TABLE OF CONTENTS:

INTRODUCTION

This manual is the result of the Leonardo da Vinci project titled: IMPROVING VOCATIONAL EDUCATION IN THE CONSTRUCTION INDUSTRY SECTOR WITH THE AIM OF IDENTIFICATION AND RECOGNITION QUALIFICATIONS IN EUROPEAN UNION COUNTRIES 2008-1-PL1-LEO05-02059.

Polish Association of Construction Industry Employers – Poland was the promoter of the project.

Partners of the project: Polish British Construction Partnership Sp. z o. o. – Poland, CREDIJ (Centre régional pour le développement la formation et l'insertion des jeunes) – France, University of Minho – Portugal, Ufficio Scolastico Provinciale di Venezia – Italy, Econometrica Ltd. – Greece, The Chartered Institute of Building – United Kingdom.

PROCONSTR was the project concerning developing an innovative program of vocational trainings based on eight selected construction professions for graduates from vocational schools and technical secondary schools and employees who are professionally active and want to increase their skills.

Aim of job modules was to promote idea of regular vocational development, support activities leading to implementation of European tools concerning education and vocational training – equalization of opportunities on European labour markets, intensification of cooperation among companies from construction sector and social organizations in order to promote vocational development with reference to EQF and ECVET in the Europe.

Moreover project's challenge was to make participants in the trainings aware of requirement of increasing their vocational qualifications due to regular trainings, learning new techniques and technologies utilized in construction industry and language education since gaining these skills and especially, language skills gives them opportunity of being employed in the whole territory of the European Union.

Unification of essential regulations of vocational qualifications in European Countries might simplify easy transfer of the most modern technologies as well as it would enable common usage of knowledge and generate new employees able to meet requirements of contemporary European market.

Nature of trainings were directed into men and women, due to this fact supporting efforts heading for equalization of opportunities of access to vocational education and ensuring equality on the labour market, in this case, giving special consideration to the construction branch.

Outcome of the project is an innovative didactic material for beneficiaries. Eight job modules were created on the basis of collected data and domestic markets available didactic materials with support of construction companies on national levels.

Job Module for Manson

Job Module for Carpenter

Job Module for Plumber

Job Module for Electrician

Job Module for Concrete builder

Job Module for Roofer

Job Module for HVAC worker

Job Module for Plasterer

Module for trainer

Each job module consists of two parts – first one – theoretical including the latest know-how concerning specific trade necessary for an employees and second one – training part with appropriate examples and set of exercises based on chosen innovative aspects.

Project's creators head for the situation, in which the final product might have a long-term influence and would be exploited successfully in vocational education in the whole territory of the Union. Exploitation of unified pack of vocational trainings in all countries would result in elimination of formal and informal barriers concerning easy-flow of employees and equalize differences in professional qualifications level.

Equalization of qualifications between European countries would result in effective experiences exchange; simplify identification of different types of problems (in lower developed countries) and implementation of preventive means.

Conclusions made from executed project could be utilized in order to create new training solutions as well as to prepare vocational education system reforms on a domestic level.

More information on project website: www.proconstr.eu.

INFORMATION ABOUT THE COURSE

Participants should have the following prerequisite knowledge concerning the tasks pertaining to a plumber prior to attending this course.

The innovations participants will discover on the course are: installing and make the maintenance of solar thermal systems and knowing the innovative solutions for building conditioning (solar cooling).

The advantages of this modern technology are:

- providing considerable opportunities to safe
- generating heating water and meeting the 65-70% of the demand
- improving energy efficiency
- using renewable energies
- using solar energy to produce cool air

The participant will gain knowledge about installing different types of collectors and systems, knowing materials and components depending on the expected operating temperature range, knowing different solar cooling systems, new skills and competences concerning dealing with these specific technologies.

After the course participants will be able to select and install adequate solar thermal systems and solar cooling systems. Moreover they will be able to apply this technology on their own.

Participants will receive a manual and CD, full of didactic materials like powerpoint, pdf files and vocabulary.

They will be asked to participate in the theoretical lectures (3 days) and practical workshop (1 day) conducted by a vocational trainer. Moreover they will gain knowledge on how to read and use the additional materials included in this course.

Their knowledge will be tested/assessed by a trainer with a set of questions at the end of the course.

After completion of the course they will gain the **PROCONSTR CERTIFICATE.**

PREFACE

The PROCONSTR project is intended for two main groups of construction workers: qualified workers and medium-level technical supervisors. Eight trades covered by the project represent the main professions of the large cubature house building industry as well as the infrastructure industry such as: office buildings, hotels, commercial, cultural and sport centres, healthcare infrastructure and other public utility buildings. Experts in the fields covered by the project are also crucial for the single-family house building. They are equally important in the industrial and road construction sector.

Traditional trades like: concrete builder, carpenter, reinforced concrete builder, mason, roofer, and plumber are currently undergoing a dynamic evolution due to the technical progress in the construction field.

The common use of concrete pumps together with concrete mixers, as well as concrete mixes or a widespread application of chemical products in construction such as self levelling floor compounds, resin and an important share of prefabricated reinforced-concrete elements used for ceiling construction or a common use of prefabricated reinforcement elements such as meshes and cages have an important influence on the change of traditional notion of a concrete and reinforced concrete builder, joining the two trades together in one, more universal trade of a reinforced concrete builder-concrete builder.

The widespread application of formworks and scaffoldings used on all types of construction sites has a decisive influence on the ongoing changes in the profile of the carpenter profession. Similarly, an exceptionally wide range of roof coverings and new methods of assembling them have a crucial impact on the modern definition of the profession of a roofer. Even more important changes are happening in the field of masonry, where masons have to have an excellent knowledge of all types of plasters and glues. The knowledge of an electric fitter has to cover a wide range of low current electric installations. A trade, which is undergoing particularly dynamic changes due to a huge progress in the field of air conditioning techniques, is the HVAC fitter.

An equally significant progress can also be seen in the field of sanitary techniques. A whole range of equipment is now available on the market that has not been used before. The use of internal or external materials made of epoxy resins, carbon fibres and other synthetic materials has already exceeded by percentage the use of traditional materials. The introduction of different types of plasters, dry walls or other wall elements like cardboards widens significantly the requirements relating to the trade of a plasterer.

Apart from technological changes which have influence on the profile of vocational trainings, it is impossible not to mention general requirements which have to be fulfilled by modern construction teams.

It is enough to mention:

- a significant shortening of the project implementation cycle,
- limiting the area of construction sites, particularly in urban agglomerations,
- the expansion of a vertical-building projects,
- the introduction of a top-down method, i.e. a simultaneous construction of both the underground and ground structures,

- carrying out the works in extreme weather conditions, due to the possibility of putting concrete layers at low as well as at high temperatures.

Nonetheless, health and safety at work is the most important issue, relating to both the dynamics of changes in vocational profiles and strict requirements.

The expansion of the European Community favours the free movement of services in the construction sector. This also maintains the tendencies to create construction companies with international capital. It creates the necessity for the mobility of construction teams, which together with the high quality requirements constitutes an incentive for the unification of qualification of construction workers on the highest level in the whole Union. The above mentioned general remarks underline the importance of changes undergoing in the field of construction trades.

Good economic situation on the construction market affects the economy development substantially. Demand for residential housing, office space and infrastructural building grows up. Orders placed by investors motivate contractors to carry out their jobs and the contractors stimulate enterprises manufacturing building materials to maximize their production capacities; it enables quick completion of construction investments. Consequently, a system enabling stimulation of economies and decrease in the unemployment rate is launched.

When a market presents a demand for a quick and solid carrying out of investments, the most serious problem there is finding out a relevant contractor team consisting of high-class specialists knowing all secrets of a profession, who are trained at the latest methods and technologies used at the construction, in particular, at fields of their specialization.

