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DETERMINANTS OF ENERGY BALANCE

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ABSTRACT— *Industrial development is the main culprit for the problem of environmental pollution which was released for the first time at UNO Conference on the environment in Stockholm (1972). The greatest responsibility for environmental pollution is carried by the man, pollution being the consequence of physiological activity especially its social-economic .*

Technical multiple human activities have an impact that is not neglected on the chemical and energy balance of the planet. The most alarming manifestations of human activity on current developments are acid deposition, urban smog, changes in tropospheric ozone, reducing ofthe stratospheric ozone layer and influence of the gas concentration with greenhouse effect.

Keywords: emissions, energy, environment, industrial activities, pollution.

1. INTRODUCTUON

Acid rain is a form of pollution of both air and water and soil which the acids formed as a result of air pollution produced by human activities, fall to Earth in different regions. The problem begins with the production of sulfur dioxide and nitrogen oxides resulting from burning fossil fuels (coal, gas, oil) both in industrial and domestic purposes.

Acid rain is formed when sulfur dioxide and nitrogen oxides, both results of industrial pollution it combines in the atmosphere with water vapor.

Acid rain has a series of devastating ecological consequences and the presence of acid particles in the air affects health. Acid rain removes nutrients from the soil, vegetation slows and turns water lakes in an environment that can not support life.

Aware of the danger of pollution, people have stepped up research in this area, establishing measures to limit both the causes and effects of this phenomenon.

The main problem is air pollution and for limiting this problem humanity is in a struggle that began to foresee positive results.

2. SOURCES OF AIR POLLUTION IN GORJ COUNTY

The atmosphere is the most unpredictable driver of pollutants emitted by sources of pollution, but at the same time is the most unstable of the environmental factors.The main cause of air pollution in Gorj county is the industrial activities, and of these the biggest share falls to power generation

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based on fossil fuels through the two power plants, Rovinari and Turceni, released into the atmosphere various gases (SO_2, NOx, CO) and solid particulates.

Rovinari Thermal Power Plant is located in the south-west of Targu Jiu, approx. 20 km away. Has an installed capacity of 1320 MW (4x330), comprising power blocks 3, 4, 5 and 6, put into operation between 1976 - 1979. Each block has a steam boiler type Benson of 1035t / h.

Coal supply is directly from lignite quarries in operation in the area (Rosia Pinoasa, Rovinari East, Tismana I and II).

Turceni Thermal Power Plant is one of the largest in the world with a continuous operating mode, equipped with four large combustion plants (LCPs), made up of energy blocks 1,3,4,5,6 and 7 each with an heat output of 789 MWt.

Power blocks are each provided with a steam boiler 1035 t/h, Benson type and a steam turbine of 330 MW.

Ash particulate from the combustion gases are retained using electrostatic type dedusting facilities. Coal supply is mainly from coal basin Jilt through two careers, Jilt North and Jilt South, the coal being transported by rail.

Another source of air pollution is the mining of lignite (9 careers), especially their coal deposits, which the phenomenon of self-ignition of coal eliminates in the atmosphere large amounts of SO_2, NOx, CO and particulates.

Development of mining industry in the Gorj county has led to the emergence of industrial units specialized in the production of materials, parts or equipment needed coal mining.

Thus, in the north of Targu Jiu was built an industrial unit specialized in producing conveyor belts rubber of high capacity (SC ARTEGO SA), another specializes in producing spare parts and repair of mining machinery (SC GRIMEX SA) and one for the production of press and forging machines (SC MIRFO SA).

Currently their activity was greatly diminished so that environmental pollution was significantly reduced. Also in the west of the city functioning with reduced activity a number of three industrial units specialized in the production of construction materials: SC CRH ROMANIA S.A., SC MACOFIL S.A. and S.C. SIMCOR VAR S.A.

For urban the road transports are quite important sources, representing 60% of total air pollutant emissions, and in some areas even 90% of all emissions in the atmosphere. The substances emitted by motor vehicles are quite numerous, such as carbon monoxide, nitrogen oxides, lead, carbon dioxide, aldehydes, etc.

Amount, nature and concentrations of pollutants emitted by vehicles depend on the type, nature fuels and technical operating conditions. By burning a liter of gasoline is released into the atmosphere 275 g of carbon monoxide, oxides of nitrogen 13,5 g, 24 g of aromatic hydrocarbon, 1,5 g suspension.

Emissions of pollutants due to the motor vehicles have two features: the elimination of harm is low to the ground, which leads to achieving high concentrations in this area, and the exhaust emissions are over the entire surface area, making it difficult to monitor.

For a city household activities constitute another source of pollution, especially during the cold season. For various domestic purposes burn various fuels such as wood, coal, natural gas, etc., resulting in a number of pollutants, some highly toxic.

