Renewable energies

LEONARDO da VINCI Partnership
"DISCOVER A NEW WORKING FIELD"

2012-1-TR1-LEO04-35470-1

Part 2

This project was financed with the support of the European Comission. This publication reflects only the views of the authors, and the Comission can not be held responsible for any use which may be made of the information contained therein.

Using geothermal energy

If we talk about the use of clean energy type such as geothermal then this has as practical applicability the hot water or steam. Considering the hot water extraction method and related technologies used, we can define the following methods:

· Water is in sufficient quantities and are only required low excavation for extracting it

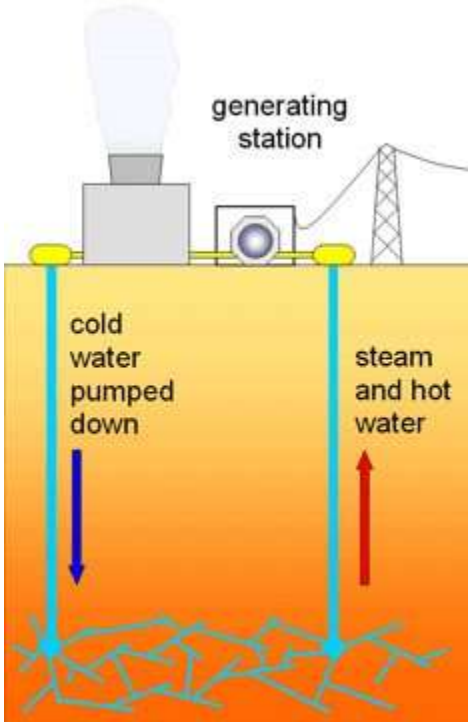
· Water is present but in insufficient quantities

In this situation it can be applied technologies that rely on hot water extraction. It can be concluded that not every place is suitable for energetic exploitation. Water should not regenerate and can be inexhaustible. Many corporations make major investments to consider soil and getting in the way of positive results from investments made. If the water is low, there is likely inflicted technology to exploit the energy potential. Another problem is the depletion of rich mineral content, with the water. It has a negative influence on the environment, in addition corrode pipes carrying hot water. It is not possible to use this energy directly but it must be used heat converters.

Generating electricity using geothermal sources

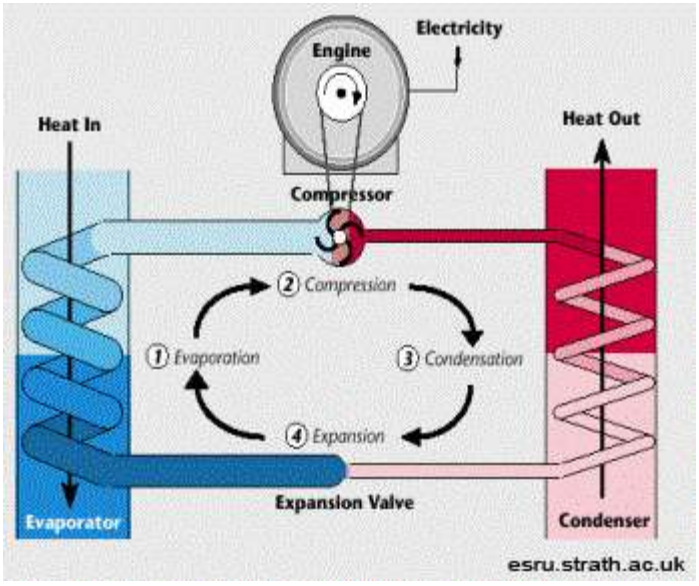
Power generation is one of the most important uses of geothermal energy.
Hot steam inside the Earth is collected and transmitted to the power generator without producing harmful emissions into the atmosphere, removing only water vapours with low pressure, that could be used for heating. Another advantage of this type of energy is that it can be used in various environments such as desert areas, wooded areas or even in areas of recreation resorts - if the environment allows. Geothermal power processing principle is simple. Cold water is pumped inside of hot granite rocks - used as a tank - located near the earth's surface and steam with a temperature greater than 200^0 C, is produced by the action of intense pressure. This steam enters a turbine connected to a generator that converts the mechanical energy into electricity. The system is similar to the common thermal power plants that use fossil fuels to generate the heat source. Water from the process is discharged into rivers, or, more often, is returned to the tank. Recycling water in the tank has the effect of reducing both pollution and reducing pressure loss inside the tank, and reduce their rate of loss.

The price of electricity depends on the temperature of the geothermal fluid in the reservoir. From an economic perspective, electricity becomes advantageous when geothermal sources have a higher temperature of 180^0 C. It can be produced electricity from geothermal sources that have a lower temperature of 180^0 C, but in this case, to be efficient, do not use water, but other organic liquid reaches its boiling point and keeps it when it passes through the turbine. This organic liquid is heated by the liquid geothermal liquid by heat exchange.



Hot steam rises, because the earth lithosphere at depths between 30 and 60 km below sea level, water may be present in the form of lakes. If they come into contact with lava, give rise to wet or dry steam, which rise to the surface. This steam is in most cases extremely harmful to human health. Using hot steam to produce electricity must include first the filter of the corrosive acid gas and sand, which harms powerful turbines.

The heat pump uses the energy from the ground, water or air. A heat pump can raise the water temperature a few degrees above zero, which can not be used in any way for direct heating of the house, according to a high temperature.



The first phase – evaporation: the refrigerant agent flows through the pump extracting heat from the air, water or land, changing its state from liquid to gas and then is evaporated.

The second phase – Compression: heat pump compressor compresses the refrigerant gas agent rapidly heating it a few degrees, by the physical principle of compression (high pressure temperature increases) to raise the temperature of the heat to low and high levels of temperature , about 80 ° C.

The third phase - condensation: heated refrigerant is sent to a second exchanger in water heaters, then is cooled and condenses, releasing heat into the water. Delivers heat radiators in the room and chilled water in the heating circuit returns to the secondary exchanger for reheating.

