GREEN - BRIDGES FROM GREY TO GREENING JOBS
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Cartography of processes in the renewable energy sector

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INTRODUCTION

GREEN - BRIDGES FROM GREY TO GREENING JOBS Project is financed by the European Commission within the framework of the Lifelong Learning Programme, in order to support the realization of a European area for lifelong learning and to enhance the attractiveness of vocational education and training and mobility for employers and individuals. It will be developed during 2011-2013 in a coordinated manner in Spain, Finland, Lithuania, France and Bulgaria.

The nature of the energy has dramatically changed during the past century. We now once more see the beginnings of a fundamental reorientation, away from the polluting fossil fuels that destabilize the climate and toward renewable sources of energy.

A Green New Deal, however, cannot simply focus on new technologies or accounting systems. It also needs to directly improve the welfare of people, in part by generating "green jobs" that contribute to a more sustainable economy and offer decent employment. More broadly put, the education system plays a critical role in social and environmental progress by empowering people to unfold their talents and to acquire the skills needed in modern, knowledge-based societies. In particular, greening the economy will require large-scale research, education and professional training to provide scientific knowledge and to build a properly skilled workforce.

In order to that, GREEN project is aimed at developing and testing a European device, in electronic format, to favor the professional mobility and recognition of the knowledge, aptitudes and competences acquired by employees of renewable energies, in different countries and in different contexts (formal and non formal).

As we indicated in the previous report on the trends in the renewable energies "Report of prospective and trends in the renewable energy sector", this kind of energies are quite plural and the processes vary from one renewable energy to another, so we decided to divide the research into five main renewable energies:

- thermal solar,
- photovoltaic solar,
- biomass,
- wind
- hydro

OBJECTIVE and METHODOLOGY

Objective

The objective of this report is to disaggregate the renewable energies activity (thermal solar, photovoltaic solar, biomass, wind and hydro) into processes, following the Product / Client line, to subsequently select those considered as key and describe them in terms of Learning Outcomes afterwards. We understand as "key" process the one that in the SMEs' opinion:

- Is more important according to certain established indicators: Human Capital, Financial Capital, Know-How Capital and Environment.
- Is more sensitive to the *most important,* the *most influencing* technological – organisational trends, and those that are going to affect the renewable energies in the *short-medium term:* Suitable law framework and specific laws for RE, Technological innovations in the production (technology and equipment), Environmental legislation, Demand of new technologic competences, Access to funding, funding lines for investments (these trends were selected, through primary and secondary sources, in a previous phase).

Therefore, the disaggregating of the activity into processes does not start from the analysis of a typical organization in the renewable energies sector, but it focuses its attention in ensuring that the addition of all the identified processes includes the entire activity developed in the group of the renewable energies identified as basic.

According to the version ISO 9000:2000, process is defined as "*the group of activities mutually interrelated or interacting which transform incoming elements into results; the incoming elements for a process are generally results for other processes; the processes are usually planned and executed under certain conditions to provide a value*".

Methodology

In order to determine the typical process map for the different renewable energies previously identified, we have used the procedure explained below, agreed by the group of partners:

Analysis of "process diagrams or maps"

Questionnaires with key informants

Analysis of “process diagrams or maps”

The analysis of the different “process diagrams or maps” is aimed at knowing and identifying the group of processes for the analysed renewable energies (thermal solar, photovoltaic solar, biomass, wind and hydro).

It is agreed that each partner develops one kind of map processes, being able to choose the type of renewable energy taking into account their experience and accessibility to the productive field.

These “process diagrams or maps” are constituted in precursor documents, in which they will be integrated and completed with the information gathered in the questionnaires, until achieving the process map type for each renewable energy.

2.2. Questionnaires with key informants

We are willing to complete and improve the process map type in the sector. Therefore, we proceed to know the opinion of 4 - 5 expert interlocutors per each kind of renewable energy (thermal solar, photovoltaic solar, biomass, wind and hydro). The questionnaires are focused on the activity: which activities are done to get the product / service.

