If, in addition to 11,400 tons of metal lithium, 100,000 electric cars were produced annually in Serbia, this would increase carbon dioxide emissions by at least 1.15 million tons or by an additional 3.5 percent.

In addition to the justified concern for damage (pollution of underground and surface water, devastation of forests and agricultural land) that can be produced by the mine and processing plants for obtaining compounds of lithium and boron in the Jadar river valley, there are also less well-known harmful consequences that these activities, and the eventual launch of the production of electric cars in Serbia, I can have.

According to data published in February 2021 by the Rio Sava Exploration company itself, the mine would annually produce about 60,000 tons of lithium carbonate (Li_2CO_3) or about 11,400 tons of metallic lithium. Without going into the issue of mining, the brochure states that the processing plant would consume 80.8 million cubic meters of natural gas per year, which would increase the consumption of that energy source in Serbia by 3.1 percent, given that in 2020, 2,265.96 million cubic meters.

The annual emission of carbon dioxide CO_2, the main cause of global warming, in the technological process of lithium carbonate and boric acid production would be between 526,000 and 620,000 tons, which is an increase of 1.22 to 1.44 percent of the total emission in Serbia, which is 2020 amounted to 43 million tons.

In that estimate, in addition to CO_2 emissions due to the burning of 80.8 million cubic meters of natural gas and during production, other necessary chemicals that would be used in the technology of obtaining lithium carbonate and boric acid, as well as the effects of the use of 60,000 tons of calcium oxide (quick lime), 320,000 tons of sulfuric acid, 188,000 tons of different types of cement, 110,000 tons of sodium carbonate (Na_2CO_3) for the deposition of lithium carbonate, while on the other hand, the destruction of more than 520 hectares of forest and agricultural land will permanently destroy the assimilation of atmospheric carbon dioxide. This assessment does not include gas emissions from various means of transport, bulldozers, trucks, commercial passenger cars, necessary for the functioning of the mine, production plant and administration.

According to official announcements, Serbia is ready to invest significant funds in the gigafactory for the production of lithium-ion accumulator batteries (LIB), and later also electric cars. With the optimistic estimate that 100,000 electric cars with a 50 kWh battery will be produced annually, this would increase carbon dioxide emissions by an additional 500,000 tons or 1.16 percent, because it is known that one kWh battery emits about 100 kilograms during production. CO_2. For the production of electric cars without batteries, which include various metals, plastics, glass, rubber, approximately five to six tons of CO_2

are emitted per vehicle, or 500,000 to 600,000 tons for 100,000 vehicles, which would increase the emission by 1.16 to 1, 4 percent.

All together, the production of lithium and 100,000 electric cars would annually emit about 1,150,000 tons of CO2 into the atmosphere, which means that the annual emission of greenhouse gases would increase by at least 3.5 percent. In other words, each electric car would emit about 11,500 kilograms of CO2. The same amount of CO2 would be emitted by the consumption of 4,420 liters of diesel in ordinary cars (a liter of diesel releases 2.6 kilograms of CO2). This means that with an average consumption of five liters per 100 kilometers, a diesel car would travel 88,400 kilometers before the electric car even leaves the factory.

The EU is planning or has introduced taxes of 50 euros per ton of CO2, so increased emissions would expose Serbia to a cost of at least 75 million euros per year (50 euros times 1,150,000 tons). In addition, it should be noted that the production of just one kWh of lithium-ion battery requires 328 kWh of different types of energy, and Serbia, in addition to importing gas and oil, has been importing electricity for more than a year, and the prices of all energy products are at record levels.

With all that, even if Serbia were to produce 100,000 electric cars a year, which is unlikely, with a 50 kWh battery, it would require about 800 tons of lithium metal. So, only seven percent of the total annual production in Jadro, while Rio Tinto could sell the remaining 93 percent to whoever it wants. Of course, Serbia would also buy lithium from him at realistic, market prices.

In addition to lithium (its share ranges from four to ten percent), positive (cathode) materials contain many other expensive and rare metals, cobalt, manganese and nickel, which Serbia does not have and would have to be imported, and the price of cobalt on the world market has varied from 30,000 to 90,000 dollars per ton in the last five years.

Many were also surprised by the announcement of the Memorandum of Understanding between the Government of Serbia and the Slovakian company InoBat, one of whose investors is Rio Tinto, on the construction of a gigafactory for the production of lithium-ion storage batteries with an innovative, revolutionary approach (?!), but on the basis of already well-known nickel-manganese-cobalt cathodes NMC622.

By looking at InoBat’s website, it can be seen that they have developed only one so far prototype of a lithium-ion battery, giving virtually no specifications of that prototype, such as voltage, specific capacity, energy, etc. The internet presentation does not show any mini-factory built so far, so the construction of a giga-factory of this extremely technologically demanding production is highly debatable. Of course, the presentation

