

Sistema de qualificação do Auditor de Energia ENACT

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PERFIL DO AUDITOR DE ENERGIA ENACT

O Auditor de Energia ENACT é o profissional responsável pela realização de auditorias energéticas no setor residencial. O perfil profissional foi desenvolvido com base na análise das atividades e dos requisitos para o exercício dessas funções, bem como tendo em conta o sistema de qualificação (conhecimentos e competências) e os seguintes pontos:

- O quadro de qualificação profissional a nível nacional, e quando aplicável, a nível regional, e os relatórios dos países parceiros do ENACT (Itália, Polónia, Portugal e Espanha).
- As normas nacionais e europeias sobre gestão de energia e perfis profissionais para as auditorias.

O programa de formação e os requisitos de acesso foram preparados de acordo com o ECVET - Sistema Europeu de Créditos do Ensino e Formação Profissionais.

Com uma abordagem modular, as atividades e as competências do *Auditor de Energia ENACT* correspondem a peças que podem ser progressivamente integradas no processo de desenvolvimento profissional de todo o setor civil (incluindo os serviços, a administração pública e o residencial), assim como a indústria e os transportes.

ATIVIDADES DO AUDITOR DE ENERGIA ENACT

O *Auditor de Energia ENACT* é o responsável pela gestão do processo da auditoria energética n setor residencial, desde a recolha de dados e informação até a análise destes, passando pela comunicação com os clientes. O *Auditor de Energia ENACT*, para além da identificação das medidas para a melhoria da eficiência energética, disponibiliza conselhos e sugestões para a respetiva implementação em termos de planeamento e de recuperação do investimento, assim como apoio na monitorização das economias de energia e de redução de custos alcançadas.

O perfil profissional integra quatro áreas principais - Gestão, Auditoria, Planeamento e Implementação/Monitorização – as quais se encontram articuladas em termos de atividades conforme indicado na tabela abaixo.

AREA	ATIVIDADES
1. Gestão	<ul style="list-style-type: none"> • Planeamento da auditoria energética em termos de âmbito, recursos e prazos e gestão do tempo • Coordenação • Gestão de conflitos • Comunicação e relatório
2. Auditoria	<ul style="list-style-type: none"> • Recolha de dados, medição e observação • Diagnóstico do edifício e sistemas existentes
3. Planeamento	<ul style="list-style-type: none"> • Definição das medidas de melhoria da eficiência energética • Avaliação económica das medidas de melhoria da eficiência energética • Definição e seleção das medidas de melhoria mais adequadas para a redução do consumo de energia • Elaboração do plano de ação para a realização dos investimentos apropriados para a melhoria da eficiência energética
4. Implementação / Monitorização	<ul style="list-style-type: none"> • Implementação das medidas de melhoria selecionadas • Monitorização do consumo e das performances energéticas • Eventual implementação de ações corretivas

AUDITOR DE ENERGIA ENACT – CONHECIMENTOS, COMPETÊNCIAS E CAPACIDADES

Para cada atividade, o perfil profissional do *Auditor de Energia ENACT* define os conhecimentos, competências e capacidades (CCC). O mapa resumo do perfil ENACT global está representado na tabela seguinte, sendo que o esquema CCC completo do *Auditor de Energia ENACT*, articulado por módulo de formação, se encontra no Anexo 1.

Conhecimentos	Capacidades	Competências
Unidades de energia e fatores de conversão	Identificar quantidades físicas e efetuar medições, e fatores de conversão	Aplicação de unidades de energia e gestão de fatores de conversão
Fontes de energia e operadores	Identificar fontes de energia e operadores envolvidos na auditoria energética	Gestão das fontes de energia e dos operadores
Legislação, políticas, regulamentos, contratos e normas nos domínios da eficiência energética e das energias renováveis (aos níveis europeu e nacional) aplicáveis à auditoria energética	Selecionar a melhor solução em termos de contrato e/ou procedimento a aplicar na realização da auditoria energética	Aplicação e gestão da legislação, regulamentos, normas, contratos, políticas e incentivos relevantes

<p>Métodos de recolha de dados, indicadores de desempenho, fatores de ajustamento e balanço energético</p>	<p>Recolher informação útil para a realização da auditoria energética. Propor e calcular indicadores de desempenho energético adequados</p>	<p>Avaliação do consumo e utilização de energia, de acordo com o âmbito da auditoria. Capacidade de selecionar os indicadores de desempenho energético em conformidade com o âmbito da auditoria energética e comparar com referências (benchmarks, normas).</p> <p>Verificação e validação das medições de todos os dados e resultados de testes que possam afetar a fiabilidade dos resultados da auditoria energética</p>
<p>Princípios físicos relacionados com a energia (térmica, elétrica, termodinâmica, transferência de calor, mecânica dos fluidos, luz, etc.)</p>	<p>Identificar os princípios físicos relacionados com energia e com os fluxos de energia</p>	<p>Compreensão dos processos físicos e termodinâmicos e fluxos associados aplicada à utilização de energia no edifício</p>
<p>Ferramentas e medições técnicas, monitorização e equipamentos de medição para realizar uma auditoria energética</p>	<p>Identificar o perfil de consumo de energia e as áreas de consumo ineficiente, e gestão do equipamento para a realização de uma auditoria energética.</p>	<p>Elaboração de um plano de medição e verificação, comparação e validação de poupança de energia</p>