From the gathered information, the partners make an effort to synthesise the information and elaborate a proposal to disaggregate the activity into processes (proposal of the most relevant processes map) for the kind of the different renewable energies. This proposal is validated by the rest of the Partnership, who in turn, consults expert agents and suggests contributions which are integrated, if opportune.

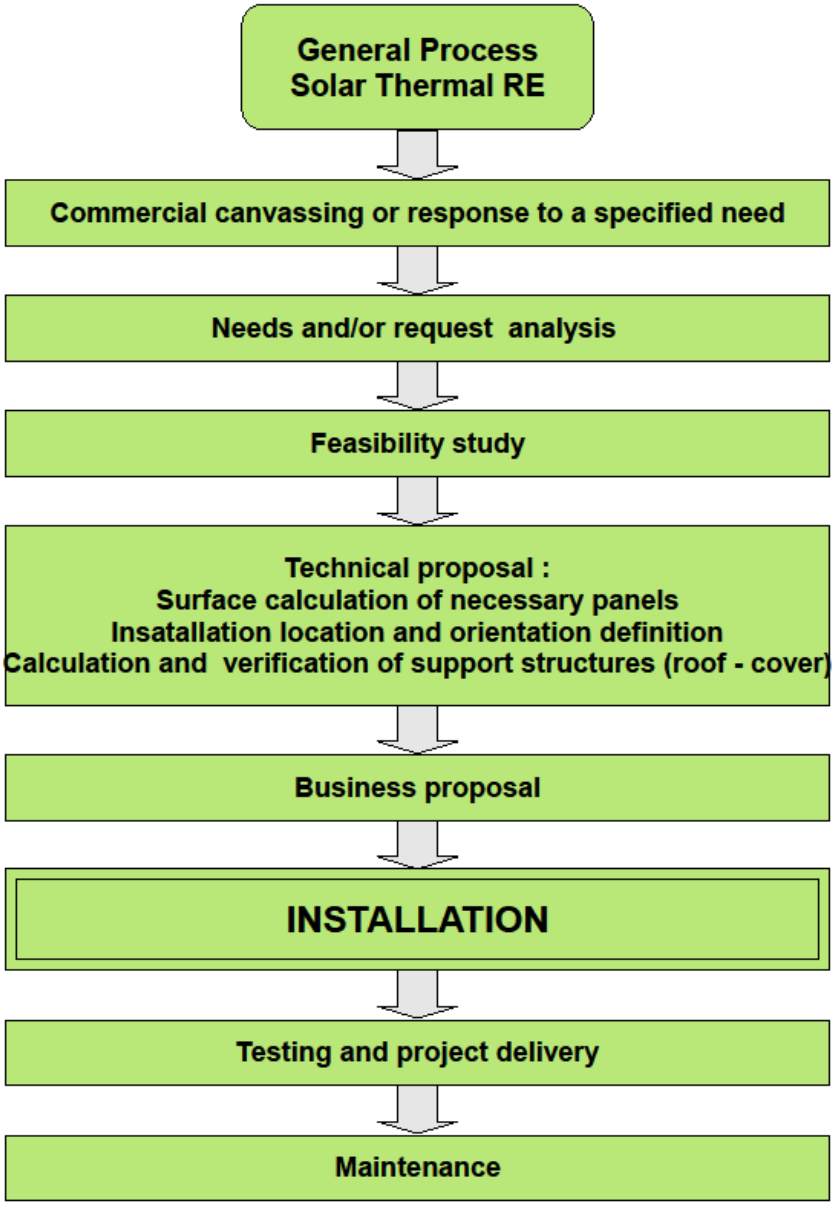
Within the general processes map of each renewable energy selected, it is decided to describe more in detail the strategic processes susceptible to be analyzed further the Learning Outcomes:

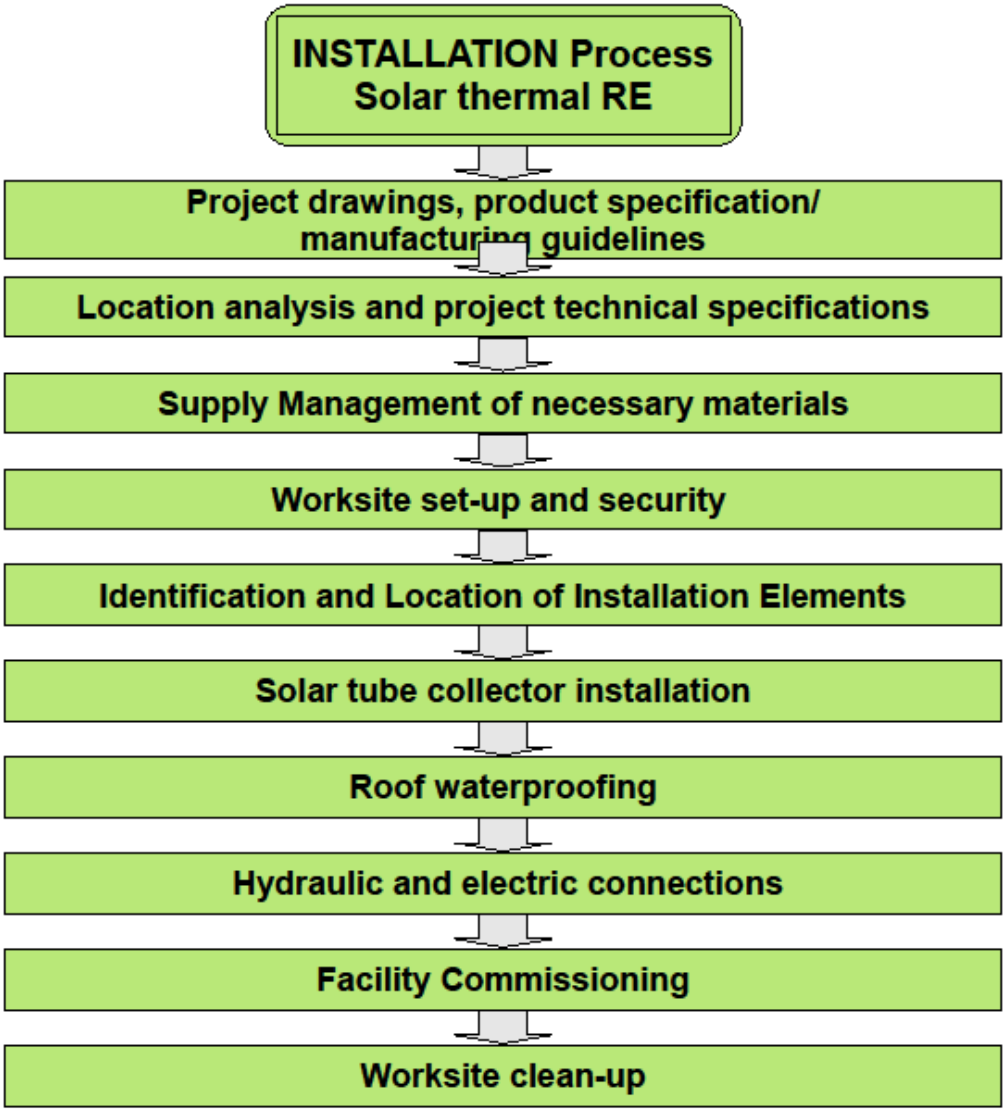
- thermal solar: installation process
- photovoltaic solar: assembly process
- biomass
- wind: maintenance process
- hydro: maintenance process

In the following pages, the cartography of processes of the different kind of renewable energies is shown, with the different processes and activities.

