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# Application Of The Law Of Conservation Of Energy In Economics

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## ABSTRACT

The article is devoted to the effective use of the laws of nature for the economy. Here we are talking about the law of conservation of energy. The article will be useful for students in the field of physics.

## KEYWORDS

Energy, energy transfer, matter, law of conservation of energy, motion of matter, efficiency.

## INTRODUCTION

Humanity has fought and is fighting for energy sources for survival and development since ancient times,. People are waging this struggle either with Nature or with each other to this day. In business, in the market, the same thing is happening: the struggle is being waged for an energy carrier for business activity.

The ability to manage energy in the economy can be determined by the knowledge and skill of practical use of fundamental physical laws that govern EVERYTHING in the visible part of the Universe, man incl.

Energy is a single measure of various forms of movement of matter and a measure of the

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transition of the movement of matter (money) from one form to another (from one owner to another). In addition, energy is a measure of the ability of a physical system (business, enterprise, leader, manager, etc.) to do work.

The work can determine the amount of energy transmitted or received by the system by changing its external parameters. With regard to a person, work is a person's activity aimed at creating value or meeting the needs of other people. Moreover, work is directly related to strength.

It turns out that energy is what is inside the work. Energy indicates the presence of force, the ability to carry out (project, business, task, etc.).

The law of conservation of energy is a fundamental law of nature, established empirically. At the level of everyday simplicity, he says that energy cannot arise from nothing and cannot disappear into nowhere, it can only change from one form to another (for example, the energy of falling water turns into electrical energy at a hydroelectric power station).

Using the concept of energy and the law of its conservation, one can describe, investigate and resolve any situation in the business environment. Because business is determined by business relations between people, which are already regulated at the level of the human mental world. And the psyche is nothing more than energy, which is the cause of all physical manifestations of a person. And it is the psyche that determines the life principle, the life force of a person - his ability to do work in business, both independently and together with others (clients, colleagues, partners).

Another point is how a person in the role of a leader uses this energy - how effectively he invests it in each of his actions in the market. It is also worth remembering that the daily practice of energy management is carried out in at least 4 areas of life:

1. Personal personal sphere (the physical aspect of the existence of a person)
2. Sphere of affective relationships (emotions, sex, love, family, friendship)
3. Business sphere (intermediaries in economic, legal activities, etc.)
4. Sphere of social relations (communications, diplomacy, politics)

A functional, mature leader harmoniously manages his life in these areas and knows how to prioritize the two most important resources in them: time and energy. As for employees, within the framework of business activity, their energy is either prioritized into the energy of the business (according to the law of conservation), or not.

So we have two options:

1) The employee purposefully invests in the relationship with the client; acquires knowledge for business; strives to grow and develop its functionality; flexibly manages his time, leaving the "simple joys of the earth" until the moment of triumph as a reward for the achieved result.
2) The employee resists or opposes (self-sabotaging); spends working time on personal affairs using company resources; serves the term of office life "from call to call" while maintaining the visibility of work; spends personal resources on regular emptiness, i.e. nourishes the body without developing the mind.

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Thus, an ambitious leader has a "performance problem" that is expressed in two aspects:

1. How to effectively structure the energy of the internal business environment (personnel, assets, technology, infrastructure)
2. How to effectively invest the force of the company's actions in relations with the external environment (customers, partners, competitors, society)

What is efficiency? It is the ability to produce the desired results. In the economic sphere, efficiency is expressed in relation to the useful end results of the functioning of the system (profit, values) to the expended resources (time, energy). The principles can work here: the maximum result with the minimum cost or the required result with the optimal cost.

The great thing is that this energy efficiency can be learned. It can be acquired as a skill, as a regular criterion and principle for action. Yes, this requires, in turn, certain time and energy costs on the part of a person. Yes, no one is obliged to guarantee you the result, because after mastering the knowledge and working it out in practice within the framework of the training cycle, the moment comes to make a volitional decision: to act or not to act in a new paradigm. However, this game is worth it, because the law of conservation of energy, and together with it the law of synergy, operate independently of our will. And here, again, there are two options (our world is so dialectical ...):

1) A person reacts with an accurate energy response (action of force) to every opportunity to make money. It is embedded in the context (situation, relationship), and the result of the interaction leads to an increase in the person's energy. I put part of my energy into action before, and then I took the energy of the result of interaction and grew, earned.
2) A person does not react with the action of force to an opportunity for earning, or spends the energy of an inevitable response to a situation nonfunctionally. He does not invest in the context and dissipates his energy, belittling himself, degrading. I don't put energy into action, and then it is spent in some other way (on empty deeds, on aggression, on illness, etc.), "heating the space" - I have not grown, I have not earned.