The fourth phase - Expansion: The refrigerant travels through the expansion valve back to the first exchanger, where it is reheated.

Heat pump does not start automatically, generally being electrically triggered, the stored energy is between 20 and 40% of energy produced.

At present, the compressor PC powered by an electric motor is used almost exclusively for domestic heating. Depending on the compressor used, heat pumps are divided into:

· Spiral route compressor - are more expensive but have a better heating factor. Currently is the most widely used type. Spiral compressor resistance is at least 20 years.

· Rotary compressor - can be found in air conditioners and cheaper heat pumps. Have a heating factor lower than spiral pumps compressor.

· Absorption Heat Pump - Works without compressor so it is completely silent. The disadvantage is a much lower heating element. Currently used for heating only in special cases but can still be found in air conditioning.

From an environmental perspective cooled and heated, heat pumps are classified as:

· Air / water - universal type, heating system,
· Air / Air - additional source of heat, hot air heating, air conditioning,
· Water / Water - heating using waste, geothermal heating, central heating,
· Antifreeze / water - universal type of heating system, heat is obtained by probing,
· Water / air - hot air heating systems.

Advantages and disadvantages of using heat pumps in industrial applications

Disadvantages current industrial heat pumps

• Lack of refrigeration in the temperature range of interest;
• Lack of experimental installations;
• Uncertainty about the reliability by heat pumps;
• Lack of necessary knowledge among designers and consulting engineers about the technologies needed to heat pumps and their application.

Advantages current industrial heat pumps

• high coefficients of performance in applications that require a low temperature variations
• operation at high ambient temperatures;
• extended period of operation during the year;
• relatively low investment cost due to large capacity unit and the small distance between the heat source and ambient heating;
• heat demand and heat production based on waste takes place simultaneously.

Biomass and its place among renewable energy sources

Obtaining energy from biomass is one of the oldest technologies used by human energy. Biomass used to generate heat and light since the Stone Age, and has remained an essential source of energy for another 400 000 years. He lost his primacy with fossil fuel-spread and electrification.
Biomass is organic material for energy purposes, found in nature or produced by human activities. It is solar energy stored by plants through photosynthesis, converted into organic matter. This is in the form of wood, plants or other agricultural residues, including fecal material from breeders can provide useful forms of energy in the form of:

- Electricity
- Heat
- Liquid fuel for cars

Biomass is one of the most important renewable energy sources, and a domestic source of energy and fuel production volume and price can be predicted easily enough.
Its importance is reflected in its storage capabilities of certain substances, especially in improving the level of CO_2. Plants absorb CO_2, thus reducing its concentration in the atmosphere.
Biomass is not only important as a source of energy, but can be as important or even play a role in socio-economic issues, especially in rural areas because it can create new jobs, permanent and sanitation help.

Definitia biomasei

Biomasa poate sa fie definita ca substanta de origine biologica (horticultura, cresterea de animale, produse de sorginte organica, resturi organice). Biomasa se poate produce in mod intentionat ca rezultat al unei activitati de productie, se pot folosi reziduuri agricole, resturi din industria alimentara si din exploatarea silvica, sau din partea sectorului municipal de intretinere si salubrizare.

Energy production from biomass

Nature of using biomass for energy is creating heat, which is used in the place of production or in its immediate vicinity. The heat is used to heat water or produce steam or in order to set in motion generator that produces electricity. Other products are charcoal and liquid bio-fuels for motor vehicles.

The process of energy production from biomass

The ability to produce electricity from biomass is bazaza on its physical and chemical properties. An important parameter is the humidity, respectively continuturl dry matter biomass. The distribution of the dry matter content:

- · Up to 50% solids - wet process
- · Over 50% solids - dry process

Distribution of the energy conversion process

- · Thermochemical conversion of biomass (dry process):
  - Cremation
  - Gasification
  - Pyrolysis
  - Biochemical conversion of biomass (wet process)
    - alcohol fermentation
    - a methane addition to its core
  - · Physical and chemical conversion of biomass:
    - Mechanical (division, crushing, pressing, briquetting, pelleting, grinding etc.)
    - Cchemical (the esterification of crude vegetable oils)
  - · Heat storage by processing waste:
    - composting
    - aerobic water purification
    - an anaerobic fermentation

There are several ways to use biomass for energy in practice prevail combustion process of solids processes involving wet biomass, biogas fermentation. Another way is production of bio-oil methyl ester.

Incineration

The method of direct combustion of biomass is the most common method of use of energy. This process is verified in practice and commercially available at very high levels. Combustion devices have different designs and performance, they are able to burn any fuel wood (timber), straw bales to municipal debris. Importance is burning wood waste (straw). Heat generated is used in manufacturing processes (process heat) and energy generation. Wood combustion takes place in the following stages:

- The water inside the timber begins to boil (old and relatively dry wood contains 15% water in cell structure)
- Wood fuel gas is gradually released for a good combustion is important that the gas is not released by burning chimney.
- Gas is mixed with atmospheric air and burned at high temperatures.
- The remaining wood (mainly carbon) burns well and produces waste ash.

For efficient combustion is required to be provided:Suficient aer,

- · Sufficiently high temperature,
- · Sufficient time to ensure complete combustion of biomass.

Although direct combustion is the simplest and most used way of using biomass, it is not always an efficient process. Designing a fuel tank, which is characterized by a much higher efficiency, requires understanding the entire combustion process. An important step is understanding the evaporation timber, a process that consumes energy. Energy consumption, however, represent only a small fraction of the available energy. Modern combustion devices are very similar to those used for coal and have a 90% fuel efficiency.