CHAPTER I
INTRODUCTION TO PLUMBER TRADE

Plumber – Job description

A plumber performs activities involving the design, installation and testing of gas and water pipelines, sanitary systems, solar collectors, heat pumps, pools and air conditioning systems. He/she designs and installs heating systems, exhaust fume purification systems, ventilation, and combustion systems as well as gas and diesel fuel boilers, faucets, and systems to drain rain water. He/she knows the drawing of heating and water systems, the resistance of materials and fluid machines and their mechanical solicitations.

Plumber's technical-professional competences

The plumber is able to:

- design and plan the activities to be performed according to information acquired (schemes, designs, procedures, materials, etc.)
- arrange tools, equipment and engines appropriate for different working phases according to the activities to be performed, the procedures planned and the expected results
- monitor equipment, tool and engine, functioning and perform ordinary maintenance
- arrange and organize the workplace to comply with health and safety regulations, to prevent fatigue and industrial diseases
- assemble systems
- test systems in compliance with safety and efficiency standards
- carry out ordinary and extraordinary maintenance in order to issue safe functioning documentation

Plumber – Studies and Training

In Italy the Ministry of Education, Universities and Research has reformed the education and training system. The reforms will be implemented by 2010/2011.

Under these reforms, a person who wants to perform this profession can gain a secondary school – second level – diploma. In particular a student can attend a polytechnic school – Technology Sector – Course of studies: Mechanics, Mechatronics and Energy. For relevant vocational training, a student can attend a vocational school – Sector Industry and Crafts – Course of studies: Maintenance Services and Technical Assistance.

The training path is divided in two two-year periods and a final fifth year which ends with the exam.

More information can be found on the website http://nuovesuperiori.indire.it

If a person doesn't want to attend the relevant secondary school, then he/she can gain a Junior High School Diploma and then attend a course (lasting at least 3 years) organized by a training vocational centre to gain the specific qualification. In Italy, formal education is compulsory until 16 years of age.

Requirements to perform the profession

A technical manager can work only for one company. Otherwise a person who wants to perform the profession should hold one of the following technical-professional requirements:

- degree in a specific technical subject (college of engineering, school of architecture, physical science, etc.)
- secondary school diploma – second level with a sector-based specialisation; a working period (at least 1 year) in a company
- qualification awarded by the Region or other authorized bodies and a working period (2 years) in a company
- hiring by a company for a period (at least 3 years) as "qualified worker" who performs the installation, the conversion, the enlargement and the maintenance of the systems. The period can be carried out also in different companies.

Professional development

In the last few decades, the role of a plumber has changed due to technological innovation. In particular, the skill to manually perform different tasks has been replaced by the skills required to control maintenance and the preparation of equipment.

The plumber should understand the principles of electrical engineering and electronics and be able to face different situations. The plumber should be flexible and able to face new situations, and acquire new skills with a view to lifelong learning.

The plumber should be able to use control and adjustment systems, know the right procedures to install technical systems, and find and repair malfunctioning engines.

The plumber should hold a specific qualification and know the functioning of water and heat systems, internal combustion engines in compliance with safety, energy saving and environmental pollution regulations.

The plumber must also know about advanced technologies and especially electronic devices.

He/she has to correctly interpret technical drawings of simple systems in order to install them, be able to find out and repair potential engine and technical system malfunctioning; test systems, and advise on costs.

CHAPTER II

LEGAL BASIS

In Italy

This sector has undergone considerable change, particularly regarding Decree 22/01/2008, which regulates the installation, conversion, enlargement and extraordinary maintenance of buildings. The list of activities is described in the Decree and also includes those relating to the profession. The act doesn't deal with ordinary maintenance of systems and public systems such as the electricity distribution network, aqueducts, gas pipelines or street lighting.

The activities of companies and workers in the sector are also regulated by Act 5/3/90 No. 46 "Safety regulations regarding systems" and Decree 6/12/91 No. 447 which implements the previous law.

Other relevant Acts issued by the Government are: Decree 37/2008; Decree 412/93; Decree 192/05.

To work in this sector a company should submit a start-up declaration to the local Chamber of Commerce in order to be listed on the Companies Register.

The company, the owner or the partners may not be the subject of security or prevention measures, or legal proceedings relating to Mafia activities.

At least one Technical Manager (the owner or one partner) must be appointed in order to launch the company's activities.

According to Decree 37/2008 the company must issue a Conformity Declaration which should be submitted to the Construction Counter Service of the Municipality where the system is located. The Municipality will send a copy of the declaration to the local Chamber of Commerce.

Standard

Pursuant to article 37 of Law no. 99 of July 23rd, 2009, the *Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)* comes into existence on September 15th, 2009 with the appointment and installation of its Commissioner and Sub-Commissioners.

The above-mentioned Law states that the Agency's activities are targeted to "research, innovation technology and advanced services in the fields of sustainable economic development and energy, especially nuclear energy". Furthermore, the Agency's activities will be carried out "with the funds, instruments and personnel supplied by the former Italian National Agency for New Technologies, Energy and the Environment", which has been abolished due to the installation of the High Commissioner and Sub-Commissioners.

The Agency's definition and organizational process will be finalized by an ad hoc Decree signed by the Italian Minister for Economic Development, and will be enforced with the cooperation of the Minister of Economy and Finance, the Minister for Public Administration and Innovation, the Minister of Universities and Research, and the

Minister for the Environment, Land and Sea, after submission to Parliamentary Commissions for approval.

ENEA has arranged a refresher course aimed at technicians who are in charge of testing heat systems on behalf of local bodies according to article 31 of the Act 10/91 and the art. 11 of the Decree 412/93 as changed by the Decree 551/99.

After Decree 412/93 came into force, the training course was arranged. Although the course keeps its original framework it is continuously updated in order to comply with the new legislative regulations.

The technicians have to hold the requirements listed in the Annex 1 of the Decree 551/99 (art. 3 of the Act 46/90). In particular they must know and be able to perform specific tasks:

- Legislative regulations (Act 10/91; Decree 412/93; Decree 551/99; Act 1083/71; Act 46/90; UNI 7129; UNI 10389; etc.)
- Tasks for the local authority (planning controls, self-declaration, etc)
- Technician behaviour and responsibility
- The chemical and technical requirements for installing heating systems
- Fuels and combustion
- Central heating in buildings
- Measuring tools
- Practical exercises to test burning achievement, CO_2 and Bacharach index
- Filling in reports

Safety regulations

- The main legislation concerning safety at work. Several Regions have also issued regional acts.
- Decree President of the Republic No. 547 – 27/04/1955 “Legislation to prevent industrial accidents”
- Decree President of the Republic No. 164 – 07/01/1956 “Legislation to prevent industrial accidents in the construction sector”
- Decree President of the Republic No. 303 – 19/03/1956 “Hygiene at work”
- Legislative Decree No. 494 – 14/08/1996 “Implementation of Directive 92/58/CEE concerning the minimum safety and health standards to be applied in construction sites”
- Legislative Decree No. 277 – 15/08/1991 “Implementation of several EU Directives concerning the protection of workers against risks due to exposure to chemical and physical agents”
- Legislative Decree No. 493 – 14/08/1996 “Implementation of Directive 92/58/CEE concerning minimum standards for safety signs at work”
- Ministerial Decree 10/03/1998 “Safety criteria for fire prevention and emergencies at work”

- Legislative Decree No. 235 – 08/07/2003 "Implementation of Directive 2001/45/CE concerning minimum safety and health standards when using equipment at work"
- ISPESL guidelines to identify and use protection devices to prevent falls

Links:

- Ministry of Labour: www.lavoro.gov.it/
- Ministry of Infrastructure and Transport: http://www.mit.gov.it/mit/site.php
- ISPESL: www.ispesl.it

Important links

For further information on legislation concerning the construction sector you can visit the following websites:

- Ministry of Infrastructure and Transport - http://www.mit.gov.it/mit/site.php
- ANTA (Associazione Nazionale Termotecnici e Aereotecnici) - http://www.antainrete.org/
- CONFARTIGIANATO – www.confartigianato.it
- Chamber of Commerce - www.camcom.gov.it/
- ENEA – Italian National Agency for New Technologies, Energy and Sustainable Economic Development - http://www.enea.it/com/ingl/default.htm
- CAN – Confederazione Nazionale Artigianato - http://www.cnapmi.org/cna/

In the United Kingdom

Generally, the laws governing health and safety relate to all construction activities and trades (including design) and are not industry specific. There are several Acts and Regulations.