Now we have touched on only one of the laws of Nature that works in business. Perhaps this did not come out quite clearly, because here it is necessary to explain and show "live". However, the universality of this law (it works always and everywhere) makes it possible to use it in all spheres of life. One has only to begin to realize that the primary causes of all our actions arise in the inner world, in our psyche - energy begins to move there, generating certain results depending on our activity or passivity in relation to the external world.

Also in business - all the results and economic effects of a company's actions in the external environment are determined by energy causes that arise in its internal environment, in the internal world of the organization, if you like, in the "psyche of business". Who knows - he can. Who wants to - he acts. Whoever acts effectively wins, and he is the market leader. There is no other way.

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Ignorance of universal laws does not absolve one from responsibility for results. And these laws operate regardless of what we are and what we think of ourselves. And you can learn and apply - knowledge is around us. And the one who wants, takes this knowledge and invests in his business.

Does the law of conservation of energy work in the economy?

Since the discovery of the law of conservation and transformation of energies, since 1849, no one has asked the question whether this law is valid in economics.

It is known from history that alchemy wished us to live long, because the law of conservation of the amount of matter was discovered in it. This law is essentially the law of conservation of energy in relation to the substance of nature - the form of the potential state of energy.

In the economy from small farms to large farms, farms of countries and the world economy, people deal with goods, mainly material, which suggests that there are similar conditions between economics and chemistry for the law of conservation of energy. Material goods are composed of the substances of nature. The essence of any production of material goods is reduced to the transformation of these substances and to transformations of various kinds of kinetic states of energies, attracted by people in production in huge quantities

If the law of conservation and transformation of energy in the economy is in effect, which I personally have no doubt about, then what name could it have in it?

Obviously, the law of conservation of value. Or even simpler - the law of value, the existence of which was assumed by both Marx himself and his contemporaries and predecessors, literally the same way as M. Lomonosov assumed the existence of the law of conservation of energy.

If the law of conservation of energy also operates in economics, then, apart from the name, what could be its formulation? I suppose this is enough:

“The benefits in production do not disappear and do not appear for no reason. They are transformed in it, with each production cycle they qualitatively and quantitatively increase from transformations, additionally attracted, previously spontaneous (useless, and even harmful) energies of nature, into useful goods".

It follows from this definition that labor is not the source of value creation, because it is value itself and requires it to find the source of its value. The source of value, including the value of labor, can only be the energy of nature. All its types, in any of its two states.

Energy is good for humans. A fundamental benefit for all other benefits known to mankind. It is the source of all other benefits.

Energy (gr. Energeia - activity) is the source of life, the basis and means of managing all natural and social systems.

Energy - one of the main properties of matter - the ability to do work; in a broad sense, strength.

It is obvious that the laws of energy transformation are manifested in all processes occurring in nature and society, including

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economics, culture, science and art. Energy is the driving force of the universe. There is an energy component in everything: in matter, information, works of art and the human spirit.

Energy exists in many forms and types: solar, thermal, chemical, electrical, nuclear, wind, water, and others. The forms of energy are different in their ability to perform useful work. The energy of weak wind, surf, low-power geothermal sources can do a small amount of work. Concentrated forms of energy (oil, coal, etc.) have a high working potential. The energy of sunlight, in comparison with the energy of fossil fuels, has a low efficiency, and in comparison with the dissipated low-temperature heat, it is high. The quality of energy concentrated in biomass of plants, animals, and fuel differs from the quality of dissipated thermal energy.

The quality of energy characterizes its ability to perform work, that is, its exergy (gr. Ex - the highest degree, ergon - work).

Exergy is the maximum work that a thermodynamic system performs during the transition from a given state to a state of physical equilibrium with the environment.

Exergy is a useful fraction of the energy involved in a process, the value of which is determined by the degree to which a certain parameter of the system differs from its value in the environment.

