

## SLIDE 1

### Introduction

Changing the approach to a more sustainable one is a big step towards a healthier environment. Years ago, green solutions for the common people were not available without huge investments that were never fully paid off, but that began to change. The growing demand for ecological solutions, especially in the construction sector, has resulted in a decline in the prices of many parts and technologies that are now not only available but also competitive with traditional solutions.

The content of the training was developed in accordance with the requirements of the PROGREEN project, financed by ERASMUS +, and covers the basics of knowledge about green solutions.

## SLIDE 2

### Introduction

The term "green solutions" refers to reducing human impact on the environment. These are all solutions for companies / people that help make operations more sustainable. According to numerous studies, the ecological approach will be responsible for a large part of the competitive advantage in any industry in the near future.

## SLIDE 3

### Introduction

Green jobs are about implementing production processes and the performance of products and services that have a positive impact on the environment

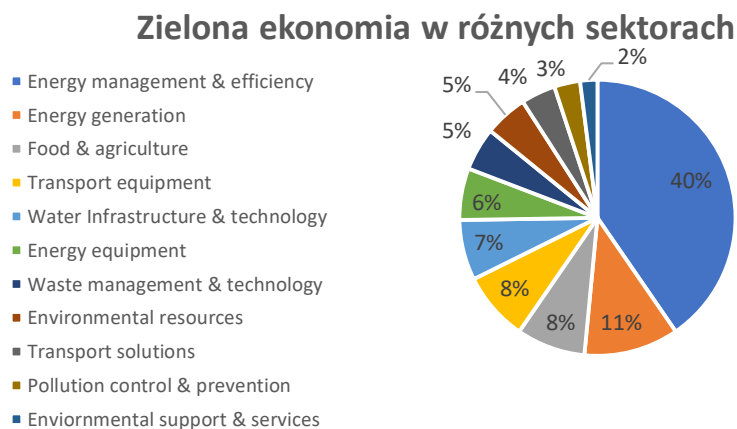


Figure 1. Green economy by sector

Source: FTSE Russell, data as of December 2017

## SLIDE 4

### Introduction

After completing this course, the candidate should acquire basic knowledge of implementing green solutions. This module includes 3 lessons:

- L01: The role of the advisor
- L02: Introduction to the green economy

- L03: Implementation of selected green solutions

## L01: Role of advisers

### SLIDE 1

#### The role of the advisor

A consultant is a person with deep knowledge in a specific field who provides services to other entities. Good advisers have specialist knowledge and well-developed soft skills to be able to fully understand the needs of their clients.

Basic roles of the advisor:

- Providing appropriate solutions for clients
- Source of information

### SLIDE 2

#### Skills required by advisers

The counselor should acquire the following skills and qualities:

- Sector-oriented knowledge - every consultant needs to know the advantages and disadvantages of all solutions and products.
- Communication and negotiation skills - advisers work with clients, therefore they need to be communicative in order to clearly present the proposals.
- Motivation - a good advisor needs to expand and update his knowledge, especially in the area of green solutions, where there is so much innovation.
- Sales skills - from how the advisor understands the needs of customers, he must also be able to successfully recommend an appropriate solution.

### SLIDE 3

#### Duties of advisers

There are many responsibilities when providing services to customers. The most important thing is:

- Act honestly and competently
- Client's interests above their own
- Be professional, all advisers should be objective when recommending products and services
- Should disclose any conflicts of interest, if any, with the clients it deals with

### SLIDE 4

#### The effectiveness of advisers

Counselors are effective when they have the right qualities:

- Curiosity about new solutions on a dedicated market
- Interest in consulting
- Clarity in expressing thoughts
- Motivation to encourage customers to change

## L02 Introduction to the green economy

### SLIDE 1

#### Definition

The green economy focuses primarily on low carbon emissions, resource efficiency and social inclusion. It is one of the fastest growing markets in the world, it caught up with the fossil fuel industry in 2018 and is on track to account for 10% of the world market by 2030.

- 1) Low Carbon Emissions - Refers to the low emission of all greenhouse gases in general, which is considered to be the most important factor in the fight against climate change.
- 2) Resource Efficiency - The green economy generally places great emphasis on responsible use of resources, which are of course inherently limited.
- 3) Social inclusion - is a priority under the UN Sustainable Development Goals. Promoting social inclusion by reducing poverty and ensuring greater equal opportunities is a core idea of all development programs.

### SLIDE 2

#### Green professions

Green jobs are generally defined as jobs that are environmentally friendly and can be created in any industry as long as they meet the sustainability goals.

