

## INTERESTING FACTS



In the summer of 2014, solar energy was responsible for 50% of the electricity produced in Germany on some days.



Sweden is a leader in the use of biomass energy. It accounts for 60% of renewable energy and 25% of total energy consumption in the country. Most of this energy is produced from biomass derived from separate waste collection and recycling.



Experience gained in the EU and North America shows that solar energy can be used on an industrial scale even at night. In Spain and the US, there are companies that generate electricity at night from heat accumulated from the sun by day.



In Iceland, 70% of energy consumption is provided by geothermal sources.



Over the last five years, the use of clean energy in the national electricity system of Portugal increased from 15% to 45%.



The UK and Germany plan to become the leaders of wind energy development due to offshore wind farms.



Due to strong winds, on one summer day in 2015, wind farms in Denmark produced 140% of the electricity needs of the country. This made it possible to export excess energy to Germany, Norway, and Sweden. In 2014, clean wind energy reached 39% of the electricity produced in Denmark for the year. It is expected that by 2020 this percentage will increase to 50%.



**Improving energy efficiency in buildings and reducing energy consumption as a whole is a prerequisite for the introduction of clean energy sources.** This must be the first stage of fossil carbon fuel substitution. It makes the process of transitioning to clean and safe types of energy possible.



Reaffirming the importance of energy, the English science fiction writer Arthur C. Clarke, many of whose scientific predictions came true, stated that by 2016 all currencies of the world will be superseded by a universal equivalent in the form of an energy consumption unit, the kW/h.



Saving 1% of the energy consumed in the world, or substituting 1% of fossil fuels with alternative energy sources, would mean the reduction of greenhouse gas emissions by 396 million tons, which roughly corresponds to burning 200 billion m<sup>3</sup> of gas.



**USAID** | MUNICIPAL ENERGY REFORM IN UKRAINE  
FROM THE AMERICAN PEOPLE



Проект USAID "Муниципальна енергетична реформа в Україні"  
[www.facebook.com/merpukraine](http://www.facebook.com/merpukraine)

[www.merp.org.ua](http://www.merp.org.ua)

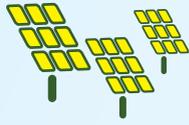


# CLEAN ENERGY — CLEAN FUTURE

## WHAT IS CLEAN ENERGY

Clean energy is energy generated from alternative and renewable energy sources (RES) as well as energy conserved by improving energy efficiency (EE).

ЕНЕРГІЯ  
СОНЦЯ



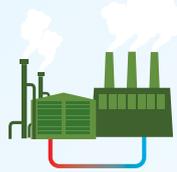
ЕНЕРГІЯ  
ВІТРУ



ЕНЕРГІЯ  
ВОДИ



ГЕОТЕРМАЛЬНА  
ЕНЕРГІЯ



ЕНЕРГІЯ БІОМАСИ  
ТА БІОПАЛИВА



ЕНЕРГІЯ  
ВІДХОДІВ



Solar energy, wind energy, hydro-energy, geothermal energy, biomass, biofuel and waste energy are all examples of RES that can form the basis of energy for the future and ensure zero greenhouse gas emissions to the environment.

Throughout the world, renewable energy sources generate heat and electric energy.

For example, in the European Union, a significant part of its thermal energy is produced from clean sources such

as biomass. In Sweden, biomass accounts for 60% of the heat production, in Austria – 31%, in Finland – 27%, in Denmark – 25%, and in Latvia – 15%. According to one forecast, by 2020 bioenergy will account for 65% of all RES energy consumed in the EU.

Fossil fuels cause global warming. They are coal, petroleum and natural gas. We must keep in mind that the more renewable sources are used in industry, housing, and communal services and other sectors, the less will be the need for fossil fuels, and the cleaner our energy will be.

## CLEAN ENERGY IS THE PATH TO ENERGY INDEPENDENCE FOR UKRAINE

An urgent need has appeared to minimize the dependence of our economy on imported gas. Ukraine needs to reduce its consumption in the short term by 50%. This can be achieved if various industrial sectors, agriculture, and especially the housing and communal services sector and the populace at home use mainly alternative and renewable energy sources.

Therefore, the Government of Ukraine has adopted a number of legislative initiatives to substitute natural gas usage. To speed up this process, mechanisms were developed for giving loans to the populace and stimulating investments in non-gas boilers in the buildings and communal sector facilities. The National Action Plan of Renewable Energy was approved, which provides for increasing the share of clean energy sources in Ukraine from 5% in 2014 to 11% by 2020.

Ukraine's municipal governments have readily joined the initiative. Realizing their important role in reducing

energy consumption and increasing the use of renewable energy, they are engaging more and more actively with the leading European Union initiative – the Covenant of Mayors. According to this Covenant, which has brought together more than 100 municipalities across Ukraine, local authorities accept voluntary commitments to improve energy efficiency and increase the use of renewable energy sources in their jurisdictions. Covenant signatories seek to reduce their emissions of CO<sub>2</sub> by at least 20% by 2020 through reduction of energy consumption by 20% and increasing the share of renewables to 20%.