Informação fundamental sobre o mercado de energia (produção, transporte e distribuição) e os atores de mercado	Avaliar o mercado de energia e os atores envolvidos	Compreensão do mercado de energia
Tarifas e estrutura tarifária	Analisar as tarifas de energia (taxas de utilização, custos de picos de consumo, perfil de consumo)	Compreensão e gestão do sistema tarifário
Fundamentos do mercado da construção e dos modelos de construção	Compreensão do mercado da construção	Capacidade para identificar as diferentes tipologias de edifícios
Edifícios (envolvente, sistemas técnicos e serviços associados)	Avaliar o edifício em termos de performance energética	Avaliação energética do edifício
Tecnologias convencionais e inovadoras para a melhoria da eficiência energética e aproveitamento das energias renováveis	Identificar medidas/propostas de melhora	Personalizar e adaptar as propostas de medidas de melhoria, incluindo viabilidade técnica e económica
Técnicas para alcançar economias de energia técnica e economicamente viáveis	Cálculo das economias de energia técnica e economicamente viáveis e/ou das melhorias da eficiência energética	Avaliação das economias de energia e propostas de ações corretivas
Financiamentos e subsídios existentes	Identificar as oportunidades de financiamento e os subsídios disponíveis	Gestão dos procedimentos para a obtenção de financiamento ou de subsídios

Indicadores da avaliação económica	Realizar uma adequada avaliação económica das propostas	Análise comparativa da avaliação económica das propostas
Princípios, metodologia e resultados da auditoria energética conforme definido na norma EN 16247	Compreender o âmbito e os limites da auditoria energética e atividades associadas	Aplicação de princípios, metodologia e tarefas de acordo com o âmbito e o nível de detalhe da auditoria energética
Fundamentos de relatório, comunicação e marketing no domínio da auditoria energética	Capacidade de comunicação	Apresentação de resultados de forma compreensiva, funcional e devidamente organizados. Competente em comunicação e marketing
Fundamentos de gestão de projeto	Identificar globalmente o processo de auditoria energética	Gestão integral do processo de auditoria energética

** os serviços prestados pelos sistemas técnicos dos edifícios e dos equipamentos de climatização (conforto térmico, qualidade do ar, qualidade visual e acústica) e outros serviços relacionados com a utilização do edifício*

*** equipamento técnico para aquecimento, arrefecimento, ventilação, águas quentes sanitárias, iluminação e produção local de energia*

PROGRAMA DE FORMAÇÃO DO AUDITOR DE ENERGIA ENACT

De acordo com o perfil profissional em termos de atividades e do esquema CCC, está previsto um curso de formação. A tabela abaixo contém uma apresentação resumida do programa de formação ENACT, nomeadamente:

- Estrutura, articulação e carga horária dos módulos formativos. No [Anexo 2](#), encontra-se o programa ENACT [detalhado](#), bem como as unidades de aprendizagem que integram cada módulo.
- **Metodologia** de formação e critérios de **avaliação**;
- **Créditos ECVET**. Foi atribuído um total de **6 créditos ECVET** ao curso ENACT (80 horas). Estes créditos foram calculados a cada um dos módulos formativos de acordo com um esquema de ponderação múltipla, e que teve em conta **3 aspetos**: a carga horária, a metodologia de formação e avaliação e o nível de dificuldade.

Módulo	Horas	Metodologia	Avaliação Metodologia	ECVET
1. Introdução a auditoria energética no setor residencial	12	Recursos online Aulas (online ou presencial) Tutor online	Escolha múltipla (10 questões)	0,5
2. Legislação, regulamentos e contratos no setor residencial	5	Recursos online Aulas (online ou presencial) Tutor online	Escolha múltipla (10 questões)	0,5
3. Envolvente do edifício	9	Recursos online Aulas (online ou presencial) Tutor online Exercícios práticos/lab	Escolha múltipla (10 questões)	0,5
4. Aquecimento, ventilação e ar condicionado e sistemas de produção de águas quentes no setor residencial	8	Recursos online Aulas (online ou presencial) Tutor online Exercícios práticos/lab	Escolha múltipla (10 questões)	0,5
5. Sistemas de iluminação, eletrodomésticos e outros equipamentos consumidores de energia do setor residencial	7	Recursos online Aulas (online ou presencial) Tutor online Exercícios práticos/lab	Escolha múltipla (10 questões)	0,5
6. Produção de energia a partir de fontes de energia renovável no setor residencial	10	Recursos online Aulas (online ou presencial) Tutor online	Escolha múltipla (10 questões)	0,5
7. Avaliação económica	6	Recursos online Aulas (online ou presencial)	Escolha múltipla (10 questões)	0,5

		Tutor online Exercícios práticos/lab		
8. Metodologia para a auditoria energética	13	Recursos online Simulações orientadas, exercícios, projeto (casos práticos) Tutor online	Escolha múltipla (10 questões) e/ou Casos práticos	1,5
9. Gestão de projeto	4	Recursos online Aulas (online ou presencial) Tutor online	Escolha múltipla (10 questões)	0,5
10. Comunicação e marketing	6	Recursos online Aulas (online ou presencial) Tutor online	Escolha múltipla (10 questões)	0,5
	80			6

REQUISITOS PARA A QUALIFICAÇÃO COMO AUDITOR DE ENERGIA ENACT

O sistema de qualificação está articulado em três partes principais:

- Requisitos** mínimos de qualificação, denominado de **nível de admissão**, e que integra as habilitações académicas e a experiência profissional para cada um dos países participantes (tabela abaixo).
- Frequência** do **Curso ENACT**, com aproveitamento e/ou **reconhecimento/validação** das **competências** profissionais associada a cada módulo formativo
- Exame de qualificação** realizado por entidades formadoras certificadas. Os candidatos são admitidos ao exame final se cumprirem com os requisitos indicados nas alíneas a) e b), de acordo com o seu curriculum vitae (CV), o qual deverá ser verificado por entidades formadoras certificadas.