Taking into account the location of major sources of pollution in the Gorj county air quality is monitored by continuous measurements using three automatic stations located in Targu Jiu (GJ-1), Rovinari (GJ-2) and Turceni (GJ- 3). These are industrial type and form part of the National Network for Monitoring Air Quality in the country consists of more than 140 stations. The pollutants monitored in the county Gorj are: SO_2, NOx, NO, NO_2, CO, O_3 and solid particulates (PM10 fraction). These staions include the laboratory equipment used to measure heavy metals from air particulates (Cd, As, Ni, Pb) for determining the concentrations of particulates (PM_{10} și $PM_{2,5}$) through the gravimetric method.

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Annually, besides monitoring immissions of pollutants in ambient air by the three automatic stations, based on consumption of fuels and some specific emission factors for each type of pollutant are calculated the emissions from sources of pollution in the county.

These aspects should be noted that in accordance with [10], the emission of pollutants is the elimination of air pollutants, and immission, the transfer of pollutants from the air to a receiver.

3. EMISSIONS OF ACIDIFYING GASES IN THE COUNTY GORJ

Any change in the composition of the atmosphere is defined as air pollution, due to the presence of one or more substances in small or large quantities and with characteristics that may alter the normal environmental conditions and which have a direct or indirect danger to human health and ecosystems.

Acidification is the process of changes of the chemical nature of a component of the natural environment due to the presence of compounds which result in a series of chemical reactions in the atmosphere, leading to changes in pH of the soil and even precipitation. Atmospheric emissions of acidifying substances such as SO_2, NO_X resulting mainly from burning fossil fuels can persist in the atmosphere for several days and can be transported thousands of kilometers, until there is the process of converting acids (sulfuric or nitric acids).

Given that air pollution is not confined to the borders of a country, measures to reduce emissions of pollutants must be internationally coordinated through the adoption and signing of bilateral and multilateral environmental agreements. Acceptance of any international agreement means its ratification, and this includes adopting new legislation or amendment in question in accordance with the existing provisions, political and financial commitment from the signatory countries, and participation in international organizations.

In this way Romania is a signatory to the Convention on Long-range Transboundary Air Pollution in 1999. The Convention was ratified by Law 271/2003 and aims to reduce acidification, eutrophication and level of tropospheric ozone.

The sulfur dioxide, together with nitrogen oxides form the basis of acidification of the environment. Emitted into the atmosphere by pollution sources in contact with water vapor and sunlight, they form acidic compounds. They come with rainfall to soil or water.

The most significant share (over 99%) in the total emission of SO_2 in Gorj county is hold by emissions from fossil fuel combustion in energy industries and manufacturing industries and construction. [11].

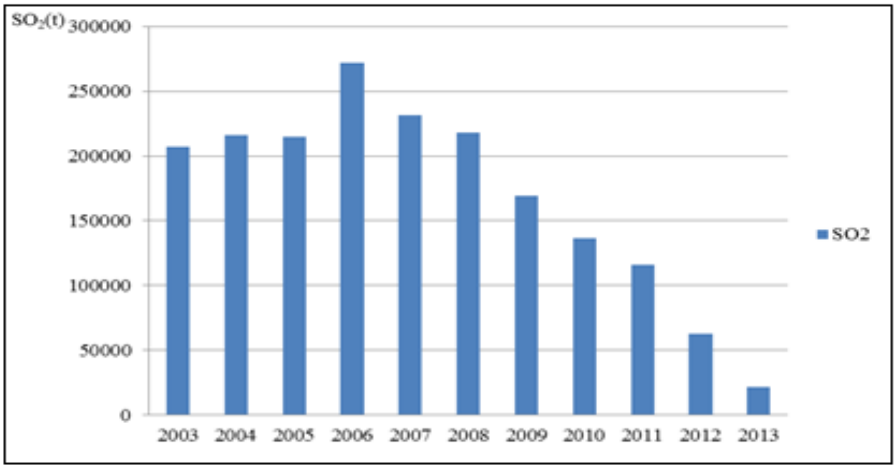

Fig. 3.1. The emission of SO_2 in Gorj county

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An analysis of these data shows that in the period of 2003-2006 emissions of sulfur showed a variable progression. For example, in 2004 the total emissions of sulfur dioxide were higher than 2003 by more than 4% for the next year to decline by 0.5%. (Fig. 3.1.).

The next year, 2006 recorded the highest value of total emissions of sulfur dioxide, which is 21% over the previous year.

Since 2007 emissions of sulfur dioxide evolution was a decreasing until the end of the review period, the most pronounced reductions recorded in 2012 and 2013.

