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IMPACT OF COVID-19 EPIDEMIOLOGICAL MEASURES, FOCUSING ON THE REDUCTION AND CONSEQUENCES OF ROAD TRANSPORT EMISSIONS

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Abstract: Road transport is partly responsible for urban air pollution, which endangers the health of many people. Pollutants emitted by vehicles, according to WHO (World Health Organization) estimates, claimed the early deaths of 4.2 million people worldwide in 2016. The Member States of the European Union also try to control the emissions of harmful substances in various ways, hence transport greening plays a key role in Hungary's short- and long-term goals. However, on March 4, 2020, the coronavirus appeared in Hungary as well. In order to prevent a large-scale outbreak of the epidemic, schools were closed and stricter access restrictions were introduced in several stages, forcing companies and institutions to allow their employees to work from home. Factories and service industry have been forced to shut down, in part or in full, leading to a reduction in the number of road users, with a significant impact on human health, the economy and wildlife. As a result of the reduction of pollutant emissions, the air became clearer. However, due to the topographic conditions of our country, this process could only take place to a small extent and slowly until mid-April. At the end of April, windy, rainy weather removed pollutants from the atmosphere to an increased extent. The sky over Hungary became clear and blue. Greening traffic would help maintain this status quo.

Keywords: Covid-19, epidemiological measures, reduction and consequences, road transport emissions

INTRODUCTION

One of the main sources of air pollution is the emission of transport. At the same time, the freedom to go wherever we want has its price that our health suffers the most. Air pollution is a silent killer. The World Health Organization (WHO), the European Union, and the individual Member States themselves, are working to take measures to reduce emission from transport in several forms.

Earlier this year, however, another opportunity came unexpectedly to reduce transport emission. However, this opportunity did not expect and did not want to, and in fact, it created fear and tension in people. With a Chinese source, a new type of SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus-2) coronavirus has arisen.

Due to the cross-continental pandemic, different countries introduced different levels of authority measures

to prevent the rapid spread of the virus at different times, including keeping mandatory social distance, cities under lockdown with curfew, school closures, and forced home office everywhere it was possible. The economy suffered severe damage, health institutions became overburdened in several countries due to illness and death, and layoffs and pay cuts occurred due to factory shutdowns. Economic damage is measured in hundreds of billions of dollars worldwide. Factory shutdowns, dusk-to-dawn curfew, home office and other restrictions have been accompanied by a decline in all sub-sectors of transport; air, water, rail or road. The reduction in mobility and emissions associated with the closures also had an impact on air pollution. Concentrations of harmful substances decreased near all sources, up to 30 to 40 percent overall in Europe.

AIR POLLUTION

Traffic air pollution Transport has been a jointly managed policy area in the EU for more than 30 years, and the importance of harmonizing national laws, regulations and administrative provisions and the technological, social and tax environment is constantly growing. [1] Road transport is estimated to account for Particulate Matter (PM) of up to 50% of the emissions in the Organization for Economic Co-operation and Development (OECD) countries, and up to 30% in European cities, mainly due to diesel vehicle traffic. Air pollution poses different challenges in different regions of Europe: only 36% of the European cities meet the WHO annual target for PM_{2.5}. In 2019, the highest level of PM_{2.5} among European countries was in Eastern and Southern Europe (14.6 µg/m³ in Hungary), while the cleanest cities and regions are mainly in Northern and Western Europe. [2] Many European cities are focused on preventing high concentrations of NO_x and NH₃, while others continue to face challenges with unsafe levels of PM₁₀ or PM_{2.5}. [2] In general, air quality in Hungary was basically good on March 13, 2020, a few cities showing higher levels of pollution only. [3]

Adverse effects of air pollution The road transport sub-sector has always had a number of environmental problems, including air pollution, noise, congestion, accidents, etc. Controlling and reduction air pollution is currently not just an urgent issue, but a local priority. The environmental impacts of increased emissions and polluted air from transportation are becoming more severe, endangering human life, and habitats of living things around the Earth. [4] According to WHO data from 2016, about 4.2 million premature deaths have been attributed to environmental (outdoor) air pollution, 91% of which belong to the poor and populous countries of Southeast Asia and the Pacific. According to the Health Effect Institute (HEI, 2018), more than 95% of the world's population breathes polluted air and up to 60% of people live in areas that do not meet even the most basic WHO standards. [5]

