

EDITORIAL

Industry 4.0: towards the electrification of energy

From the origin of the humanity, the energetic requirement has been one of the fundamental problems for the evolution of society, it is enough to remember that for millions of years humans was a hunter and gatherers to satisfy his own energy needs.

A turning point in the evolution of humanity was the emergence of the industrial society. The world began to transform with speed never seen in history, primarily by the greater ability to perform work; at this time, in the form of thermal energy converted into mechanics thanks to the combustion engine. Steam horses reflect the impact of this change; for example, a 100 HP engine could do the same job as 100 horses.

The result was a real revolution that gave origin to industrialization, the factories, the generation of employment and with it to economy and development; nevertheless, this also generated inequality and the massive use of natural resources.

At the beginning of the industrial revolution, denominated Industry 1.0, engines were fueled by coal as one of their main fuels; however, the industrial boom motivated the search for more efficient conversion processes, due to the relatively low performance of the combustion machines.

In this context, as an alternative of higher efficiency, electric power arises, and many combustion machines begin to be replaced by electric engines, which leads to the 2.0 industry with a massification of electrical power systems and a strong technological growth; not only for the industry but also for the well-being of people. However, all this causes a strong increase in energy consumption, which continues to be sustained by fossil fuels, adding oil and gas to the energy matrix of that time.

The rise of electronics and the consequent development of information and communication technologies (ICTs) consolidate industrial growth, giving birth to the so-called industry 3.0 and with it the age of objects: televisions, computers, satellites and multiple electronic devices for all types of applications. The massification of these devices and the subsequent emergence of information networks again create a strong increase in the energy requirements of the planet.

Alongside with the requirement of electric energy, the development of transport and various thermal processes cause fossil fuels to become the basis of the planet's energy supply, as indicated by the International Energy Agency (IEA), which indicates that the total supply of primary energy in 2017 was supplied in an 81% by fossil fuels, where oil constitutes 32%, coal 27%, and gas 22%.

This reality is not sustainable, both due to the inevitable disappearance of fossil fuels and the adverse effects they generate, mainly from the environmental point of view.

On the other hand, industrial development continues to grow, and little by little the so-called smart systems are being installed in the world. Perhaps the best example is the Smart City, a new paradigm that no longer sets the development of new objects, but as it says Fritjof Capra "a society where objects are no longer the important thing, but the relationships between them." In this way, the emergence of the so-called Industry 4.0 begins, where cyber physical systems and digitalization will allow creating a new communication language between objects and their environment, enabling the development of many new smart applications.

The impact of these smart systems in daily life will be tremendous, estimating that the 23 billion devices currently connected (2018) will increase to 75 billion in 2025 (IHS, Statista 2018). In other words, in 2025

each person will have an average of ten connected devices, all of which will unavoidably demand more energy; constituting, therefore, a future scenario where the energy requirements will continue to increase.

Connected to the information mentioned early, is the fact that the shortage of fossil fuels will critically affect transportation, highly dependent on this energy source. This is the reason why the electromobility will begin to be a protagonist, which shows a future increase of electrical energy in the energy matrix of the planet.

In this scenario, the discovery of new energy sources and conversion processes seems urgent; however, to date, there is no more optimal conversion process than electricity, but it is imperative, as indicated by the International Energy Agency (IEA), to begin “promoting sustainable energy policies that stimulate economic growth and environmental protection in a global context; above all, regarding reducing greenhouse gas emissions that contribute to climate change “(IEA 2018).

Consequently, in this new society led by industry 4.0, the trend seems to be the electrification of energy, but with a strong increase in sustainable generation friendly with the environment such as renewable energy. The development of new energy storage systems, like new batteries and fuel cells, and the efficient use of energy through new smart systems such as smart grid, smart meter, smart home, among others, seek that the end user would not only a consumer, but also an active element of the system, perhaps the most relevant to achieve a sustainable environmental, social and economic growth.

How it looks, the world has evolved, from the caverns age to smart homes, but from the energy point of view, the problem remains the same.

Dr. Horacio Díaz Rojas
Escuela Universitaria de Ingeniería Eléctrica-Electrónica
Universidad de Tarapacá
Arica, Chile, hdiaz@uta.cl