Pirolisys

Pyrolysis is a simple form, and probably oldest, amending biomass in a superior fuel, so-called charcoal (charcoal). Its production can be used both wood and other raw materials such as straw.
Pyrolysis involves heating biomass in the absence of air at temperatures between 300 ° C and 500 ° C to remove all volatile substances. After pyrolysis, coal is the fuel wood energy density nearly double compared to the original material and also burn better.
Pyrolysis may occur even in the presence of small amounts of air - gasification, water - steam gasification or hydrogen - hydrogenation. Not only wood charcoal, and other pyrolysis products have a considerable energetic importance. Modern systems are able to collect pyrolysis volatile products resulting from this process. One of the most useful products such as methane may be suitable for power generation in gas turbines. Liquid products from pyrolysis oil have a similar potential, but has a certain acidity, and therefore should be handled properly before use. Fast pyrolysis of wood at a temperature of 800-900 ° C, leads to the production of only 10% charcoal and up to 60% of the material is transformed into an energy-rich fuel gas containing primarily hydrogen and carbon monoxide .

Currently pyrolysis is considered a potential technology. This is related to the fact that it occurs at relatively low temperatures, leading to lower emissions of potential pollutants in relation to total biomass combustion. Emission reductions associated with this process leads to attempts pyrolysis of materials such as plastics and tires.

Gasification

Basic principles of biomass gasification are known from the early 19th century. This technology was so versatile and reliable that during the 2nd World War on Europe's roads several million vehicles were equipped with gasification units that produce gas then burned wood in your vehicle engine.
Gasification is the process of producing flammable gases such as hydrogen, carbon monoxide, methane and some flammable products. The entire process occurs by partial combustion of biomass heating with heat generated during combustion. Emerging gas mixture has a high energy value and can be used like other gaseous fuels to produce both heat and electricity, and in motor vehicles. In vehicles, this lowers gas engine power by about 40%.
Gasification can take place in a boiler with a limited air supply. Lack of oxygen causes incomplete combustion. For complete combustion of hydrocarbons that make up wood, oxygen combines with carbon and hydrogen and gives rise to CO2 and H2O. Insufficient ventilation allows an incomplete combustion, carbon is partially oxidized to CO, but is not hydrogen oxidized to form water molecules, but delivered as pure gas - H2. This process is also releases other components, such as carbon particles in the form of smoke. Heat generated by incomplete combustion is used to break bonds between atoms hydrocarbons. Carbon atoms of hydrogen release joins, releasing heat, claiming the entire process without releasing energy outside. The result is the release of gas, which can and it burns. Depending on the design of gasification devices can increase the rate of methane or other gas product. Gasification is thus simple process of obtaining gaseous fuels from solid fuels.

Synthetic fuels

Gasification using air instead of pure oxygen, producing a gas mixture containing mainly H_2, CO and CO_2. The advantage of this process is that after the removal of CO_2 to obtain a synthetic gas can be produced from almost any hydrocarbon. For example, a mixture of CO with H_2 may be obtained from the pure methane (CH_4). Another byproduct of the process is methanol (CH_3OH), which can serve as a direct replacement of gasoline in internal combustion engines. Methanol production process is relatively expensive and is not currently commercially exploited. It turned out that adding biomass technology can produce synthetic gas (and then methanol) to exploit coal.

Fermentation

Fermentation of sugars solutions is the production of ethanol (alcohol) from the biomass. This is an anaerobic process in which sugars are altered by the action of microorganisms (yeast) alcohol - ethanol or methanol. Ethanol is a high quality oil and

methanol can be used as a replacement for gasoline vehicles.
For the production of ethanol and methanol as raw materials can be used more plants: cereals, potatoes, corn, sugarcane, sugar beet, fruit and more. The value of any starting material for fermentation depends on the ease with which it is possible to obtain sugars. The best material is sugarcane, or molasses resulting from the extraction of juice from it. Other suitable materials are potatoes and grains. Sugars can also be obtained from cellulose, but the process is complicated. Cellulose is first shredded and then mixed with hot acid. After 30 hours the paste contains about 6-10% alcohol, which can be removed by distillation. Since the raw material used to produce biofuel obtaining valuable products that can replace protein feed. The entire fermentation process requires a considerable amount of heat, which is normally produced by waste incineration plants. Although the loss of energy in ethanol production is high, it is usually compensated by the quality of fuel and transportation easy.

Anaerobic decomposition

Nature has the ability to provide a method of disposal of organic wastes by their decomposition. Anaerobic decomposition occurs in the absence of air, the degradation occurs by bacterial agent rotting while under the influence of high temperature pyrolysis. Decomposition of organic wastes takes place above all in a warm and humid environment, and even under the water, resulting in the gases coming out of the water. Since gases are flammable, self-ignition may occur, which previously led to mysterious phenomena over the lakes. The gas generated from surface lakes such as gas generated by rotting organic matter in different environments is called biogas, consisting primarily of methane (CH_4) and carbon dioxide (CO_2).
Generation of biogas from waste incineration and gas turbines is a simple process and technology elements available on the market. Simplicity biogas collection and transformation into useful energy is so obvious that, in developing countries like India or China, there are millions of families to make use of very simple devices just using biogas for heating and cooking in households.

Solid bio-fuels

The term biofuels covers a number of sources of organic origin from wood to organic matter from municipal landfills. All biofuels are essentially solid, liquid or gaseous fuels from organic matter either directly from plants or indirectly from industrial wastes, agricultural or domestic. Plants except those that come directly from nature can be grown specifically for energy purposes.

Wood for energy production

For thousands of years wood has been one of the most important sources of fuel for humanity. Essential for its use is that energy can be recovered in a sustainable manner (is renewable). Worldwide, there is considerable potential for using wood for energy purposes.

Many of Europe's forests can be used for energy purposes without compromising existing natural ecosystems. This reflects the fact that harvesting and processing wood for energy purposes other than those involving large amounts of waste, often remain unexploited. Wood shavings, or sawdust, which can produce so-called pellets are a valuable fuel.

The big advantage of wood is that time keeps energy content, and even in the first two to three years there is a relative increase. This is because during this period the drying occurs. This is important because moisture is removed in wood boilers calorific price. At the same time burning wet wood lowers the combustion temperature, which leads to imperfect oxidation of all combustible components: appearance of smoke, fouling flue gas channels, reduce boiler life.