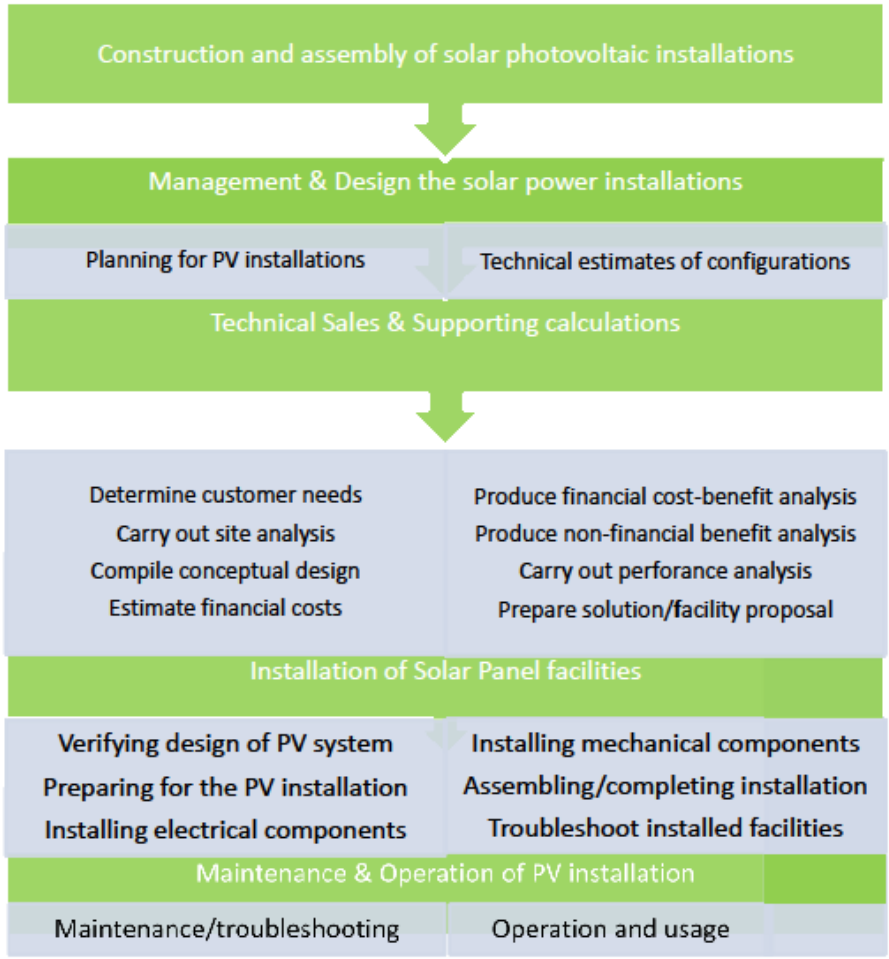
MAP OF THE SELECTED RENEWABLE ENERGIES

Solar thermal general process map

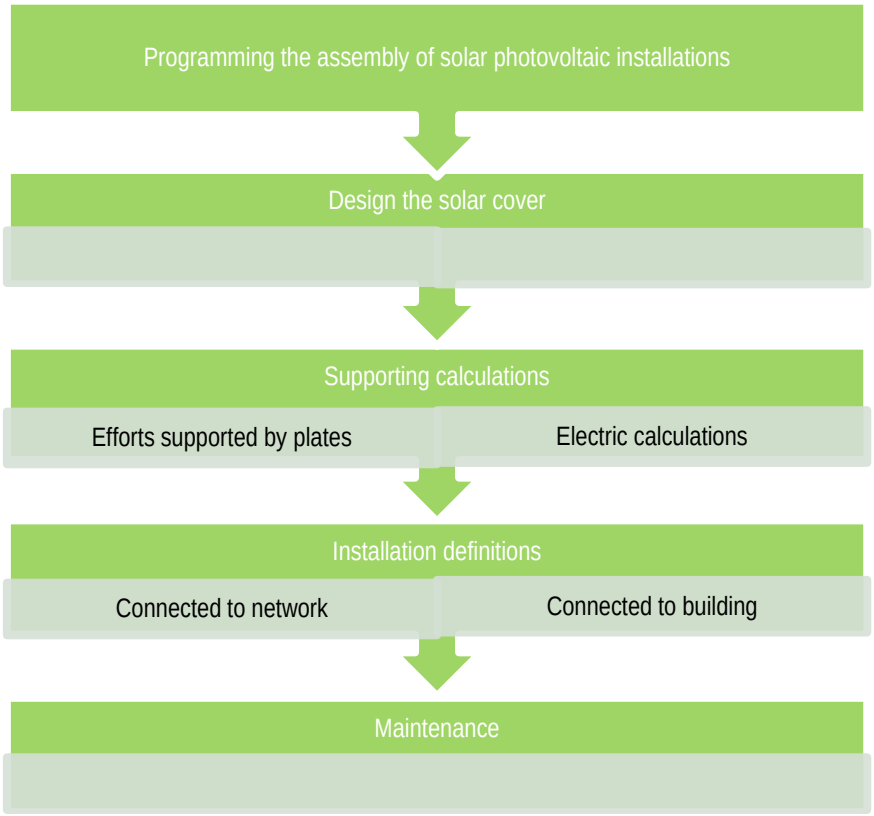



INSTALLATION Process
Solar thermal RE
Project drawings, product specification/ manufacturing guidelines
Location analysis and project technical specifications
Supply Management of necessary materials
Worksite set-up and security
Identification and Location of Installation Elements
Solar tube collector installation
Roof waterproofing
Hydraulic and electric connections
Facility Commissioning
Worksite clean-up

Solar photovoltaic general process map



Solar photovoltaic assembly process map



Biomass general process map

Primary Biomass Primary activity waste	Secondary Biomass Industrial activity waste	Energetic cultures	Sources of Biomass
Thermal Uses (air conditioning)		Electric uses	Kinds of use
Individual	Collective	Micro generation < 2Mw / Plants >2Mw	
Processes linked to the value chain of the Biomass Energetic Valorisation			Professional profiles
• Biomass collection / transport / adaptation			Collector /carrier worker Primary school Driving Licence: C-1; Operation of the required machines and equipments
• Elaboration of facilities feasibility / equipment implementation surveys o *Elaboration of facilities feasibility and cost-effectiveness surveys* o *Design of renewable energy installation technical projects:* • *Dimensioning, drawings, estimations* o *Design of Solar Water Heating (SWH) both at home level and for big consumptions (hospitals, hotels, estates, industry, laundries, etc.) Elaboration of memorandums to apply for benefits to install renewable energies.* o *Processing the documents required to start the installation of renewable energies, including:* o *When necessary, declaration of community interest or the survey of environmental impact of the installations.* o *Architectural integration of the Renewable Energies installations*			Technicians on biomass use Intermediate and/or higher University Studies Industrial Technical Engineering; Industrial Engineering; Bachelor degree (physics, etc.) Higher Vocational Training Development of Mechanical Projects, Development of Projects on Fluid, Thermal and Maintenance Installations; Electro technical Installations, Maintenance of Industrial Equipment.