A) NÍVEL DE ADMISSÃO PARA A QUALIFICAÇÃO COMO AUDITOR DE ENERGIA ENACT

A tabela seguinte contém o nível de admissão para cada um dos países participantes.

	Habilitações académicas	Experiência profissional (anos)
Itália	<i>Technical degree</i>	0
	<i>Technical diploma</i>	2
	<i>Other degree</i>	3
	<i>Other diploma</i>	3
Polónia	Licenciatura em engenharia ou arquitetura reconhecida pela respetiva associação profissional	0
	Outras licenciaturas	1
Portugal	Licenciatura em engenharia ou arquitetura reconhecida pela respetiva associação profissional	0
	Outras licenciaturas	1
Espanha	<i>Technical degree</i>	0
	<i>Technical diploma</i>	0
	Formação e educação profissional de 2 anos	1
	Nenhuma	3

B) FREQUÊNCIA DO CURSO ENACT DE FORMAÇÃO DO AUDITOR DE ENERGIA E/OU VALIDAÇÃO DE COMPETÊNCIAS

Como anteriormente indicado, o sistema de qualificação requer:

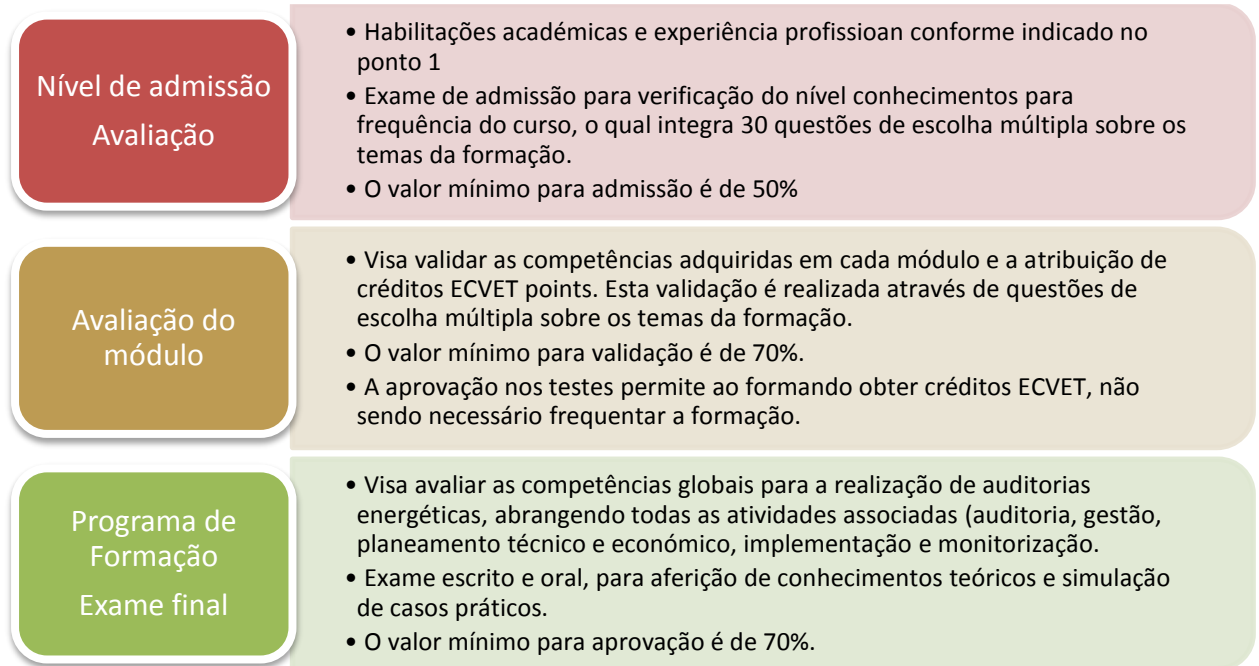
- **Frequência do Curso ENACT**, com aproveitamento (incluindo o exame final), ou nos 2 últimos anos, de cursos similares cujos conteúdos programáticos assegurem a formação nas áreas de competência ENACT e realizadas por entidades formadoras certificadas.

e/ou

- **Competências profissionais** validadas por entidades formadoras ou associações profissionais certificadas.

Para a **frequência do Curso de Formação ENACT**, recomenda-se que cumpram com os requisitos (habilitações académicas e experiência profissional) indicados na tabela acima, embora seja também obter aprovação no exame de admissão (mínimo de 50% de respostas corretas às 30 questões de escolha múltipla). Para além disso, para **realizar integralmente e com sucesso o curso de formação**, é necessário obter aprovação em cada um dos testes associado aos módulos formativos e no exame final do curso.

A avaliação ENACT integra os seguintes 3 níveis: avaliação para admissão, avaliação do módulo e avaliação final.



A avaliação é parte integrante do **Memorando de Entendimento ECVET** entre as entidades formadoras que reconhecem as competências adquiridas no quadro do ENACT.

C) EXAME DE QUALIFICAÇÃO DO AUDITOR DE ENERGIA ENACT

O exame de qualificação do Auditor de Energia ENACT é realizado por entidades formadoras certificadas.

Os candidatos são admitidos ao exame final se cumprirem com os requisitos a) e b) acima indicados, de acordo com o seu currículo vitae (CV) e posterior verificação por entidades formadoras certificadas.

O exame de qualificação ENACT está estruturado conforme a seguir indicado, e tem ainda em conta a Norma CEI EN 16247/5:

- 1) Verificação do **currículo vitae**;
- 2) Teste de **escolha múltipla**, constituído por 20 questões sobre auditoria energética, gestão, planeamento económico e técnico, implementação e monitorização no setor residencial;
- 3) Teste **escrito** sobre gestão no setor residencial e estudo de casos práticos;
- 4) Teste **oral** sobre casos práticos e todas as áreas de competência relevantes.