Wood Boilers

Today there are on the market a large number of small domestic wood burning boilers, which are designed to heat targets such as homes. Such boilers generally burn pieces of wood, pellets or kindling. Heat is transferred to radiators and so is distributed as in boilers using other fuels. Besides space heating, modern wood boilers are used for hot water production.
Many small wood boilers are equipped with a fuel tank and supply tank is done manually, but there are on the market and boilers with automatic feeding, which usually use pellets or chips, stored in a separate compartment. There are automatic boiler that regulates fuel delivery according to need home consumption. For larger boilers for wood heating objectives such as farms, energy saving is usually enough to be equipped with an automatic in the woodpile.

Preheat wood boilers

The simple wood boilers, so-called pre-heating boiler works on a principle similar to conventional wood stoves. Their construction is such that air enters through the bottom of the boiler and passes up through the fuel. In this case, the wood does not burn gas preheats quickly and completely as the boiler temperature is relatively low. Most of the gases are released to the basket, and with them more useful energy. Gases, also have very little space for transferring energy to another medium, such as water. These boilers usually are not suitable for burning wood, because their efficiency is low - about 50%.

Boilers with lower furnace

Bottom boilers burning boilers differ preheating. The air is passed into the whole volume of the fuel, but only on one side, and the combustion takes place only in the layer of wood at the bottom. The remaining wood dries slowly and release gas. Adding additional air directly into the flame to burn gas there, the situation improves. In modern boilers of this type is a ceramic combustion chamber, which is an excellent insulator and keeps the heat inside the room. This is achieved by firing at high temperatures and a

more efficient combustion. Current effectiveness of such boilers is about 65-75%.

Wood gasification boilers

Gasification boilers are among the most effective devices and are designed to burn fuel instead of pyrolytic distillation, in which all components undergoes gasification fuel. Combustion is a three-step process in each area of the boiler:
Zone 1 - gasifying wood
Zone 2 - burning wood gas from entering the nozzle secondary air preheating
Zone 3 - combustion chamber bottom in Nerac.

Thus, the system controller provides a high efficiency combustion - often up to 90%. With this in mind, boiler performance is continuously variable from 40% to 100%. Combustion space typically includes nozzles made of special refractory material. Control of boiler operation is done with a controller, depending on the temperature and its preferences.

Given the high degree of automation gasification boilers, operation of such devices requires only minimum requirements. Content fuel compartment is sufficient for at least 8-12 hours of operation at average power. Blackouts automatically go into standby boiler. The automatic operation of the fuel tank providing everything happens in the same way as gas or electric boilers. Special arrangements will ensure the provision of the heat during the day and night, depending on the objective needs heated. The boilers are designed for installation in a forced circulation or gravity. The boiler is usually a separate fuel supply, which must be properly insulated.

Mass gasification boilers can burn dry wood, natural wood waste in a variety of forms, from chips to stocks with lengths up to 80 cm and a diameter of up to 30 cm, briquettes or pellets. However, never painted wood boilers burn not paint or glue laminated as additives in paint or glue burning leads to the formation of toxic substances.

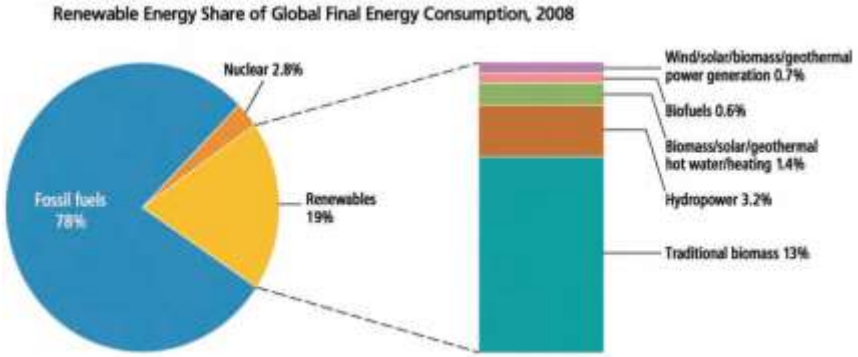
Buildings with very low power consumption

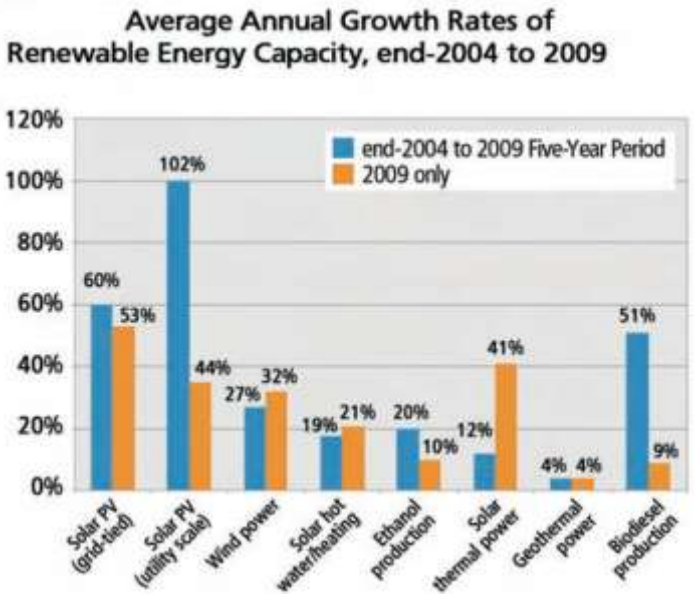
Passive houses

Key elements that contribute to a low power consumption, considering the severe demands on the health, comfort and cost effectiveness are:

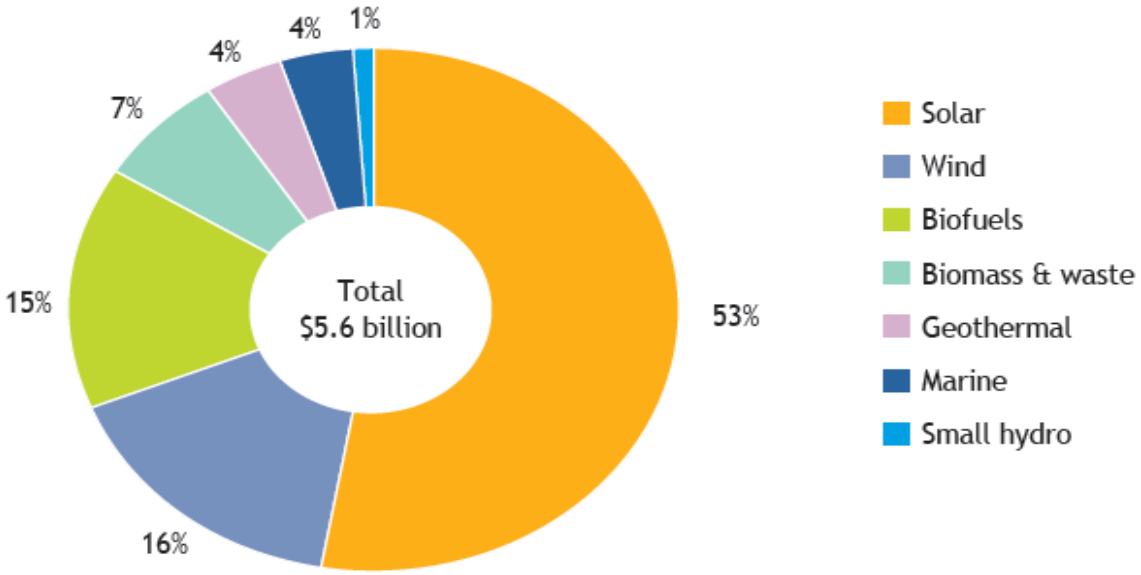
- Very high energy efficiency of the building envelope
- High thermal resistance
- Avoiding thermal bridges
- Excellent Tightness
- Ventilation and Energy Efficiency

Renewable energy production



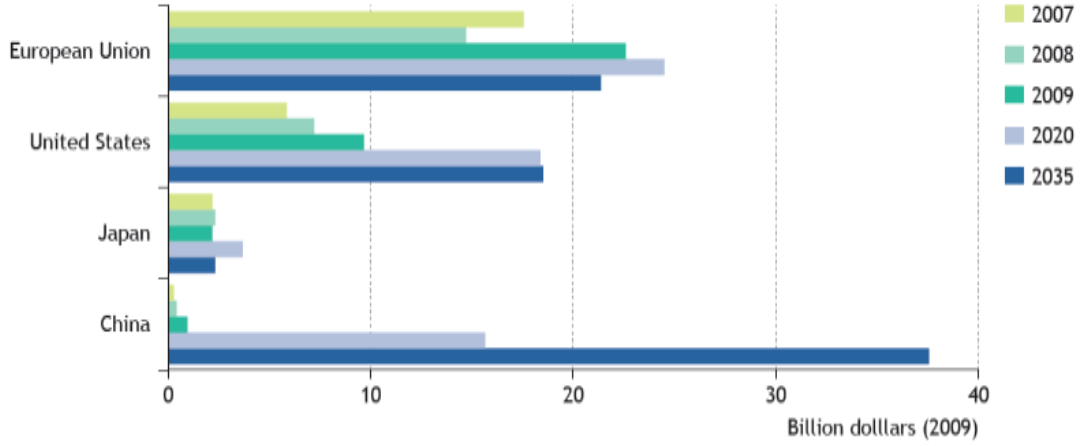


Global spending on research and development in renewable energy by technology, 2009

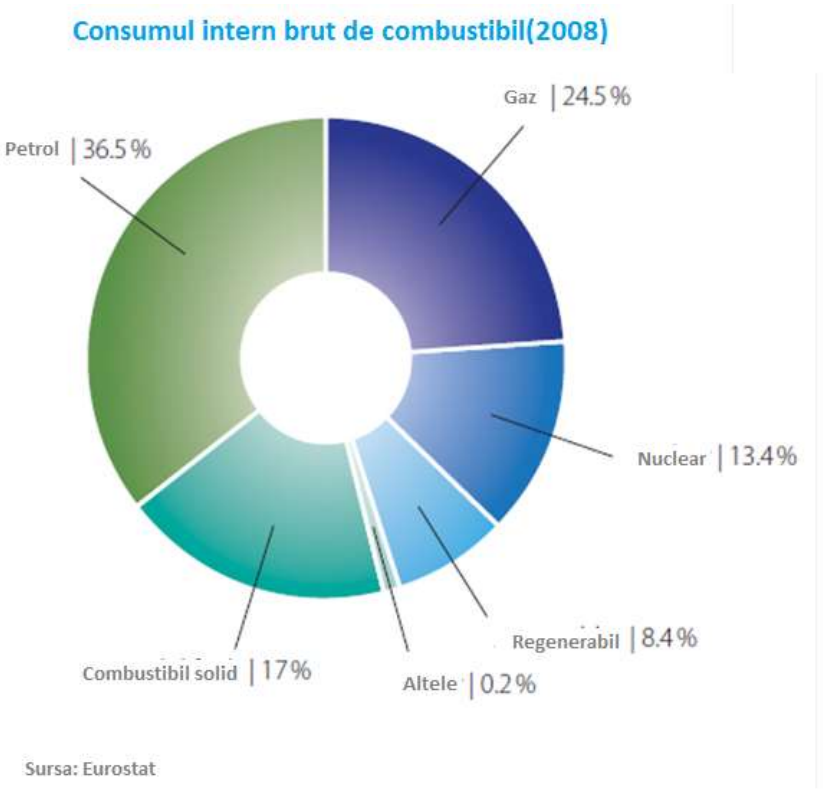


Source: Bloomberg New Energy Finance databases.