In nature, an indicator of the quality of energy can be the number of calories of sunlight that must be dissipated to produce 1 calorie of a higher quality form of energy.

The transformation of sunlight in the food chain, or the electricity generation chain, or other transformation chain is always accompanied by a decrease in the amount and an increase in the quality of the energy accumulated at each stage.

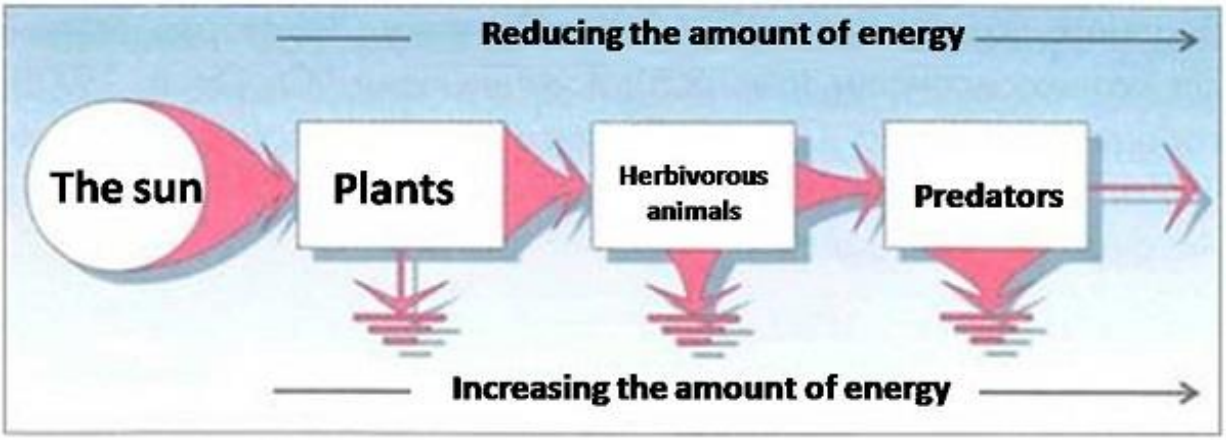


**fig. 1**

Changes in the quantity and quality of energy in the food chain (according to Yu. Odum)
In fig. 1. it is shown that the amount of energy coming from the Sun decreases at each subsequent level, but its quality increases. To form 1 kcal of plant biomass, approximately 10 times fewer kilocalories of sunlight are required than for the formation of 1 kcal of plant biomass. The ability to perform work per

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unit of animal biomass is correspondingly higher than the same biomass of plants.

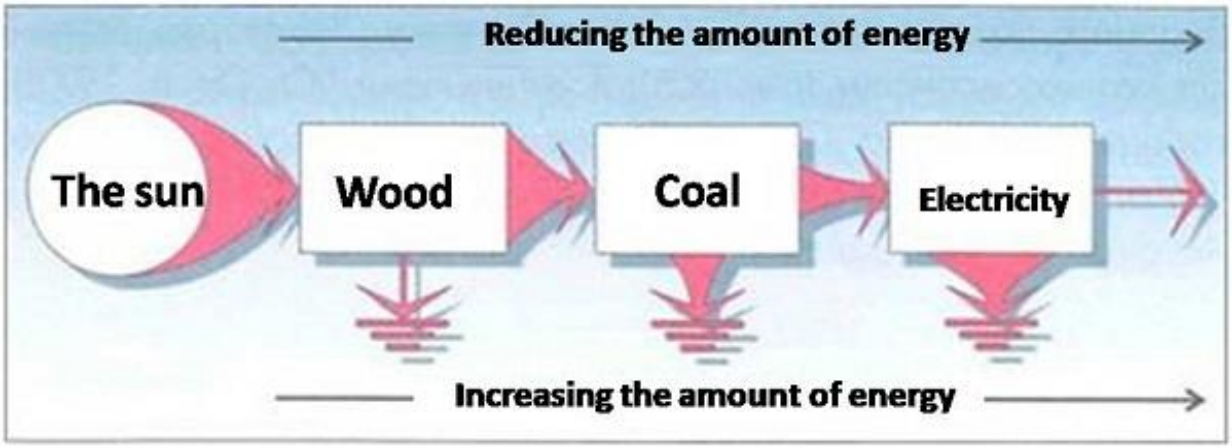


**fig. 2**

Change in the amount and quality of energy in the electricity generation circuit (according to Yu. Odum)The working potential of electrical energy is also many times higher than the working potential of wood (Fig. 2). In essence, the quality of energy is measured by the length of the path it has traveled from the Sun.