The fastest growing green jobs:

- 1) City grower
- 2) Electric car engineer
- 3) Water quality technician
- 4) naturalist
- 5) Green builders
- 6) Eco-educator
- 7) Green design specialist

### SLIDE 3

#### Renewable energy

Renewable energy is becoming a serious alternative to traditional energy sources, in 2017 it accounted for over 24% of total energy consumption. In many countries it is supported by governments with special programs and grants for local businesses. This gives companies many opportunities to develop their process and reduce their carbon footprint. Not only is renewable energy more environmentally friendly in many cases, it is also becoming a competitive advantage for companies in both economic and marketing terms as consumers have shifted their interests to a sustainable economy.

#### SLIDE 4

##### Renewable energy sectors

##### Main sources of renewable energy:

- Hydropower - the main source of renewable energy, in 2017 accounting for 65% of total renewable energy produced worldwide.
- Wind energy - This is the second source of renewable energy worldwide that can be placed both on land and offshore.
- Solar energy - the fastest growing area of all renewable energy sources. Solar energy simply converts solar energy into energy using a concentrated solar system or photovoltaics.
- Bioenergy - divided into 2 categories: traditional - combustion of biomass (wood, animal waste, etc.), and modern - liquid biofuels made from bagasse from sugar cane and other plants
- Geothermal energy - hot water tanks at high temperatures located below the earth's surface

#### SLIDE 5

##### Photovoltaics

The price of solar modules has dropped more than 100 times in the last 30 years. With the greater availability of this type of technology, both hard costs and soft costs decrease significantly.

Many companies are striving to reduce their net emissions to zero, and solar cells play an important role in this. In many European countries, the installation of panels is partially subsidized to reinforce the shift towards cleaner energy.

### Solar PV Module Cost (1976-2016)

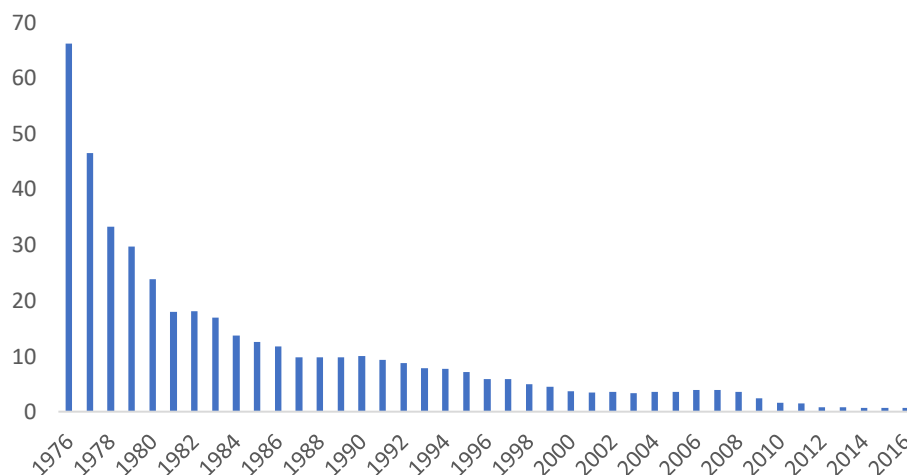


Figure 6. Solar PV module cost in years 1976 - 2016

Source: <https://ourworldindata.org/grapher/solar-pv-prices>

## SLIDE 6

### Wind farms

Important factors for the development of a wind farm:<sup>1</sup>

- 1) Understand your wind resources
- 2) Estimate the distance from the existing transmission lines
- 3) Identify the benefits and barriers to enabling development of your land
- 4) Establishing access to capital
- 5) Identify a credible energy buyer or market
- 6) Considering the location and feasibility of the project
- 7) Understand the economics of wind energy
- 8) Get zoning and expertise permit
- 9) Engage in dialogue with turbine manufacturers and project developers

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<sup>1</sup> [https://openei.org/wiki/Wind\\_energy](https://openei.org/wiki/Wind_energy)

## SLIDE 7

### Resource efficiency

Natural resources are limited and therefore must be handled with care in the production process. To measure a company's performance, there are several indicators: carbon footprint, water footprint, land footprint, material consumption.

There are several programs that have been created to help balance natural resources:

- Circular economy - consists of the following activities: reuse, sharing, repair, refurbishment, production and recycling to create a closed system to minimize the use of additional resources
- Cradle-to-cradle - a biomimetic approach to viewing the manufacturing process and materials as nutrients circulating in a healthy, safe metabolism
- Regenerative Design - a process-oriented whole system approach to design. The term "regenerative" describes processes that restore, renew, or revitalize your own sources of energy and materials. Regenerative design uses whole thinking systems to create resilient and equitable systems that integrate the needs of society with nature.