Some of the principal Acts which deal with health, safety and welfare in construction are as follows:

- Health and Safety at Work etc. Act 1974
- Mines and Quarries Act 1954
- Factories Act 1961
- Offices, Shops and Railways Premises Act 1963
- Employers Liability Acts – various
- Control of Pollution Act 1989
- Highway Act 1980
- New Roads and Streetworks Act 1991
- Corporate Manslaughter and Corporate Homiside Act 2007.

The fundamental Act governing health and safety in construction is the Health and safety at Work etc. Act 1974. The principal regulations of this Act which affect design and construction, are:

- Management of Health and Safety at Work Regulations 1999 amended 2006
- Construction (Design and Management) Regulations 2007 (known as the CDM Regulations)
- The Work at Height Regulations 2005 amended 2007.

Some other related regulations and guides are:

- Site Waste Management Plans Regulations 2008
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 1995
- The Control of Major Accident Hazards Regulations 1999 (COMAH) amended 2005
- The Chemicals (Hazard Information and Packaging for Supply) Regulations 2003 (CHIP 3)
- The Health and Safety (Display Screen Equipment) Regulations 1992
- COSHH (Control of Substances Hazardous to Health) Regulations 2002: Provision and Use of Work Equipment Regulations (PUWER 98)
- Lifting Operations and Lifting Equipment Regulations (LOLER 98)
- Personal Protective Equipment at Work Regulations 1992
- Signposts to the Health and Safety (Safety, Signs and Signals) Regulations 1996
- Control of Asbestos Regulations 2006

Some of the principal Acts and Regulations which deal with environment, are as follows:

- The Environmental Protection Act 1990
- Environment Act 1995
- The Clean Air Act 1993
- Radioactive Substances Act 1993
- The Control of Asbestos Regulations 2006
- The Ionising Radiation Regulation 1999
- The Control of Lead at Work Regulations 2002

The regulatory organisations are (according to the Environment Act 1995):

- The Environment Agency (in England and Wales)
- The Scottish Environmental Protection Agency (in Scotland).

In Greece

Under Greek legislation all construction workers' professional activities are considered hazardous. Thus, the profession of the Plumber is also considered hazardous.

The major dangers are as follows:

- Falls from height
- Dropped tools or materials
- Incorrect use of equipment
- Fire
- Explosions
- Scalds

The legal framework for the Plumber profession covers the following sections:

1. Rules of preparing and undertaking the job
2. Health and safety regulations

The general rules for welding are covered by:

P.D. 95/1978

Works at heights are covered by:

1. Works at height without scaffolds - P.D. 778/80 art. 17
2. Works on scaffolds - P.D. 778/80 art. 9, 11
3. Works on roofs - P.D. 778/80 art. 18, 19

The health and safety regulations can be categorized as following:

- General regulations for health and safety
- Working at height using scaffolding and mobile platforms
- Protection from electrical shock
- Environment protection

Legislation referred to health and safety regulations:

- P.D. 22/12/33 (I.G.G 406 A΄) "On security of workers using ladders"
- P.D. 778/80 (I.G.G 193 A΄) "On security measures during building construction"
- P.D.1073/81 (I.G.G. 260 A΄) "On security measures whilst performing tasks related to housebuilding and engineering works"
- L. 1396 (I.G.S 126 A΄) "Obligations of observance of security measures in structures"
- L. 1430/84 (I.G.G. 49 A΄) "Ratification of the 62 International Employment contract, "As regards the safety provisions in the construction industry and resolving directly related issues"
- L. 1568/85 (I.G.G. 177 A΄) "Health and safety of workers"
- P.D.71/88 (I.G.G. 32 A΄) "Regulation for fire protection of buildings"
- M.O. 9087 1004/96 (I.G.G 849 B΄) "Operational protection of outside workers exposed to the risk of ionizing radiation during their activities in controlled areas"
- P.D.395/94 (I.G.G 220 A΄) "Minimum safety and health requirements for the use of work equipment by workers at work in compliance with directive 89/655 EU"

- P.D. 396/94 (I.G.G 220 A΄) "Minimum safety and health requirements for the use by workers of personal protective equipment at work in compliance with the directive of the Council 89/656/EU"
- P.D. 105/95 (I.G.G 67 A΄) "Minimum requirements for safety and health at work in compliance with directive 92/58/EU"
- P.D.16/96 (I.G.G 10 A΄) "Minimum safety and health in the workplace in compliance with directive 89/654/EU"
- P.D. 17/96 (I.G.G 11 A΄) "Measures to improve safety and health of workers at work in compliance with the instructions 89/391/EU and 91/383/EU"
- P.D. 305/96 (I.G.G 212 A΄) "Minimum safety and health requirements at temporary or mobile construction sites in compliance with directive 92/57/EU"
- P.D.. 62/98 (I.G.G 67 A΄) "Measures for the protection of young people at work, in compliance with directive 94/33/EK"
- M.O. 7568 F. 700. 1/96 (I.G.S 155 B΄) "Fire protection measures for hot works"
- M.O. 130646/84 (I.G.G 154 B΄) "Security measures calendar"

Glossary:

L.: Law

P.D.: Presidential Decree

I.G.G.: Issue of Government's Gazette

M.O.: Ministry ordinance

In Portugal

*Labour Law***:** The Labour Code in Portugal is regulated by Law n. 7/2009 of 12th February. Further information regarding construction work contracts may be found in the Collective Work Contracts in the Construction Sector (*CCT, Contratos Colectivos de Trabalho para o Sector da Construção)* published by the Ministry for Labour and Social Solidarity in the Employment and Work Bulletin (*Boletim do Trabalho e Emprego)* n. 12 of 29th March 2009.

Standards for Small and Middle-size Enterprises (SME): There are no specific regulations for SME. For the construction and real-estate companies there is a regulating entity (the Construction and Real Estate Institute -*in PT, Instituto da Construção e do Imobiliário, INCI*) and specific regulations concerning the admission and practice activity, namely:

- Decree-law n. 12/2004 of 9th January 2004 establishes the legal framework for the admission to and permanency in the construction activity;
- Decree n. 19/2004 of 10th January 2004 establishes the categories and subcategories related to the construction activity;
- Decree n. 21/2010 of 11th January 2010 establishes the value of the construction works according to the qualification categories of the building permit for 2010;

- Decree-law n. 211/2004 of 20th August 2004 regulates the real estate activity.

*Basics of construction standards***:** General Regulations of Urban Buildings (*in PT: Regulamento Geral de Edificações Urbanas, RGEU*) approved by Decree-law n. 38382 of 7th August 1951 (altered by Decree n. 38888 of 29th August 1952 and further revisions). A new version is foreseen to be published soon (*in PT: RGE*).

*Basics of construction Works Contract***:** For general contracts, the Civil Code approved by Decree-law n. 47344/66 of 25th November 1966 (1st version) and for public contracts, the New National Public Procurement Code approved by Decree-Law nº 18/2008 of 29th January 2008 (modified by Decree-law n. 278/2009 of 2nd October and Decree-law n. 223/2009 of 11th September).

*Health, Safety and Welfare Regulations***:** Decree 41821 of 11th August 1958 establishes the work safety regulations for building construction; Decree-law 441/91 of 14th November 1991 establishes the general principles for the promotion of Health, Hygiene & Safety at work (transposes Directive n.º 89/391/CEE of 12th June); Decree-law 273/2003 of 29th October revises the legal framework on Health and Safety conditions in the construction site (incorporating the minimum prescriptions required for temporary/mobile construction sites established by the Directive n.º 92/57/CEE of 24 June).

