ENERGY FOR ALL

A guide to key concepts and institutions in the energy sector

USAID
FROM THE AMERICAN PEOPLE

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USAID's Energy Policy Activity (USAID EPA) wishes to express gratitude to members of the Public Outreach Working Group who have contributed to the quality of this document with their work. It was a pleasure to work with you.

"If you want to find the secrets of the universe, think in terms of energy..."

(Nikola Tesla)

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1. INTRODUCTION

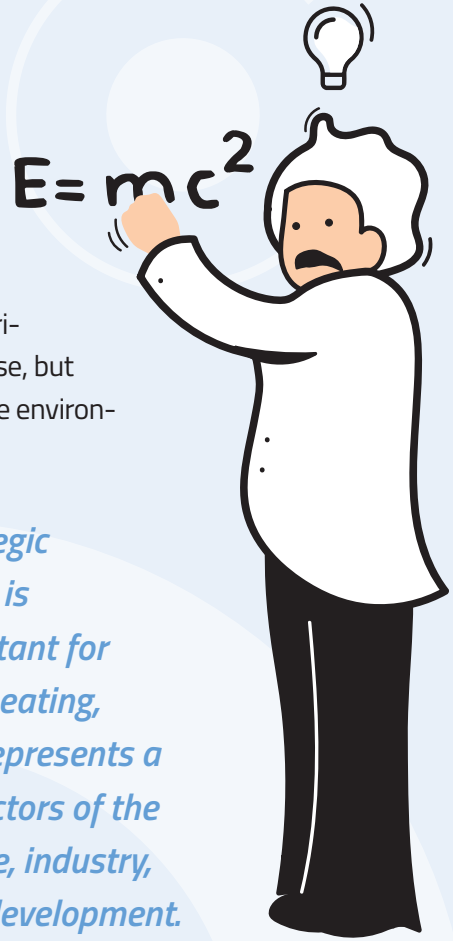
1.1 Why is this Guide necessary?

Energy is the driving force behind everything. The word that originally comes from the Greek language (ἐνέργεια) has found its place in most living languages. It is used in different scientific disciplines, physics, biology, chemistry, technology, economy or in a philosophical sense.

It is present in the famous formula ($E = m c^2$) in which Albert Einstein stated that energy is the product of mass and the square of the speed of light. We know that energy is present in everything that surrounds us, in every substance, microparticle and even in the unimaginably distant depths of space. Everyone needs energy and everyone should use it, but also know and understand it.

With the spread of knowledge about energy and its manifestations, a special scientific and practical field called energetics (energy technology) emerged. Energetics deals with energy sources, the transformation of different forms of energy into the required form, the generation of electricity, transmission and distribution, procedures for its rational use, but also the effects of energy use on the environment.

The energy sector has strategic importance because energy is necessary and vitally important for everyday life - for lighting, heating, transportation, but it also represents a key element for all other sectors of the economy such as agriculture, industry, services and research and development.



Modern times require large amounts of energy and therefore a functional, operational, adaptable and stable energy sector is crucial for survival and development.

At the same time, it is one of the key economic sectors in Bosnia and Herzegovina.

The complexity of energy and the energy sector and the need for their understanding by the public at large were the guiding ideas for creating this Glossary, which will serve everyone as a kind of a guide to key concepts and relevant institutions.

The glossary provides clarifications of key, universally used terms from the energy sector without the intention of merely presenting fixed definitions in a scientific or legal sense. A part of the document deals specifically with Bosnia and Herzegovina, primarily providing clarification of the structure, functioning and the role of institutions and organizations in the energy sector, but it also provides an overview of the legal framework in Bosnia and Herzegovina.

1.2 For whom is the Glossary intended?

The shortest and the most correct answer is – for everyone!

Consequently, this called for a special approach to the preparation of this document whereby precise definitions and explanations would be written in accordance with the rules of the profession. On the other hand, the language and style used will undoubtedly make the Glossary useful to the domestic public, but also to all those who wish to learn more about the energy sector in Bosnia and Herzegovina.

Decision makers, as well as those responsible for implementing decisions, will also be able to find answers to key questions in the Glossary.

This is also an important document for media professionals as it has been designed to expand the understanding of the sector and to help adequately prepare for reporting on the energy sector. The document provides clear insight into the various responsibilities and

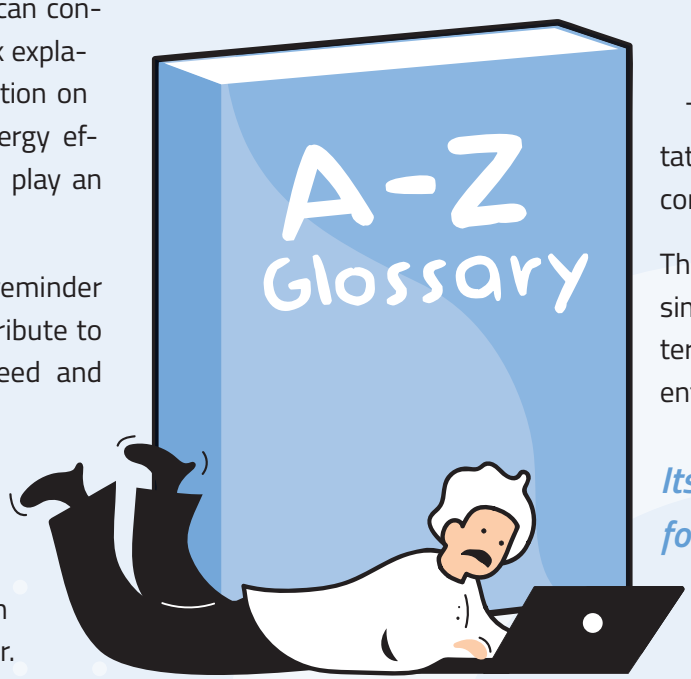
relevant institutions and organizations in order to facilitate comprehensive, accurate and timely reporting and recognition of the importance of this field and its impact on the lives of the citizens.

And having mentioned citizens: this is their document!

The document contains a wide range of information, including how prices are set, it explains the electricity bill and bills for other fuels, it provides addresses citizens can contact when they need answers or seek explanations, but it also provides information on incentives and ways to improve energy efficiency, as well as how citizens can play an active role in the sector.

This document will also serve as a reminder for experts in the field and will contribute to their consistent understanding, speed and efficiency.

It is worth mentioning that this document is an excellent ally to all those getting prepared for public and media appearances on matters concerning the energy sector.



The document's conciseness and easily understandable language will be of great help when preparing media messages and will contribute to their better understanding.

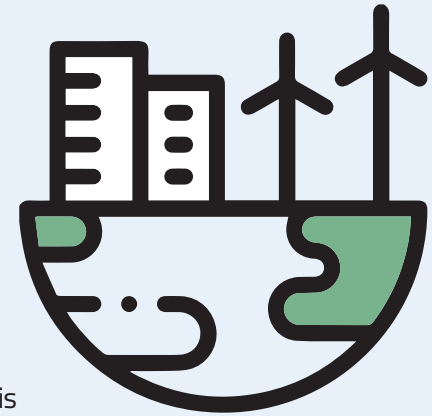
The fact that members of the USAID Energy Policy Activity's (EPA) Public Outreach Working Group in Bosnia and Herzegovina took part in the preparation of the Glossary adds special value to this document. The Working Group is comprised of representatives of the relevant ministries, regulators and companies in the energy sector.

The structure of the document allows for its simple use, regardless if the user needs a single term, a chapter or the broader context, i.e., the entire text.

Its online format makes possible for regular updates to reflect new information and changes in the sector.

2. WHAT IS ENERGY?

Energy is a physical quantity that represents the ability of a body or system to perform work or to bring about a change in its environment.



In nature, it exists in different forms, such as: kinetic, potential, electrical and thermal energy. Energy can neither be created nor destroyed, it can only change its form. An example of energy transformation is the conversion of the mechanical work of the generator into electrical energy, as is the case in hydroelectric power plants.

Energy can be categorized in many ways. According to form and usability, it is divided into primary, secondary (or transformed) and useful forms of energy.

2.1 Primary forms of energy

Primary forms of energy are found in nature or appear in it. According to renewability, they can be classified as:

- **non-renewable energy sources** are those that cannot be renewed when consumed and are currently used for satisfying most of our energy needs, which poses a great problem for humanity. They are further divided into:
  - fossil fuels (coal, crude oil, natural gas, oil shale, peat, etc.) and
  - nuclear mineral raw material (uranium, thorium, etc.);
- **renewable energy sources** (RES) are those that are renewed on their own or through certain processes and are inexhaustible by their nature. They are a source of clean energy and their use preserves the environment. These sources include:
  - hydro energy;
  - wind energy;
  - solar energy;
  - biomass;

- biogas, gas from waste or water treatment facilities;
- tidal energy and other sea and ocean energy;
- geothermal energy.

2.2 Secondary forms of energy

Certain primary forms of energy cannot be used in their natural form because it is environmentally unacceptable and economically or technically unviable. Energy transformation is then applied to obtain secondary energy sources.

Secondary forms of energy include: thermal and electrical energy, oil derivatives, enriched nuclear fuel, coke, briquettes, etc.

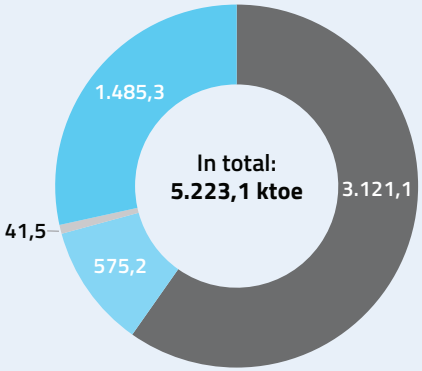
The most common energy transformations are:

- **combustion** (chemical change where combustible ingredients of a fuel oxidize creating heat and possibly light);
- **turbine transformations** (transformations of potential, kinetic energy or geothermal energy into mechanical energy);
- **distillation** (transformation of crude oil into oil derivatives);
- **nuclear reactions** (a process of changing atomic nuclei by external influence);
- **coking** (dry distillation of coal at high temperatures without the presence of oxygen to obtain metallurgical coke) and
- **degassing** (selective separation of hydrocarbons from natural gas).

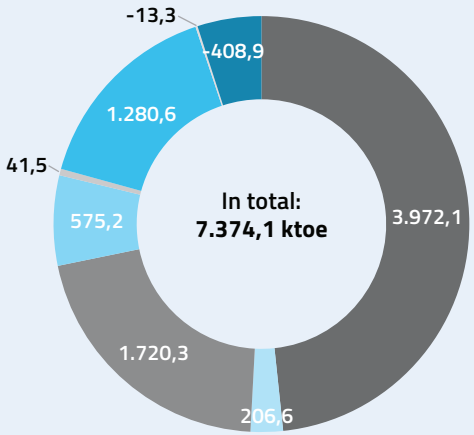
2.3 Useful forms of energy

Useful forms of energy are created through certain transformations and can then be used by consumers. Useful forms of energy include: heat, mechanical, light and chemical energy.

Primary production of energy in BIH in 2021 (in ktoe)



Gross available energy in BIH in 2021 (in ktoe)



- Solid fossil fuels
- Natural gas
- Oil and oil derivatives
- Hydropower
- Solar, wind energy and biogas
- Primary solid biofuel
- Charcoal (export)
- Electricity (export)

Primary production of energy is any extraction or gathering of energy products in a useable form from natural sources. This occurs when natural sources are exploited (for example, in coal mines, crude oil fields, hydro power plants, wind farms and solar power plants) or in the fabrication of biofuels. Transforming energy from one form into another, such as electricity or heat generation in thermal power plants (where primary energy sources are burned), or coke production in coke ovens, is not primary production.

Gross available energy represents the quantity of energy needed for satisfying all the energy needs of the country. It includes: energy needed for transforming energy into useful forms and for the operation of the energy sector itself, as well as for transmission and distribution losses, final energy consumption, fossil fuels used as raw material for non-energy purposes (e.g. in the chemical industry) and all other energy products purchased by the country, but used elsewhere (e.g. kerosine for international aviation).

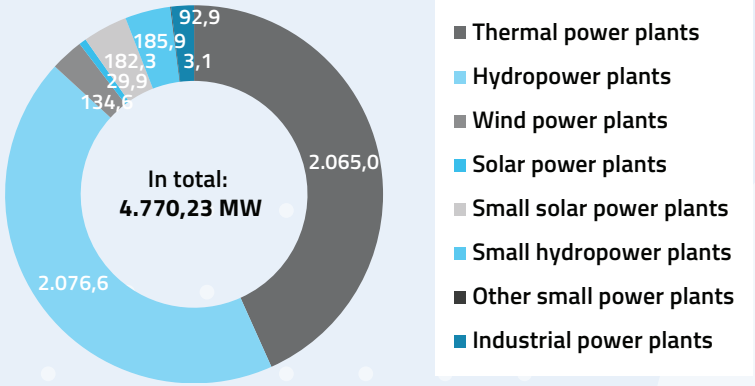
3. ELECTRICITY

3.1 Electricity generation

Electricity is the standard and most frequently used form of energy for residential and industrial consumption. It is produced in power plants by transforming other forms of energy, i.e., by using fossil, renewable (water, wind and sun energy, etc.) or nuclear fuels.