• Design / engineering of equipments and systems (boilers, furnaces, burners, systems to handle biomass (hoppers, belts)) o *Mechanical and structural design of components and equipments to use Biomass* o *Design automatic control systems to improve the industrial processes*			Intermediate and/or higher University Studies (Industrial Technical Engineering; Industrial Engineering)
• Equipments / components manufacture (boiler forging, electric systems,)			Higher Vocational Training Development of Mechanical Projects, Development of Projects on

	Fluid, Thermal and Maintenance Installations; Electro technical Installations, Maintenance of Industrial Equipment.
• Automation (Control systems for burners and combustion, PLC systems)	Higher Vocational Training Development of Mechanical Projects, Development of Projects on Fluid, Thermal and Maintenance Installations; Electro technical Installations, Maintenance of Industrial Equipment.
• Installation (supervision) o Equipments and systems o Plants Management of biomass energetic projects. Works management Participation in installation projects Placement of the sites Calculation and dimensioning of installations Optimisation of installation systems Basic engineering, detail engineering depending of each client's cases and, occasionally, managing the permissions and the projects working.	Intermediate and/or higher University Studies (Industrial Technical Engineering; Industrial Engineering)
• Installation (workers) o Equipments and systems o Plants	Installers Higher Vocational Training • Electricity and electronics, Maintenance of industrial equipment Intermediate Vocational Training • "Installation and electromechanical maintenance of machines and lines piping". • "Assembly and maintenance of cool air installations, air conditioning and heating" • Mechanical and electric connections; Operation of mechanical, electric and electronic tools; electric controls; Calibration and measuring; Drawing interpretation.
• Network connection(electric) o Equipments and systems o Plants	
• Operation / maintenance /assistance (technicians)	Biomass plant operation Technicians