In Poland

- Act dated 07.07.1994 – Building Act (Journal of Laws 2006 No. 156, item 1118 with subsequent amendments, Journal of Laws 2006 No. 170 item. 1217 and Journal of Laws 2006 No. 193 item 1430),
- Regulation of the Minister of Transport and Building dated 28th April 2006 on technical functions in building industry (Journal of Laws 2006 No. 83 item 547)
- Act dated 16.04.2004 on building products (Journal of Laws 2004 No. 92 item 881),
- Act dated 27.04.2001 Environment Protection Act (Journal of Laws 2006 No. 129 item 902 with subsequent amendments)
- Regulation of the Minister of Infrastructure dated 12.04.2002 on technical conditions for buildings and location of buildings (Journal of Laws 2002 No. item 690 with subsequent amendments),
- Regulation of the Minister of Economy and Labour dated 27.07.2004 on industrial safety (Journal of Laws 2004 No. 180 item 1860 with subsequent amendments)
- Act dated 30.10.2002 on social work accident and occupational diseases (Journal of Laws 2002 No. 199 item 1673 with subsequent amendments),
- Regulation of the Minister of Labour and Social Policy dated 26.09.1997 on general industrial safety regulations (Journal of Laws 2003 No. 169 item 1650 with subsequent amendments),
- Regulation of the Minister of Infrastructure dated 6.02.2003 on building work safety (Journal of Laws 2003 No. 47 item 401)

- Regulation of the Minister of Economy dated 30.10.2002 on minimum safety requirements for machinery use by employees (Journal of Laws 2002 No. 191 item 1596 with subsequent amendments),
- Act dated 24.08.1991 on fire protection (Journal of Laws 2002 No. 147 item 1229 with subsequent amendments)

In France

1- Basic concepts: standards, DTU, Technical advice (Avis Techniques)

1.1 Standards: see Standards and European directives (source: AFNOR)

French approved standards are mandatory for State and local government funded contracts. They are also recommended for privately funded contracts.

1.2 DTUs (Unified Technical Documents) are documents that contain technical rules relating to the execution of building works using traditional techniques. They are recognized and approved by construction professionals. They also provide a reference point for insurance experts and the courts. Failure to comply with DTUs may lead to the invalidation of warranties offered by insurance providers. DTUs specify standards for traditional construction methods and are considered the epitome of reference texts. They are intended for relevant state bodies as well as contractors (whether architects or general contractors), owners and other experts. They are authored by a committee advising on technical texts.

1.3. Technical advice is advice from a committee of experts specialising in relevant trades and the expected behaviours of materials, components or processes. They define the characteristics of any materials, components or processes involved, and give advice on their durability and suitability for use and how they comply with regulations.

2 - DTU

2.1. Status of DTU

The DTUs are established by a body created in 1958, the "Groupe de Coordination des Textes Techniques / Groupe DTU" (the "Coordinating Group of Technical Texts or Group DTU").

In 1990, this group became the "Commission Générale de Normalisation du Bâtiment/DTU "(the General Committee for the Standardisation of Building / DTU) in order to integrate it into the French official system, which was necessary to comply with European technical harmonization (Eurocodes)

This means that the DTUs have become standards. The transformation took place gradually through the regulatory procedures that govern standardsation.

As a result, the DTU(s) now have one of the following statuses:

Approved French standard (Norme française homologuée): this is a standard which has received official government approval, its technical value is recognized, and it plays an important role in the construction system;

Experimental standard (Norme expérimentale): which is undergoes a period of probation before being confirmed or amended to become a certified French standard;

Documentation booklet (Fascicule de documentation) : standard documents, essentially informative documents;

DTU: the original form of the documents. Not part of the official standard system. In most cases DTU status is temporarily held in anticipation of its integration into the official standard system.

2.2. Private works

DTU is implemented following an agreement between the "maitre d'ouvrage" and the construction contractor. A DTU only commits the signatories, giving it a sense of obligation of contract.

Some standards and some French registered DTUs can be mandatorily enforced by regulatory decisions (often when safety-related).

2.3. Public works

The amended Decree of January 26, 1984 governs the application of French standards in contracts approved by the government, local authorities, public bodies etc., except in special cases as listed in the decree.

2.4. Composition of a DTU

A DTU may consist of the following documents:

- Technical specification clauses booklet (cahier des clauses techniques: CCT) which sets out the requirements for the selection and use of materials;
- Specification of special provisions booklet (cahier des clauses spéciales: CCS) which defines performance limits and obligations to other trades;
- Rules for calculating the structural design.

All these documents are contractual documents and must be adhered to. There are also other documents, such as memos and selection guides, which are useful for structural designs that are not intended to be imposed by contract.

Like ISO standards, the DTU(s) must be bought. They can be found on the CSTB website: http://boutique.cstb.fr/

(CSTB = centre scientifique et technique du bâtiment: scientific and technical center for construction)

DTUs and other required documents are listed on the CSTB website. There are specific DTUs for each profession : (see example for roofers on the next page)

http://boutique.cstb.fr/dyn/cstb/Upload/Fichiers/Liste_0310.pdf

3 - Healt and safety

On building sites required by the coordinator of safety to have a general plan of coordination, the companies involved must create a PPSPS (Particular plan of safety and protection of health) valid for all workers on the building-site

PPSPS: Particular plan of safety and protection of health

Contents of the PPSPS

1. The name and address of the company, the address of the building site, the name and qualifications of the person in charge of the work.
2. The description of work and methods of work showing
   a) the company's specific risks and chosen means of prevention, taking into account any environmental constraints
   b) Work involving risks of interference arising from co-activity with other companies, mutual risks and the prevention methods available.
3. Procedures for observing any measures of general coordination defined by the coordinator.
4. Rules for hygiene and for workers' areas as laid out in the general coordination plan .
5. First aid organization of the company; including the medical equipment available, first-aiders and on site, measures for evacuating any injured persons, according to the general coordination plan.

The descriptive part of the plan is the most important; it must be accompanied by a detailed analysis of the risks related to procedures, materials, devices and installations, the use of dangerous substances or preparations, and to circulation on site.

Plans or sketches drawn for the building site can effectively replace text. Photocopies of documents are to be avoided in general , except for private copies.

The plan can evolve and change, so it is always possible to modify any of the given procedures or preventive measures if the incurred risks are decreased or if the preventive measures give an equivalent guarantee.

4. Legal basis

Texts referring to the labor regulation:

- Principle of prevention articles R 230-1 with R 234-23
- General plan of coordination R 238-20 to R 238-36

Texts for the prevention and the safety of the workers:

- N° circular 6 DRT of April 18th, 2002 of the ministry for employment and solidarity
- Law N° 91-1414 of December 31st, 1991 published with the OJ N°5 of January 7th, 1992
- European directive 89/391/CEE of June 12th, 1989
- Decree 2001-1016 of November 5th, 2001 relating to the single document published in the 258 Olympics of the 11/7/01 page 17523.

CHAPTER III
A NEW CONTEXT

EU legislation (environment, sustainable development)

Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 relates to the energy performance of buildings and the EU's climate change package which aims to ensure that the EU will achieve its climate targets by 2020:

- a 20% reduction in greenhouse gas emissions
- a 20% improvement in energy efficiency
- a 20% share for renewable energies in the EU energy mix.

This has changed the working context of the plumber in our country.

Thus due to the changes and innovations introduced, the context is characterised by

- ongoing technological evolution of 1) heat engines 2) system components 3) control systems
- creation of new systems using renewable energy.

Such systems use electronic technology to exchange information in order to optimize the functions of the heat system (energy – environment – safety parameters).

Directive 20 20 20 establishes that systems producing heat energy from a renewable source in buildings should effectively integrate with systems producing heat and refrigeration energy from fossil fuels. Thus the plumber needs to be able to work and operate using complex production and distribution systems (including pipelines and different engines or components that are difficult to connect).