## SLIDE 8

The main goals of the current work for the green economy

- 1) Supporting a macroeconomic approach to sustainable economic growth through regional, sub-regional and national form
- 2) Presentation of the approach to green economy, with particular emphasis on access to green finance, technology and investments
- 3) Supporting countries for macroeconomic development and mainstreaming to support the transition to a green economy

## SLIDE 9

### Urban challenges

In 2015, approximately 54% of the population lived in cities (International Organization for Migration). The United Nations predicts that 68% of the world's population will live in cities by 2050. This trend creates major urbanization challenges:

- Poor air and water quality
- Insufficient water availability
- Problems with waste disposal
- Huge energy consumption
- Water circulation disturbance (drainage occurs faster with higher peak flows)
- Soil contamination
- Overheating
- Noise
- Lack of resources

### L03 Implementation of selected green solutions

#### Slide 1

#### Green roofs

Green roofs are sometimes referred to as the future of architecture. Admittedly, investments in this type of solution are associated with higher construction costs, and the solution only applies to flat roofs, the slope of which varies between 2% - 30%, but there is a list of their benefits:

- Extending the service life of waterproofing membranes
- Reducing the amount of rainwater runoff and delaying its occurrence
- Reduction of the urban heat island (UHI) effect - green roofs reduce heat thanks to the daily dew and evaporation cycle
- Reducing the energy needed to lower the building temperature (on the hottest and coldest days)

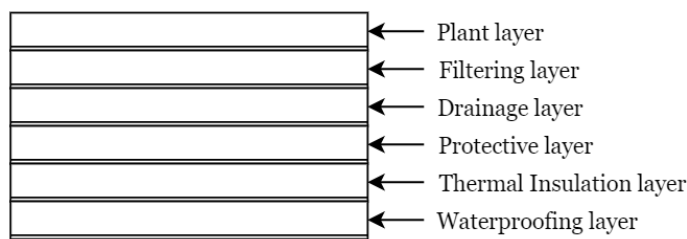


Figure 2. Order of layers in Green Roofs solution

#### Vertical green system

The vertical greening system is similar to the green roof system, but the plants are placed on a vertical level. The main goal is passive energy saving. When implementing such a system, the following factors should be taken into account:

- The type of structural system used to place plants on building facades
- Climate influences not only the thermal behavior of a building, but also the choice of plant species and their influence on their growth
- The type of plant species used
- Mechanisms influencing the operation of these systems

There are four main effects on the passive energy saving potential of this<sup>2</sup>:

- 1) Shadow effect - plants capture solar radiation
- 2) Cooling effect - takes place due to evapotranspiration from plants and substrates
- 3) Insulating effect - refers to the insulating ability of different layers, such as air in the plant layer, possible intermediate air layers, substrate layers
- 4) Wind barrier effect - Refers essentially to the ability of vertical green systems, plants and supporting structures to modify not only the direct effects of wind on the building facade.

<sup>2</sup> G. Perez, J. Coma, I. Martorell, LF Cabeza (2014) Vertical Greenery Systems (VGS) for energy saving in building: A review, Renewable and sustainable energy reviews, vol. 39, pp. 139-165

### Slide 3

#### Walkway that cleans the air

In city centers, air-purifying pavements are being implemented, especially in those that are exposed to pollution by exhaust fumes. Such a pavement is covered with a photocatalytic chemical that is capable of collecting air pollutants (nitric oxide) and converting them into less hazardous pollutants. Research has shown that in urban conditions, such a solution allowed to reduce nitric oxide by up to 30%.

### Slide 4

#### Light motion sensors

Motion sensors are small electronic devices that detect infrared waves - heat waves from moving objects. This is a very cheap innovation, but it helps increase energy efficiency. When someone enters an area, the light is on. People can adjust the length of the lighting time when there is no movement in the area. After a certain time, the light goes out.

### Slide 5

#### Solar collector

Solar collectors were discovered in the 18th century, so the technology is not new. The basic operation is to use solar energy and convert it to heat water or space. While there are different types of collectors, they all work similarly. The most common solar collector is a flat plate.