- **What is installed capacity of a power plant?** Maximum output a power plant is able to continuously generate under normal operating conditions. It is usually expressed in kilowatts (kW) or megawatts (MW).

Installed capacity of generation facilities in Bosnia and Herzegovina, 31 December 2023. (MW)

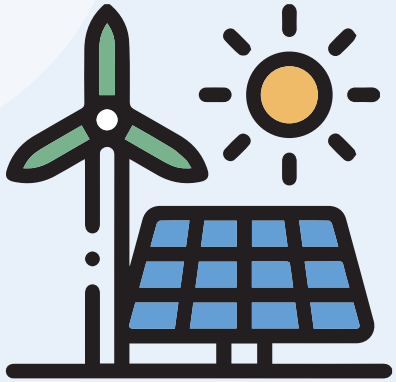


Hydropower – is a renewable energy source fueled by moving water. It is characterized by the highest level of energy efficiency in energy transformation.

- **How is electricity generated in hydropower plants?** The water flow turns the turbine connected to the generator and as a result mechanical energy is transformed into electricity. There are two types of hydropower plants: those using the flow of rivers (with a possible small reservoir), and impoundment plants where water is accumulated and subsequently used when the need arises for electricity generation. Although hydropower plants can be generally described as environmentally acceptable, there are certain problems, such as: negative impact on biodiversity, preventing the migration of fish and disruption of river continuity, silt build-up in riverbeds, risk of dam failure, etc.

Wind power – kinetic energy of wind traditionally used for moving boats (sailboats), as well as in windmills, such as mills for milling grain or as water pumps.

- **How is electricity generated in wind farms? ?** A wind farm is comprised of an array of wind turbines all exposed to the same wind and connected via a common switchgear to the power system. The wind turbine uses rotor blades to transform kinetic energy of the wind into mechanical energy, and then through generators into electricity.



Solar energy or radiation from the sun is the most abundant and completely clean source of energy. Solar energy created by nuclear reactions is directly or indirectly the source of almost all available energy on Earth. Solar panels or collectors are used to transform solar energy into heat energy or can be used for heating water. Solar photovoltaic power plants and solar thermal power plants are used for the generation of electricity.

- **How is electricity generated in solar power plants?** Solar photovoltaic power plants directly transform solar radiation into electrical energy. When the solar ray reaches the photovoltaic cell, a certain amount of light (photons) is retained and absorbed, and the photovoltaic panels transform these photons into electricity. The second type of solar power plants (solar thermal power plants) transform solar energy into thermal energy and then into electricity. Given that this process requires high temperatures, practically all forms of solar thermal power plants use some form of concentration of solar rays from a large surface to a small space.

Coal is a fossil fuel formed from remnants, i.e., the products of plant and animal decomposition, it represents a non-renewable energy source and a so-called "dirty" fuel. Fuel is any matter that can serve as a source in the process of obtaining useful energy (short: "source" of energy).

Biomass is a biodegradable portion of a product, waste or logging and agriculture leftovers, including matter of plant (wood, sugarcane, etc.) and animal origin. It is a renewable energy source usually released by burning, which creates carbon dioxide, and the use of biomass does not mitigate the emission of greenhouse gasses.

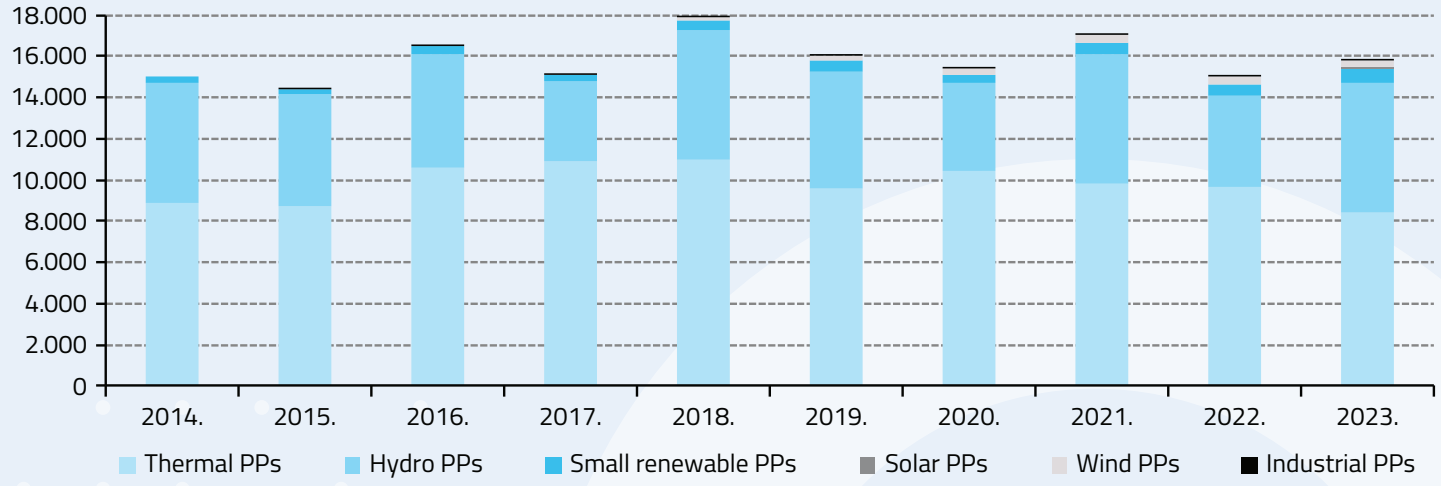
Biogas is a gaseous fuel produced from biomass, by anaerobic decomposition or fermentation of organic matter (such as a sewage sludge, municipal waste, manure or some other degradable waste), primarily composed of methane or CO_2.

- **How is electricity generated in thermal power plants?** Thermal power plants generate electricity by burning a certain fuel (coal dominates as the primary form of energy in BIH; certain plants use natural gas, biomass, biogas, etc.) in order produce thermal energy. The produced steam is transformed into mechanical energy. The turbine drives the generator rotor. An al-

ternating generator has a source of magnetic field in the rotor, while the stator has coils in which an electric voltage is induced. This means that mechanical energy is transformed into electrical energy in the generator.

- **Cogeneration** (*Combined Heat and Power* – CHP) is the simultaneous production of both electricity and useful heat in a single process. The waste heat produced by standard electricity generation in a CHP thermal power plant is in most cases used for heating settlements or cities.

Electricity generation in BIH over the last ten years (GWh)



Nuclear energy is a form of energy released by nuclear fission, nuclear fusion or radioactive decay. The energy of particles is in the core of the atoms, made up of protons and neutrons linked by strong or weak nuclear forces. Nuclear reactions include changes in the atomic nucleus (number and type of particles in the nucleus changes), unlike chemical reactions which are limited to changes in the electron structure around the nucleus. Nuclear energy is used in the industrial sector, the production of other forms of energy, in medical and scientific research, transportation and, unfortunately, in the production of nuclear weapons.

- **How is electricity generated in nuclear power plants?** A nuclear power plant is in essence a thermal power plant which uses heat produced during atomic fission of a nuclear fuel (isotopes of Plutonium Pu-239, Uranium U-235 and U-233) in the nuclear reactor. Heat is then used to produce water steam to spin steam turbines connected to electrical generators. A well-constructed nuclear power plant is a reliable, safe, economically and (for many) environmentally acceptable source of electricity because this is a technology practically without greenhouse gas emissions.

Is generation from renewable energy sources in BIH incentivized?
In order to increase the share of electricity generated from renewable energy sources in Bosnia and Herzegovina, legislation prescribes incentives for electricity generation in small plants by ensuring a guaranteed price above the market price (feed-in tariff – FIT), as well as for large plants in the form of an additional fixed premium for delivered electricity (feed-in premium – FIP), on top of the market price.

Who is responsible for the incentive system?
The Operator for Renewable Energy Sources and Efficient Cogeneration (RES Operator) is responsible for the operational implementation of incentives in the Federation of Bosnia and Herzegovina, the Directorate for Incentive System Operator Affairs is responsible in the Republika Srpska and in Brčko District of Bosnia and Herzegovina the responsible authority is the Incentive System Service, which is a part of the Brčko District Government's Department for Utility Affairs, Sub-Department for Utility Services Development and Strategy.

The charge for incentivizing electricity generation from renewable energy sources and efficient cogeneration is a legally prescribed charge and obligation paid by all end customers in order to collect funds for incentives.

How is the incentive charge paid and used?

Pursuant to rules governing incentives for electricity generation from renewable energy sources and efficient cogeneration, as well for setting incentive charges, each supplier is required to clearly indicate the amount of the total charge for incentivizing electricity generation from renewable energy sources and efficient cogeneration as a separate item on the electricity bill sent to the customer. Rules provide for a unit charge expressed in Convertible Marks (KM) per used kilowatt hour of electricity (KM/kWh). The collected funds go to the competent RES operators and are then used for payments to RES electricity generators, to cover the cost of work of the operators, as well as other costs related to the incentive system.

Feed-in tariff (FIT) is the guaranteed electricity purchase price for small generation facilities which is set administratively or through a FIT auction, i.e., a bidding process.

Table: Installed capacity of small facilities eligible for incentive

	Federation BIH	Republika Srpska	Brčko District BIH
Solar power plants (ground-mounted)	≤ 150 kW	≤ 150 kW	≤ 150 kW
Solar power plants (rooftop)	≤ 150 kW	≤ 500 kW	≤ 500 kW
Wind power plants	≤ 250 kW	≤ 150 kW	≤ 150 kW
Hydro power plants	not applicable	≤ 150 kW	≤ 150 kW
Biomass or biogas power plants	≤ 500 kW	≤ 500 kW	≤ 500 kW

Feed-in premium (FIP) is a fixed premium awarded to the FIP auction winner, in addition to the market price of electricity. All large facilities (not eligible for the feed-in tariff) generating electricity from renewable energy sources and efficient cogeneration are eligible for the feed-in premium.

Table: Installed capacity of large facilities eligible for incentive

	Federation BIH	Republika Srpska	Brčko District BIH
Solar power plants (ground-mounted)	> 150 kW	> 150 kW, ≤ 50.000 kW	> 150 kW
Solar power plants (rooftop)	> 150 kW	> 500 kW	> 500 kW
Wind power plants	> 250 kW	> 150 kW, ≤ 50.000 kW	> 150 kW
Hydro power plants	not applicable	not applicable	> 150 kW, ≤ 10.000 kW
Biomass or biogas power plants	> 500 kW	> 500 kW	> 500 kW

3.2 Electricity transmission and distribution

Electricity transmission is the transmission of electricity via a high-voltage interconnected system (alternating current – AC) in order to deliver it to end customers or distributers.[1]

Transmission System Operator (TSO) is a legal person responsible for the operation, maintenance and development of the transmission system and its connection with other systems.

Electricity distribution is the transmission of electricity via medium voltage and low voltage distribution systems for its delivery to end customers.

- **Distribution System Operator (DSO)** is a legal person responsible for the operation, management, maintenance and development of the distribution system in a given area. It is connected with other systems.

1 Electricity transmission over large distances is also possible with high-voltage direct current (HVDC), but this technology is not used in Bosnia and Herzegovina.

How does electricity flow?

Electric energy flows in closed electric (current) circuits from the point of higher towards the point of lower potential. Electric energy generated in power plants is delivered to consumers via transmission and distribution power lines. This complex power system includes substations with transformers, switchgear and power lines connecting generators with electricity consumers.

High-voltage power lines allow for the transmission of electricity over large distances, from power plants to consumers on the transmission network, distribution networks and neighboring power systems. Medium voltage and low voltage power lines are used for the distribution of electricity to customers on low and medium voltage, as well as the transmission of electricity generated in power plants connected to the distribution network.

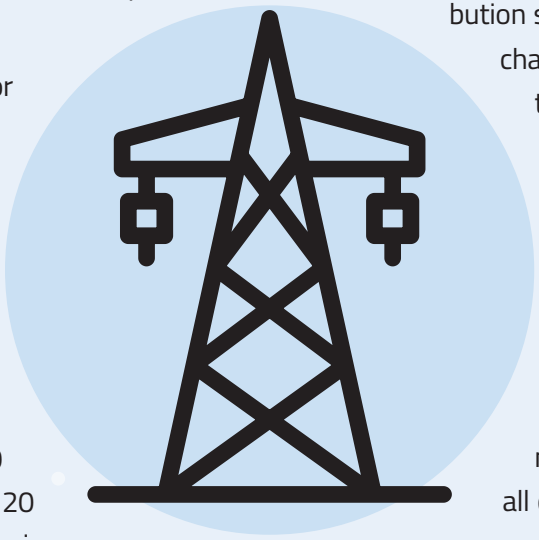
Substation (transformer station is an electrical facility with one or more power transformers. It has switchgear, as well as control, oversight and protection equipment. It is connected to the transmission and/or distribution system via power lines or cable lines. Electricity can flow from the power plant to the consumer through several substations with different voltage levels.