Manage the machines and equipments manufacture, conservation and repair processes. Organise the operations: prepare and supply materials and tools for the equipments Coordinate, control and supervise the operations. Carry out and supervise the machines, boilers and digesters cleaning and maintenance operations. Supervise the workers (operator/s) Supervise the correct use of the planning, execution and control procedures.	Higher or intermediate University Degree; Higher Vocational Training
Operation / maintenance / assistance (Workers) Carry out the suitable exploitation and maintenance works, following the technician's instruction Carry out corrective and preventive activities for the correct operation Operate with the existing boilers inside the plant; handling and maintenance of the boiler services and its auxiliary equipments. Care for the turbine and generator operation. Take samples Repair and correct the possible working mistakes Control pressures, oil levels, readings, review equipments. - Detect failures and review the compliance with all the plant maintenance and production process requirements - Electromechanical works for the biomass energy generation plant - Control the operation and maintenance of the industrial complex under their responsibility	Biomass plant operators Intermediate / higher Vocational Training Electricity and Electronics; Maintenance of Industrial Equipment
Horizontal services Elaboration and surveillance of offer and estimation; relation with clients and suppliers Carry out energetic audits Development of biomass energetic conversion projects, as well as the electricity and heat generation from biomass, Elaboration of projects related with biomass. Support business and investment projects Advise the clients regarding installation and projects Survey of the reference external market.	Biomass use Consultants, Equipment Salespeople, Energy Auditors Higher and/or intermediate university studies.