The plumber must know the sector-based technical regulations and the specifications illustrated on the engines and components to be installed. The companies must clearly write the specifications and procedures according to the European Directives and the plumber should be able to understand and apply them.

For what concerns the changes in the labour market ASSOTERMA has written a report on the topic and the following figure can clearly explain it.

EU legislation on the energy efficiency: energy performance of buildings

1. Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings. The Directive was implemented in Italy in 2005 by issuing the Decree 192/05 "Certification of the energy efficiency of buildings". The main key points are:
    a) minimum standards of energy performance of systems – energy performance and consumption
    a) regular inspection of
    b) boilers and central air-conditioning systems
    c) systems and installations.

The certification and inspection should be carried out by qualified and independent personnel.

1. Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of eco-design requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council
1. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC Text with EEA relevance. The Directive encourages the installation of innovative engines and systems using renewable energies.

Labour market changes

ASSOTERMICA is an association involving 60 industries producing heating and air-conditioning systems.

According to the information provided by ASSOTERMICA, the plumber should be able to perform his/her tasks in the following sectors:

- installation
- service company (controls, repair service, replacement, etc.)
- CAT (spare parts, assistance, emergency services – hot water heaters, etc.)
- Energy supplier (controls on the supply, maintenance on the distribution network).

CHAPTER IV
DESCRIPTION OF INNOVATIVE ASPECTS

There are three innovative aspects concerning the profession:

a) performing services to improve system performance

b) installing systems to produce energy from renewable sources

c) performing ordinary and extraordinary maintenance.

The training of plumbers is very important for those who take their profession seriously. Gaining competencies and knowledge in innovative areas can be a competitive advantage and allow the provision of better service to customers. A qualified plumber should provide services which are tailored to the customers'specific requirements, and also be able to inform customers of the costs and advantages of renovating buildings to increase energy efficiency. The plumber should inform the customer of the potential energy savings and any tax incentives.

A plumber should know about all aspects of energy efficiency, in particular. the legislative framework: for example, the national minimum standards for the energy performance of new buildings and existing buildings subject to major renovation; opportunities provided by national tax incentives, etc.

These new regulations and solutions to improve the efficiency and effectiveness of technologies already on the market, and the proposal of innovative technologies, encourage the plumber and other professions to continuously learn with a view to lifelong learning.

Equipment and tools

Besides the traditional equipment, a plumber uses electronic tools to research, analyse and control, as described below:

- Combustion analyser
- Manometer to test the stamina of the gas systems (methane, liquefied petroleum gas)
- Tool to measure the draught of fireplaces
- Anemometer is a device for measuring wind speed and temperature

Control systems

Control devices are designed to operate systems according to the energy required by the users.

Junction boxes installed on systems are designed to manage them according to the following parameters:

- external temperature
- room-temperature
- starting water temperature

The most common piece of equipment in city power stations is DTE 611 made by COSTER.

DTE 611 is a digital regulator of a power station (yearly scheduling); it is able to adjust:

- boiler's fixed-point or not fixed-point temperature
- climate adjustment of the heating plant
- adjustment of the boiler's temperature , control charge pump.

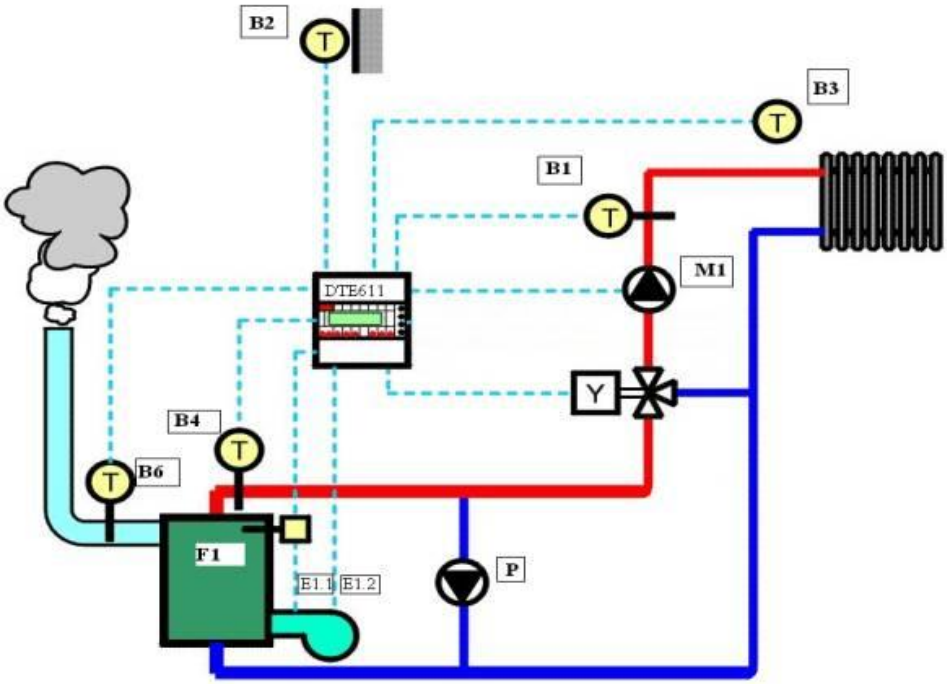
DTE uses the following communication systems:

- C-Bus – proprietary communications protocol for home and building automation
- C-Ring – use of common data among local regulators.

The main functions of DTE 611 are:

- adjusting the boiler's temperature (variable) according to the external temperature or at the boiler, heating plant or other plants' request (if the regulators are connected to the DTE 611 by the C-Ring)
- control of a gas burner (1 or 2 stages)
- climate adjustment of the heating plant, control ball valve:
  - system start-up and stop timer optimization
  - control of the system pump with timer and stop postponement
  - environment anti-freeze
  - limitations of the minimum and maximum temperature (55°C- 75°C)
  - correction of the heating curve's origin
  - adaptation of the heating curve to the environment
  - economy function
- adjustment of the temperature concerning the sanitary water storage:
  - control of the charge pump by drill or timer
  - priority and antibacterial function
  - daily and weekly timer
  - date timer: 25 holidays; winter time; special time
  - automatic correction of daylight saving time
  - summer antilock periodical functioning of the valve and pumps
  - measurement of daily degrees and working hours of the gas burners
  - remote control to change the timer
  - 5 On-Off inputs alarm signal
  - alarm signals for short-circuit or drill disruption and system malfunctioning
  - C-Ring connection for local transmission of data to other regulators
  - C-Bus connection for data transmission with local or remote computers.

DTE 611 is programmed with specific software to allow the heating plant to best meet the user's requirements. It is possible to specify daily programmes, daily timer, weekly programmes, holidays, special time and emergencies.



B1 – Drill plant temperature	E1.2 – 2nd stage boiler
B2 – Drill external temperature	F1 – Boiler's thermostat
B3 – Drill environment temperature	M1 – Heating pump
B4 – Drill boiler temperature	P – Anti-condensation pump
B6 – Drill fumes	Y – Heating motorised valve
E1.1 – 1st stage boiler	C-Bus – Data transmission Telemanagement

New solution: Installation and maintenance of solar power plants

Solar energy can be harnessed to provide hot water or to heat buildings and offices; Solar radiation, alongside secondary solar-powered resources such as wind and wave power, hydroelectricity and biomass, account for most of the available renewable energy on earth. Only a minuscule fraction of this available solar energy is used.

Solar powered electricity generation relies on heat engines and photovoltaic cells.

New Italian legislation (Decree 192/05 and Decree 311/06) establishes that solar thermal technologies are mandatory when building new houses. These solar thermal collectors should generate at least the 50% of the hot water requirements.

Solar thermal technologies can be extremely efficient. therefore if they are well designed they can provide large cost-savings.