Power transformer is an instrument transforming high voltage into lower voltage and the other way around. This is the most expensive instrument in the power transmission system, but it is vitally important for the efficient transmission of electricity over great distances.

Power line is an overhead line of high, medium or low voltage used for the transmission and distribution of electricity.

Cable line is an underground or underwater line of high, medium or low voltage used for the transmission and distribution of electricity.

Voltage levels are standardized voltage values used in electricity transmission and distribution. In BIH, high voltage includes 400 kV, 220 kV and 110 kV; medium voltage includes 35 kV, 20 kV and 10 kV; and low voltage is 0.4 kV. Electricity is supplied to households at a voltage between phase conductors of 400 V, whereby the voltage between each phase conductor and the ground is 230 V, with permissible deviations of ±10%.



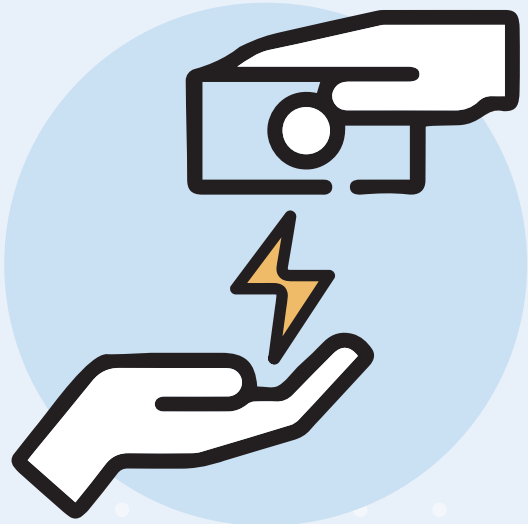
Electricity losses occur as electricity flows through the transmission and distribution system from the point of generation to the point of consumption. They can be either technical (unavoidable heat losses) or non-technical (unregistered and unauthorized consumption).

Network charge is a tariff for electricity transmission or distribution services, which is used for the calculation of the charge for the use of the network. These funds are then used to cover the costs of operation, management, maintenance and necessary investments. These tariffs are set by the regulatory commission based on pre-defined transparent methodologies (regulatory commissions in BIH are DERK, FERK, RERS - each in their own domain). Network charges are cost reflective, they are transparent and non-discriminatory, consequently they are the same for all customers from the same category in a defined geographic area. These charges are non-negotiable.

What does the customer pay as part of the network charge?

- Costs of the distribution system (operation, maintenance and development);
- Costs of the transmission system (operation, maintenance and development);
- Costs of power system management, and
- Costs of system services, i.e., ancillary services (balancing services – frequency and active power control; voltage and reactive power control, covering losses in the transmission system, etc.).

All these costs are determined by the competent regulator.



3.3 Electricity trading

Electricity trading is the purchase and sale of electricity on the wholesale market between various participants (producers, traders and suppliers), but does not include delivery to final customers.

Power exchange is an organized marketplace for trading electricity at the day-ahead or intraday time horizon depending on the time of electricity delivery. In terms of electricity trading, organized markets complement bilateral contracting or the OTC market (Over the Counter – OTC).

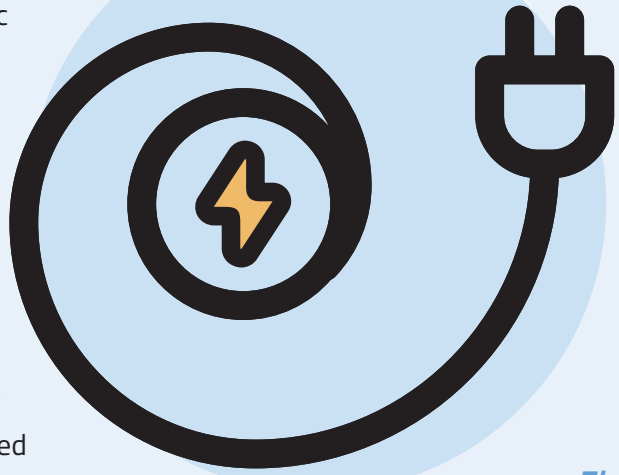
OTC markets regularly report higher electricity trading than power exchanges because market participants require customized agreements and products for most of their portfolio.

Trading at the power exchange provides many benefits, including:

- reliable reference electricity market price;
- transparency in trading, more opportunities and greater security for investors;

- efficient procurement and sale of electricity (as compared to regular public procurement);
- elimination of risks in trading
- additional tool for trading portfolio management.

Despite the large number of market participants, BIH does not have a power exchange. In terms of the regional price of electricity, the Hungarian Power Exchange (HUPX) is most frequently used as a reference.



Day-ahead electricity trading is a market segment where trading is concluded one day before the physical delivery of electricity. Bids and offers are accepted in accordance with the auction trading rules and the market price, as well as the quantity traded are determined based on the intersection of supply and demand curves.

Intraday electricity market is a market segment where trading is conducted continuously within the day during which the physical delivery of energy takes place. Trading at this market segment begins after the end of trading at the day-ahead market and closes just before the start of the period to which the trading relates (one hour, 30 or 15 minutes).

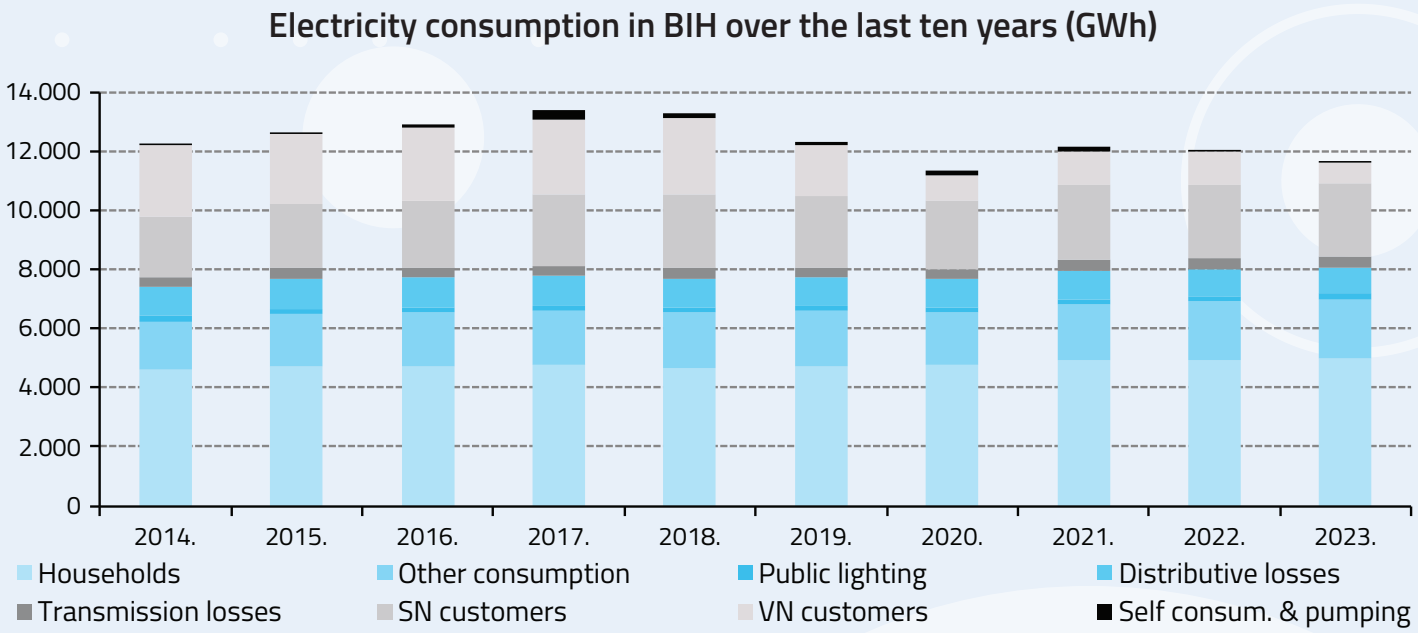
Bids and offers are accepted by pairing individual transactions with matching buy and sell conditions (delivery period, quantity, price).

3.4 Electricity supply

Electricity supply means the sale of electricity to final customers, including billing, invoicing and collection.

It is regulated by a supply agreement signed by the customer and the selected supplier.

Final customers in Bosnia and Herzegovina consume 12.000 GWh of electricity annually, with certain variations during the last ten years.



Public supply and market supply services are available to final customers.

What is public supply and who is eligible?

Household and small customers connected at a voltage lower than 1 kV are eligible for the public supply service. Small customers must fulfil additional criteria defined according to the administrative area and provided in the table. Furthermore, "final customers of special social importance" whose facilities are connected to a voltage lower than 1 kV and who perform activities of educational, humanitarian, social and religious institutions, organizations and associations, activities of employment and accommodation of special categories of persons and activities of primary health care, determined as such by decision of the FBIH Regulatory Commission, also have the right to the service of public supply in the Federation BIH.

Table: Small customers eligible for the service of public supply

	Federacija BIH *(customer fulfils all listed conditions)*	**Republika Srpska** *(customers fulfils first conditions and at least two of the remaining three conditions)*	**Brčko Distrikt BIH** *(customers fulfils first conditions and at least two of the remaining three conditions)*
Annual consumption	< 50.000 kW	< 35.000 kW	< 35.000 kW
Number of employees	< 50	< 50	< 50
Annual income	< 8.000.000 KM	< 2.000.000 KM	< 2.000.000 KM
Value of assets	*N.A.*	< 1.000.000 KM	< 1.000.000 KM

Who are vulnerable and protected customers?

In addition to being eligible for the service of public supply, customers from the categories of vulnerable and protected customers also have the right to an additional form of protection. These customers, who based on their indigent position are awarded such status, have the right to a portion of their electricity bill, i.e., consumption, to be subsidized. Furthermore, electricity supply cannot be suspended to a household where the life of a member with a medical condition could be put at risk by such a suspension.

A public supplier is an electric power entity designated by the competent body of the Federation of Bosnia and Herzegovina, Republika Srpska or Brčko District of Bosnia and Herzegovina to supply electricity to customers who exercise the right to the service of public supply in a given administrative area.

Market supply is supply of customers according to freely agreed market conditions. Supply prices are determined by suppliers following individual policies for their setting, and customers can negotiate them in this case.

Supplier of last resort is a supplier designated by the competent authority of the Federation BIH, Republika Srpska or Brčko District BIH, which is required to supply final customers with electricity in a defined administrative area in the event that the selected supplier suspends supply.

What is included in the structure of the overall price of electricity?

The overall price of electricity paid by customers includes the following costs:

- costs of the energy component, including costs of electricity generation and procurement, costs of the supply service, costs of balancing, costs of ensuring cross-border capacity and costs related to the risk of operation of the supplier;
- network charge costs, which include costs of the transmission and distribution network (construction and maintenance of the transmission and distribution network, construction, maintenance and reading of metering point, network losses, functioning of the Independent System Operator in BIH – ISO BIH, ancillary and system services);
- renewable energy and efficient cogeneration charge for incentivizing electricity generation from renewable energy sources and efficient cogeneration.

Prices of transmission and distribution network use, including the price of ISO BIH services and the price of system service, are regulated by the competent regulatory commissions.

Unit prices of the charge for renewable energy source and efficient cogeneration are determined by the competent bodies of the Federation BIH, Republika Srpska and Brčko District BIH.

Which items are on the electricity bill for households

Active energy means charge paid by the customer based on electricity consumption according to the approved price of public supply for the energy component.

Network charge omeans charge paid by the customer for the use of the transmission and distribution network at regulated unit prices for the quantities of electricity taken from the network.

Metering point means regulated fixed charge paid by the customer for the service of reading the meter and processing billing metering data.

Supply service means regulated fixed or variable charge paid by the customer for the public supply service.

Renewable energy source and efficient cogeneration charge means charge paid by the customer for incentives for electricity generation from renewable energy sources and efficient cogeneration, according to prescribed unit prices for quantities of electricity taken from the network.

Shared consumption means charge paid by the customer for the appropriate share of consumption of an appliance used together with other final customers, such as staircase lighting, elevator, hydrophore, etc.