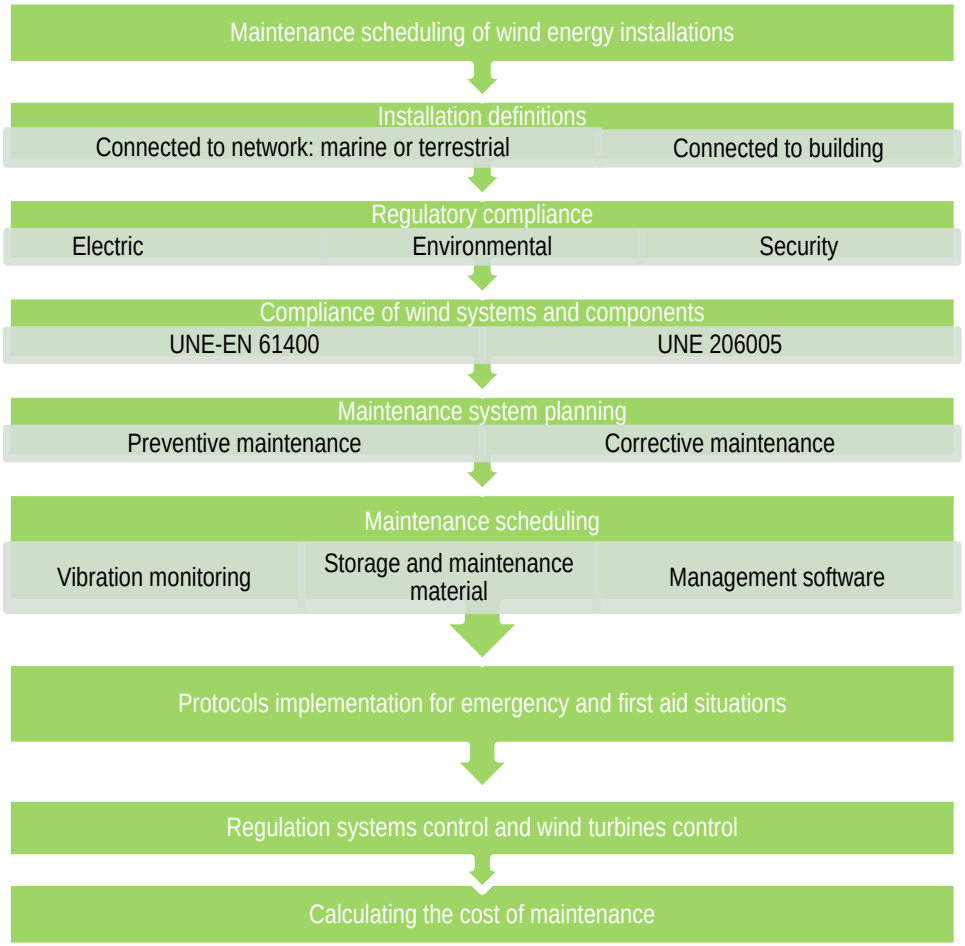
Wind general process map

Self-consumption and Micro generation	Big generators and wind parks	
Processes linked to the wind energy value chain		Professional profiles
• Elaboration of facilities feasibility / equipment implementation surveys o *Elaboration of facilities feasibility and cost-effectiveness surveys* o *Design of renewable energy technical projects:* • *Dimensioning, drawings, estimations* o *Elaboration of memorandums to apply for benefits to install renewable energies* o *Processing the documents required to start the installation of renewable energies, including:* o *When necessary, declaration of community interest or the survey of environmental impact of the installations.* o *Architectural integration of the Renewable Energies installations*		Intermediate and/or higher University Studies Industrial Technical Engineering; Industrial Engineering, Bachelor Degree (Physics, etc.)
• Design / engineering of equipments and systems o *Mechanical and structural design of components and equipments* o *Design automatic control systems*		Intermediate and/or higher University Studies (Industrial Technical Engineering; Industrial Engineering)
• Equipments / components manufacture o Self-consumption and micro-generation equipments o Spades / rotors / towers / generators /inverters		Higher Vocational Training Development of Mechanical Projects, Electro-technical Installations, Maintenance of Industrial Equipment Welders Parts assembly Tool-machine operators.
• Manufacture and Installation o Equipments (micro-generation and self-consumption) o Big Isolated Generators, Wind parks		Intermediate and/or higher University Studies (Industrial Technical Engineering; Industrial Engineering) Architecture (three-year degree) Higher Vocational training Development of Mechanical Projects, Electro-technical installations
• Manufacture and installation (workers) o Equipments (Micro generation and self-consumption) Identify a place to put the supporting tower oriented in the predominant wind direction, to get the maximum production and avoid the turbulences provoked by the obstructions.		Installers Higher Vocational training • Electricity and Electronics Maintenance of industrial equipment"

Anchor the support tower base in a technically correct place, explaining the wind direction to the user, to minimise the damaging effects as far as possible. Check the correct operation of the installation. Mount the tower sitting on the ground by installing the wind generator and its electric connections. Interconnect the wind generator to the control board Connect the rotor. Connect the generator Make the connection of the consumption elements. o Big generators and wind parks Preparing the ground Building foundations for structures Assembly of parts and equipments Electric interconnections Connections to the control boards	Intermediate Vocational Training: • "Installation and electro-mechanical maintenance of machines and lines piping". • "Mechanical and electric connections; Handling mechanical, electric and electronic tools; electric controls; Calibration and measuring; Drawing interpretation.. • Crane and special machines operators.
• Electric network connection o Micro-generation o Big generators and wind parks	
• Operation / maintenance / assistance (technicians) Periodical equipment revision Sensor calibration Repair of broken components	Wind turbines maintenance technicians Higher and/or intermediate University Studies Intermediate / higher Vocational Training Electricity and electronics; Equipment maintenance
• Horizontal services Offer legal assistance Offer financial assistance, identify investment funds Carry out administration and management tasks Elaboration and surveillance of offers and estimation; relation with clients and suppliers Carry out energetic audits. Advise the clients regarding installation and projects Survey of the external reference market	Consultants Equipment salespeople Energy managers Higher and/or intermediate University studies

Carry out administration and management tasks Survey and audit projects Inspect installations and elaborate reports	