Using a solar thermal system to generate hot water can meet 65-70% of demand. Such a saving allows the cost of the investment to be recouped within 5-10 years – depending on the type and quality of the system.

Description

Solar water heating is a reliable and renewable energy technology used to heat water. Sunlight strikes and heats an "absorber" surface within a "solar collector" or an actual storage tank. Either a heat-transfer fluid or the actual potable water to be used flows through tubes attached to the absorber and picks up the heat from it. (Systems with a separate heat-transfer-fluid loop include a heat exchanger that then heats the potable water.) The heated water is stored in a separate preheat tank or a conventional water heater tank until needed. If additional heating is required, it is provided by electricity or fossil-fuel energy by the conventional water-heating system.

Although solar water heating systems all use the same basic method for capturing and transferring solar energy, they do so with three specific technologies that distinguish different collectors and systems. The distinctions are important because different water heating needs in various locations are best served by certain types of collectors and systems.

Materials and components used in solar water heating systems vary depending on the expected operating temperature range.

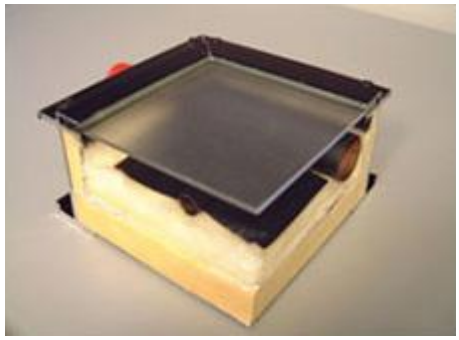
Small sample of unglazed low temperature solar collector showing flow passages and header pipe.

Low-temperature systems (unglazed) operate at up to 18 F° (10 C°) above ambient temperature, and are most often used for heating swimming pools. Often, the pool water is colder than the air, and insulating the collector would be counter-productive. Low-temperature collectors are extruded from polypropylene or other polymers with UV stabilizers. Flow passages for the pool water are moulded directly into the absorber plate, and pool water is circulated through the collectors with the pool filter circulation pump. Swimming pool heaters cost from $10 to $40/ft² [2004].

Mid-temperature systems produce water 18 to 129 F° (10 to 50 C°) above outside temperature, and are most often used for heating domestic hot water (DHW). However, it is also possible to use mid-temperature solar hot water collectors for space heating in conjunction with fan-forced convection or radiant floors.

Mid-temperature collectors are usually flat plates insulated by a low-iron cover glass and fibreglass or polyisocyanurate insulation. Reflection and absorption of sunlight in the cover glass reduces the efficiency at low temperature differences, but the glass is required to retain heat at higher temperatures. A copper absorber plate with copper tubes welded to the fins is used. In order to reduce radiant losses from the collector, the absorber plate is often treated with a black nickel selective surface, which has a high absorptivity in the short-wave solar spectrum, but a low-emissivity in the long-wave

thermal spectrum. Mid-temperature systems range in cost from $90 to $120/ft² [2004] of collector area.



Small sample of mid-temperature flat plate collector showing cover glass, insulation, and copper absorber plate and flow passages.

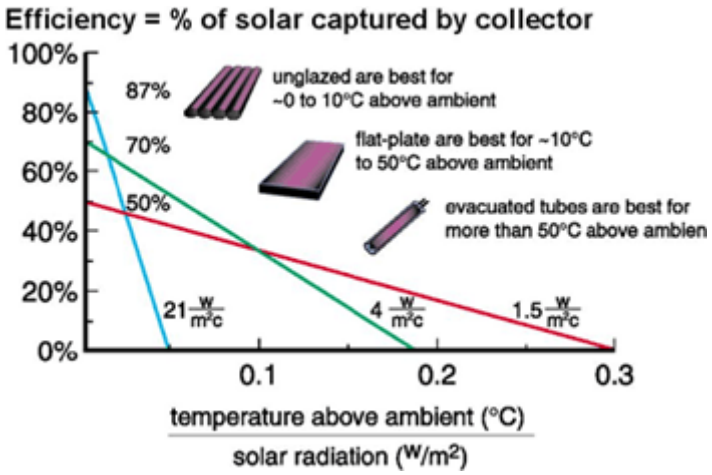
High-temperature systems utilize evacuated tubes around the receiver tube to provide high levels of insulation and often use focusing curved mirrors to concentrate sunlight. High temperature systems are required for absorption cooling or electricity generation, but are used for mid-temperature applications such as commercial or institutional water heating as well. Due to the tracking mechanism required to keep the focusing mirrors facing the sun, high-temperature systems are usually very large and mounted on the ground adjacent to a facility. Evacuated tube collectors themselves cost about $75/ft², but use of curved mirrors and economies of scale get this cost down for large system sizes to a relatively low cost of $40-70/ft² [2004].

Components of a Solar Water Heating System

Close-up view of an evacuated glass tube with black copper absorber plate inside.

Solar Collectors—Solar collector efficiency is plotted as a straight line against the parameter (Tc-Ta)/I, where Tc is the collector inlet temperature (C), Ta is the ambient air temperature (C), and I is the intensity of the solar radiation (W/m²). Notice that inexpensive, unglazed collectors are very efficient at low ambient temperatures, but efficiency drops off very quickly as temperature increases. They offer the best

performance for low temperature applications, but glazed collectors are required to efficiently achieve higher temperatures.



In addition to solar collectors, all solar hot water systems have thermal storage, system controls, and a conventional back-up system.

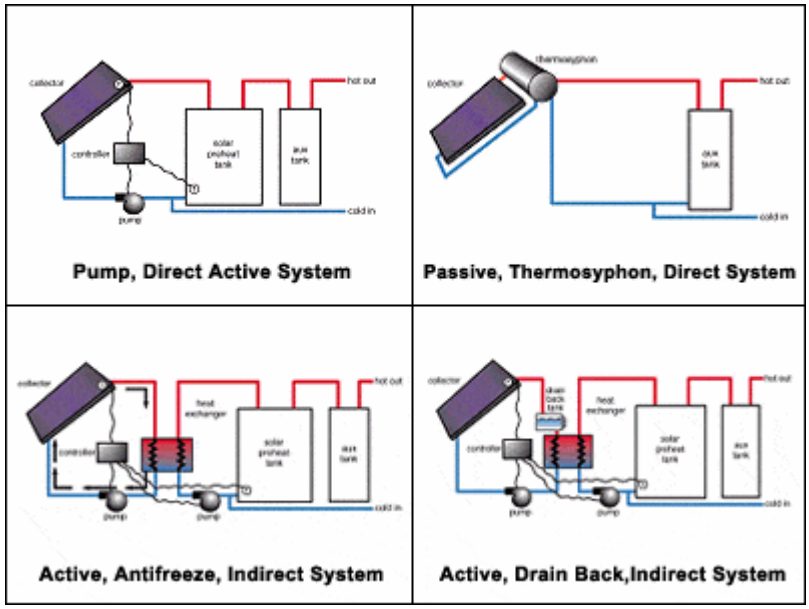
Thermal storage—Storage is generally required to couple the timing of the intermittent solar resource with the timing of the hot water load. In general, 1 to 2 gallons of storage water per square foot of collector area is adequate. Storage can either be potable water or non-potable water if a load side heat exchanger is used. For small systems, storage is most often in the form of glass-lined steel tanks.

Controls—Active systems have a "delta T" (temperature difference) controller to start and stop the pumps. If the temperature in the solar collector outlet exceeds the temperature in the bottom of the storage tank by a set amount (say 6 C°), the controller starts the pump. When this temperature difference falls below another set value, say 2 C°, the controller stops the pumps. The controller will also have a high-limit function to turn off the pumps if the temperature in the storage tank exceeds a third setting, say, 90 C°. Due to the simplicity and low cost of a delta T controller, it is wise to keep controls independent of any whole-plant energy management system, although it is desirable to include some indication of system performance, such as output from a Btu meter or preheat tank temperature in the building control system.