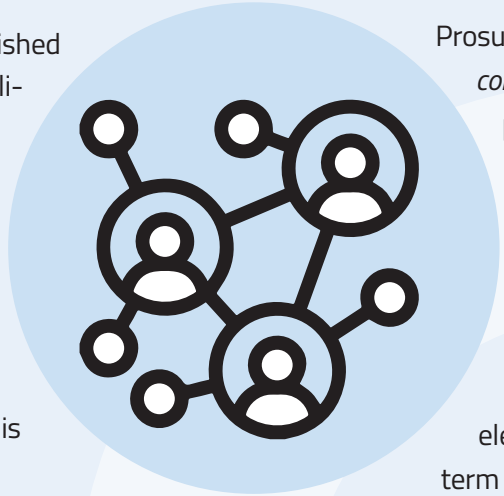
Taxes and fees mean payments made by final customers to the state in addition to the price of electricity. VAT of 17% is currently applied in BIH for electricity.

IThe amount for electricity consumed is obtained by adding up all the costs for the delivery of electricity (energy, network charge, metering point, supply service, RES incentive charge and other charges), as well as the related amounts of taxes and fees.

3.5 New concepts in the power sector

Active customer is a final customer or a group of final customers together acting, consuming or storing electricity generated at the point of consumption or who are selling surplus electricity generated by them, whereby such activities do not represent their principal commercial or professional activity.

Citizen energy community is a legal entity established in accordance with the laws governing the establishment, organization and management of cooperatives, associations and foundations. The purpose of establishing a citizen energy community is primarily to ensure environmental protection, economic or social benefits for its members or share owners or for the environment they operate in, and not to make profit. The citizen energy community is required to obtain a license for this activity from the Regulatory Commission.



A renewable energy community (REC) allows citizens to get organized and together participate in the market as part of a legal entity under their control. REC members have the right to store, exchange and sell electricity from renewable energy sources. Natural persons, small and medium companies, local self-government units, as well as institutions and companies in which they are majority owners may become members of the community. By doing so, citizens contribute to the transition to clean energy and help protect the environment, they help the development of local communities and economic growth.

What is a customer-producer, i.e., prosumer?

Prosumer is a portmanteau of two words, ***pro****ducer* and *con****sumer***. The term describes a final customer who produces electricity from renewable sources to cover a part of its own needs, but also has the possibility to inject surplus into the grid and in return to receive compensation in the form of an energy or monetary credit. By using their own power plants, prosumers cover a part of their electricity needs and by doing so reduce their electricity bill. In addition to the term prosumer, the term customer-producer is also used in BIH.

Who can be a customer producing electricity for own needs?

In the Federation BIH:

Every electricity customer may produce electricity for own needs as an active customer, in the way defined by the Law on Electricity. Prosumers represent a subcategory of active customers who have the right to the calculation of consumed and deliver electricity by applying net metering and net billing schemes.

The installed capacity of the prosumer's generation facility cannot be greater than the connection capacity of the customer's structure (as a consumer) and the maximum installed capacity of prosumers facilities is limited to 150 kW.

Prosumers from the category of households, with an approved connection capacity of up to 10.8 kW, have the right to choose between the net billing scheme or the option to use the net metering scheme for the first ten years and then to use the net billing scheme.

In Republika Srpska and Brčko District BIH:

Every electricity customer has the right to build a plant using renewable energy sources and connect it to the internal installations of its facility for own consumption, whereby the installed capacity of the power plant, when the net metering or the net billing scheme is used, cannot be greater than the approved connection capacity of the final customer's facility.

Electricity consumed and injected by the prosumer is calculated using the net metering scheme for plants with an installed capacity of up to 10.8 kW, the net billing scheme for plants with an installed capacity between 10.8 kW and 50 kW, and the standard supply scheme for plants with an installed capacity greater than 50 kW.

Prosumers who annually have surplus generation relative to consumption, and in relation to whom the net metering or the net billing scheme is applied according to the installed capacity criteria, have the right to apply the standard supply scheme.

Energy credit (as part of the **net metering scheme**) is the prosumer's surplus generation relative to his consumption during the billing period (typically one month), which is carried over to the next billing period and used in the period during which the prosumer's consumption is higher than generation.

Monetary credit (as part of the **net billing scheme**) is the pecuniary value of the prosumer's surplus generation relative to his con-

sumption, which is delivered into the network during the billing period (typically one month). The monetary credit is carried over to the next billing period and used to reduce the electricity bill for the period during which the prosumer's consumption is higher than generation. The monetary credit is determined based on the energy credit and the unit price of the energy component in the overall price of supply.

Energy storage is a new market activity and its introduction into the regulatory framework represents one of the key preconditions for increasing the use of renewable energy sources. Renewable energy sources are difficult to control and are characterized by unpredictability and production variability. Energy storage increases the flexibility of the system, the possibility of integration of renewable energy sources and security of supply.

Aggregation of distributed resources is a process whereby aggregators, specialized entities, combine the capacities of many small system users, including generators, consumers and energy storage operators. The purpose of such grouping is to facilitate the centralized management of the production and consumption of electricity in order to enable the sale or provision of services within the system.

Given that most active customers include entities with lower installed capacity, who due to their limited size cannot independently participate in the electricity market, aggregation represents a mechanism that enables their association.

Electromobility refers to the use of electric vehicles and related technologies for transportation. It is based on the replacement of traditional fossil fuels with electricity, with the aim of reducing harmful gas emissions and increasing energy efficiency. It includes the development and application of electric cars, buses, bicycles, as well as the infrastructure needed for their charging and maintenance, thereby contributing to sustainable mobility and energy transition.

An electric vehicle charging station, also known as an electric charging station, serves as a place where drivers can recharge the batteries of their electric cars. Charging stations are crucial for supporting the transition to electromobility, given that the developed network of charging stations allows for long journeys. These stations can be publicly available or private, such as home charging stations, and can offer different levels of charging power – from standard charging to fast charging.

4. NATURAL GAS

Natural gas is a fossil fuel used for different purposes: heating, electricity generation and as raw material in the chemical industry. It primarily consists of methane.

Gas exploitation is the process of obtaining natural gas from the ground, which includes drilling, testing and the production of gas from gas fields.

Natural gas production means a procedure in the production facility used to achieve natural gas meeting natural gas quality requirements following its exploitation, which is carried out in accordance with the regulations in the sectors of energy and mining, so that it can then be safely transported or distributed through the gas system for the purpose of sale and delivery.

Direct line is a gas pipeline connecting the natural gas producer with the final customer's isolated facility and is not a part of the transmission or distribution system.

Pressure in the context of natural gas refers to the force pushing gas through pipelines. Proper pressure regulation is key for the safe and efficient transportation of gas.

Compressor station is a facility used for increasing pressure in the gas pipeline in order to ensure constant flow of gas through the entire network.

The gas transmission network in Bosnia and Herzegovina is comprised of s single pipeline of 246 kilometers. It passes through a number of cities, including: Zvornik, Kladanj, Sarajevo, Kakanj, Zenica and Travnik. Although the gas pipeline between Zvornik and Sarajevo was designed for a transmission capacity of 1.25 billion cubic meters annually (16 inch = 40.64 cm, 50 bar), the actual transmission capacity of the gas pipeline is 0.71 cubic meters annually because the compressor station in Zvornik was never built. The guaranteed hand-over pressure is 30 bar. The network has one cross-border entry

Three companies own and operate the gas transmission network in BIH. In Republika Srpska, Gas promet a.d. Pale (Gas promet) is the owner of 22 km of pipeline from the border with Serbia to

Zvornik and Kladanj. The same company also acts as the distributer and supplier of final customers. The largest segment of the pipeline (184 km) is in the Federation BIH and is owned by the operator BH-Gas d.o.o. Sarajevo.

Natural gas is delivered at seven exit points from the transmission system for the supply of gas distribution networks and directly connected industrial final customers.

Distribution networks are connected in Zvornik, Sarajevo, East Sarajevo and Visoko. The distribution network in East Sarajevo is not directly connected to the transmission system, but is connected to the distribution network of the KJKP Sarajevogas d.o.o. Sarajevo. The distribution network in Bijeljina has been constructed, but is yet to be connected to the transmission system. The construction of the distribution network in Zenica is underway. Industrial customers in BIH are connected in Zvornik, i.e., Karakaj, Ilijaš, Visoko, Kakanj and Zenica.

KJKP Sarajevogas d.o.o. Sarajevo and JP Visoko Ekoenergija d.o.o. Visoko are distribution companies responsible for supplying natural gas to final customers in Sarajevo Canton and in the area of Visoko. KJKP Sarajevogas d.o.o. is the largest distribution company in the country and supplies 95% of customers. The JP Zenicagas d.o.o. company in Zenica is developing the distribution network and supplying natural gas to final customers.

Sarajevo-gas a.d. Istočno Sarajevo and JP Zvornik-stan a.d. Zvornik are also providing natural gas distribution services. Several companies have a license for trading and supplying natural gas, including: Sarajevo-gas a.d. Istočno Sarajevo, Zvornik stan a.d. Zvornik, Gas-Res d.o.o. Banja Luka, CNG Energy Banja Luka, Prvo gasno društvo d.o.o. Zvornik, Oil Refinery Brod a.d. Brod, Optima Grupa d.o.o. Banja Luka, Bijeljina-gas d.o.o. Bijeljina and Alumina d.o.o. Zvornik.

Gas-Res d.o.o. Banja Luka is the dominant supplier and the only importer of natural gas for the RS. In the Federation BIH, the activities of BH-Gas have been limited in April 2021 to transmission system management only, while Energoinvest d.d. Sarajevo has taken over the role of wholesale supplier.

Approximately 80% of natural gas is used in the Federation BIH and the rest is consumed in Republika Srpska (Brčko District BIH does not have a natural gas network). In the Federation BIH, households and commercial customers use 71% of gas while in Republika Srpska their consumption accounts for 8%. Sarajevo is the largest consumer of gas in Bosnia and Herzegovina.

Beyond Sarajevo, industrial customers that use natural gas in their production process are directly connected to the transmission pipeline (e.g. ArcelorMittal Zenica and Alumina d.o.o. Zvornik) account for a significant portion of overall gas consumption in Bosnia and Herzegovina. Natural gas is used for district heating in Zvornik.

The natural gas market in BIH is small – approx. 68,500 final customers supplied with natural gas. All household customers in Bosnia and Herzegovina are supplied at regulated prices. Some 5,000 customers in the RS have the possibility to choose their supplier, however customer switching is sporadic.

Regulating and metering station is a facility regulating natural gas pressure and measuring its flow in the gas system.

Gas connection means gas lines for the delivery of natural gas from the point of connection to the distribution system to the main shut-off device at the entry to the building, including the metering device and equipment.

Internal gas installations means a system of installations and devices within the building or structure used for distributing gas to the final points of consumption. This includes gas appliances, ventilation shafts, air intake and combustion products removal system, as well as the release of exhaust gasses into the atmosphere.

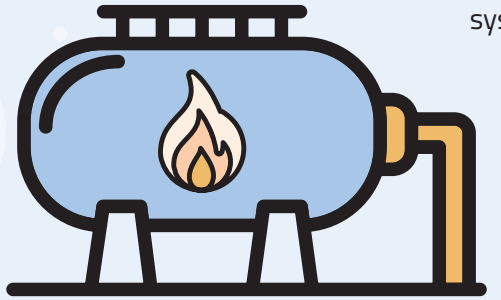
Natural gas fueling station is a point where it is possible to refuel vehicles using natural gas. Fueling stations can use liquified natural gas (LNG) or compressed natural gas (CNG).

LNG (liquified natural gas) is natural gas that has been cooled down to liquid form for ease of transport and storage.

CNG (compressed natural gas) is natural gas that has been compressed under high pressure and is used as an alternative fuel for vehicles.

Natural gas storage facility is a structure used for natural gas storage, including the part of the liquified natural gas terminal used for storage, but excluding the parts used for production activities and facilities intended exclusively for performing the functions of transmission system operator.

Storing gas means injecting natural gas into the natural gas storage facility in the storage working volume and the withdrawal of natural gas from the storage facility.



Liquified natural gas terminal means a terminal used for the liquefication of natural gas or the offloading, shipment and re-gasification of liquified natural gas, including temporary storage necessary for the re-gasification process and further delivery into the gas system, but excluding parts of the liquified natural gas terminal used for storage.

Gas transmission means the transport of natural gas through a pipeline with a pressure hither than 16 bar for the purpose of delivering natural gas to final customers or distribution system operators, excluding natural gas supply.

Gas distribution means the transport of natural gas through the distribution system for the purpose of delivering natural gas to final customers, but does not include natural gas supply.

Balancing responsibility means the obligation of market participants to balance the quantity of natural gas at the entry to the system and the exit from the system during the period of imbalance and to take financial responsibility for the deviation.

Gasification is the process of transforming solid fuels such as coal or biomass into gas, which can then be used as a fuel.

Gas turbines are machines that use natural gas for electricity generation transforming the thermal energy of gas into mechanical energy.

