

Revolution and not a perpetuum mobile

The C-GEN installation flexibly adapts to the situation and, at the operator's request, it stores or delivers as much electricity to the system as is currently necessary, ensuring energy security. Using the energy mix, in which there is both RES and the cheapest hydrocarbons or biomass - says President of Clean World Energy Systems Ltd. - Mr. Tadeusz Bąk about C-GEN installations.

BiznesAlert.pl - Your company implements C-GEN technology, which will use coal, the cheapest energy carrier. As I understood, this technology is an integration into a highly efficient production process of several already known technologies, well-proven in the power industry, petrochemistry and the chemical industry. Can you briefly present this process?

President Tadeusz Bąk - Contrary to appearances, coal fuels do not have to be the cause of the growing greenhouse effect. Properly used, they can contribute to the immediate reversal of this process. As a result, we can produce oxygen based on coal. It sounds futuristic, but the C-GEN technology we implement gives such opportunities. Poland can become a global leader in changes in the energy sector. In the opinion of scientific and business communities, well, mainly mainly foreign, we are on the verge of tectonic changes in the energy sector and overcoming the existing paradigms in the field of environmental protection.

C-GEN technology integrates in a novel way several well-known, mature and widely used partial technologies in the industry, which makes it possible to achieve remarkable synergy effects. It is suitable for multi-sector use - in power engineering, industrial chemistry, agriculture, and environmental protection. C-GEN is based on the well-known and recently used in Poland gasification process (mineralization) of coal fuels - hard coal, lignite, biomass or municipal waste. As we remember in many Polish cities, there were gasworks, from which gas was supplied to residents, but also served to illuminate cities. This type of low temperature gasification forms the basis of C-GEN technology.

Excess and cheap electricity during periods such as night, is directed to the process of electrolysis - decomposition of water into hydrogen and oxygen. Hydrogen is directed to a well-known methanation process using gases from the gasification process, whereby we get methanol or methane - no different from pure methane, which can be liquefied to the storage form of LNG. It is worth noting that the storage of surplus electricity in synthetic LNG can take place at any industrial scale and is relatively cheap in contrary to unusually expensive and environment cluttering LI-ion batteries. Oxygen from the electrolysis process and water vapor from the methanation process are directed to the mineralization process. In this part of the process, we manage all waste products from electrolysis and methanation. This is the most effective way known to science to conduct gasification.

On the other hand, in periods of electricity demand, gases from the gasification process are directed to catalytic oxidation with the use of atmospheric air, as a result of which we obtain CO₂, H₂O and N₂. What is extremely important, the low temperature mineralization

process excludes the formation of nitrogen oxides, dioxins or furans. We have an increase in the temperature of gases, comparable to the boiler of a power plant. The steam generated there is converted into electricity and heat in a classic turboset. In C-GEN technology, we use carbon dioxide and pure nitrogen produced during daylight hours as well as hydrogen produced during the night hours as by-products, for the production of ammonia and urea in well-controlled synthesis processes. However, the production of urea does not require the use of imported natural gas. This is an extremely favorable situation for Poland, because it allows you to become independent from expensive, imported gas from the East. This situation means that the cost of urea production can be at least two times lower than on imported natural gas, thanks to which Poland can gain a competitive position in the supply of fertilizers worldwide. We realize that for our chemical industry this technology can be a deadly threat. Of course, if this technology is owned by companies from the west or east.

The combination of several known technologies allows for the production of electricity and heat in a virtually emission-free manner, also excluding the production of dust and smog. The waste is natural gas, urea, ammonia or methanol. One more curiosity, in the classical ammonia production process in chemical plants, approximately 1.2 tons of CO₂ are emitted into the atmosphere per one tonne of ammonia. In our case, ammonia is produced completely without emission. I believe that the interministerial team can prepare new environmental proposals for the UN climate summit in Katowice as part of Poland's contribution in this area.

- Is it possible to say that this is a process in which we can generate electricity, but we can also consume it when it is in excess? - for example, produce synthetic natural gas, without large losses, as in the case of battery and battery storages?