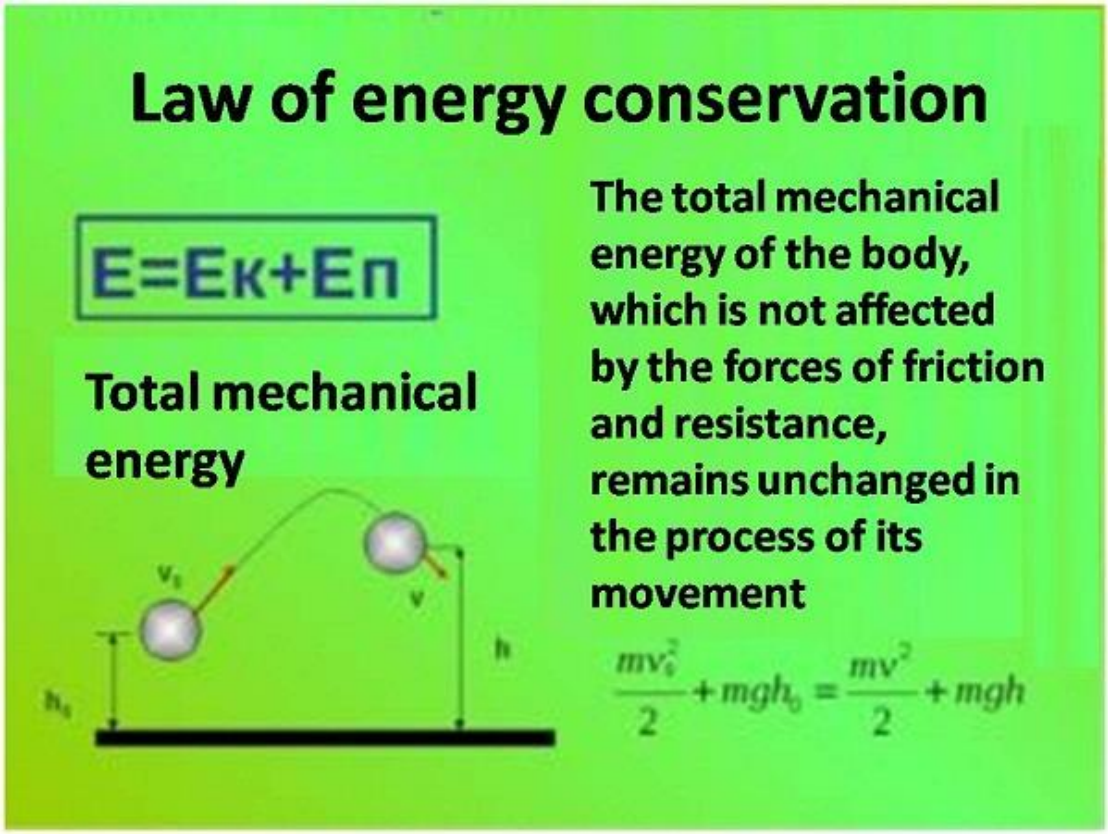


**fig. 3**

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This law is formulated as follows in the most concise formulation: "The energy of any closed system, for all processes occurring in the system, remains constant.

Energy can only transform from one form into another and redistribute between parts of the system.

For an open system, an increase / decrease in its energy is equal to a decrease / increase in the energy of bodies interacting with it and physical fields."

The law of conservation of energy is a fundamental law of nature, established empirically and consisting in the fact that for an isolated physical system a scalar physical quantity can be introduced, which is a function of the parameters of the system and is called energy, which is conserved over time.

Some authors disagree that energy is a scalar quantity. After all, energy is a physical quantity that characterizes the movement of matter, and the concept of movement is obviously associated with the concept of direction.

The law of conservation of energy in the modern interpretation says nothing about the conservation of the direction of motion, since energy is interpreted as a scalar quantity.