Odorization is the process of adding an odorant to natural gas, which is otherwise odorless, in order to make detecting leaks easier.

Gas distributer is a company or undertaking responsible for the distribution of natural gas through the local network to final customers.

Public supplier means an energy undertaking supplying gas to small household customers and final customers of special social importance that have not selected a market supplier.

Public supply means the public service of natural gas supply to small household customers and final customers of special social importance, under conditions prescribed by this law.

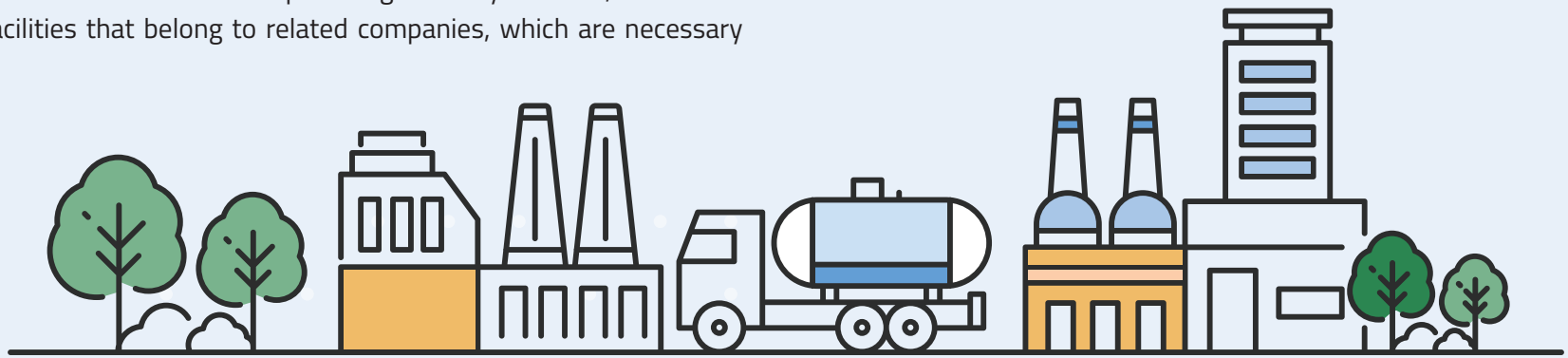
Supplier of last resort means supplier with the obligation to supply natural gas to a final customer when the chosen supplier suspends supply.

Supply of last resort means public service of natural gas supply to final customers who have lost their supplier under conditions prescribed by this law.

Delivery means the handover of natural gas at the point designated for delivery.

Gas system means transmission system, distribution system, liquified natural gas terminals and/or natural gas storage system owned and/or managed by an energy undertaking, including linepack and its facilities for providing ancillary services, as well as facilities that belong to related companies, which are necessary for providing access to transmission, distribution and liquefied natural gas terminals.

Gas infrastructure facilities means pipelines, compressor, regulation and metering stations, wells, natural gas storage and other facilities and infrastructure necessary for the functioning of the gas system.



5. ENERGY EFFICIENCY

What is energy efficiency and how is it different from energy conservation?

Energy efficiency refers to optimization, i.e., efficiency in the use of energy in order to achieve maximum performance with minimal consumption.

This means that technologies, processes and systems are designed or adapted to reduce energy consumption while at the same time achieving same or better results, or, in brief: it is the use of less energy for the same or better result.

For example, energy efficient appliances use less energy while providing the same functionality as a less efficient model, or, insulation of a building to reduce the need for heating or cooling, or the implementation of more efficient lighting systems, etc.

Energy conservation, on the other hand, refers to reducing overall energy consumption, i.e., it is a form of deprivation, regardless of efficiency, e.g., turning off the lights, reducing the temperature indoors, use of vehicles with lowest consumption, etc.

However, energy efficiency and energy conservation often go hand in hand because increasing energy efficiency often leads to energy conservation.

By introducing energy efficiency measures in buildings and facilities, unnecessary and excessive energy consumption is reduced, and users of buildings or facilities achieve direct financial savings.

In addition to saving energy, energy efficiency measures improve living standard and comfort, and energy efficiency measures reduce greenhouse gas emissions, including carbon dioxide. Given that it helps reduce the need for primary energy use, energy efficiency could be described as a new source of energy.

Energy efficiency measures are applied in buildings, households, technical heating and air conditioning systems, industrial processes, transport and other services. As a result, significant financial savings are achieved, depending on the type of measures applied. With small investments, it is possible to reduce costs by 20% to 30%, and by simply using energy in a smart and rational way, it is possible to save between 5% and 10%. After the initial investment for implementing energy efficiency measures is paid off, the consumer continues to make savings.

Energy efficiency as a development opportunity for BIH

Energy efficiency offers numerous development opportunities to Bosnia and Herzegovina, including the ones listed below.

- **Economic potential**: an increase in energy efficiency results in a reduction of costs for individuals, companies and public institutions. The implementation of energy efficiency measures contributes to increasing the competitiveness of the economy, reducing production costs and increasing profits.
- **Creation of new jobs:** investing in energy efficiency leads to the creation of new jobs in sectors such as construction, production of energy-efficient devices and equipment, as well as in service sectors such as consulting and installation of devices and equipment.
- **Reduction of energy dependence:** Bosnia and Herzegovina, as a gas and oil importing country, can reduce its energy dependence through energy efficiency measures. Increasing energy efficiency in households, industry and transport reduces the need for imports and contributes to energy security.
- **Reduction of greenhouse gas emissions:** improving energy efficiency reduces the consumption of fossil fuels, thereby reducing emissions of greenhouse and other harmful gases, as well as the negative impact on the environment and climate change.
- **Technical cooperation and transfer of knowledge:** the development of energy efficiency projects requires cooperation with international organizations, institutions and experts. This enables the transfer of technology and knowledge.

Investing in energy efficiency improves the economic stability, sustainability and competitiveness of Bosnia and Herzegovina and at the same time contributes to the global sustainable development goals and the fight against climate change.

Bosnia and Herzegovina consumes approximately five times more energy to generate one thousand euros of gross domestic product than the EU average, which threatens the competitiveness of producers and reduces funds for further development. Energy efficiency has great potential for saving energy and improving the efficiency of the economy. At the same time, it frees up financial resources for necessary investments and opens up the market for domestic small and medium-sized enterprises that produce materials and equipment for energy efficiency and provide services in this area.

Useful tips for an energy efficient household

A number of factors affect household energy consumption, and consequently energy bills. Some of them are: the type of building, the presence and quality of thermal insulation, the number of electrical appliances and their efficiency, and the habits and behavior of the people living in them. Energy efficiency is promoted through numerous activities of various institutions and non-governmental organizations, the main goal of which is to increase citizens' awareness of the efficient use of energy and encourage the application of economically profitable and energy-efficient technologies, materials and services. One such publication, 20 USEFUL TIPS FOR AN ENERGY EFFICIENT HOUSEHOLD (link), offers advice on how to use energy more efficiently, improve the quality of life and reduce bills. In brief, the publication recommends that special attention be paid to the following characteristics and actions:

- thermal insulation of the building;
- reduce heat loss through windows;
- heating of rooms;
- room ventilation;
- hot water preparation;
- use water-saving toilet flushing systems;
- use class A energy efficiency appliances;
- don't leave the TV in standby mode;
- don't leave mobile chargers (and other appliances) plugged in;
- use energy saving light bulbs motion sensors;
- use dishwashers and washing machines;
- save (hot) water by using atomizers and aerators;
- usage of electric fan;
- what to watch out for when purchasing an air conditioner;
- air conditioner cooling factor;
- how to cool the rooms;
- daily housework practices;
- using the refrigerator;
- renewable energy sources – heating using wood and biomass;
- renewable energy sources – heat pumps and thermos solar.

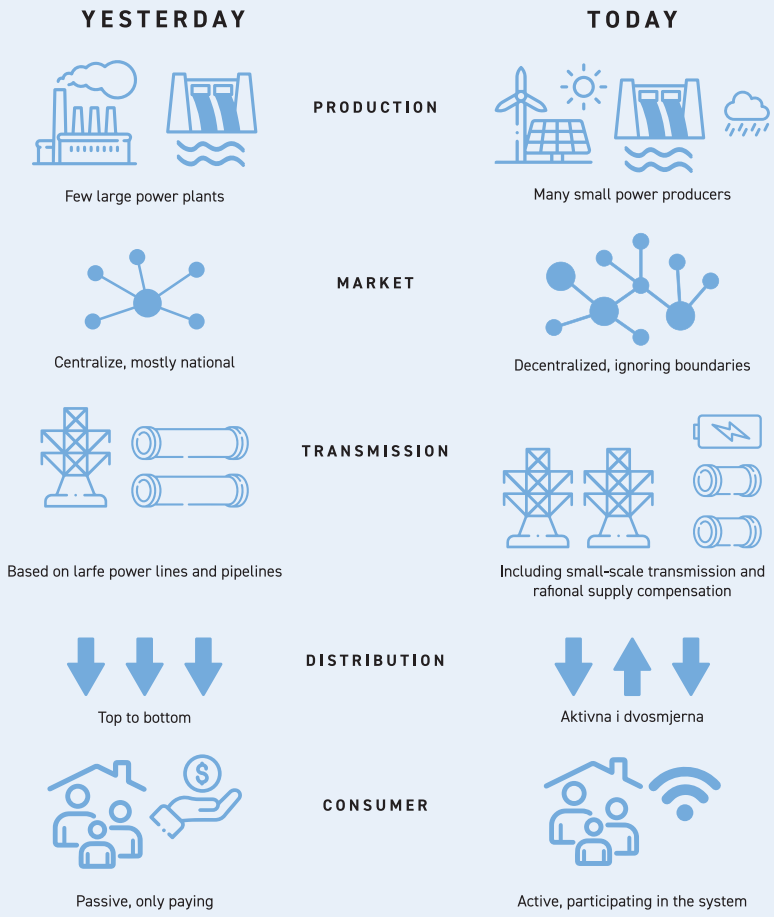
6. ENERGY TRANSITION

Energy transition is a significant, long-term and very complex transformation of the energy sector of a country and beyond, which is primarily implemented for the purpose of decarbonization.

This process includes transition from the use of fossil fuels (coal, oil and natural gas) to the use of renewable energy sources in order to reduce greenhouse gas emissions to the amount that can be absorbed from the atmosphere through sinks. This is a key step in the fight against climate change, but also in reducing dependence on limited fossil fuel resources.

In addition to decarbonization, the transition of the energy sector is also based on the decentralization of production, as well as on the digitization of processes, which leads to changes in energy production, transmission and consumption.

Using the example of the power system, the figure below shows the structural change made possible by the use of advanced digital tools and principles of work.



Just transition is a concept of economic transition based on principles that do not cause social and economic harm to communities, especially those that are most vulnerable in this transformation. This concept emphasizes the importance of a balanced approach that respects the different needs and perspectives of all stakeholders involved in the transition process aimed at ensuring that:

- there is no loss of jobs or a reduction in living standard for workers employed in sectors that are changing or disappearing;
- transition is not implemented to the detriment of the environment and the health of local communities;
- the benefits of transition are equally distributed between all segments of the society;
- all have equal opportunity to participate in transition, without discrimination.

Special attention in the transition process in Bosnia and Herzegovina needs to be paid to regions rich in coal, since in these areas a significant number of workers and their families depend on this segment of industry (mines, coal transport, thermal power plants, etc.) and related sectors.

Just transition activities should include education, retraining and opportunities for new employment of workers.

Energy transition as a development opportunity for BIH

Energy transition represents a significant development opportunity for Bosnia and Herzegovina for several reasons, which are presented below.

Bosnia and Herzegovina possess significant (untapped) potential of renewable energy sources, such as water, sun, wind and biomass (sometimes many times better than the average in developed European countries).

Diversification of the production portfolio, which primarily relies on fossil fuels, will through massive investment in energy capacities based on renewable energy sources and infrastructure lead to safer and more sustainable energy supply in the long term.

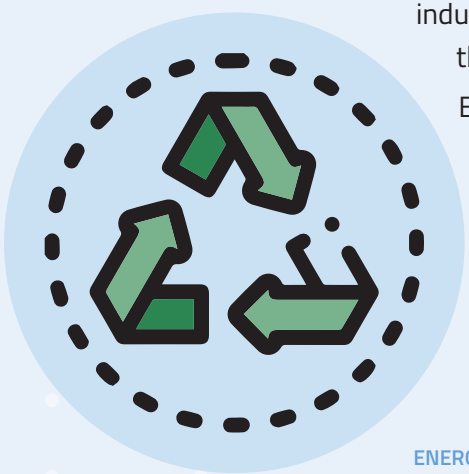
The use of renewable energy sources reduces emissions of greenhouse and other harmful gases, which positively affects the environment and the health of the population. This improves the quality of life and reduces the costs of medical treatment for diseases caused by pollution.