Wind maintenance process map



Hydro general process map

CONSTRUCTION OF SMALL HYDRO POWER PLANT

⇩

DETERMINATION OF THE MOST SUITABLE SITE ON RIVER OR PONDS FOR SHPP CONSTRUCTION

⇩

TECHNICAL-ECONOMICAL EVALUATION OF RENEWABLE ENERGY SOURCE USING THE CONCEPT OF AVOIDED DAMAGE FOR ENVIRONMENT

⇩

METHODOLOGY OF DETERMINING OF OPTIMAL HYDRO DEVELOPMENT SCHEME

⇩

SELECTION OF ENERGY EQUIPMENT FOR SHPP IN LITHUANIAN CONDITIONS

⇩

METHODOLOGY OF DETERMINING OF OPTIMAL HYDRO DEVELOPMENT SCHEME

⇩

BUSINESS PROPOSAL

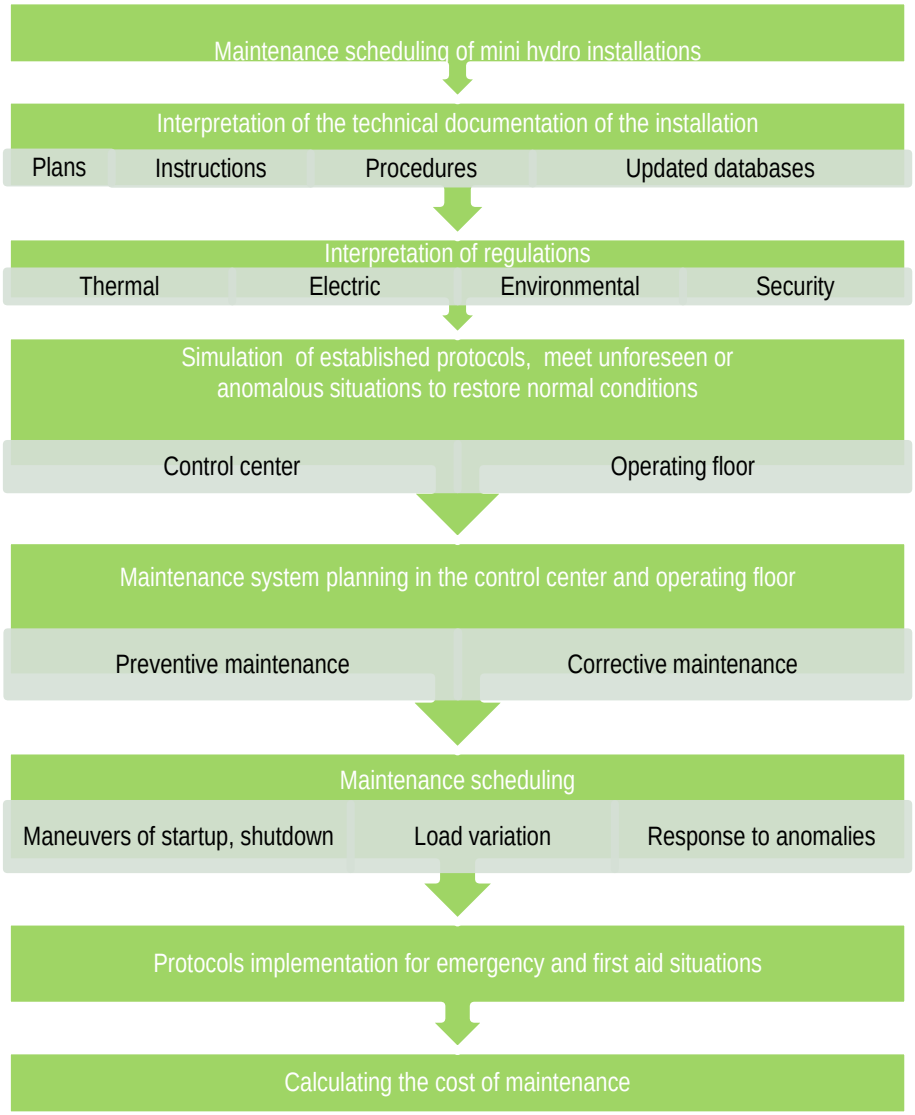
⇩

INSTALLATION

⇩

TESTING AND PROJECT DELIVERY

⇩

MAINTENANCE

Hydro maintenance process map