**It is important to understand that implementing energy efficiency measures in multi-apartment buildings and using renewable energy sources in the private sector is a personal contribution that every Ukrainian can make toward Ukraine's energy independence.**

## ADVANTAGES OF CLEAN ENERGY USE

### ENERGY SECURITY

Reduces our dependence on imports of energy resources



### ENVIRONMENTAL SAFETY

Reduces the emission of pollutants and greenhouse gases



### ECONOMIC SECURITY

Promotes private investment in the energy sector, and the creation of new business and jobs



## WHAT IS IMPORTANT TO KNOW ABOUT THE USE OF CLEAN ENERGY SOURCES

In Ukraine, 98% of all renewable energy is from wind, sun, and water. Experts predict the rapid development of clean biomass energy, which is already widely used around the world. Today it is considered to have the brightest future for RES in Ukraine. Although biomass generates only 2% of alternative energy in this country now, it could easily grow to 20% by 2020.

**Energy of biomass and biofuels** – Biomass includes organic waste from agriculture, forestry and the housing and communal services sectors suitable for burning directly as well as for producing biofuels and biogas. Biomass that is regularly grown as an energy source and does not reduce vegetation in the region is recognized as a renewable resource and is considered to be environmentally neutral (has zero carbon emission balance). Wood granule pellets are the biofuels most often prepared for burning as they are environmentally beneficial, and existing gas boilers can be easily adapted for them. The economic feasibility of using any type of biomass usually depends on the distance the fuel needs to be transported. So, for example, in agricultural areas, straw or secondary agricultural waste is often used.

**Wind energy** – The potential for wind energy is 50 times more than humanity currently needs. Wind energy does not affect in any way the Earth's atmosphere, and it causes no environmental pollution or greenhouse gas emission. The major drawback of wind energy is its unreliability and our inability to control wind flow. It is very difficult to predict wind power plant production, even one day ahead. Further, wind turbines can contribute to soil erosion. They work best at an optimum wind speed of about 6 m/s. Another current drawback of wind turbines is their high price. The most attractive regions for wind energy in Ukraine are on the shores of the Black Sea and Azov Sea, the mountainous areas of Crimea, the Carpathians, and Odessa, Kherson and Mykolaiv oblasts.

**Solar energy** – This clean energy is also safe for the environment. It can be produced as long as the sun shines. Solar energy can be used throughout Ukraine. Solar energy plants (heliostations) are absolutely noiseless. A significant drawback is that such plants occupy large areas. Each MW produced by a solar energy plant (SEP) requires almost 2 hectares of land. The downside is also that the energy output is not constant. Nevertheless, the largest increase in solar energy capacity is in SEPs. Worldwide over the last 5 years, SEP capacity has increased by 50% every year, and in 2014 reached 170 GW. This amount replaces 170 nuclear units. Photovoltaic cells are what transform solar energy into electricity.

**Hydro-energy** – Water related energy also does not pollute the atmosphere. Hydro-energy produces 8% of Ukraine's total energy balance. New facilities can be placed in any region with either small or large rivers. There are over 22,000 rivers in Ukraine, most of which are small. Since the main potential of major rivers is almost harnessed and powerful hydroelectric plants are already built on them, further hydro energy development in Ukraine will focus mainly on small rivers less than 100 km long. An important condition for the construction and operation of small hydro-energy facilities is consideration of all environmental risks.

**Geothermal energy** – This is energy which derived from the natural heat of the Earth. There are high temperature geothermal sources of energy such as thermal waters, and low grade energy sources, which are formed due to the temperature differences between different layers of the earth or between earth and air. This energy is delivered by heat exchangers or heat pumps that bring the heat carrier to the required temperature. The Donets Basin, the Carpathians and Transcarpathia are all promising areas for potential high temperature geothermal resources. Heat pumps can be used in any part of Ukraine, as well as in households.

**Waste energy** – This energy comes from organic residues of animal waste, sewage, biological waste from the food industry and municipal trash. One way to produce this energy is to extract biogas from solid or liquid waste. Special biogas plants serve this purpose at wastewater treatment plants, farms, and enterprises processing agricultural products, or at landfills. The main component of biogas is methane, which has the potential to replace natural gas as a fuel in Ukraine for production of heat and electricity. Waste energy is an alternative, and eventually it could satisfy the needs of large cities for energy resources. A second way to produce energy from waste is by burning municipal trash directly to produce steam or hot water that generates electricity or heat. The fuel is free, and incineration also solves the problem of waste accumulation in landfills. However, the plant operator must use special equipment to clean toxic elements from the exhaust gas.

For more information about the sources of clean energy and how they are used, see the Alternative Energy section at [www.merp.org.ua](http://www.merp.org.ua).