Decrease in mobility, outage of traffic At the end of January 2020, the Government of Hungary established the Operational Staff Responsible for the Control of the Coronavirus Epidemic. (III. 11.), according to security reasons, the central state ceremony was no longer held on 15 March and the personal form of education was closed from 16 March. It was recommended to companies and institutions to allow anyone to do the work at home. The country has virtually stalled in terms of mobility. They promoted the use of public transport and bicycles, while the closure was accompanied by a drastic reduction in vehicle traffic. Similar measures have been introduced in other countries of the world, depending on the date of local appearance of the coronavirus. All four sub-sectors of transport (road, water, air and rail) have been affected to some extent by curtailment and mobility restrictions. Planes have been forced to the ground, cars are resting in garages, and supply chains are jammed. The frequency of public transport was reduced primarily due to underutilisation, but was slightly re-condensed due to the possibility of maintaining a mandatory social distance.

Decrease in vehicle use The road traffic stop is also reflected in the change of numbers of active users of the Waze application, the number of vehicles on the roads has decreased. The current data also show lower values on weekdays from mid-March than on weekends before March 13, with less than 7,500 vehicles per day in total. [6]

Increase in the number of cyclists The number of cyclists increased on weekdays. Weekend data are lower than those counted during the week, but higher after March 15th than before. [7] The number of cyclists will

continue to grow by designating and making temporary bike lanes safe.

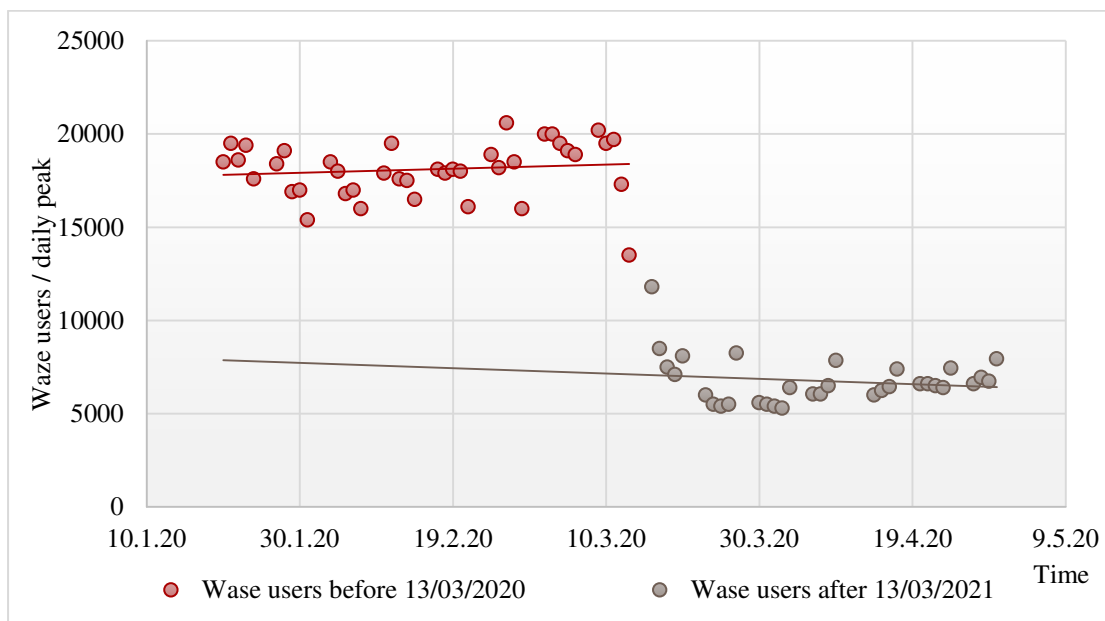


Figure (1) Waze user data, daily peak [6]