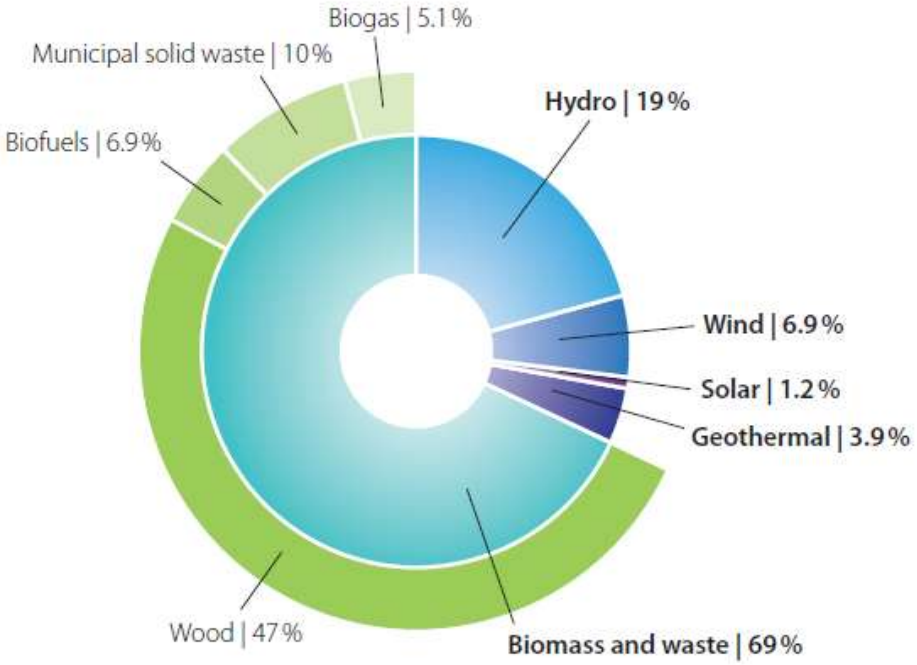
Global government support for renewables-based electricity generation by region in the New Policies Scenario



The expectations of EU in the field of renewable energy

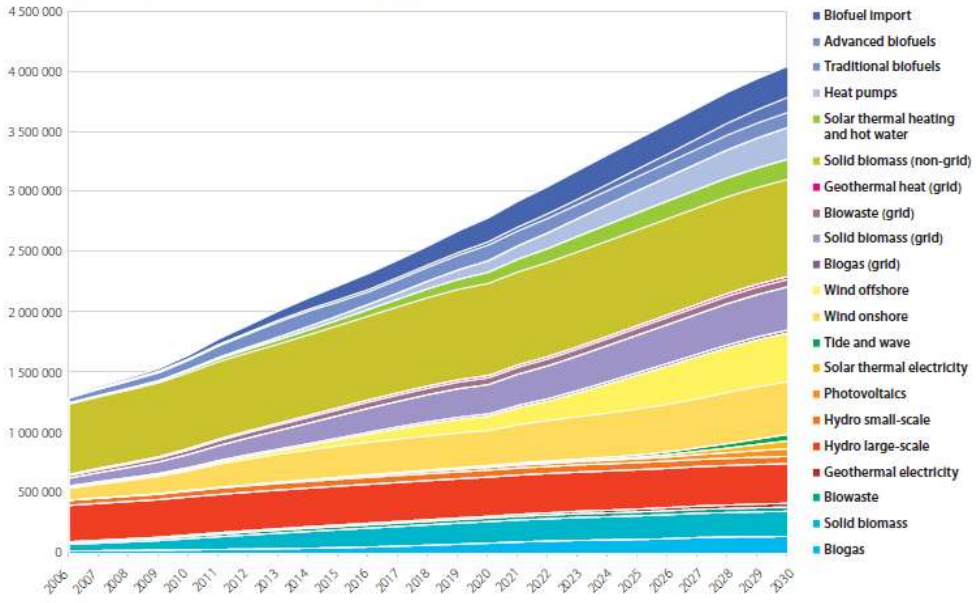


Primary energy production from renewable energy sources, breakdown by individual source (EU-27, 2008)



Source: Eurostat.

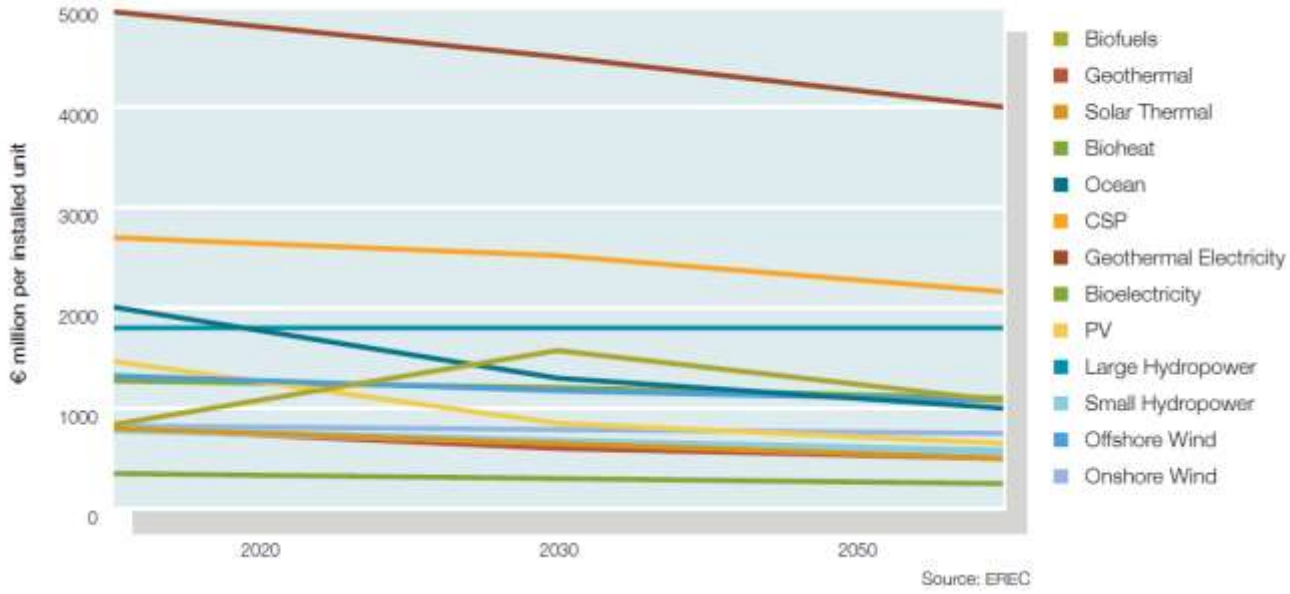
Green X-model estimate of renewable growth for the 'EU–27, 2006–2030, GWh