Diversification of sources reduces dependence on energy imports, which in turn reduces the vulnerability of consumers in Bosnia and Herzegovina to a possible energy crisis or an increase in energy prices at the international market.

Investments in renewable energy sources, energy efficiency measures and advanced (smart) solutions stimulate economic growth and create new jobs. Development of new solutions and technologies through engineering, production of equipment or parts of equipment with innovative technologies, maintenance and consulting services contribute to strengthening the economy and reducing unemployment.

Greenhouse gases are gases that have the ability to retain heat. Their accumulation in the upper layers of the atmosphere prevents the radiation of planetary heat back into outer space, which causes an increase in the temperature of the Earth's surface and disturbances in climate conditions. This phenomenon is known as global warming or the greenhouse effect.

Controlling greenhouse gas emissions and reducing their concentration in the atmosphere are key to mitigating climate change and reducing its impact on life on Earth.



The most important greenhouse gasses are:

- carbon dioxide (CO_2) – is a gas that is released during the burning of fossil fuels, due to the rotting of biomass, and when people and animals breathe;
- methane (CH_4) – is a gas released during the production of coal, natural gas and oil, and in processes such as fermentation in the digestive tract of animals and decomposition of organic waste in landfills;
- nitrous oxide (N_2O) – is a gas that is produced in industrial and agricultural processes, but also during the burning of fossil fuels;
- sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and nitrogen trifluoride (NF_3) – gases used in industrial processes (often as substitutes for older substances that damage the ozone layer).

Each of these greenhouse gases has its global warming potential. In order to compare different greenhouse gases, their impact is usually expressed using the carbon dioxide equivalent (CO2eq).

Greenhouse gas sinks are systems, i.e., phenomena and processes that absorb or remove greenhouse gases from the atmosphere. They play a very important role in regu-

lating the concentration of greenhouse gases in the atmosphere and can contribute to reducing global warming and mitigating climate change. The main greenhouse gas sinks include:

- plants, which in the process of photosynthesis absorb CO_2 from the atmosphere and use it for their growth. Forests and other forms of vegetation act as natural sinks of greenhouse gases;
- oceans, which dissolve CO_2 in contact with the air, and partially absorb it through the process of photosynthesis in plankton and algae;
- soil, which in the process of organic decomposition and photosynthesis of microorganisms can absorb CO_2 from the atmosphere and store it in the soil, as well as through carbonate minerals in their composition, which absorb CO_2 from the atmosphere during their creation.

Carbon neutrality (climate neutrality is also a term frequently used) is a state in which total emissions of carbon dioxide (CO_2) into the atmosphere are matched with the total amounts of CO_2 that are removed from the atmosphere with the help of the so-called sinks, or are neutralized in some other way (this state is also called the state of net zero CO_2 emissions). A system that absorbs more carbon dioxide than it emits is called a sink.

Given that we as a society currently emit more CO_2 than we absorb, achieving carbon neutrality involves reducing CO_2 emissions and/or increasing the absorption of CO_2 from the atmosphere through various measures. These measures may include replacing the use of fossil fuels through solutions based on renewable energy sources, implementation of energy efficiency measures, sustainable management of agriculture and forestry, protection of marine ecosystems and the use of technologies for capturing, using and storing CO_2 (carbon capture and storage - CCS; *carbon capture and utilization* – CCU).

The goal of achieving carbon neutrality has become vital for global efforts in combating climate change and creating opportunities for the regeneration of nature and the climate. As a result of the European Green Deal, Europe should become the first climate-neutral continent that removes the same amount of CO_2 emissions as it produces by 2050.

Carbon capture and storage (CCS) is a very complex process that involves capture, i.e., separation of carbon dioxide from other flue gases, its transport and storage at a suitable location with the aim of reducing its concentration in the air. There are solutions that directly separate carbon dioxide from other flue gases at the

very source of emissions within large, carbon-intensive industrial plants before it is released into the atmosphere, and there are also solutions that indirectly separate carbon dioxide from the atmosphere.

Storage methods include injecting carbon dioxide into very deep underground geological formations or injecting it into the ocean depths. These technologies and the overall process are very expensive and are still not in commercial use.

Carbon capture and utilization (CCU) is a very complicated procedure that involves the capture, i.e., the separation of carbon dioxide from other flue gases resulting from certain industrial processes and its transport to the place of intended use. This process is carried out with the aim of reducing the concentration of carbon dioxide in the exhaust gases from large, carbon-intensive facilities, such as facilities for the production of natural gas, cement, iron, steel, electricity by burning fossil fuels, as well as refineries.

CCS is different from CCU in that CCU does not result in permanent storage of carbon dioxide. Instead, CCU aims to adequately utilize the sequestered carbon dioxide in certain commercial products and applications, primarily through industrial binding into appropriate chemical compounds. In this regard, carbon dioxide is primarily used today in the fertilizer industry, and increasingly in the production of synthetic fuels, chemicals and construction elements.

CCU and CCS are sometimes considered together through carbon capture, use and storage (CCUS). These technologies and the overall process are very expensive and are still not widely used commercially.

Carbon Footprint is a measure of the total amount of greenhouse gases that have been directly or indirectly emitted as a result of the activities or products of an individual, organization, event or process. This measure expresses the amount of greenhouse gas emissions emitted into the atmosphere as a result of a certain activity or product, and is expressed in tons of carbon dioxide equivalent (CO2eq) per unit of time or unit of that product.

In this respect, the carbon footprint can be related to and expressed for different aspects of human activity, such as:

- **individual carbon footprint** – is a measure of the total amount of greenhouse gases expressed in CO2eq that an individual emits as a result of their daily activities, for example in transport, use of electricity, heat and cooling energy, food

consumption, etc. In this regard, different modes of transport, such as walking, cycling, driving a car, using public transport, traveling by plane, etc. have different greenhouse gas emission coefficients;

- **organizational carbon** – is a measure of the total amount of greenhouse gases expressed in CO2eq that an organization emits as a result of its business activities, including production, transportation, building management and other operational processes;
- **product carbon footprint** – is a measure of the total amount of greenhouse gases expressed in CO2eq that is emitted during the production of a certain product, including the production of necessary raw materials, their processing, transportation, use and ultimately disposal of that product.

Determining the carbon footprint can help individuals, organizations and society as a whole to identify and understand their contribution to climate change.

Furthermore, determining and understanding the carbon footprint can help establish appropriate policies and measures to reduce greenhouse gas emissions through changes in behavior, selection of energy sources and technologies in practice, etc.

The EU Emissions Trading System (EU ETS) is a system aimed at reducing greenhouse gas emissions by setting maximum emission limits for industries with high energy consumption and for the electricity generation sector. When emissions are higher than what is allowed, this system enables the purchase of certain quotas, i.e., the sale of unused quotas when the realized emissions are lower than the allowed limits.

The ETS is the EU's main tool for achieving the goal of reducing greenhouse gas emissions, as well as for encouraging innovation and investment in solutions based on renewable energy sources and low-carbon technologies. It includes numerous installations in the energy sector and the manufacturing industry, airline operators, and maritime transport operators are expected to be included soon as well. In addition to EU countries, Iceland, Liechtenstein and Norway are also a part of this system.

The main elements and principles on which the functioning of the EU ETS is based are:

- allocation of emission allowances - implies the allocation of certain quotas of permitted greenhouse gas emissions to operators included in this system, which gives them the right to emit a certain amount of greenhouse gases in a certain period of time. The total amounts of permitted emissions are limited and reduced

over time, in accordance with the set goals for reducing greenhouse gas emissions of individual countries or the European Union as a whole. This approach is designed to ultimately result in the complete abolition of permitted quotas, i.e., the cessation of the allocation of emission allowances for greenhouse gases;

- emissions market – operators that emit less greenhouse gases than their allocated allowances can sell their surpluses on the emissions market to other operators that exceed their allowed quotas. This approach creates an economic incentive for operators to reduce their greenhouse gas emissions, implement clean technologies, invest in innovation and use their energy resources more efficiently, all with a view to reducing their emissions and even make a profit through emissions trading.

The money collected from the emission quotas of individual operators remains in the country and is redirected to a fund intended for the decarbonization of the country's economy.

The Carbon Border Adjustment Mechanism (CBAM) is a climate measure introduced by the EU in the form of a tax on the import of certain products from countries that do not have an established greenhouse gas emission taxation system compatible with the EU emissions trading system, i.e., the EU ETS.

The basic idea of this mechanism is to prevent "carbon leakage" by imposing an obligation to pay a fee at the EU border for the import of goods from countries that do not have an ETS in place, and during the production of which significant amounts of greenhouse gas emissions were emitted. By doing so, the EU prevents the possibility of EU companies transferring their production to countries with less ambitious climate policies or replacing their products with more carbon-intensive imports.

The introduction of the Carbon Border Adjustment Mechanism will be gradual and in the initial phase it will be applied to the import of cement, iron and steel, aluminum, fertilizers, electricity and hydrogen. The initial phase lasts from October 2023 to December 2025 and during this time the exporters of these goods from countries that do not have an ETS in place are required to monitor and report on their direct and indirect greenhouse gas emissions, without paying financial fees. The adjustment phase will begin in January 2026 with the gradual introduction of compensation payments for realized greenhouse gas emissions and it will become fully operational from January 2034. Unlike the ETS concept, all financial resources generated from emissions through this concept are directed to the funds of importing countries, i.e., EU member states, for measures intended for further decarbonization of the EU economy.

7. CYBERSECURITY

Cyber space is a global domain consisting of a network of IT infrastructure, including the internet, telecommunications networks, computer systems, embedded processors and controllers.

It provides a unique platform for the development of business, communication, connectivity and exchange of ideas in a given area. Given that it is so connected, it is susceptible to various forms of threats that can have a negative impact and huge consequences for the security of various areas, including the energy sector.

Cybersecurity refers to preserving the security of the entire cyber space. It primarily refers to the security of the information that is used and processed. Protection of information security entails the protection of three of its properties: confidentiality, integrity and availability.

Information confidentiality ensures that information is available only to those authorized to access it. Information integrity means that it cannot be changed by unauthorized persons without being detected. An additional aspect of integrity refers to the possibility of determining the source of information. It is important to know where the information comes from, i.e., to know the authenticity of the source. Information availability ensures that it is available to authorized persons when needed. For these characteristics of information to be protected, it is necessary to define who has the right to access information and which information. These rules are defined by the information security policy, as a separate document. A secure system is one in which this policy is complied with.

Cybersecurity of critical infrastructure in the energy sector is becoming increasingly important for the security of supply, distribution, transmission and storage of energy.

EU rules require member states to adopt their own strategy for the security of information and communication systems with the aim of achieving and maintaining a high level of their security, which includes the energy sector.

Information technology (IT) deals with all aspects of information management. This includes the storage, transmission and processing of information. IT encompasses all devices, tools (including software) and processes that deal with information.

Operational technologies (OT) refer to the physical domain. In the power sector, these are all technologies that support the production, storage, transmission and distribution of electricity. Attacks on information security can endanger the operation of the system.

Nhe most frequent forms of cyberattacks are ransomware, phishing and DDoS.

Ransomware is an attack on the availability of information. The attacker encrypts the victim's files rendering them inaccessible. Files are encrypted by running malware that is launched by deceiving the victim or exploiting a security flaw. The attackers demand financial compensation for decryption. This is blackmail (ransom), hence the name. Paying the ransom does not guarantee the return of files.

Phishing is an attack on confidentiality. The attacker obtains the victim's access data by fraud. In most cases, the victim will receive a false notification requiring it to urgently access the protected location for some apparently very important reason. That notification contains a link that supposedly leads to the protected location, but actually it leads to a location controlled by the attacker. The website opened by the victim by clicking on this fake link usually looks identical to the real website. When the victim enters access data on this fake page, the attacker comes into their possession and can misuse them. The name of the attack comes from a word that is pronounced similar to fishing, albeit spelled differently, because the victim is literally "hooked".

DDoS is an attack on the availability of information. The attacker, after taking control, takes control of a significant number of online devices. The attacker uses this to direct a large amount of data from all those devices to the victim's online location. The victim's resources become overloaded and it cannot provide services to its users. Such attacks are usually carried out against organizations and the damage from them can be very large. DDoS stands for Distributed Denial of Service.

CSIRT is a common abbreviation for Cyber Security Incident Response Team. CSIRT helps to eliminate the negative consequences of an incident related to information security. In addition to this, CSIRT can and should participate in the implementation of other

protection measures, and it also directly provides assistance or advice following an incident. CSIRT also acts preventively by providing information about current threats and the implementation of adequate protection measures. The basic tasks of the CSIRT are:

- receive incident reports;
- incident triage (verification, prioritization, notification and coordination);
- incident resolution (stopping the incident, removal and recovery),
- incident closure (analysis, archiving, reporting and informing the public).