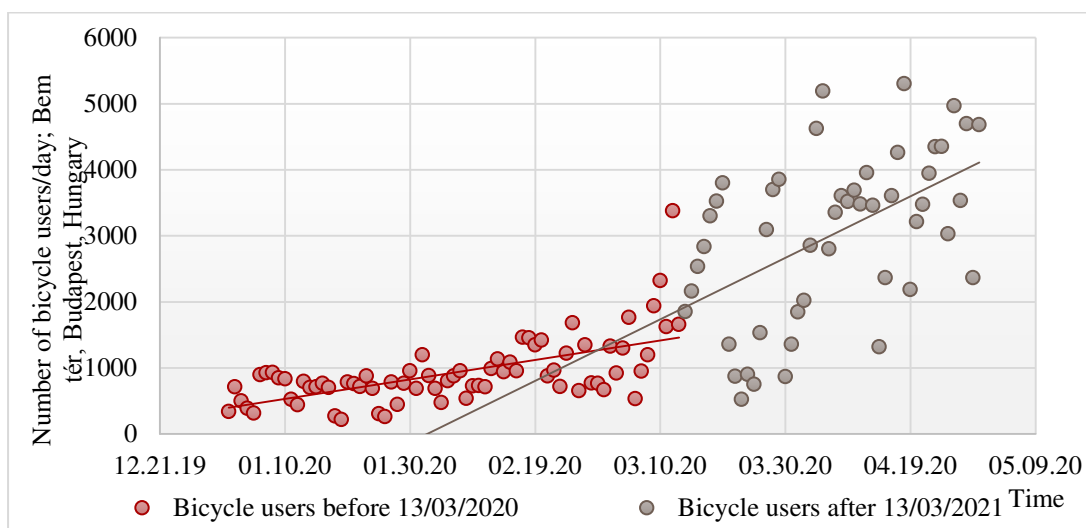


Figure (2) Number of cyclists a day, Bem tér Budapest, Hungary

Changes in the number of public transport users Number of public transport users decreased significantly due to home office and the closure of public educational institutions. More people switched to cars, so the total number of public transport vehicles and their emissions decreased during reviewed period (mid-March to end April) [8].

Narrowing of the used car market In China, after the first two months of 2020, the previous trend changed from one moment to the next. The number of sales decreased significantly due to the decrease in mobility, but those wishing to sell used cars are also waiting, so the market is not saturated. The recession is expected to be 5% for used cars aged 0-6. Experts are calculating with a quick recovery after the current stagnation due to the epidemic.

Changes of car market Previously, experts calculated with a massive expansion of the car market, for example they predicted a 40% increase in the sales of battery electric cars by 2020. But, one of the adverse effects of the coronavirus epidemic is the drastic decline in car sales. The decrease of newly registered passenger cars and light commercial vehicles was low in February, increased already significantly in March,

and dropped dramatically in April compared to the same month of the previous year. A similar trend can be observed in European countries as well [9]. Same number of new cars were sold in the UK in April 1946, a total of 4,321 were registered, 97% less than a month earlier. The Dealers and Manufacturers Association estimated that 1.68 million of new passenger cars will be sold by the end of the year, a 27% drop compared to 2019.

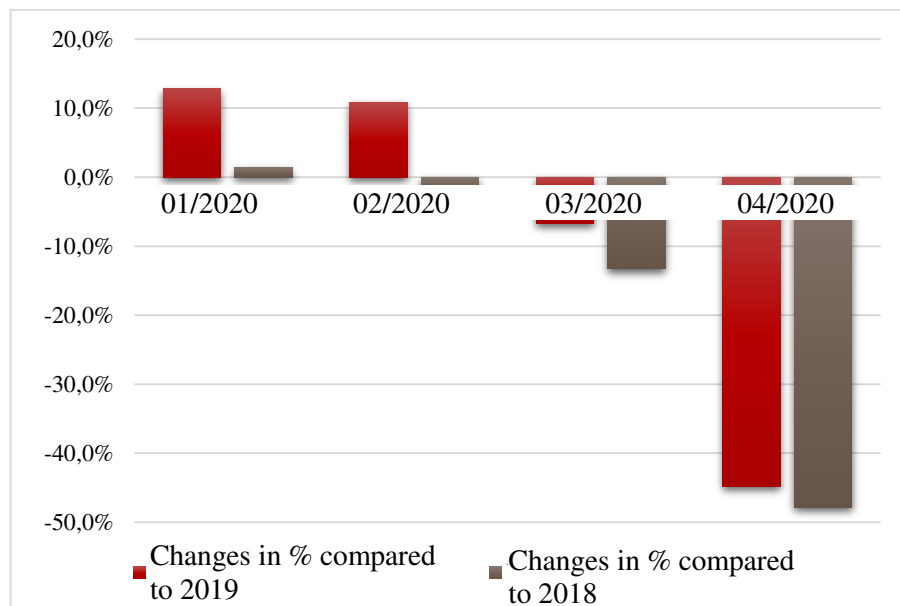


Figure (3) Changes of the car and light commercial vehicle registrations in the Hungarian market in the first four months of the year in 2020 compared to 2019 and 2018 [Datahouse]