Conventional Back-Up Heater—Solar water heaters save energy by preheating water to the conventional heater. Solar DHW systems are usually designed to meet 40% to 70% of the water-heating load. A back-up, conventional heater is still needed to meet 100% of the peak hot water demand for cloudy days or for when

Types of Solar Water Heating Systems

Solar water heating system types are classified as follows:

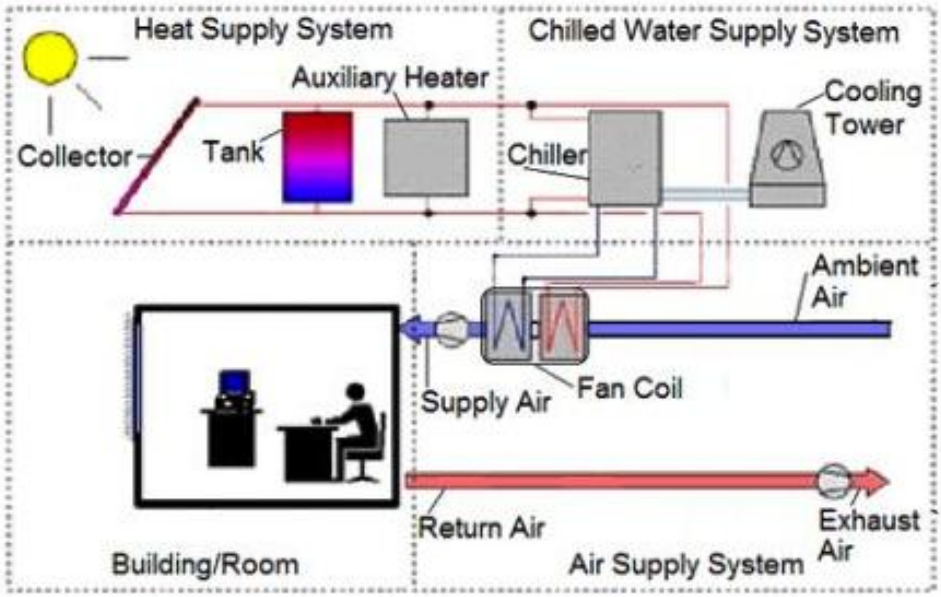


- Active—requires electric power to activate pumps and/or controls.
- Passive—relies on buoyancy (natural convection) rather than electric power to circulate the water. Thermosyphon systems locate a storage tank above the solar collector, while integrated-collector-storage collectors place the storage inside the collector.
- Direct—heats potable water directly in the collector.
- Indirect—heats propylene glycol or other heat transfer fluid in the collector and transfers heat to potable water via a heat exchanger.

Innovative solutions for building conditioning: solar cooling

Using solar energy to produce cool air is becoming an advantageous opportunity. The general principle is the production of cold air beginning with a source of heat. The synthetic description of the production process is the following:

- the sun is the source of heat that radiates energy that is then absorbed by solar collectors
- the production of cold air occurs by means of refrigeration devices
- the cold carrying fluid, air or water depending on the type of device is used to condition the interiors.



Solar cooling systems can be classified as follows:

- closed systems: are cooling devices fuelled by hot water or vapour to produce cooled water; the heat transfer fluid can be used directly in the treatment unit of the air conditioning systems or distributed by means of a network of tubes to decentralized conditioning terminals in the various zones to be conditioned
- open systems: allow complete air treatment. The air is cooled and dehumidified to guarantee environmental comfort. The coolant is always water; the most common systems exploit the principle of "desiccant cooling" and use rotating dehumidifiers with solid absorbent substances.

In Europe solar thermal market is increasing and also Italy has the same trend.

Solar cooling could solve the problem of summer air-conditioning and at the same time would give the possibility to use thermal energy during summer. The result would be a better sizing of plants with economic advantages.

Unfortunately in Italy the potential prospects for growth are vast but stymied by the present national industrial sector and the lack of national policies. The technology is not fully understood by the professional world and global costs can be high due to the relatively restricted diffusion of these types of systems.

Further applied research and experimentation is necessary and it would be wise to launch new incentives and introduce awareness campaigns.

ENEA

In Italy, several organisations work to create new technologies in this sector. In particular, under to article 37 of Law no. 99 of July 23rd, 2009, the Italian National

Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) comes into existence on 15th September 2009, with the appointment and installation of its Commissioner and Sub-Commissioners. The above-mentioned Law provides that the Agency's activities are targeted to "research, innovation technology and advanced services in the fields of sustainable economic development and energy, especially nuclear energy". Furthermore, the Agency's activities will be carried out "with the funds, instruments and personnel supplied by the former Italian National Agency for New Technologies, Energy and the Environment", which is abolished with effect as from the installation of the High Commissioner and Sub-Commissioners. The Agency's definition and organizational process will be finalized by an ad hoc Decree signed by the Italian Minister for Economic Development, to be adopted together with the Minister of Economy and Finance, the Minister for Public Administration and Innovation, the Minister of Universities and Research, and the Minister for the Environment, Land and Sea, after submitting them to the competent Parliamentary Commissions for approval.

ENEA contributes to minimise energy-produced emissions with a view to improve energy technologies – especially renewable energy – by applying innovation to CO2 capture and confinement. ENEA is particularly dedicated to develop the following technologies and activities:

- New photovoltaic technologies: optimisation of the industrial manufacturing processes of crystalline-silicon devices; development of thin-film silicon devices on low-cost substrates for building integrated flat-plate modules; development of hybrid photovoltaic generating thermal and electrical energy simultaneously at different temperature
- New solar thermal technologies: R&D activities related to space conditioning technologies using heat generated by solar collectors with special attention to drying cycles

One of ENEA's objectives is to accelerate the technological development of limited eco-impact energy systems. In line with this objective many projects covering several different fields have begun with a view to keep the Italian system's competitiveness high in the framework of the sustainable development. ENEA is particularly dedicated to develop the following strategic projects:

- New generation photovoltaics: optimisation and industrialisation of Point-focus technology developed by ENEA in the framework of PhoCUS project. This technology uses module-integrated primastic refractive lenses allowing for a product which is highly-efficient, reliable and commercially-competitive when compared to plan photovoltaics.

Safety and workplace organization

SPISAL is the body designed to regulate hygiene and safety in workplaces (SERVIZIO PREVENZIONE IGIENE E SICUREZZA NEGLI AMBIENTI DI LAVORO); it is a branch of the local medical corps and managed by the Regional Authority.

SPISAL was established by Act No. 833 in 1978. It has control, surveillance functions as well as it promotes a health and safety culture in workplaces by preventing professional illnesses and the industrial accidents.

We briefly describe some safety files provided by SPISAL.

1. Arranging the workplace

Possible problems	Questions and notes	Measures to improve safety
Environmental conditions of the workplace	Is the work performed in poor environmental conditions?	In case of bad weather conditions, avid performing works outside
- Cold - Warm - Rain	Please indicate the measures already taken or those which are necessary	Appropriate clothing (cold, rain)
Lighting of the workplace	Did you take measures to ensure that the lighting is suitable?	- Use portable lamps - If the natural light is not enough use additional lamps
Lifting and transport of loads - Radiators - Tool chest	Did you take measures to avoid overloading?	- Use auxiliary means of transport or equipment for lifting (lift trucks, cranes, etc.) - Reducing the load

1. Work organization

Possible problems	Questions and notes	Measures to improve safety
Personal behaviour towards risks	Is it normal to take safety measures?	- Provide appropriate instructions - Organize regular meetings on safety regulations
- Not enough information on the professional risks - No use of safe working procedures or safety equipment	- Did dangerous situations occur due to incorrect workers' behaviour?	- Inform of possible damage due to incorrect behaviour
- Etc..	- Please indicate the measures already taken or those which are necessary	