Source: Green-X model from the Fraunhofer Institute and EEG (European Economics Group — Vienna University of Technology).

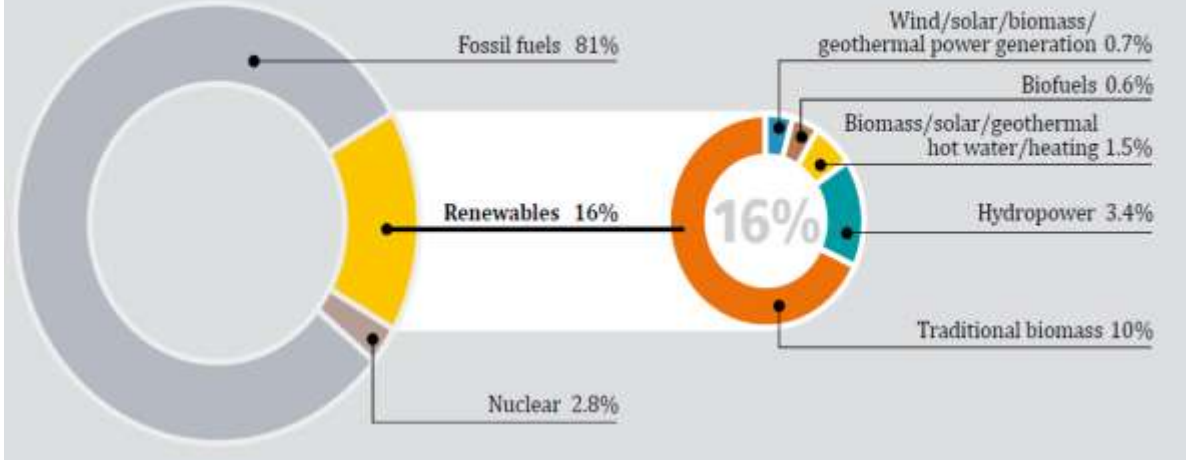
Further information: http://ec.europa.eu/energy/index_en.html

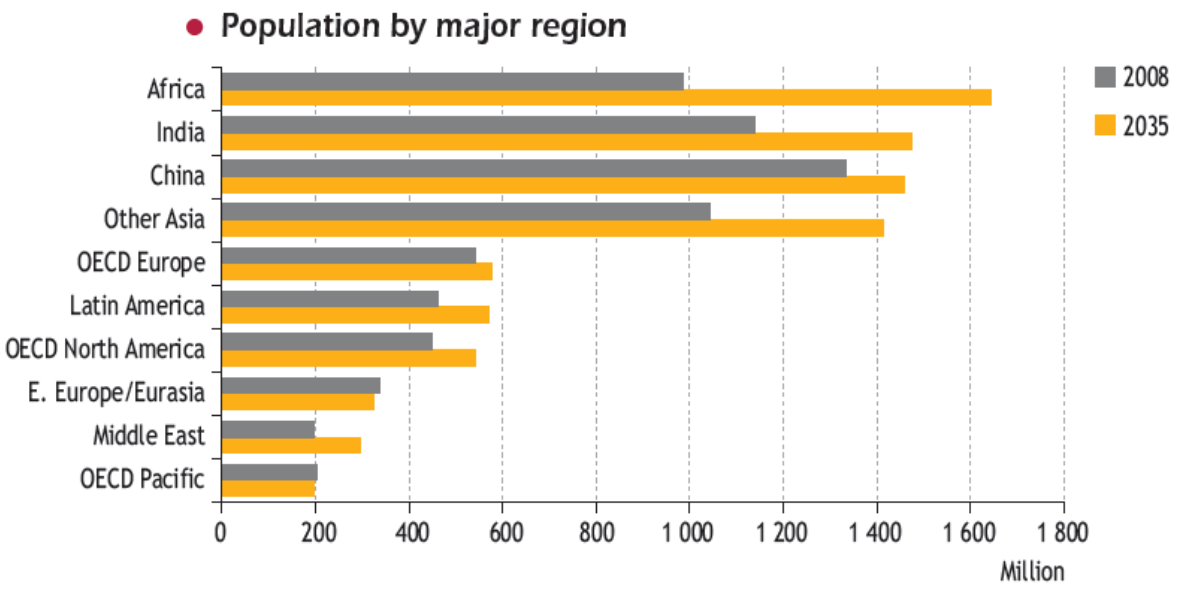
Capital Costs of Renewable Energy Technologies Per Unit Installed (2020-2050)