CHANGE IN AIR QUALITY

Road traffic stop, like everything, have both advantages and disadvantages. Undoubtedly, the biggest benefit is the reduction in air pollution. Satellite measurement data from the Copernicus program prove that NO_2 emissions have been reduced and the atmosphere has been cleared. However, concentration of pollutants in Hungary is due to not only the level of emissions, but also for topographical reasons. It is landlocked, mountains surrounding the country do not allow the cleansing effect of the weather to prevail, winds blowing at high speeds are rare and amount of rain falling is less and less. In the Carpathian Basin, the air is able to sit down for a long time, allowing the concentration of pollutants to increase above the limit value.

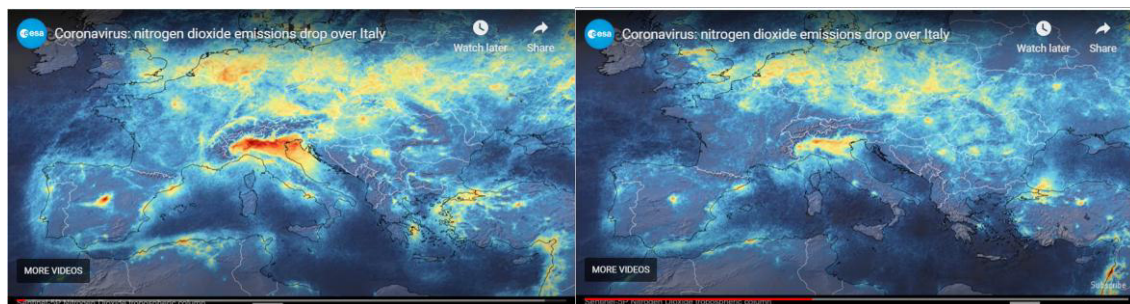


Figure (4) Changes in NO_2 concentrations in the atmosphere over southern Europe between January and March 2020 [10]

The impact of road transport on air quality in Hungary is not entirely clear by direct examination of the concentration in the short term. Concentrations of pollutants also basically change periodically over the course of a year, depending on the weather and the activity of the sources. Due to residential heating as a source of pollution, the amount of PM_{10} , which is so problematic for Hungary, increases in the winter. Looking at the first months of 2020, atmospheric concentrations of PM_{10} and CO decreased significantly,

while concentrations of NO_2 changed to a lesser extent. The period from 15 March to 30 April shows the effects of road traffic stoppages. Concentrations of the main pollutants also decreased in the period from 1 January to 15 March 2020, but the rate of reduction became higher after the cessation of road traffic. NO_2 has strong correlation with the reduction of transport and it has a low decrease before 15th March and higher drop after lockdown. Heating in wintertime has mainly an effect on other pollutants with decrease in concentration before 15th March as well with the exception of ozone. Any change in its concentration has a strong relationship with sun radiation based on oxidative smog.

