BREAKTHROUGHS IN ENERGY INDUSTRY

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Nowadays it is impossible to imagine our life without energy or electricity. Computers and smartphones have become an integral part of people routine or job; moreover, we don't even pay attention to something so ordinary for us as a light bulb or availability of mobile communication. All of these objects don't work by themselves, but require electrical energy.

How often do we consider where the electric current in a wall socket comes from? Let's be honest – not very often. We just know that there are NPPs, TPPs and HPPs and other types of power plants. Many people do not need additional information; because an average consumer isn't interested in Physics and technologies – it does not matter – what really matters is the result (i.e. the received resource). From this point of view, advanced scientists and those indifferent to energy issues are quite similar: both of them need to have a power supply for their devices. When many people need energy, availability decreases, leading to higher costs. Despite the pursuit of economy, humanity consumes more and more. Thus, the focus shifts to the sources of energy and their sustainability.

It is necessary to understand why renewable energy sources (not any others)

are so necessary in the context of current and future technological development. Initially, people managed to convert thermal energy into mechanical and later into electrical energy. This can be considered the first major breakthrough in this field. It seemed very convenient: you burn something as long as it burns, and you have electricity in your house. However, fuel has the unfortunate property of running out. The Earth isn't a bottomless reservoir of oil, natural gas, or coal. Thus, we have come to the point that we must look for an alternative to fossil and non-renewable fuels.

Energy does not simply appear or disappear; it changes from one form to another. The Law of Conservation of Energy cancels all hopes on inventing something fictional like a "perpetual engine". All energy sources including renewables are exhaustible and will require replacement over time; the only difference is the duration of their availability.

Energy is everywhere: in atoms, mechanical waves, photons, etc. The next scientific breakthrough is the utilization of the following three forms of energy to generate electricity:

- Mechanical (used in wind and hydroelectric power plants)
- Atomic
- Solar

These renewables, especially solar energy, can be considered "infinite" relative to human lifespan and the existence of civilization. However, there are other working types of energy sources. All the three sources mentioned above have disadvantages: reactions in nuclear reactors at NPPs can be dangerous, as evidenced by tragedies like Chernobyl; hydroelectric power stations and wind power plants are difficult to build and not feasible everywhere; the construction of solar power plants requires a very large land area, in addition, their energy production will be uneven due to changes in the length of daylight periods in different seasons. Summing up, we should search additional renewable options. The next third breakthrough shifts focus from physics and new methods of energy conversion back to fuel. Yeas, like that – burn something again. The development of chemistry made it possible to obtain some type of fuel from waste. When there is nothing left to burn, you could recycle garbage into fuel

(usually, in gas form, but not always). It allows us to continue to generate energy from combustion while reducing pollution; everyone wins from this.

It very beneficial if we can take energy from the environment (the second "breakthrough"), as Sun, wind, rivers and especially atoms will remain available for an incredibly long period, but it is much better when you can renew resources (the third "breakthrough") and replace exhausted ones with them. The first "breakthrough" (regarding fossil fuel) isn't related to renewables, although, it gives the reason for the emergence of the next two. We've known since school that microorganisms are among the most common life forms. Microbial fuel cells include them as components. Microbial fuel cell is a device that uses the byproducts and processes of bacteria's vital activity to obtain energy. It's like a "live battery" – the fourth "breakthrough". The advantages include: 1) it doesn't pollute environment, on the contrary, industrial waste can be used; 2) resourcefulness is easily restored: as some microbes die, new ones appear. Efficient designs are being developed, so this is not widely applied. But the beginning has been made and, possibly, in a few dozen years this technology will become as common as NPPs.

Regarding the fifth "breakthrough", it could be anything, but the tendency is the following: take something that is always available and won't end too quickly if you start mining it and you'll get a new renewable energy source. It could be extracting energy from sound waves or the Earth's magnetic field, you can fantasize, because renewables are really a promising topic.

All in all, energy is one of the most essential resources. Thanks to it, most of our technologies function, and our gadgets aren't just useless pieces of plastic with radio and electrical components. Since energy sources are not eternal, we must look for new renewables and, strive for further breakthroughs in this branch of science.

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