Para aprovação no exame final de qualificação é obrigatório obter um resultado de 70% em cada um dos testes.

O exame final de qualificação é realizado por um comité de avaliação, composto, no mínimo, por dois especialistas no domínio da auditoria energética no setor residencial, incluindo gestão, planeamento económico e técnico, implementação e monitorização.

As competências dos membros do um comité de avaliação devem ser as seguintes:

- Experiência em gestão de energia, planeamento económico e técnico, implementação e monitorização;
- Experiência em auditorias de energia no setor residencial, comprovada através de documentação que atestem a certificação como peritos em gestão de energia e auditoria energética, de acordo com as normas nacionais e europeias;
- Credenciais profissionais para o setor residencial;
- Participação em conferências ou seminários;
- Conhecimento da Norma UNI CEI EN 16247 e de outras normas técnicas e legislação aplicável à realização de auditorias energéticas.

MANUTENÇÃO DA QUALIFICAÇÃO COMO AUDITOR DE ENERGIA ENACT

A qualificação como *Auditor de Energia ENACT* é válida por 5 anos. Para a manutenção da qualificação, o *Auditor de Energia ENACT* deverá atualizar e melhorar os conhecimentos técnicos e competências para a realização de auditorias energéticas. A verificação do cumprimento dos requisitos para a manutenção da qualificação é efetuada através da análise do curriculum vitae, da participação em conferências/seminários e realização de auditorias energéticas, incluindo o planeamento técnico e económico das intervenções e a monitorização.

ANNEX 1 – THE KSC SCHEMA PER LEARNING OUTCOME AND LEARNING UNIT

Module	LEARNING UNIT	h	Descriptionn	Knowledge	Skills	Competencies
1.Introduction to energy auditing in residential sector	1	1	The Unit aims to provide basic information concerning the energy sources and the energy unit conversion factors. Energy conversion is a main aspect of energy management. The energy auditor constantly uses these concepts. Therefore it is essential that the energy auditor is familiar with them.	Knowledge of energy sources (primary and secondary; conventional and renewables); energy unit definition and conversion factors; GHG emission factors; GHG effect; forms of energy; European and National scenario.	Ability to manage perfectly the physical quantities and conversion factors in order to verify and validate the measurements, make comparisons and have a good background for drawing up the energy audit.	Competent in understanding and applying energy units, conversion factors, identifying and managing energy sources.
	2	1	The Unit aims to provide fundamental concepts of thermodynamic and physics of the building that are crucial for the following more specialized modules. The energy auditor constantly uses these concepts in order to understand energy processes.	Knowledge of physical and thermodynamic principles related to energy (e.g. thermal, electrical, heat transfer, fluid mechanics, theoretical basis of lighting, etc.).	Ability to understand the physical and thermodynamic principles, underlying energy conversion processes also dynamic and static energy management aspects as applied in buildings.	Competent in understanding the physical and thermodynamic processes linked to the building energy use and related fluxes.
	3	2	The Unit aims to provide the general information to conduct an energy audit and guidance on how to carry out energy audits in accordance to the European standard 16247 or similar standards.	Knowledge of energy auditing principles, methodology and deliverables as described by EN 16247 (parts 1, 2) standard or similar standards.	Ability to apply energy audit principles and methodology	Competent in understanding and applying principles and methodologies of energy audit described in EN 16247 standard or similar.
	4	1	The Unit aims to provide the requirements, tasks and activities of auditor in residential sector. It specifies the necessary competencies in order to effectively implement the requirements of EN 16247/1, which may be supplemented by the specific part EN 16247/2.	Knowledge of the core activities he may performs.	Ability to understand the scope and the boundaries of the energy audit and relating activities	Competent in applying the EA tasks with reference to the scope and thoroughness of the energy audit
	5	2	The Unit aims to provide information on the energy market and actors involved. In particular, the energy auditor constantly	Knowledge of the energy market (energy production, distribution, transmission,	Ability to understand the energy market context,	Competent in finding market opportunities for energy

			uses concepts and solutions involving energy market from the production to the distribution, transmission, and supply of energy sectors. Therefore it is essential that the energy audits were updated based on the main feature of the European and National Market (i.e. market size, offer and demand; market players; market infrastructure); the wholesale market; the retail market; margins and market prices in order to make suitable assessment energy efficiency proposals.	supply) and market players (i.e. Energy Manager, Energy management expert, ESCO, energy suppliers).	proposing options and make comparisons.	efficiency investments and cost savings.
6	Charges and tariff structuring	1	The Unit aims to provide information about reading and interpreting the energy invoices, considering the electricity, gas and other energy sources tariff structures. The energy auditor tasks include a review of contracts for the supply of energy. It is therefore essential that the energy auditor acquires knowledge that will allow to evaluate the tariffs and their structure and eventually switch the energy supplier.	Knowledge of metering equipment, tariffs and tariff structures.	Ability to read the utility tariff, bearing in mind the time of use rates, the peak charges, the usage profile, the demand charges, green power offerings and contractual obligations in order to propose suitable solutions to reduce the energy expenses.	Competent in understanding of the various energy tariffs and making a metering plan for the data collection and analysis and to reduce energy supply costs
7	Data analysis	2	The Unit aims to provide information on methodology of the data collection, analysis of energy consumptions and costs. The energy auditor shall collect and analyze all data concerning energy, including energy carriers, adjustment factors affecting energy consumption, information concerning the building.	Knowledge of data collection methods useful for the energy audit and method of analysis.	Ability to collect information through effective interviewing, listening, observing, measuring, reviewing documents, records and data. Ability to assess and act on the quality of the data provided by the customer.	Competent in verifying and validating the collected data and competent in assessing factors that may affect the reliability of the energy audit findings.
8	Developing a building energy balance	1	The Unit aims to provide the knowledge about methodology to develop an energy balance. One of the first steps of the energy auditor is to create an energy balance that represents the energy flows. This allows to locate critical energy consuming sectors of the building and at the same time identifies the energy losses areas. The capacity to create an energy	Knowledge of baseline consumptions; direct consumer impact; end users consumptions (heating, hot domestic water, lighting ...) and the adjustment factors in order to establish an energy balance.	Ability to quantify and analyze energy consumption, energy consumption breakdown. The energy auditor shall be able how to use metering models or calculations to determine the actual energy use profile and primary energy demand.	Competent in explaining the energy balance supported by reliable calculations