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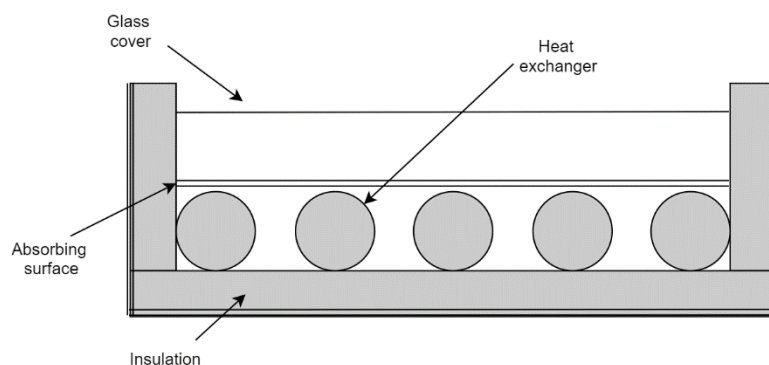


Figure 3. Flat-plate collector scheme

The absorbing surface may be:

- Black nickel electroplating surface



- Black chrome
- Black copper
- Pylon coating with titanium oxide

Heat exchanger - copper pipes with glycol inside (very important to use flat pipes or have channels inside the absorbing surface for a larger contact surface).

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## Photovoltaics

Unlike thermal solar collectors, photovoltaics (PV) produces electricity, not thermal energy. A photovoltaic cell is a semiconductor element, most often built on the basis of silicon (Si), in which an electric potential difference is created under the influence of incident light. However, a single link gives very little, so they are bundled together in the form of panels. The result is a direct current which is then converted into alternating current by the inverter.

Currently, there are 2 types of PV on the market:

- 1) Monocrystalline modules - more efficient, but also more expensive
- 2) Polycrystalline modules - less efficient but generally more common (around 90% of all investments)

Slide 7

## Energy Reclaim Ventilation (ERV)

Energy recovery through ventilation is becoming a very common solution in single-family homes. It has many advantages. ERV enables easier oxygen exchange in all weather conditions and helps to reduce heat losses by almost half thanks to an additional recuperator and heat exchanger coupled to the ground (on warmer days it works the other way around).

ERV is related to:

- Recuperator - enables the recovery of heat from the exhaust air
- Ground heat exchanger - can trap heat and / or dissipate heat to the ground

Overall, the solution is much more efficient than traditional gravity ventilation and is the basis for energy-efficient buildings. The main condition for the effective use of ERV is proper insulation of the house. In addition, the air passing through the ERV is much cleaner as it is pre-filtered by a filter in the recuperator.

Slide 8

## Rain water

Rainwater can have many uses, the most trivial of which are watering the garden and cleaning the car. Well-managed rainwater is not only a cost-saving solution, it is also environmentally friendly (helping to conserve groundwater resources).

Important factors influencing the design of the retention and drainage system:

- Ground and water conditions
- The minimum distance from other objects (trees, electrical installation, platform boundaries)
- Possibility to filter rainwater
- Does the system only need to deliver rainwater or will it have to drain the water to the sewage system?

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### Drainage system

Following a successful environmental assessment for our drainage system, we also need to consider rainwater contamination to select the appropriate filtration systems. This is very important as it guarantees a long and trouble-free system uptime.

Then we have to estimate the rain parameters using the PN-EN 752-4 standard or apply to the local meteorology office.

The most effective drainage system is based on boxes (according to research, 1 box with a capacity of 300 liters has more than 3 times the capacity of a drainage ditch)

How it's working:

- First, water from the roof is collected and transported through the gutters to the wells, where the filtration process takes place.
- Secondly, the water is transported to a storage tank or to a retention and drainage system (boxes can be used for various functions)
- Third, all boxes are covered with a geothermal membrane to prevent water from entering the ground

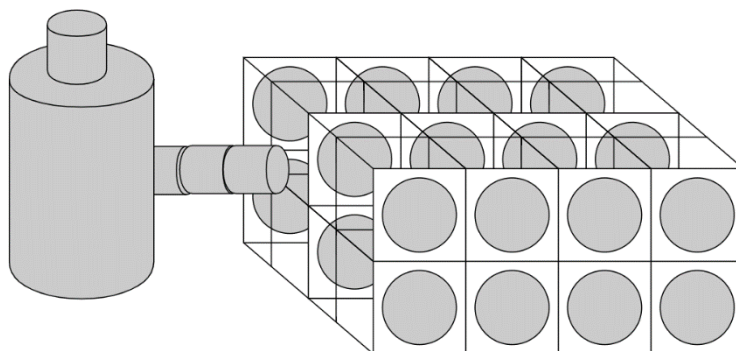


Figure 4. Boxes used in a drainage system