Since energy is a characteristic of motion, the law of conservation of energy is a special case of a more general law of conservation of motion, which takes into account not only the conservation of the amount of energy, but also the conservation of the direction of motion.

It is the law of conservation of motion that reflects not only the eternal existence of matter, but also its eternal motion. The law of conservation of energy says that energy is not created out of nothing and is not lost without a trace. With all processes occurring in nature, one type of energy is converted into another.

The chemical energy of flashlight batteries is converted into electrical energy, in a light bulb, electrical energy is converted into heat and light - this is a simple example of an "energy chain" showing how one type of energy is converted into another.

Since the law of conservation of energy does not refer to specific quantities and phenomena, but reflects a general, applicable everywhere and always, regularity, then it can be called not a law, but the principle of conservation of energy.

Efficiency

At first glance, the law of conservation of energy seems to assert that energy should not be lost during any transformations. But we are all familiar with the concept of efficiency, that is, we know that the transformation of energy of one type into another is associated with energy losses.

There is no contradiction here, since we are talking about "useful action". When we talk about efficiency, we always, explicitly or implicitly, mean some process of converting energy into work, and we compare the amount of energy expended with the work received.

But the efficiency of any real (irreversible) process cannot be 100% when converting energy into work (this principle is known as the second law of thermodynamics).

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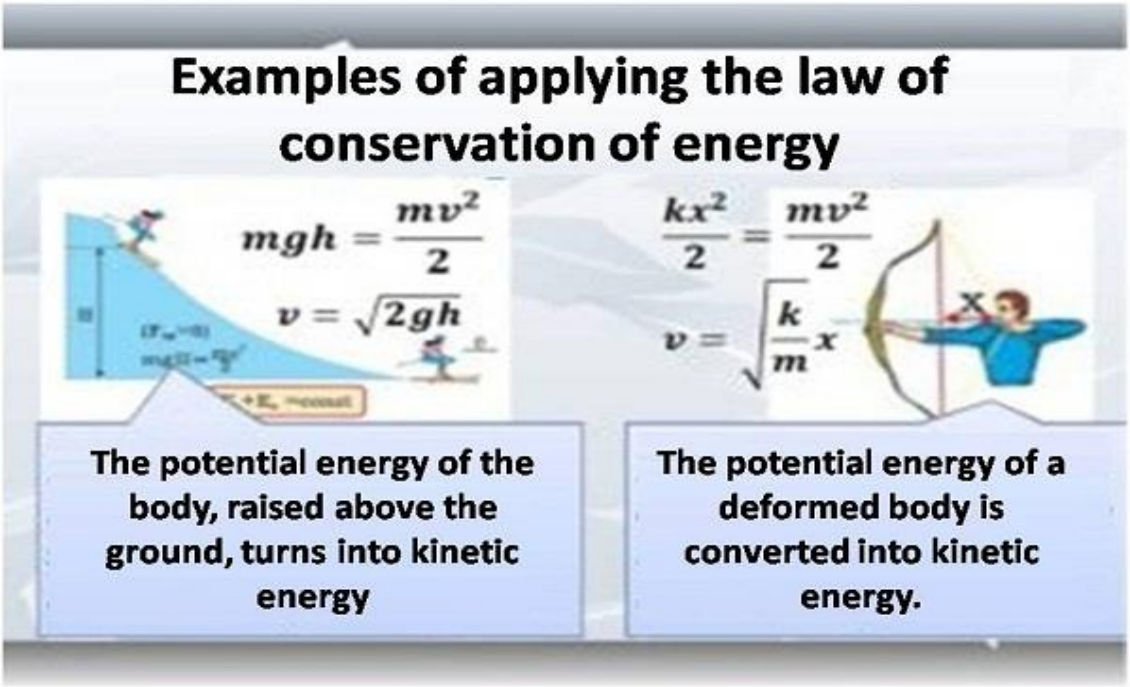
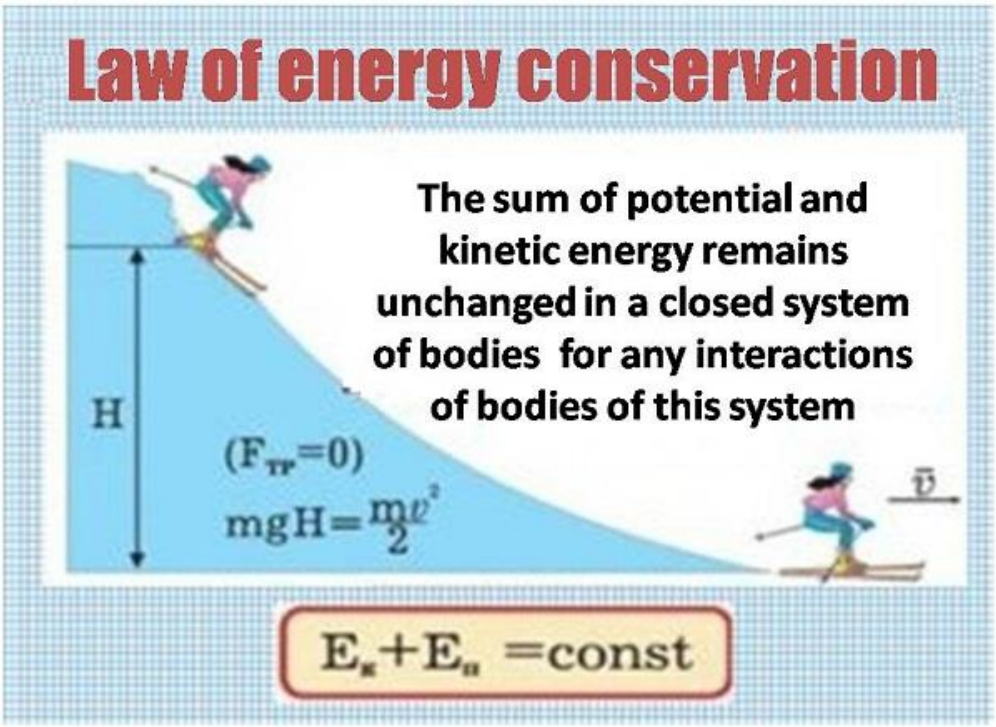
The reason is that in the course of any such process there are inevitable losses of energy, mainly due to friction and heating of the bodies involved in the process. Friction is also a result of heating, that is, part of the expended energy always turns into heat.