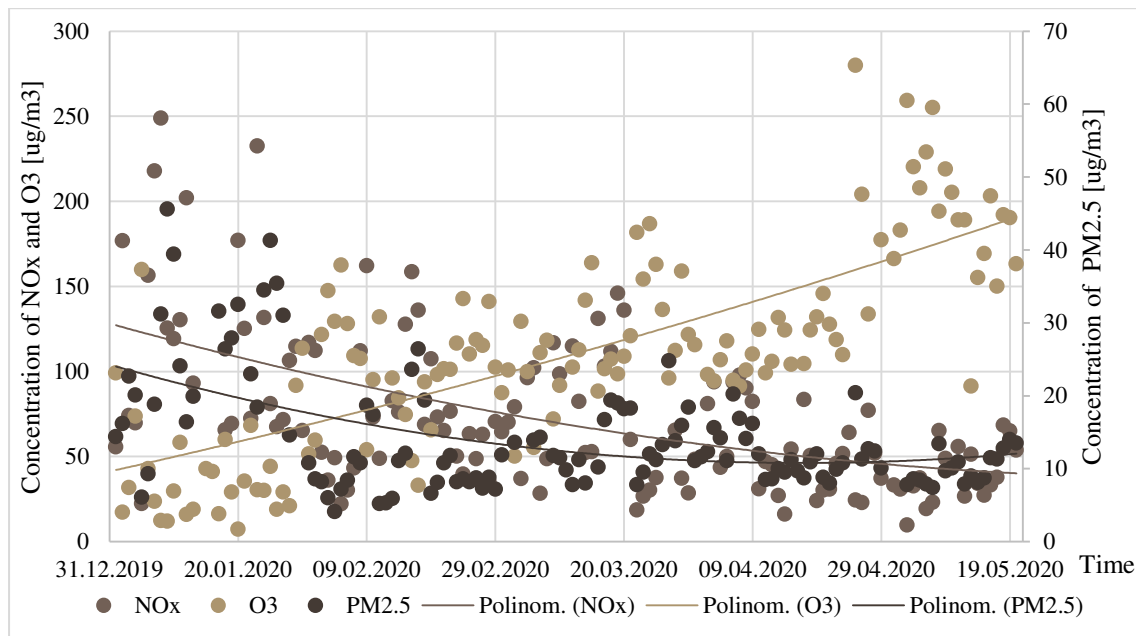


Figure (5) Daily data measured at Széna tér, Budapest measuring station in the period January-May 2020 [11]

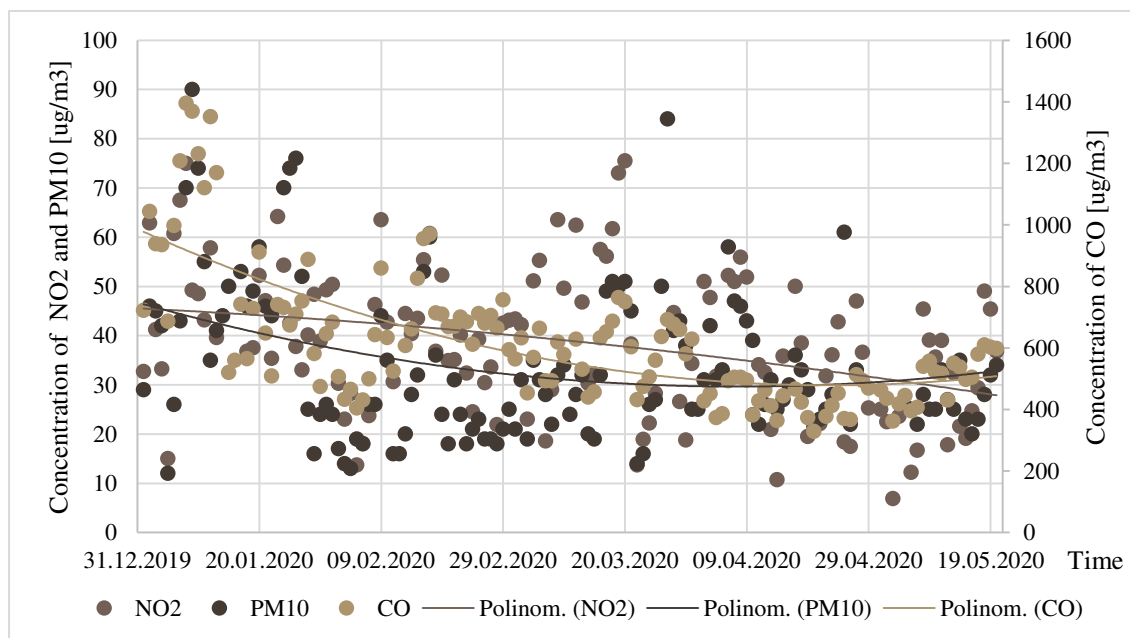


Figure (6) Daily data measured at Széna tér, Budapest measuring station in the period January-May 2020 [11]

Plotting the concentration data as a function of the number of Waze users makes it possible to see the relationship between the number of car users and the level of pollution. The main source of PM_{10} is residential combustion, depending not so strongly on the number of vehicles, in contrast to the concentration of CO and NO_x , which actually increases with increasing number of users.