			balance is an essential skill of energy auditor.				
	9	Energy performance indicators	1	The Unit aims to provide information on calculation for the Energy Performance Indicators in accordance with the National Standards. Identifying the key energy performance indicators is vital for the planning process, as it provides energy auditors a clear overview of how their client uses energy and can highlight ways to manage resources better.	Knowledge of reference indicators (benchmarks and standards) and current energy performance indicators.	Ability to identify and reviewing one or more energy performance indicators and identification of factors that may affect them. The energy auditor should be able to propose and calculate suitable energy performance indicators to quantify the energy performance and compare it to existing references (benchmarks, standards). Ability to use correctly ready-available energy performance indicators.	Competent in understanding if the energy performance indicators are in line with the scope of the audit. Competent in measuring the effectiveness of the energy management efforts and to identify inefficient areas with low energy performances.
			12				
2. Legislation, regulations and contracts in residential sector	1	Regulations and procedures for procurement, tenders, working contracts, energy supply contracts - financial instruments	2	The Unit aims to provide information on relevant regulations and procedures for procurement and tenders, working contracts and energy supply contracts, financial instruments at European and National level. The energy auditor constantly analyze and use updated regulation and procedures recognized in this sector. It is essential and in some case compulsory that energy auditor uses the schemes and produce documents according to law both for quality of documents and for legal requirements.	Knowledge of existing regulations and procedures for procurement and tenders, working contracts and energy supply contracts, financial instruments. For each regulation and procedure knows the field of application, information and competitive conditions, transparency of award procedures, definition of technical specifications.	Skills to perform and to choose the best solution of contract and or procedure to improve the energy performance of the buildings. The choices have to be done considering the actions plan, the amount of the cost, the payback period and other economical and financial aspects, the technological reliability, the know-how and the availability of key actors.	Competent in implementing procurement and tenders, working contracts, energy supply contracts and financial instruments according to different regulations, laws and procedures. It is important that auditor implements procurement and tenders also considering best practice (available on websites or other sources), adaptation for the specific action plan.
	2	European and National legislation concerning energy efficiency, renewables	2	The Unit aims to provide the basis on the relevant European and National legislation concerning energy efficiency and renewables. The Energy auditor has to check the compliance of the energy audit to the regulations.	Knowledge of existing relevant laws, policies, rules, regulations and directives at European and national level concerning energy efficiency and renewables.	Ability to understand the relationships among the different laws, policies, rules, regulations and shall be able to apply them related to energy audit.	Competent in applying of regulations, directives, etc, related to energy efficiency and renewables.

				It is therefore essential that energy auditor uses the schemes and produce documents according to law both for quality of documents and for legal requirements.			
	3	European and National standards	1	The Unit aims to provide information on the European and National standards that can be useful to carry out an energy audit. The Energy auditor needs to have the tools to carry out the audit, ensuring the compliance with the relevant standards. It is therefore essential that energy auditor uses the schemes and produce documents according to standards both for quality of documents and for legal requirements.	Knowledge of existent European and national standards concerning energy auditing for building sector.	Skills to check if the auditing and the proposed improvement of the building energy performance are according to standards. The selection have to be done considering all the compulsory aspects and also other features aspects such as technical implementation, methodology and templates included in standards.	Competent in finding the proper standards applicable to energy audit and in verifying if documentation and indentified action plan are in accordance with them.
			5				
3. Building envelope	1	General information on the building market and the main elements of the construction process	2	The Unit aims to provide knowledge that energy auditor must obtain regarding the main types of buildings and their value in the market. The objective will be to supply relevant information related with the built environment and real estate market, including the status of the building (new, rehabilitated, under renovation, etc.).	Knowledge and relevant information about the building market and the methodologies associated to the buildings construction (new and existing).	Skills to evaluate the building market and identification of methodology of construction for each type of building, in accordance with the norms and regulations.	Competent in working with the different typology of buildings, identification of construction techniques and their accomplishment with the norms and regulations.
	2	Building evaluation in terms of: windows, roofs, doors, walls, air exchanges	3	The Unit aims to provide the essentials of passive components of the buildings. The objective will be to supply relevant information related to identifying the components of the buildings, namely walls, roof, windows, floors, etc.	Knowledge of the passive components of the buildings, the materials used and the energy characterization of opaque and transparent building envelope elements	Ability to evaluate a building in terms of passive components and their impact in the building energy efficiency.	Competent in assessing the thermal behaviour of the buildings and the expected energy efficiency and thermal comfort.
	3	Techniques, tools and calculation to improve energy efficiency	4	The Unit aims to provide knowledge about thermal behaviour of the buildings, taking in account their insulation, shading devices and other relevant passive component and provide solutions for the improvement of the energy efficiency.	Knowledge of the thermal components of the building, namely the calculation of the thermal transmission ratios, plain and linear thermal bridges, and the identification of thermal comfort areas and spaces without air conditioning. Knowledge of energy efficient improvement opportunities and	Ability to perform and develop projects of thermal behaviour of buildings. Ability to calculate energy savings and energy efficiency improvements. Ability to recommend energy efficiency improvement opportunities and possible different	Competent in the calculation of thermal behaviour of buildings, identification of passive solutions and energy efficiency, aiming to improve the thermal comfort of the building.