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## CONCLUSION

The discovery of the law of conservation and transformation of energy is usually associated with the names of R. Mayer, D. Joule, G. Helmholtz. They came to the discovery in different ways. The formulation of the law of conservation and transformation of energy, according to Helmholtz, is as follows: an increase in the kinetic energy of a body is equal to a decrease in its potential energy.

He expressed the resulting law in mathematical form and linked the law of conservation of energy with the principle of the impossibility of creating a perpetual motion machine. Joule determined the value of the equivalent of the conversion of mechanical energy into heat.

Mayer considered various types of energy: kinetic, potential, their sum - mechanical energy, as well as thermal, electrical, chemical energy. He believed that all these types of energy can be mutually transformed - provided that the total amount of energy remains unchanged.

For example, the quantitative expression of the law of conservation of energy in chemical production is the thermal (energy) balance.

It is the law of conservation of motion that reflects not only the eternal existence of matter, but also its eternal motion.

The chemical energy of flashlight batteries is converted into electrical energy; in a light bulb, electrical energy is converted into heat and light - this is a simple example of an "energy chain" showing how one type of energy is converted into another.

Since the law of conservation of energy does not refer to specific quantities and phenomena, but reflects a general, applicable everywhere and always, regularity, then it can be called not a law, but the principle of conservation of energy.

Where does the Law of Conservation of Energy apply?

Consider another example: bodies charged with electricity, such as thunderclouds. When lightning is formed, a number of changes occur: the air heats up and the clouds are discharged. The energy of bodies depends not only on their temperature, but also on the distribution of electric charges on these bodies.

During the discharge, both change, but the total energy of the clouds and air remains unchanged.

This invariability of the total energy in all the processes occurring is the law of conservation of energy. It can be formulated in its most general form as follows. The energy of bodies depends on their speeds, position, temperature, shape, chemical composition, etc.

The change in the energy of bodies occurs either due to the work performed by these bodies, or due to the transfer of energy to other bodies. If we consider all the bodies participating in the process, then their total energy remains unchanged.

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