1. Workplace and equipment

Possible problems	Questions and notes	Measures to improve safety
Collisions and/or injuries due to engines with unprotected components - Circular saw - Drill - Grinding machine - Rotaflex - …..	During functioning is it possible to use dangerous components which can do harm? Please indicate the measures already taken or those which are necessary	- New machines must comply with EU safety standards - Safety regulations provided in the operating instructions are observed - Protection devices: covering, barriers, etc. - Check the efficiency of the protection devices - Safe grips - Safety switch - Etc..
	During special operations (for example, cleaning, maintenance, or changing of hand tools) did you take all necessary precautions? Please indicate the measures already taken or those which are necessary	- Follow the operating instructions - Disconnect the machine - Etc…

Possible problems	Questions and notes	Measures to improve safety
Wounds due to dangerous surfaces - Metal edges - Rough surface - Knifes - Pointed tips on the floor - Etc..	Did you take precautions to avoid abrasions, wounds or pricks? Please indicate the measures already taken or those which are necessary	- Gauntlets - Boots - Cover the edges - Accurately arranging the sharp tools
Powders, chips, splinters, etc - Circular saw - Drill - Grinding machine - Rotaflex - …..	Did you take appropriate measures to avoid them? Please indicate the measures already taken or those which are necessary	- Installing a suction pipe on machine tools which produce powders - Appropriate choice of sharp tools - Using protective clothing - Using eye and/or face protection
Falls due to - Slippery floors - Wet floors - Obstacles on the floor - Unsuitable shoes	Did you take appropriate measures to prevent possible falls, tripping orsprains? Please indicate the measures already taken or those which are necessary	- Keeping the floor dry - Removing obstacles - No cables or hoses in the workplace - Communicating about the obstacles - Using suitable shoes

1. Electricity

Possible problems	Questions and notes	Measures to improve safety
Electrical contact (direct or indirect) with - Drill - Grinding machine - Rotaflex - Pneumatic drill - Etc.	Are the sockets, the switches, the electric cables in good conditions and the devices closed and sealed off? Please indicate the measures already taken or those which are necessary	- everyday checks of the sockets, switches, and electrical cables - electrical devices should be regularly checked by qualified personnel - do not use defective machines and tools and control their repair - using tough cables - do not use electrical tools with wet hands

1. Physical Agents

Possible problems	Questions and notes	Measures to improve safety
Noise from: - Drills - Grinding machines - Rotaflexes - Pneumatic drills - Etc.	Are workers frequently exposed to high noise levels? Please indicate the measures already taken or those which are necessary	- Evaluation of the noise in the workplace - Reduction of exposure time -Before purchasing new e quipment take into account the noise level according to the operating instructions - Using acoustic protection
Exposure risk to unionizing radiation during welding operations	Did you take measures to prevent the exposition to unionizing radiation?	- Protection for eyes and face against infra-red and ultraviolet radiations
Risk of burns due to: - torch flame - Hot tubes - Systems (boiler, etc..) - Boiling water	What measures did you take to prevent burns?	- Protection for eyes and face - Fireproof clothing - Safety shoes

1. Chemical substances

Possible problems	Questions and notes	Measures to improve safety
Contact with materials containing dangerous substances - Paint remover - Solvents - Stickers - Plastering - Mineral fibres	Did you take precautions in handling dangerous substances or chemical agents? Please indicate the measures already taken or those which are necessary	- Asking for the safety files from the supplier - Following the instructions - Ensuring adequate ventilation when the work is performed in closed areas - Checking that the products are correctly tagged
Asbestos (type and supplier)	Is it used asbestos or products with asbestos?	- In case of works on water ducts inform SPISAL about the possible asbestos exposure - Comply with the national legislation - Putt the waste in well marked bags - Inform workers of the risks - Use specific protection clothing

1. Biological agents

Possible problems	Questions and notes	Measures to improve safety
Infection risk due to microorganisms	Did you take appropriate precautions?	- equipment to protect the body, waterproof clothing - regualr disinfection of the skin with antiseptic soap - appropriate garbage disposal
Hepatitis A, tetanus - Draining systems - Wells - waste	Please indicate the measures already taken or those which are necessary	

1. Fire and explosions

Possible problems	Questions and notes	Measures to improve safety
Fire risk during welding operations - flames - gas escape	During welding did you take appropriate fire prevention measures?	- Do not smoke - Using torches with automatic power off - Fire extinguishers - Emergency plan
	Is the welding engine equipped to reduce the fire risk?	
	Please indicate the measures already taken or those which are necessary	

CHAPTER V
TRAINING

Aims/goals:

Providing the necessary skills to install solar thermal systems and maintain them.

Target groups:

Technicians installing water and heating systems, plant installers, and technicians of energy systems.

The course lasts five days and it is divided into theoretical and practical parts;

Theoretical training (3 days)

First day:

Principles and technologies of solar thermal systems

- Renewable energy, benefits and environmental constraints
- Solar energy and climate data
- Solar thermal collectors and thermal store
- Types of plant
- Plant sizes

Second day:

Solar thermal plants

- Installation and maintenance
- Calculation method
- Economic analysis
- Laws and regulations
- Examples

Third day:

Solarcooling

- Absorption principle
- Absorption bands
- Types of plant
- Current situation

Practical training (two days)

- Practical installation of a solar thermal collector
- FAQs, remarks and conclusions

Test part

1. The sun: the power which bears on a orthogonal surface to the sunlight and out of the atmosphere is:
   a) ICS = 1367 W/m²
   b) ICS = 867 W/m²

1. Solar diagrams
   a) They are used to calculate the radiant light according to the latitude and the different months of the year
   b) They are used to calculate the radiant light according to the Azimuth and the different months of the year

1. The total radiant light is the sum of the following factors: DIRECT RADIANT LIGHT + INDIRECT RADIANT LIGHT + ??????
   a) Albedo
   b) Absorbed radiant light

1. Flat plate solar thermal collectors: which component captures the solar energy and transfers it to the tubes of the collectors?
   a) The sheet
   b) The transparent cover

1. The performance of a flat plate collector depends on:
   a) the temperature difference between the fluid and the environment
   b) the temperature difference between the collector and the environment

1. Evacuated tube collectors: they provide high performance throughout the year and they are appropriate for installation in areas with a
   a) medium-high insolation
   b) medium-low insolation

1. Storage tank: to optimise the water stratification which is the ratio of the storage sizes?
   a) $H/D \geq 1.5$
   b) $H/D \geq 2.5$

1. Placement of the solar thermal collectors

Azimuth: in order to be efficient the collector should be located at

a) South-East
b) South-West

1. Tilt – Milan: the best inclination of the collectors in order to get a maximum production is
   a) 55°
   b) 35°

1. Tichelmann system: the minimum capacity in the solar thermal collectors should not be less than…….litres/hour for one square meter
   a) 150 litres/hour
   b) 50 litres/hour

1. Demand of hot sanitary water: daily person's consumption
   a) 80 litres/person
   b) 300 litres/person

1. Practical rules: Northern Italy
   a) 1 m² of evacuated tube collector = 2 m² of flat plate collectors
   b) 1 m² of evacuated tube collector = 1 m² of flat plate collectors

1. Practical rules: size of the expansion tank for 1 m² of collector
   a) 6 litres
   b) 10 litres

1. The total cost of a solar thermal system is
   a) cost per 1 m² = 500 €/m²
   b) cost per 1 m² = 800 €/m²

1. In order to work the heat absorption pump uses:
   a) high temperature heat
   b) low temperature heat

1. Which is the fluid used by a heat pump?
   a) Gas water
   b) Water – glycol

USEFUL RESOURCES AND LINKS

Resources

- Ministry of Infrastructures
- Ministry of Education
- School “G. Galilei” – Castelfranco Veneto (TV)
- ENEA
- Assotermica
- Spisal
- Ambiente Italia
- Confartigianato

Links

http://www.mit.gov.it/mit/site.php

www.miur.it

www.enea.it

www.assotermica.it

www.regione.veneto.it

www.ambienteitalia.it

www.confartigianato.it