Above Hungary, air pollution did not decrease significantly in proportion to the decrease in traffic in the

period March-April, which was also confirmed by international measurements [11].

In order for the air-purifying effect of the road traffic shutdown to take effect, windy weather is also necessary, which, however, only reached Hungary on April 25, 2020. Precipitation to help deplete air pollutants only fell in late April 2020. In mid-March, the precipitation came partly in the form of snow, furthermore the less windy, rain-poor spring weather also did not promote the removal of pollutants from the atmosphere of the Carpathian Basin.

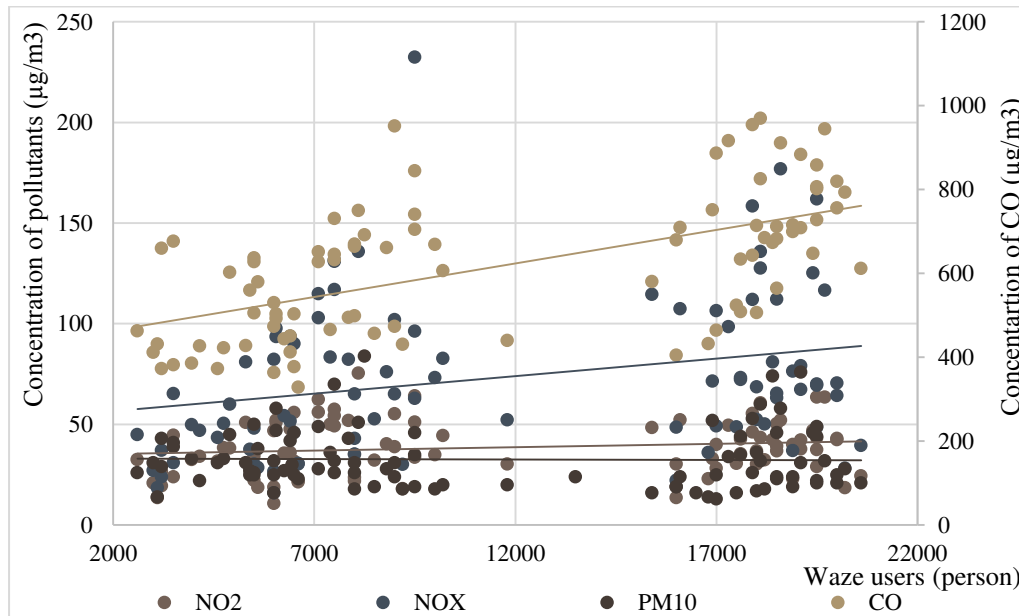


Figure (7) Daily data measured at Széna tér, Budapest measuring station for the period March-April 2020 [4, 12]

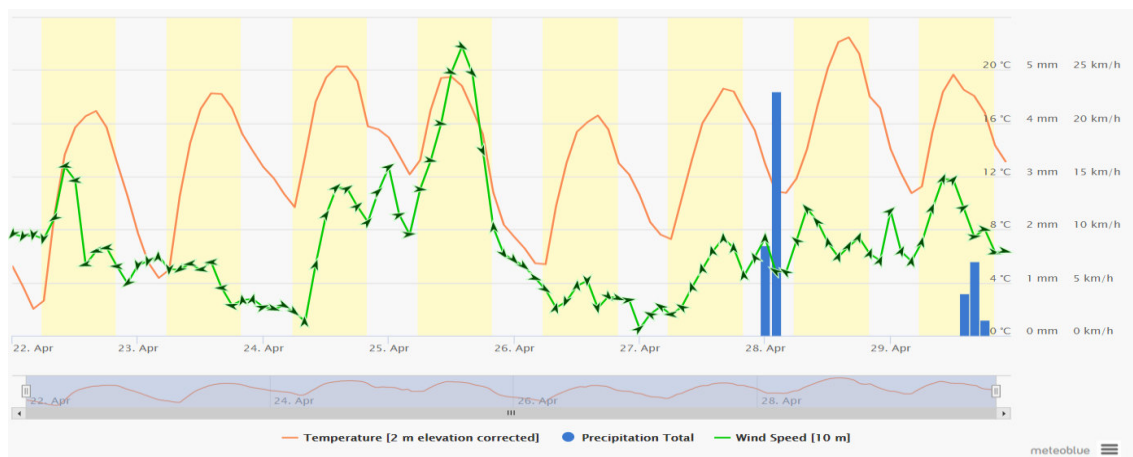


Figure (8) Temperature, precipitation and wind speed data for Budapest [13]