showed fantasies about flying cars, plant sketches, and a modern, in my humble opinion, average typical laboratory with empty desks, as if drawn.
If all these ideas and projects come to fruition, the crucial question is how to charge such “green” electric cars. The most environmentally acceptable solution is solar energy. The problem, however, is that a quick, half-hour charging of an electric car with a 50 kWh battery requires about 100 kW of electrical power. Therefore, the minimum area of the solar collector would be 800 square meters (dimensions 28 by 28 meters), because an average solar collector of 1.6 square meters (meter by 1.6 meters) and in ideal conditions gives a power of 0.275 kW, and in an average of 0.2 kW.
A multi-car charging station would have to have a huge area for the installation of solar collectors, which is technically unfeasible in urban conditions. And if solar photovoltaic panels were to be installed outside cities, even greater problems of transmission and distribution of that energy would arise. The relatively low DC voltage of the solar photovoltaic collectors would first have to be converted into alternating current by special devices, inverters, and then the voltage should be raised to a much higher value with transformers in order to reduce losses, transmission lines with copper wires should be built, and transformers again in order to reduced the voltage to a usable value and finally installed rectifiers alternating to direct current, which all represent huge investments. Aside from the fact that six to eight tons of carbon dioxide is released to produce a ton of steel for transmission lines and copper for conductors.
An even bigger problem is that solar collectors cannot work 24 hours a day, so additional accumulators are necessary to store surplus solar electricity, so that electric cars can be charged during the night, and all this produces new construction and maintenance costs.
Wind energy (wind generators) is a special story because of the big environmental consequences and oscillations (no wind, no electricity), and they are mostly built on fertile Vojvodina soil to reduce transport costs from locations like Stara Planina.
Because of all this, electric cars would probably be powered by electricity obtained from thermal power plants, because around 70 percent of electricity is produced by burning lignite in Serbia. Considering that 1,490 kWh of electricity can be produced from one ton of lignite from Kolubara, for 100 chargings on average, each electric car would consume 3.3 tons of lignite per year. Therefore, only 10,000 electric cars would increase coal consumption in Serbia by 33,000 tons, and electricity by as much as 50 GWh per year.
Certain parts for electric cars are also problematic. The construction of a lithium-ion battery consists of a positive and negative electrode, a thin porous separator that prevents their contact, and an electrolyte. The last two parts are the main causes of battery fires and

explosions. Accidents accompanied by fire and explosion are mainly caused by uncontrolled overheating of batteries, manufacturing errors, damage to batteries in collisions… Self-ignition of a battery always causes an internal short circuit, which occurs when an electrical circuit is formed inside the cell, due to damage to the separator and the formation of an electrical connection between the positive and negative electrodes. The most common cause is corrosion of the negative copper collector, which occurs when the cell discharges below 30 percent capacity.

A battery pack in some electric vehicles can store up to 100 kWh of electricity, and when ignited it can release from two to twenty kilograms of hydrogen fluoride, which is enough to contaminate between 80,000 and 800,000 cubic meters of air. It is unimaginable what would happen in a chain collision of several such cars, because inhaling hydrogen fluoride can cause laryngospasm, laryngeal edema, bronchospasm and/or acute pulmonary edema, and in the most severe cases it can be fatal. According to the standards of the American National Institute for Occupational Safety, a concentration of 24.5 milligrams of hydrogen fluoride per cubic meter of air for 30 minutes is immediately dangerous to life and health, while the latent (lethal) concentration is 139 mg/m3.

An internal short circuit caused by a manufacturing defect is believed to be the root cause of both the 2013 Boeing 787 battery accident and the 2016 Samsung Galaxy 7 cell phone battery explosion. As of February 2022, there were 354 (or about 22 per year) confirmed air/airport incidents involving lithium batteries transported as cargo or baggage.

“In an effort to minimize potential damage to the facility”, and nearby vehicles in rare cases of potential fire, we recommend parking outdoors and 15 or more meters from another vehicle. In addition, we still insist that you do not leave your vehicle unattended while it is charging, even if you are using a charger in an open parking lot,” said Dan Fowlers, a spokesman for General Motors, as reported by the Detroit News on September 17, 2021. That safety “recommendation” came is just days after a 2019 GM Chevrolet Bolt caught fire in the garage of a home in Cherokee County, Georgia.

The owner realized something was up when the smoke alarm in his house went off. When he entered the garage, he noticed smoke billowing from his electric car, which was completely destroyed. Chevrolet has recalled more than 140,000 of the model so far, but is still working with supplier LG Energy Solution to determine the cause of the battery damage that led to the fire.

On November 23, 2022, firefighters used an enormous 45,425 liters of water to extinguish the Tesla Model S fire. Unfortunately, the fire is very difficult to extinguish because it is an internal combustion in the cell, where water cannot reach. By comparison, a standard car

fire generally requires less than 2,000 liters of water. In Australia in 2021, it took three full days to put out the big battery fire at the Victorian Big Battery in Moorabbin, near Geelong. The fire started during testing in a shipping container containing a 13-ton lithium-ion battery and spread to another battery pack.

These are just some of the accidents with lithium-ion batteries. The predicted exponential growth of their application in the near future, as well as the purchase of cheaper systems with less security, leads to the thought of a drastic increase in such relatively sporadic cases, with unforeseeable consequences, especially if electric cars catch fire in densely populated urban areas or in a tunnel.

Considering the large emission of carbon dioxide during production, the possibility of self-ignition, the lack of resources for the production of a large number of lithium-based electric cars, the synergy of different alternative sources should be considered. Some of the alternatives in the near future are sodium-ion batteries, hydrogen energy and fuel galvanic couplings, as well as liquid and gaseous biofuels (biodiesel, bioalcohols, biogas), which do not pollute the environment, since the amount of carbon dioxide produced by their combustion is equal to the amount that would be released by rotting the biomass from which they are obtained. The possibilities are unlimited, and clean energy is all around us, we just need to recognize it and use it, NiN writes.