The Security Operations Center (SOC) provides incident detection services by observing technical events in networks and systems, but may also be responsible for responding to incidents. In large organizations, SOCs sometimes focus only on monitoring and detection services and then refer the handling of the incident to a separate CSIRT. In smaller organizations, CSIRTs and SOCs are often considered synonymous.

SOC is a broader term than CSIRT, as it covers all aspects of protection, with incident response being only one them.

Complete protection requires a comprehensive approach, not only incident response. An SOC which also includes CSIRT functions is, therefore, a better solution. Obviously, the establishment of both a CSIRT and a SOC will depend on the available resources of the organization.

Does BIH have a strategic document for cybersecurity?

Bosnia and Herzegovina does not have an official strategic document for cybersecurity. The working group, formed at the initiative of the Organization for Security and Co-operation in Europe (OSCE), prepared the "Guidelines for the strategic framework of cyber security in Bosnia and Herzegovina". This document contains the necessary elements of the national strategy for the securi-

ty of network and information systems. Although it does not have the power and effect of the strategy, it can be used for the coordinated implementation of elements essential for the cybersecurity of the energy sector in Bosnia and Herzegovina. This document includes and explicitly mentions electricity and natural gas in the overview of mandatory essential services sectors.

Which institutions are responsible for cybersecurity in Bosnia and Herzegovina?

There is no single body at the BIH level that is responsible for cybersecurity. One segment falls under the competence of the Ministry of Communications and Transport of Bosnia and Herzegovina and one under the competence of the Ministry of Security of Bosnia and Herzegovina, which also has a Computer Incident Response Team for bodies and institutions of Bosnia and Herzegovina within its Sector for IT and Telecommunication Systems. A similar division of responsibilities exists at other levels of government. However, each institution is responsible for the security of information in its field.

Cyber hygiene is a set of simple measures that every individual can take and which contribute to individual and overall security. Some of the basic measures of cyber hygiene are:

- do not fall for scams;
- log in to the system correctly;
- exchange files securely and
- regularly update operating systems and applications.

8. WHO IS WHO IN THE ENERGY SECTOR?

Key institutions and stakeholders in the energy sector are presented in this chapter. A brief description of the competences and activities is also provided.

Ministries

- **Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina (MOFTER BIH)** is, inter alia, responsible for performing duties and tasks falling under the competence of BIH with regard to defining the policy, basic principles, coordinating activities and harmonizing the plans of entity authorities and institutions on the international level in the areas of energy and environmental protection. www.mvteo.gov.ba
- **FBIH Ministry of Energy, Mining and Industry** (FMERI) is responsible for preparing all laws concerning energy, mining and industry in the entity Federation of BIH. www.fmeri.gov.ba
- **Ministry of Energy and Mining of Republika Srpska** (RS MER) is responsible for preparing and implementing all laws concerning energy in the entity Republika Srpska. www.vladars.net
- **Department for Utility Services in the Government of Brčko District of Bosnia and Herzegovina** is responsible for implementing energy laws in the territory of Brčko District BIH. www.kp.bdcentral.net

Regulatory commissions

The process of restructuring the power sector was initiated some twenty years ago in Bosnia and Herzegovina. The infrastructure required for the establishment of Elektroprijenos BIH and the Independent System Operator in BIH was unbundled from the three power utilities. The unbundling process continues with the unbundling of generation and ultimately of distribution and supply. Activities that were kept together within a completely vertically integrated company for a long time are being unbundled.

The goal is to unbundle activities that are a natural monopoly (i.e., transmission and distribution of electricity as network activities) from market activities in the electricity sector (i.e., production, trade and supply).

The role of the regulator in this process, which is also referred to as deregulation, is to determine the prices, i.e., the tariffs at which natural monopoly activities are performed, and to provide free access to the network infrastructure on an equal basis to all stakeholders. This creates the basic prerequisites for free trade and the

introduction of competition. At the same time, the regulator also monitors market activities.

The primary interest of customers at the energy market is reliable supply. This is followed by accessible prices because the most expensive energy is the one that is not available! An environmentally acceptable product (in this case energy) is in the interest of customers as a part of the society. Market competition is also in the interest of customers because this increases competition and reduces the possibility for price hikes.

- **State Electricity Regulatory Commission** (SERC) is an independent and nonprofit institution of Bosnia and Herzegovina which acts in accordance with the principles of objectivity, transparency and equality and has jurisdiction over and responsibility for transmission of electricity, transmission system operation and international trade in electricity, as well as generation, distribution and supply of electricity for customers in Brčko District BIH. www.derk.ba
- **Regulatory Commission for Energy in the Federation of Bosnia and Herzegovina** (FERK) is a regulatory body responsible for regulating and overseeing electricity, natural gas, oil derivatives and thermal energy markets in the Federation BIH based on principles of impartiality, transparency, fairness, non-discrimination, competition, independence and protection of market participants pursuant to special laws governing the sectors of electricity, renewable energy sources, energy efficiency, natural gas, oil derivatives and thermal energy. www.ferk.ba
- **Regulatory Commission for Energy of Republika Srpska** (RERS) regulates and oversees relations at electricity, gas and oil markets in the RS in accordance with the legal provisions and competences vested in it by the provisions of laws in the sectors of electricity, gas and oil with a view to ensuring the principles of transparency, non-discrimination, fairness, competition and protection of final customers. www.reers.ba

Power utility companies

- **Independent System Operator in Bosnia and Herzegovina (ISO BIH)** manages the electricity transmission system in BIH with a view to ensuring the continuous and reliable operation of the power system. www.nosBIH.ba
- **Elektroprijenos Bosne i Hercegovine a.d. Banja Luka (Transco BIH)** is responsible for electricity transmission via the high-voltage system. Activities of this company include maintenance, construction and the development of the electricity transmission network in Bosnia and Herzegovina, as well as harmonizing its development with the development of other networks

and neighboring transmission systems. . www.elprenos.ba

- **JP Elektroprivreda Bosne i Hercegovine d.d. Sarajevo** performs activities of generation, distribution, supply and trade of electricity for profit. Elektroprivreda BIH, together with several subsidiary companies in the field of mining and equipment manufacture, makes up the EPBIH Concern, in which it has the status of a controlling company. www.epBIH.ba
- **JP Elektroprivreda Hrvatske zajednice Herceg Bosne d.d. Mostar** performs activities of electricity generation, distribution, supply and trade. www.ephzhb.ba
- **MH Elektroprivreda Republike Srpske, a.d. Trebinje** – this mixed holding is comprised of 21 subsidiary companies, including five generation and five distribution companies. Activities of the mixed holding include electricity supply and trade. www.ers.ba
- **JP Komunalno Brčko d.o.o. Brčko** performs activities of electricity distribution, supply and trade, as well as other utility activities in Brčko District BIH. www.komunalno.ba

Renewable energy operators

Operator for Renewable Energy Sources and Efficient Cogeneration in the Federation BIH (RES Operator), Mostar provides institutional support to the system of incentives for the production and purchase of electricity from renewable energy sources and efficient cogeneration. www.oieiek.ba

Directorate for activities of the incentive system operator acts within the technical sector of Elektroprivreda Republike Srpske – parent company, a.d. Trebinje. It performs operational and administrative tasks in the incentive system for electricity generation from renewable energy sources and efficient cogeneration in Republika Srpska.
www.ers.ba/team/direkcija-za-poslove-operatora-sistema-podsticaja

Electricity trade and supply companies

A license/permit is necessary for activities of electricity trade and supply in BIH and depending on where the company is headquartered, the license is issued by DERK (for Brčko District BIH), FERK (for the Federation BIH) and RERS (for Republika Srpska). The license for international trade of electricity is issued by DERK.

The single register of electricity trading companies includes information on all license holders, i.e., licenses for this activity issued by the relevant regulatory commission in BIH.

www.derk.ba/ba/licence/registar-trgovaca-elektrinom-energijom

Gas transmission network operators

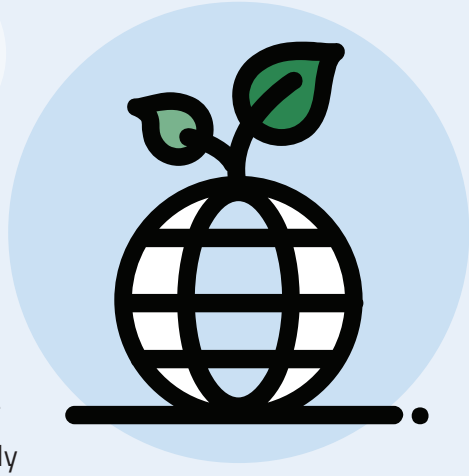
- **Gas promet a.d. Pale** - www.gaspromet.com
- **Sarajevo-gas a.d. Istočno Sarajevo** - sarajevogas.com
- **BH-Gas d.o.o. Sarajevo** - www.bh-gas.ba

Natural gas suppliers

- **KJKP Sarajevogas d.o.o. Sarajevo**
- **JP Visoko Ekoenergija d.o.o. Visoko**
- **JP Zenicagas d.o.o.**
- **Gas-Res d.o.o. Banja Luka**
- **Sarajevo-gas a.d. Istočno Sarajevo**
- **Zvornik stan a.d. Zvornik**
- **CNG Energy Banja Luka**
- **Prvo gasno društvo d.o.o. Zvornik**
- **Rafinerija nafte Brod a.d. Brod**
- **Optima Grupa d.o.o. Banja Luka**
- **Bijeljina-gas d.o.o. Bijeljina**
- **Alumina d.o.o. Zvornik**
- **Energoinvest d.d. Sarajevo** (wholesale supplier)

9. ENERGY COMMUNITY

Bosnia and Herzegovina is active in international organizations in the field of energy and its membership in the Energy Community carries special importance. *www.energy-community.org*



The basic goals of the Energy Community are to create a stable and unified regulatory framework and market space that ensures reliable energy supply.

The Treaty Establishing the Energy Community, signed on 25 October 2005 and in force since 1 July 2006, allows for the creation of the largest internal market for electricity and gas in the world, in which the European Union and nine contracting parties effectively participate: Albania, Bosnia and Herzegovina, Montenegro, Georgia, Kosovo,*[2] Moldova, North Macedonia, Serbia and Ukraine. Armenia, Norway and Turkey have observer status in the Energy Community. The Treaty is valid until 30 June 2036.

Furthermore, it aims to develop alternative supply routes and improve the environmental situation through the application of energy efficiency and the use of renewable sources.

By signing and ratifying the Treaty Establishing the Energy Community, Bosnia and Herzegovina has undertaken the obligation to transpose and implement the relevant EU directives and regulations in the areas of electricity, gas, security of supply, oil, environment, renewable energy sources, energy efficiency, infrastructure, competition, and statistics. Use this link to access the complete Pravni okvir Energetske zajednice.

2 This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

Energy Community Institutions

The Ministerial Council is the highest body of the Energy Community. It is composed of one representative from each contracting party and two representatives from the European Union.

The Permanent High-Level Group (PHLG) brings together senior officials from the contracting parties and two representatives from the European Commission. It ensures the continuity of the Ministerial Council meetings, the implementation of agreed activities and decides on the implementation of measures in certain areas.

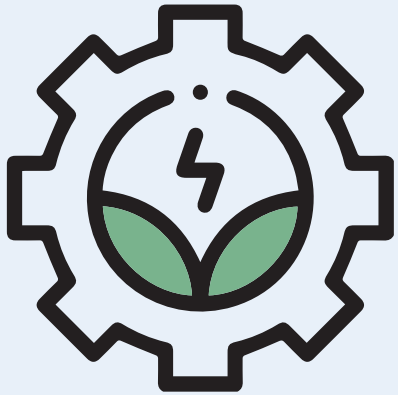
The Energy Community Regulatory Board (ECRB), based in Athens, consists of representatives of national regulatory authorities from the countries of the region. The European Union is represented by the European Commission, supported by one regulator from participating EU countries and one representative from the Agency for the Cooperation of Energy Regulators (ACER). The ECRB deals with issues of regulatory cooperation.

The Energy Community Fora bring together all stakeholders, including representatives of governments, regulators, companies, customers, international financial institutions and others. Whereas the Electricity Forum (Athens Forum) and the Gas Forum were established by the Energy Community Treaty, the Oil Forum was established by a Ministerial Council Decision in 2008. The Legal Forum, Just Transition Forum, Competition Forum, Dispute Resolution Forum and the Renewable Investments Forum convene on the basis of the Secretariat's initiative.

The Energy Community Secretariat, with its seat in Vienna, is the key administrative body and together with the European Commission it ensures the necessary cooperation and provides support for the work of other institutions. The Secretariat is responsible for monitoring the proper implementation of the obligations of the contracting parties and submits an annual progress report to the Ministerial Council.