					possible different solution for implementation.	solutions for implementation.	
			9				
4. Heating, ventilation, air conditioning and hot water systems in residential sector	1	Building systems evaluation	2	The Unit aims to provide the essentials which energy auditor must obtain in the active components of the buildings. The auditor should be able to identify the equipment or systems and associated performance in terms of energy efficiency.	Knowledge of the main equipment of heating, ventilation and air conditioning (HVAC) systems and equipment for water heating, as well as associated technical features, assessment and verification of the accomplishment of regulations and energy efficient construction in the design of HVAC systems in the buildings of the residential sector.	Ability to identify the different equipment and systems in terms of energy efficiency and other technical data.	Competent in the verification and accomplishment of the different active equipment and systems.
	2	Techniques and tools to improve energy efficiency in the residential sector	3	The Unit aims to provide the Knowledge that energy auditor must obtain regarding the features of the active components of the buildings and their application in order to reduce the energy needs and to improve the energy efficiency of the building.	Knowledge of the active components of the building (systems and equipment), their performance and utilization aiming to reduce energy consumption and/or to increase the energy efficiency of the building.	Ability to perform, develop and assess the HVAC projects and to identify measures to improve the energy efficiency of HVAC systems.	Competent regarding the energy optimization of HVAC systems for the buildings, including gas boilers, heat pumps and equipment for water heating
	3	Calculation of energy savings and energy efficiency modernizations	3	The Unit aims to provide the knowledge that energy auditor must obtain regarding application and calculation of energy savings of active components of the buildings. The auditor should be able to interpret and to apply the calculation methodologies for HVAC systems in the building in order to reduce the energy needs and to improve the energy efficiency of the building.	Knowledge of methodology of calculation aiming to improve energy efficiency and to evaluate the measures to obtain energy savings in the projects of active systems and equipment of buildings of the residential sector.	Skills to identify measures and associated calculation to improve the energy efficiency of the active components of the buildings of the residential sector.	Competent regarding verification of calculation for the energy optimization of the active components of the buildings, including gas boilers, heat pumps and equipment for water heating.
			8				
5. Lighting systems, domestic appliances and other energy consuming devices in residential sector	4	Basics of lighting and current lighting technologies	1	The Unit aims to provide the general and basic information that energy auditor must obtain in the area of lighting	Knowledge of basic theory (light, output, intensity, density, lighting intensity, equipment to measure light parameters, colour temperature, colour rendering index), Luminous efficiency of different light sources, kind of lighting (indoor	Ability to understand the information and technical data in lighting area	Competent in understanding among the different lighting technologies which is the most appropriate for each purpose

				and outdoor lighting - with applicable standards and the EU Directives).			
		Efficient artificial lighting systems, optimization and controlling lighting systems	2	The Unit aims to provide the general solutions for optimization and control of lighting equipment and systems.	Knowledge of different solutions for reducing the intensity of light flux, optimization of natural and artificial lighting systems. Advantages and disadvantages of control systems and their basic properties. Preparation of preliminary lighting modernization project	Skills in understanding when is possible to use available technologies. Ability to collect data, calculate lighting performance and understand advantages of controlling systems, propose suitable improvements	Competent in analyzing the electricity consumption (real and theoretical) from lighting in the residential building, provide suitable energy efficiency improvements and calculate energy saving.
		Economic evaluation of lighting improvements	2	The Unit aims to provide the general and basic information that energy auditor must obtain for economic evaluation of lighting improvements.	Knowledge in collecting data collection and types of indicators (usage time of light source, installed power and new installation power) Simplified methods of energy and cost saving calculation Best practice - example of calculation	Skills in collecting comprehensive data and preparing preliminary economic lighting modernization proposition. Skills in using the simplified methods of calculations	Competent in analyzing the electricity consumption and cost from lighting in the residential building-and provide lighting improvements information of investment and energy saving cost.
		Domestic appliances and other energy consuming devices	2	The Unit aims to provide the general knowledge that energy auditor must obtain in the area of domestic appliances and other energy consuming devices	Knowledge of electricity consumption in residential sector - potential cost savings and energy efficiency of domestic appliances and devices, energy efficiency labelling other labelling (energy star)	Skills in understanding the information and technical data in the area of domestic appliance and in collecting data and use them for calculations	Competencies in analyzing the electricity consumption from domestic appliances and devices in the residential building and propose suitable energy efficiency improvements.
			7				
6. Energy production from renewable energy sources in residential sector	1	PV systems	2	The Unit aims to provide knowledge on techniques and tools of PV systems. Energy auditor should be able to provide suitable propositions of energy improvements in the residential sector.	Knowledge of types of modules and inverters of PV systems as well as their detailed technical data (power, efficiency) availability of solar radiation and methods of estimation of energy income good and bad practices of installation PV systems in buildings	Ability to estimate the size of PV system considering energy income from installation, energy need of residential building and installation capacity (i.e. roof space...)	Competent in selecting the appropriate PV system for the building in the residential sector according to its demands and conditions.