- C-GEN is more than just energy storage. C-GEN allows you to manage energy - avoiding its uneconomical storage, as is the case with the absurdly expensive Li-Ion cells - producing and consuming it depending on the current demand. The specifics of this technology allows for the implementation of a stabilizing and regulatory function for the power system. Taking into account its scalability, it can meet the expectations set for prosumer sources at any scale, also meeting the expectations posed to energy clusters. The management concept, instead of storage, is the financial core of C-GEN. The so-called energy storage is an erroneous narrative that some participants in the energy market can get involved in. Instead of incurring enormous costs of building energy batteries and their subsequent utilization, you can intelligently control production and energy consumption. From the point of view of the buyer of gas or urea it is after all exactly indifferent whether the products were created at night or during the day. Together with the rapid growth of renewable energy sources and the resignation of coal-based energy in the west, it is not difficult to predict that there will be an uncontrolled increase in excess energy, which can be managed by C-GEN, the only technology of its kind in the world. What's more, we observe global transformation of the power industry (including: power industry with coal and lignite mining, gas industry, liquid fuels sector, heating) - taking place in new environments (technological, economic, business and social), embracing "everything". This situation enforces the inevitable (irrevocable) need to reorganize the entire economy, the most extensive, deepest and most dynamic process in history. C-GEN goes in line with

these changes and market expectations. There is only a question if we can use this unique opportunity? At present, the largest global companies are interested in purchasing this technology. And in Poland? Most often I meet with the statement that if it was technology from abroad, quote: "... we would buy it immediately ...".

- How are you supposed to understand the definition that C-GEN will belong to a new economic model, the so-called "Circular economy"?

- C-GEN technology is the concept of building a value chain in the closed circuit process. "Circular economy", where waste from one process becomes the raw material for another, and industrial symbiosis causes waste or by-products from one sector - for example agriculture or industry - to become a raw material for another. Thanks to this approach, we become competitive in relation to entrepreneurs from other parts of the world. In our case, we eliminate losses in the whole chain of electricity production processes and its storage.

It is worth showing this on the example of the LNG terminal in Świnoujście and Zakłady Azotowe in Puławy. Instead of the current model in which the LNG Świnoujście and Zakłady Azotowe in Puławy operate within a distance of several hundred kilometers, we will have C-GEN installations. We will not burn about 2 percent. gas and emit CO₂ to re-gasify LNG, and several hundred kilometers farther also burn gas to again produce CO₂ (and hydrogen) to produce ammonia and urea.

What are the benefits for the economy? The current annual cost of LNG regasification, with a processing potential of 5.5 billion Nm³ of gas, is about PLN 3 billion. We lose so much irretrievably - everyone pays it in gas bills in proportion to their consumption. By doubling the capacity of the terminal, according to the current plans of the government, potential losses in ten year time frame may reach PLN 60 billion, and the potential of losses in the system of the entire economy will exceed PLN 90 billion. And to avoid this it is simply enough not to burn gas, thus losing the purest form of energy, which has already been paid for – the cold energy - and make it work for the economy. We can successfully use this energy in closed circuits. However, it requires daring managerial decisions. The current government of Prime Minister M. Morawiecki is interested in tightening the economy and increasing efficiency. C-GEN technology meets the expectations of this program.

In one sentence, C-GEN is an example of synergistic multitechnology that breaks the increasing deficit of value chains in basic production processes, covering five structurally ineffective sectors of the economy, characterized by structural durable inefficiency caused by their separate functioning, which are: (entire) energy, construction (demand for heat), transport (demand for fuels), agriculture (construction of the other leg, namely energy agriculture), waste management (economy in a closed system, utilization of waste). Consolidated synergic (energy) value chains in these sectors are called "synenergy".

- What is the symbiosis of C-GEN technology with other sectors such as agriculture?

