiency for new build
6	Scotland	John Forbes, WRAP	Materials and Waste Management	14/03/2007	Electronic	Methods and resources available to assist in maximising the recycled content of construction materials. Public contracts over £1m now require a minimum of 10% recycled content
7	Scotland	Lori McElroy, SUST	What is Sustainable Construction and Why Do it?	11/04/2007	Electronic	The drivers for building more sustainable buildings including the EPBD.
8	Scotland	Alan Paton, Faber Maunsell	South Ayrshire's £76m PPP new schools project	09/05/2007	Electronic	The Building Research Establishment Environmental Assessment Method for buildings including energy efficiency and renewable energy supply.
9	Scotland	Jonathon Henderson, Carillion	South Ayrshire's £76m PPP new schools project	09/05/2007	Electronic	The design and build aspects of Sustainability on the project.
10	Scotland	Steve Luker, Consultant	Wood Energy - Its application in new developments	13/06/2007	Electronic	The market potential for utilising biomass in Scotland. Policy drivers and support for woodfuel heating and CHP projects.

## 5 Training Material in Spanish DASU

Number	Country	Author	Title	English Translation of the Title	Publication Year	Form (paper, electronic)	Brief Abstract of the main content
1	SPAIN	Francisco José Sánchez de la Flor	Contexto normativo Español y Europeo. Generalidades CTE-HE	European and Spanish Normative Context	2007	Paper and electronic	Technical aspects of the European Directive 2002/91/CE and its transposition to the Spanish regulations
2	SPAIN	Francisco José Sánchez de la Flor	Transmisión de calor en edificios	Heat transfer in buildings	2007	Paper and electronic	Fundamentals of heat transfer in buildings. Study of the external and internal parameters affecting the heating and cooling demands.
3	SPAIN	Francisco José Sánchez de la Flor	Fundamentos Técnicos de la Limitación de la Demanda Energética	Fundamentals of the Limitation of the Energy Demands in Buildings	2007	Paper and electronic	Technical aspects of the limitation of the energy demands in buildings. Explanation on the concepts and criteria used in the Building Technique Code.
4	SPAIN	Francisco José Sánchez de la Flor	DESARROLLO DE HE-1 : Opción simplificada	Building Technique Code: Simplified option	2007	Paper and electronic	Brief description of the contents of the Building Technique Code, focused mainly in the simplified option.

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5	SPAIN	Francisco José Sánchez de la Flor	Opción General: Fundamentos de la herramienta de cálculo de Referencia (LIDER)	Building Technique Code: General option (LIDER software tool)	2007	Paper and electronic	Fundamentals of the used of the software tool developed for the general option of the Building Technique Code. Overview of the software tool and its user's manual.
3	SPAIN	Francisco José Sánchez de la Flor	PROCEDIMIENTO GENERAL DE CUMPLIMENTACIÓN: Opción simplificada	Simplified option: methodology of use.	2007	Paper and electronic	Step by step on the methodology of use of the simplified option of the Building Technique Code
7	SPAIN	Francisco José Sánchez de la Flor	DESARROLLO DE HE-1 : Componentes de la envolvente	Building Technique Code: Components of the Building Envelope	2007	Paper and electronic	Brief description of the components of the building envelope. Study of their thermal performance and their influence on the building energy demands.
3	SPAIN	Francisco José Sánchez de la Flor	DESARROLLO DE HE-1 : Manejo y estructura de tablas y anexos de la Opción Simplificada	Building Technique Code: Use of tables of the Simplified Option	2007	Paper and electronic	Detailed study on the use of the simplified option. Step by step and table by table, etc.
3	SPAIN	Francisco José Sánchez de la Flor	APÉNDICE D : Zonas Climáticas	Annex D: Climatic zones	2007	Paper and electronic	Selection or calculation of the climatic zone of a certain locality. Examples.

<b>Number</b>	<b>Country</b>	<b>Author</b>	<b>Title</b>	<b>English Translation of the Title</b>	<b>Publication Year</b>	<b>Form (paper, electronic)</b>	<b>Brief Abstract of the main content</b>
10	SPAIN	Francisco José Sánchez de la Flor	CONDENSACIONES INTERSTICIALES	Interstitial Condensations	2007	Paper and electronic	Study on the interstitial condensations, and the calculation methodology proposed by the Building Technique Code
11	SPAIN	Francisco José Sánchez de la Flor	Ejemplo - Edificio multifuncional	Case study: Multifunctional building	2007	Paper and electronic	Step by step on the use of the methodology proposed by the simplified option of the Building Technique Code. Case study: Multifunctional building
12	SPAIN	José Manuel Salmerón Lissén	APÉNDICE E: Cálculo de los Parámetros Característicos de la Demanda	Annex E: Calculation of the Building Characteristics affecting the energy demands.	2007	Paper and electronic	Detailed explanation of the methodology used for the calculation of the building characteristics of walls, roofs, floors, windows. Etc.
13	SPAIN	José Manuel Salmerón Lissén	APÉNDICE F Resistencia Térmica Total de un Elemento de Edificación Constituido por Capas Homogéneas y Heterogéneas	Annex F: Thermal resistance of a building component	2007	Paper and electronic	Methodology on the calculation of the thermal resistance of a building component. Examples of the different situations depending on the layers distribution.