	2	Solar thermal systems	2	<p>The Unit aims to provide knowledge on techniques and tools of solar systems. Energy auditor should be able to provide suitable propositions of energy improvements in the residential sector.</p>	<p>Knowledge of types of solar thermal systems as well as their detailed characteristic and measures (power, efficiency), availability of solar radiation and methods of estimation of energy income good and bad practices of installation solar thermal systems in buildings</p>	<p>Ability to propose the best type of solar system (natural or forced circulation - flat panels or vacuum tube ...).Ability to estimate the size of solar thermal system considering the energy income from installation, energy need of residential building and installation capacity (i.e. roof space...)</p>	<p>Competent in selecting the appropriate solar system for the building in the residential sector according to its demands and conditions.</p>
	3	Heat pumps	2	<p>The Unit aims to provide knowledge on techniques and tools of heat pumps installations. Energy auditor should be able to provide suitable variants of energy improvements in the residential sector</p>	<p>Knowledge of types of heat pumps and their principle of operation as well as detailed characteristic and measures (energy efficiency indicators – SPC/COP) Knowledge in characteristic of lower energy source and methods of power installation estimation and calculation of energy balance of heat pump. Good and bad practices of usage heat pumps in buildings.</p>	<p>Ability to propose the appropriate type of heat pump, specify power installation and calculation of energy balance of heat pump in order to select and size the installation for specific residential building</p>	<p>Competent in selecting the appropriate heat pump to the building in the residential sector according to its demands and conditions.</p>
	4	Biomass (solid biofuels)	2	<p>The Unit aims to provide knowledge on techniques and tools of biomass boilers installations to be able to provide suitable propositions of energy improvements in the residential sector</p>	<p>Knowledge of characterization of solid biofuels and emission of pollutants technology, types of boilers and systems using solid biofuel as well as their parameters and specification value chain for biomass and conditions of fuel storage good practices of usage solid biofuels in buildings.</p>	<p>Ability to specify power installation and conditions for biomass logistic. Ability to select and size the installation for specific residential building.</p>	<p>Competent in selecting the appropriate biomass installation for the building in the residential sector according to its demands and conditions</p>
	5	Procedures for integrating renewable energy systems	2	<p>The Unit aims to provide basilar information on integration of renewable energy systems, including hybrid solutions.</p>	<p>Knowledge of useful hybrid / integrated systems including innovative solutions</p>	<p>Ability to adopt solutions relating integrated systems or hybrid installations taking into consideration the peculiarities of the building.</p>	<p>Competent in applying the procedures for integrating renewable energy systems, taking care of technical and economic feasibility.</p>

			10				
7. Economic assessment	1	Financing and subsidies	2	<p>The Unit aims to provide knowledge related to all the possibilities of public or private support (in terms of incentives and funding). It is therefore necessary for the energy auditor to identify available financial resources, as well as the schemes and mechanisms for getting hold of these resources in order to help to finance the energy efficiency actions.</p>	<p>Knowledge about all the different possibilities of public/private financial incentive measures, but also about the accessing procedures.</p>	<p>Skills to detect and control all the possible public/private incentives, manage them properly and process the ones that could be appropriate depending on the customer or the solution presented.</p>	<p>Competent in understanding and applying incentives.</p>
	2	Economic assessment	4	<p>The Unit aims to provide knowledge in the financial area and economic assessment. The energy auditor constantly uses concepts, tools and solutions involving economic elements and aspects. It is therefore essential that the energy auditor acquires knowledge that will allow him/her to evaluate and defend any situation in which economic aspects are relevant for the development of his/her business or service.</p>	<p>Knowledge of financial terminology as economic rates of return (payback), investment formulas, calculation of depreciation and amortization, financial projections, deviations, risk analysis, estimates of cost saving.</p>	<p>Ability to make suitable economic assessment take into account the lifetime equipment, the related costs and the financial measures</p>	<p>Competent in developing economic and financial analysis and defend any kind of technical project against third parties, guaranteeing the result of energy saving, economic and investment.</p>
		Total		6			
8. Energy audit methodology	1	Measuring and metering equipment	3	<p>The Unit aims to provide information on the main metering and measuring equipment and provide skills to manage the equipment necessary to conduct an energy audit and to understand the measurements results.</p>	<p>Knowledge of metering and measurement equipment (i.e. steam analyzers, thermographic cameras, loggers, manometers, thermometers, laser measurement equipment)</p>	<p>Ability to identify and manage the equipment to carry out an energy audit as well as correct interpretation of obtained results</p>	<p>Competent in understanding and validating the results of measurements with measuring and metering equipment.</p>
	2	Good practices and case studies	6	<p>The Unit aims to provide examples of best practices of residential buildings energy audits, in order to allow energy auditor to be familiar with different solutions. It also aims to show and practice methodology of preparing energy audit overview (case studies).</p>	<p>Knowledge about energy audits applied to residential buildings aiming to improve their energy efficiency, reduce their energy consumption and bring related economic and environmental benefits.</p>	<p>Ability to adapt to encountered situations and to make feasible proposals for improvements. Identification in the best way any possible failures, and the improvement possibilities as well as being able to evaluate and determine the behavior of the solutions to solve the existent failures.</p>	<p>Competent in identifying quickly any possible problem or failure and develop the sustainable strategies that lead to an improvement of the initial situation.</p>