- In classic power plants, the coal is burnt and the produced carbon dioxide is emitted into the environment. From 1 ton of coal, about 3 MWh of electricity is obtained, but with the simultaneous emission of about 2.4 tons of CO₂, thus contributing to the greenhouse effect. In contrast, in the C-GEN technology, carbon dioxide is converted into a form of fertilizer, where from 1 ton of coal, in addition to about 3 MWh of electricity, we get about 3 tons of urea. A team of scientists from the Warsaw University of Life Sciences (SGGW) conducted an analysis of the effectiveness of this technology in the environmental aspect in conjunction with the agricultural sector. Why agricultural? Because biomass is also coal and energy at the same time. The results turned out to be amazing and confirmed us in the belief that C-GEN can become a leader on the Polish and global technology market. Well, if the urea produced (from one ton of coal) is used for agricultural crops, eg corn fields (as additional fertilization), then during the growing season, plants absorb about 160 tons of CO₂ from the atmosphere, simultaneously emitting about 120 tons of pure oxygen and produce about 44 tons of pure carbon "C" in biomass. In this "circular economy" chain, the sun, water and the process of photosynthesis are included. More spectacular results can be achieved in the cultivation of energetic willow, where plants will absorb about 500 tons of CO₂ during the growing season, emitting ca. 380 tons of O₂, and the yield of pure "C" in biomass will reach about 150 tons. C-GEN technology can be a key element in the growth of competitiveness of the Polish economy in striving for equality with Western economies.

Another advantage of C-GEN technology is the ability to produce cheap hydrogen to power automotive hydrogen cells, which can perfectly fit into the electromobility program implemented by Prime Minister Morawiecki. Who would not want to cover 100 kilometers on fuel that costs at maximum PLN 0.6?

- If the C-GEN technology is a zero-emission technology, what kind of a solution in the system of this technology provides carbon dioxide capture and what happens with the eliminated CO₂ afterwards?

- C-GEN is a low-emission, environmentally friendly technology. Instead of energy-consuming CO₂ uptake, the C-GEN contains a cycle of oxidation / combustion in pure oxygen - in this way CO₂ is a useful raw material without a nitrogen ballast load. It is supplemented by CO₂ freezing (cryotechnology) from exhaust gases thanks to the LNG produced. During methane liquefaction, a phase transformation takes place, as a result of which LNG is obtained at a temperature of about -163 ° C. Produced flue gases, or CO₂, after passing through a heat exchanger, solidify into the so-called dry ice, or - depending on the pressure - to a liquid form. Next is a simple synthesis of urea.

- C-GEN will provide valuable semi-finished products for many branches of the chemical industry, which will ensure high profitability of this technology. However, Biznesalert.pl is primarily interested in the energy sector. I understand that when a power plant or renewable energy plants will supply too little power, or not at all, the production of electricity from methane in the reserve power plant will start under the C-GEN system?

- In the above situation, when there is a lack of electricity in the system, or if the price of energy is attractive, C-GEN can continuously produce electricity from a raw material cheaper than gas - based on waste or biomass, but also coal. At the same time, the C-GEN installation can additionally produce electricity based on the produced and stored LNG. However, I insist that we are already looking at the energy through the prism of building the efficiency of energy chains (C-GEN) for the currently ineffective sectors of the economy.

- It would mean that the C-GEN technology assumes an energy mix instead of mono renewable energy on the energy market as the target solution of the climate and energy policy?

- Mono RES (renewable energy sources) energy is not possible. Sunlight and wind are unpredictable, they can not be an exclusive source of energy for the state. C-GEN is a plant with stabilization and regulation possibilities of the power system, and in combination with smart grid provides automatic controllability and response to the demand for electricity from the distribution system operator. It does not matter whether the wind blows or not, nor does the intensity of sunshine. The C-GEN installation flexibly adapts to the situation and, at the request of the operator, will provide the system with as much electricity as it is required at the moment, ensuring energy security. In the above-mentioned aspect, it allows solving a number of basic problems concerning national power grids.

- For almost two weeks in the states of the eastern part of the USA, the production of energy from RES has stopped due to very low temperatures and heavy snowfall. In a similar situation, when the main producer will be RES plants, would it be enough to store methane and generate electricity in C-GEN technology to avoid the collapse of the energy supply system in a huge area?

- As I mentioned, C-GEN is a technology that allows you to generate electricity and heat regardless of weather conditions, insolation or wind power and, additionally, at any time. The issue of storage of gas stocks belongs to the strategy of gas companies. On the other hand, if for some extreme reasons the valve is closed on the gas import pipeline, C-GEN can supplement and supply the gas system with synthetic gas. It will use electricity from existing coal-fired power plants for this purpose. This is a valuable advantage of C-GEN: emergency gas supply and low-cost electricity. Due to the fact that the technology is scalable, we see the need, but also the necessity to build a network of plants in a dispersed pattern similar to wind farms, which increases energy security and positively affects power grids.