10. ENERGY POLICY, STRATEGIES AND LEGAL FRAMEWORK

In order to make the energy system more efficient, independent, and reliable, and to make energy more accessible, the competent administrative bodies create policies and initiatives to increase energy efficiency, improve energy productivity, reduce energy consumption, and enhance the stability and security of supply.



An equally important policy is contained in the European Green Deal, which defined in late 2019 that that there would be no net greenhouse gas emissions in the European Union by 2050. The document provides an action plan for enhancing the efficient use of energy and other resources by transitioning to a clean, circular economy, as well as for restoring biodiversity and reducing pollution. The plan spells out how to ensure just and inclusive transition.

Access to reliable and available energy for everyone is extremely important and is one of the United Nations Sustainable Development Goals (bosniaherzegovina.un.org/bhs/sdgs/7). Recognizing the importance of energy, the European Commission adopted the Energy Union Package in 2015. The goal of this package is to build an energy union that provides consumers – both households and businesses – with access to secure, sustainable, competitive and affordable energy.

10.1. Energy policy in Bosnia and Herzegovina

Obligations of BIH in the areas of energy and climate are primarily defined by international agreements:

- STABILISATION AND ASSOCIATION AGREEMENT between the European Communities and their Member States, on the one part, and Bosnia and Herzegovina, of the other part (2008);

- Treaty Establishing the Energy Community (2005.),[3]
- Paris Agreement on Climate Change (2015.),[4]
- Sofia Declaration on the Green Agenda for the Western Balkans.[5]

Bosnia and Herzegovina has committed to working alongside the European Union to achieve the goal of climate neutrality by 2050. Furthermore, it has pledged to incorporate parts of the EU's legal framework into national legislation with the aim of establishing a common market, aligning the operation of the energy sector with EU rules, enhancing security of supply and promoting investments and environmental protection.

10.2. Principal planning and strategic documents

The most relevant current planning and strategic documents in the energy sector in Bosnia and Herzegovina are:

- **National Emissions Reduction Plan of Bosnia and Herzegovina (NERP BIH),** adopted on 30 December 2015;
- **National Renewable Energy Action Plan for Bosnia and Herzegovina (NREAP BIH),** adopted 30 March 2016;
- **Energy Efficiency Action Plan** in Bosnia and Herzegovina 2016–2018, adopted 4 December 2017;
- **Framework Energy Strategy** of Bosnia and Herzegovina until 2035, adopted 29 August 2018;
- **Framework Energy Strategy** of the Federation of Bosnia and Herzegovina until 2035 and
- **Energy Sector Development Strategy** of Republika Srpska until 2035.

The National Energy and Climate Plan (NECP), the structure of which is defined by Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, represents one of the key strategic documents in all European Union member states. All Energy Community contracting parties, including Bosnia and Herzegovina, have implemented or are implementing intensive activities on its development (www.energy-community.org/implementation/package/NECP.html).

The first NECP elaborates in detail the period until 2030 and it also briefly presents the long-term strategy for at least the next 30 years.

3 Ministerial Council Decisions from 2021 and 2022 have included the EU legislation package "Clean Energy for All Europeans" in the Energy Community acquis.

4 Nationally Determined Contributions (NDCs) of Bosnia and Herzegovina for 2020–2030.

5 Alignment of activities of Western Balkan countries with the EU Green Plan.

The National Energy and Climate Plan of Bosnia and Herzegovina follows the analytical approach, essential for reviewing the country's planned path towards achieving the set goals by 2030 in terms of renewable energy sources, energy efficiency and reduction of greenhouse gas emissions. The plan is based on an analysis of the current situation and identifies concrete policies and measures based on precise actions that the authorities in BIH should undertake in order to facilitate the green transition and achieve its goals.

The Energy Community's Ministerial Council Decision from December 2022 defines the energy and climate targets until 2030, both for the Energy Community as a whole and the individual contracting parties.

Table: Energy and climate targets until 2030 for the Energy Community and BIH

	Share of renewable sources in gross final energy consumption [%]	Greenhouse gas emissions [$MtCO_2eq$[6]]	Primary energy consumption [Mtoe[7]]	Final energy consumption [Mtoe]
Energy Community targets	31,0	427,64 (decrease of 60,9% below 1990 level)	129,88	79,06
Bosnia and Herzegovina targets	43,6	15,65 (decrease of 41,2% below 1990 level)	6,50	4,34

Integrated governance is needed to ensure that all energy-related actions at European Union Energy Community, regional, national and local level contribute to common objectives. Goals are achieved through action in five key dimensions:

- energy security;
- internal energy market;
- energy efficiency;
- decarbonization, and
- research, innovation and competitiveness.

6 Millions of tons of carbon dioxide equivalent.

7 Millions of tons of oil equivalent.

10.3. Legal framework in the energy sector

Laws at the level of Bosnia and Herzegovina

- ZLaw on Transmission of Electric Power, Regulator and System Operator of Bosnia and Herzegovina
- Law Establishing the Company for the Transmission of Electric Power in Bosnia and Herzegovina
- Law Establishing an Independent System Operator for the Transmission System in Bosnia and Herzegovina

Laws in the Federation of Bosnia

- The Law on Energy and Regulation of Energy Activities in the Federation of Bosnia and Herzegovina
- Law on Electricity in the Federation of Bosnia and Herzegovina
- Law on Energy Efficiency in the Federation of Bosnia and Herzegovina
- Law on the Use of Renewable Energy Sources and Efficient Cogeneration

Laws in Republika Srpska

- Law on Energy
- Law on Electricity of the Republika Srpska
- Law on Energy Efficiency of the Republika Srpska
- Law on Renewable Energy Sources of the Republika Srpska
- Law on Gas of the Republika Srpska

Laws in Brčko District of Bosnia and Herzegovina

- Law on Electricity
- Law on Renewable Energy Sources and Efficient Cogeneration of Brčko District of Bosnia and Herzegovina
- Law on Energy Efficiency in Brčko District of Bosnia and Herzegovina

11. MOST IMPORTANT UNITS OF MEASUREMENT IN THE SECTOR

The SI[8] unit of measurement for energy is Joule (J).

Multiples of the unit watt-hour (Wh) are common for calculating energy in the power system, e.g. kilowatt-hour (kWh) and megawatt-hour (MWh). Knowing that J = Ws (watt-second), it follows that 1 Wh = 3,600 J, and 1 kWh = 3,600,000 J (3.6×10^6J).

- **A kilowatt-hour** is a unit of measurement commonly used by electricity suppliers for billing purposes, as monthly energy consumption of a typical household varies from several hundred to several thousand kilowatt-hours.
- **Megawatt-hours** (MWh), **gigawatt-hours** (GWh) and **terawatt-hours** (TWh) are used to measure large amounts of electricity for industrial customers and in energy production.
- **Terawatt-hour** and **petawatt-hour** (PWh) units are large enough to express the annual production, i.e., electricity consumption of an entire country and at the global level

A standard cubic meter (Sm^3) is used to measure consumption in the natural gas sector.

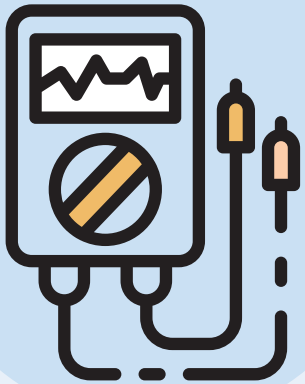
- It represents 1 m^3 of a gas at a standard pressure of 101,305 Pa (1.01325 bar) and a temperature of 288.15 K (15 °C).
- **The energy** of the delivered quantity of natural gas for a billing period is calculated as a product of the volume (quantity) of the delivered natural gas (determined by reading the measuring device - meter) and the average **calorific value** of the delivered natural gas for a given billing period.

When analyzing global energy consumption, the basic measurement unit for energy (Joule) is not used because the amounts would be too large. Due to the widespread use and importance of oil in the modern world, often all consumption, regardless of its source, is converted into **Tons of Oil Equivalent.**

1 toe = $4{,}1868 \times 10^{10}$ J = $4{,}1868 \times 10^{-5}$ PJ = $1{,}1628 \times 10^4$ kWh

8 The International System of Units SI (from French *Système International d'Unités*), is a system of measurement units the use of which is prescribed by law in practically all countries of the world.

The Anglo-American unit of measurement barrel, which has an approximate value of 0.159 m^3, is primarily used in international trade for the volume of oil and oil derivatives.



The watt (W) is the unit of power.

- Power is the work done or energy converted per unit of time.
- Multiples of this unit are common in the power system, e.g. **kilowatt** (kW) and megawatt (MW).

The **volt** (V) is the unit of electric voltage.

- Electric voltage is the difference in electric potential between two points in an electric field or circuit.
- **Kilovolt** (kV) is a common multiple of this unit.

Amper (A) is the unit of electric current.

- It is the basic unit of the International System of Units.
- Electric current is the flow of charged particles. The term strength of the electric current is used when describing the physical quantity, not the flow.

Herz (Hz) is the unit of frequency.

- One hertz is the reciprocal of one second ($Hz = s^{-1}$).
- Frequency is a physical quantity that expresses the number of repetitions of a periodic phenomenon in a unit of time.
- The frequency of alternating current in Europe is 50 Hz. In North America, it is 60 Hz.

REFERENCES

[1] H. Wayne Beaty, Donald G. Fink: Standard Handbook for Electrical Engineers, The McGraw-Hill Companies, Inc., New York, 2013.

[2] State Electricity Regulatory Commission: Annual Report 2023, Tuzla, December 2023.

[3] Energy Community Secretariat: The Energy Community LEGAL FRAMEWORK, Edition 5.0, Vienna, October 2023, updated in January 2024.

[4] Energy Community Secretariat: Annual Implementation Report, Vienna, November 2023.

[5] National Geographic Society www.nationalgeographic.org/society/education-resources/

[6] European Environment Information and Observation Network www.eionet.europa.eu/ www.eionet.europa.eu/gemet/hr/concept/2742

[7] Miroslav Krleža Institute of Lexicography: Technical Lexicon, Zagreb, 2007. tehnicki.lzmk.hr/Projekt

[8] Eurostat Energy glossary

[9] Eurostat ec.europa.eu/eurostat/statistics explained/index.php?title=Beginners:Energy_flows#Primary_and_secondary_energy_products

[10] Eurostat ec.europa.eu/eurostat/statistics-explained/index.php?title=Beginners:Energy_-_background#Energy_policies

Editor's note

It is often the case in Bosnian, Croatian and Serbian language that the following two words are interchanged in everyday speech, by the media, but also in expert circles: energetski (relating to energetics) and energijski (relating to energy). Although they sound similar, they have different meanings.

The adjective *"energetski"* (relating to energetics) is derived from the word *"energetika"*, which means energy technology. This term encompasses scientific and technical fields dealing with energy. Therefore, the adjective *"energetski"* means related to energetics. We see this in examples such as: energetski stručnjak, energetski menadžment, energetski savjetnik, etc. (energetics expert, energetics management, energetics advisor, etc.) From the noun "energetika" (energetics), an adjective in the form *"energetički"* (as in botany - botanical) could also be derived, but such an adjective is not common. On the other hand, the adjective *"energijski"* is well-formed from the word *"energija"* (energy) and the suffix -ski, thus meaning related to energy, similar to how *"hemijski"* (chemical) relates to *"hemija"* (chemistry.) It can be found in various examples such as: energijski spektar, energijski efikasan, energijski resursi, energijski zagađivači, energijski intenzivne industrije... (energy spectrum, energy efficient, energy resources, energy pollutants, energy-intensive industries...). However, in practice, the adjective *"energetski"* is often used to refer to both energetics and energy, so it needs to be clarified what it refers to. As a result, we can find such examples: energetski udar na državu, energetski slom, energetski kolaps, energetski izvor, energetski učinak, energetski kabl... (energetics strike on the state, energetics collapse, energetics collapse, energetics source, energetics effect, energetics cable...). Keeping in mind the described differences in formation and meaning between the adjectives *"energetski"* and *"energijski,"* it remains unclear how energetics can strike the state, or how the mentioned components of energy technology can collapse... Apparently energy has certain effects; it is not energetics that emerges from somewhere, but energy, energetics is not transformed from one form into another, but energy. The word *"energijski"* should have been used in these examples: energijski: energijski udar, energijski slom, energijski kolaps, energijski izvor, energijski učinak, energijski kabl... (energy strike, energy collapse, energy source, energy effect, energy cable...).

Instead of a conclusion: it is appropriate to use the adjective *"energetski"* when referring to energetics, which is the field of human activity related to energy, and the adjective *"energijski"* when referring to energy.

Legal texts and regulations in Bosnia and Herzegovina, as well as the entire energy and energetics sector, in most cases use the adjective *"energetski",* while the adjective *"energijski"* is being timidly and slowly introduced. Such a situation is also reflected in this document. We hope that the recommendation given in the previous paragraph will be fully implemented in the preparation of new documents in this sector.

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