	3	Monitoring, control and adjustment of energy consumption parameters	4	<p>The Unit aims to provide information on building energy management system as support, to control energy-consuming devices, monitor and report their performance. Moreover, this learning unit presents the fundamental principles of International Performance Measurement and Verification Protocol, the process of using measurement for determining actual savings.</p>	<p>Knowledge of common practice in measuring, computing and reporting savings achieved by energy efficiency projects at end user facilities. Knowledge of building automation and mechanisms of regulation and control.</p>	<p>Ability to make a monitoring plan within the scope of the energy audit and to calculate the energy savings.</p>	<p>Competent in assessing energy savings and making corrective actions.</p>
			13				
9. Project management	1	Basics of project management	4	<p>The Unit aims to prepare the energy auditor to manage and coordinate his own work, starting from the preparation of offers, through the development of energy efficiency improvements, ending with monitoring the energy efficiency and evaluation of his work.</p>	<p>Basic knowledge of management and project management</p>	<p>Project management and methodology skills. Organisational skills.</p>	<p>Competent in managing the complete energy audit process from the planning of energy audit, to the implementation and monitoring of energy efficiency results, to the preventing and resolving conflicts.</p>
			4				
10. Communication and marketing	1	Communication techniques concerning energy audits	3	<p>The Unit aims to provide information concerning principles of communication and communication techniques for energy auditors. The energy auditor have to use a good communication techniques to allow building owners and other stakeholders (technicians, ESCo) a comprehensive understanding of energy consumption, energy action plan and other technical and financial aspects.</p>	<p>Knowledge of principles of communication (including principles of interpersonal communications, the effective communication, the business communication, the technical and financial communication, the marketing concepts and theoretical structures, the strategic marketing, the operational marketing) Communication techniques to advise technical and non technical end users in an adequate manner on all aspects of the energy audit.</p>	<p>Good communication skills to be able to articulate and well communicate concepts and ideas with technical and non-technical persons.</p>	<p>Competent in communicating and marketing in relation to all the aspects connected to the energy audit process. Competent in understanding the customer's goals, needs and expectations concerning the energy audit.</p>
	2	Presentation of results and reporting	3	<p>The Unit aims to provide the principles of presentation of results and reporting. The energy auditor constantly uses updated and proper templates for reporting results. The presentation of the results has to be</p>	<p>Knowledge of presenting energy audits results and reporting considering available existing templates (including checklist) according to standards</p>	<p>Ability to use/modify available templates or to create new ones for presentation of results and reporting, adapting to the</p>	<p>Competent in using and filling templates for the best communication and marketing of energy audit results. Competence in</p>

			comprehensive for the end users and other technicians, complete for all technical/financial aspects, useful for understanding the baseline energy consumption and for a fast implementation of the energy action plan.	(EN16247 and similar) and in the methodology/techniques to adapt and/or to modify templates considering available assessment data and results.	scope of the audit. All aspects (e.g. the end users, the energy and environmental assessment of building envelope and technological systems, the financial aspects, the energy saving within the action plan, the compulsory and the optional aspects of the legislation and standards)	producing comprehensive, functional and well organized documents within the purpose.
		6				

ANNEX 2 – THE ENACT TRAINING PROGRAM

Module	Description	Training methodology	Assessment methodology	ECVET
1. Introduction to energy auditing in residential sector (12 hours)	The module aims at providing the general information to conduct an energy audit (data collection, field work, analysis) and guidance on how to carry out energy audits in accordance to the European standard 16247.	On line resources - Lesson (on line or in presence) - Tutor on line	Multiple choice (10 questions)	0,5
2. Legislation, regulations and contracts in residential sector (5 hours)	The module provides an overview of relevant European and national legislation, regulations and contracts applicable to energy audit	On line resources - Lesson (on line or in presence) - Tutor on line	Multiple choice (10 questions)	0,5
3. Building envelope (9 hours)	The module describes the most common information about building envelope (walls, roofs, doors, windows ...) and includes information and calculation of energy efficient interventions applicable to the different building elements.	On line resources - Lesson (on line or in presence) - Exercises/simulations/lab - - Tutor on line	Multiple choice (10 questions)	0,5
4. Heating, ventilation, air conditioning and hot water systems in residential sector (8 hours)	The module contains technical information on heating, ventilation, air conditioning and hot water systems. It also includes a series of interventions and calculation for improving the energy performance of the systems	On line resources - Lesson (on line or in presence) - Exercises/simulations/lab - - Tutor on line	Multiple choice (10 questions)	0,5
5. Lighting systems, domestic appliances and other energy consuming devices in residential sector (7 hours)	The module informs about technical data especially on energy aspects of lighting systems, domestic appliances and other energy consuming devices in residential sector. It includes interventions to improve the efficiency of the lighting system and to monitor the energy consumption of domestic appliances.	On line resources - Lesson (on line or in presence) - Exercises/simulations/lab - - Tutor on line	Multiple choice (10 questions)	0,5
6. Energy production from renewable energy sources in residential sector (10 hours)	The module presents technological solutions to produce clean and renewable energy for the building. It includes the most used energy renewable sources in residential sector: photovoltaic, solar thermal, heat pump and biomass and the way to integrate them.	On line resources - Lesson (on line or in presence) - Tutor on line	Multiple choice (10 questions)	0,5
7. Economic assessment (6 hours)	The module presents economic assessment of energy efficiency improvements considering energy savings, funding opportunities, investment costs.	On line resources - Lesson (on line or in presence) Simulations - Tutor on line	Multiple choice (10 questions)	0,5
8. Energy audit methodology (13 hours)	The aim of the module is to acquire the methodology to manage residential building energy audit, through the presentation of different case studies and practical application.	On line resources - Guided simulations, exercises, project work - Tutor on line	2 case studies (mono & multifamily building)	1,5
9. Project management (4 hours)	The module aims to manage the complete energy audit process from the planning to the development of energy efficiency improvements, ending with monitoring the energy efficiency results and documenting energy audit findings.	On line resources - Lesson (on line or in presence) - Tutor on line	Multiple choice (10 questions)	0,5
10. Communication and marketing (6 hours)	The module aims to provide information concerning principles of communication and communication techniques for energy auditors to be able to communicate with technical and not-technical people at various levels on all aspects concerning technical and economical aspects of the energy audit.	On line resources - Lesson (on line or in presence) - Tutor on line Lesson - Tutor on line	Multiple choice (10 questions)	0,5