Performance of solar cells depends strongly on the air quality. The next figure shows us the change of the power of solar plants in the relation of the concentration of pollutants; relative humidity, PM2.5 and NOx concentrations affect the most to the power production. CO has no effect. Ozone formation depends on solar radiation, hence the higher the solar radiation, the higher the ozone concentration and the solar cell performance as well. Due to the road traffic stop, the cleaner air promoted the higher electricity production as well.

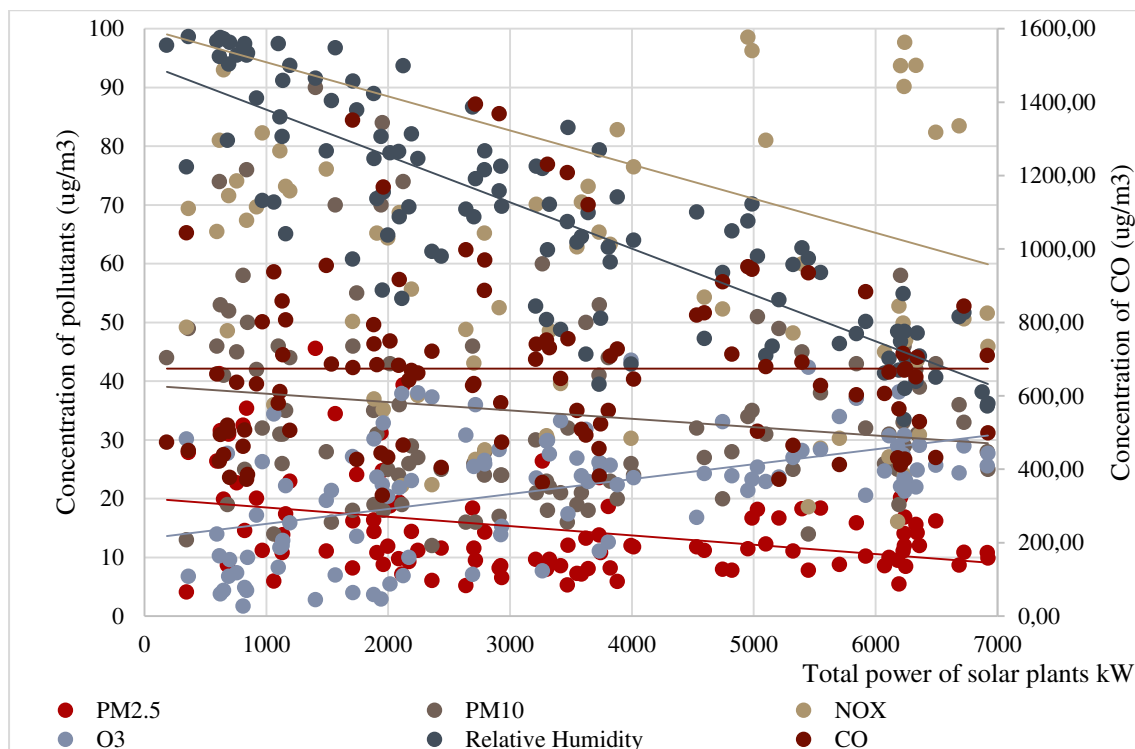


Figure (9) Performance of solar plants in Hungary in the relation of pollutants

SUMMARY

The concentration of air pollutants of Hungary decreased due to the road traffic stop, however, one and a half months after the lockdown, the air in the Carpathian Basin is still not reduced to a greater extent, because the topography of the country allows only a slow cleansing.

From the point of view of the health of the population of Hungary, it would be very important if the achievements in the field of air purification could be maintained even after the start of the economy with financial support invested in transport greening.

Due to the topographic and weather conditions, every investment made in Hungary to reduce emissions and make transport greener pays off twice.

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