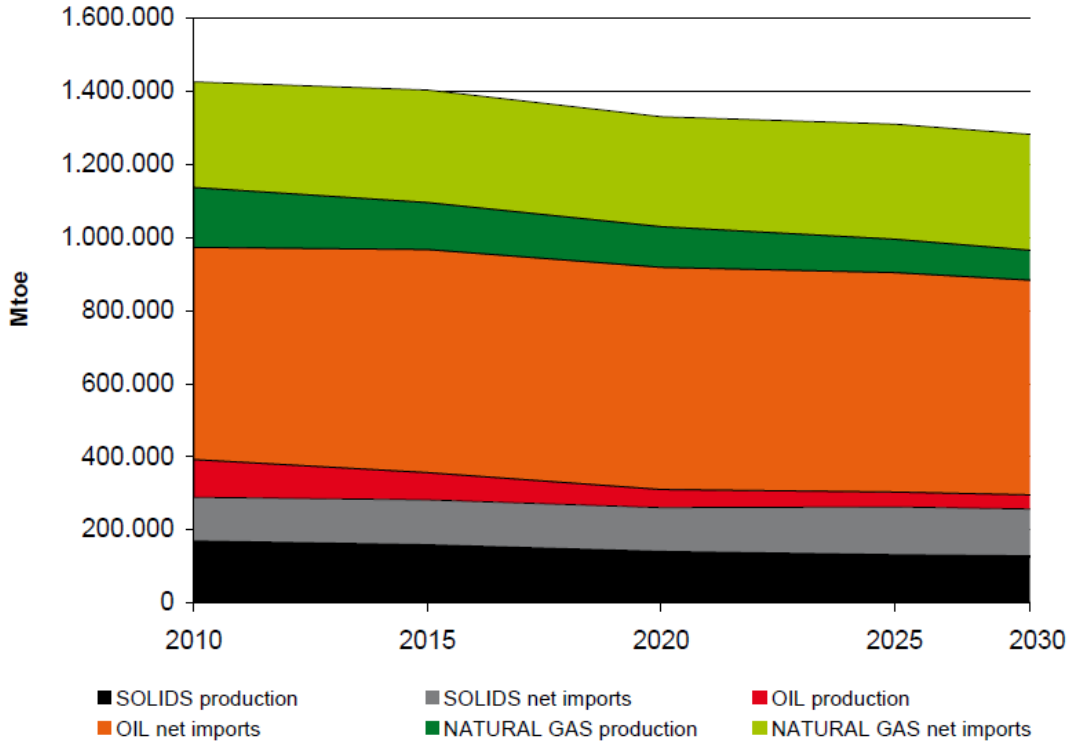


Source: EREC

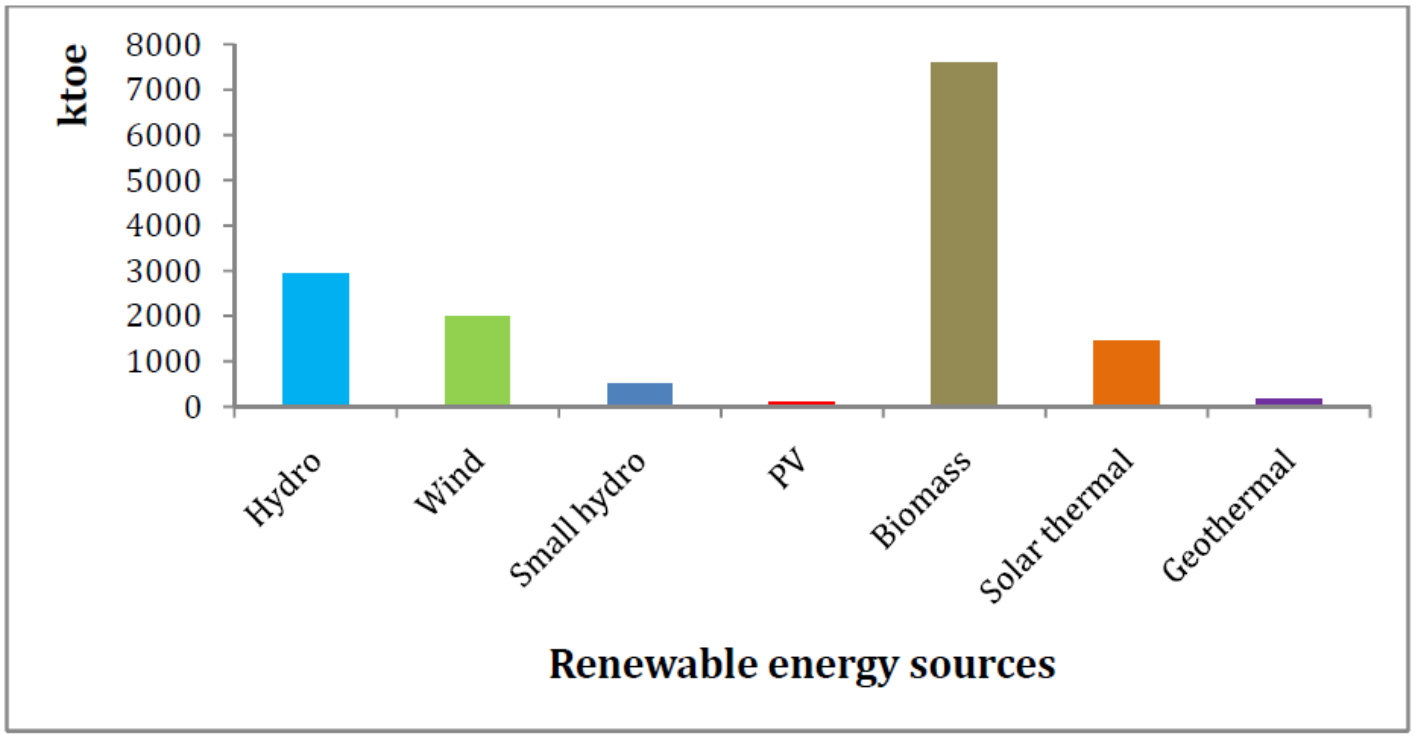
Renewable Energy Share of Global Final Energy Consumption, 2009







EU-27 fossil fuel consumption by origin in Mtoe (including bunker fuels), PRIMES reference scenario



Sources and Energy Potential of RES in Romania

Source: Own creation with data from (PNAER, 2010)