In 2007, emissions of sulfur dioxide in the Gorj county had a decrease by approx. 15% from 2006, and in 2008 by 20%. The largest reductions were observed since 2010 during which came into force the Government Decision no. 440 establishing measures to limit air emissions of certain pollutants from large combustion plants, the two thermal power plants Rovinari and Turceni taking measures in this regard.

Thus, the reported emissions in 2010 were almost twice lower than the peak year of the review period (2006), while in 2013 they are over 12 times lower than in 2006.

This significant decrease recorded in the year 2013 is due to the commissioning of the four wet desulphurisation of the flue gases, two at the thermoelectric power plant Turceni and two at the thermoelectric power plant Rovinari. Measures to reduce the sulfur dioxide emissions from large combustion plants were applied gradually on energy groups, with a deadline at the end of 2015, so as, in particular, with 2010 witnessing a gradual decrease emissions of sulfure dioxide.

Another reason that led to fluctuations in emissions, but with a much lower share than technical measures, was also reducing of the electricity demand during certain times of the years, this situation power plants operating with a reduced number of groups.

In the case of nitrogen oxides, in addition to burning fossil fuels in power plants, a significant share of air pollution has also the traffic car. Conurbations share of traffic car in nitrogen oxides pollution can reach up to 90%.

Evaluation of nitrogen oxide emissions in the Gorj county has shown that most of these emissions resulting from energy, transport and manufacturing industries and construction. Annual evolution of emissions of nitrogen oxides in the county during 2003-2013 is shown in Figure 3.2.

In this case, too, the existence of fluctuations in the evolution of often high amounts of annual emissions of nitrogen oxides. Thus, at the start of the period (2003-2005), nitrogen oxide emissions have registered a downward trend, and these values lower than 10% in 2004 and 12.5% in 2005 compared to 2003. (Fig. 3.2).

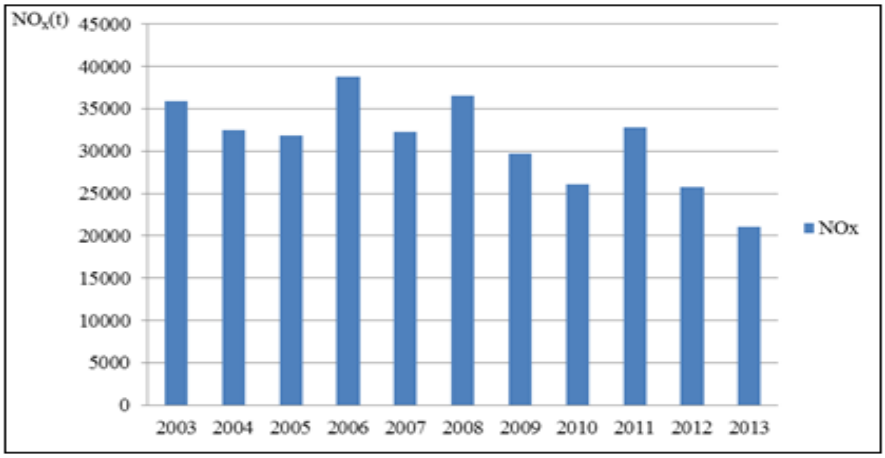

Fig. 3.2. The emission of NOx in Gorj.

Between 2006 - 2011 we are witnessing to the highest turnover in terms of emissions of nitrogen oxides.

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As in the case of sulfur dioxide and this time the largest amount of nitrogen oxides emitted into the atmosphere was estimated for the year 2006. In the coming years the amounts of nitrogen oxides emitted into the atmosphere had values lower than 2006, 6% in 2008 and 33% in 2010.

In the last two years of the evolution of nitrogen oxides emissions was one descending, so that in 2013 they experienced a 45% lower than in 2006.

4. AIR POLLUTION BY SULFUR DIOXIDE (SO_2) AND NITROGEN OXIDES (NO_X) IN TARGU JIU MUNICIPALITY

4.1. Air pollution with sulfur dioxide

Of all pollution sources, primarily fossil fuels in industrial plants is responsible for polluting the atmosphere with sulfur dioxide.

The sulfur content of fossil fuels differ depending on their origin.

From the oxidation of fuel sulfur, mostly (over 95%) is converted into SO_2, and the rest into SO_3. The conversion of SO_2 into SO_3 takes place in the flame, in the case of an excess of oxygen, and also on the flue gas way in the presence of oxides of vanadium and even iron, which acts as a catalyst, especially at temperatures above 800 ºC.

Discharged to the atmosphere, sulfur dioxide reacts with oxygen under the action of solar UV radiation giving rise to sulfur trioxide (SO_3), according to:

$$2SO_2 + O_2 + ruv = 2SO_3 \quad (1)$$

This, in turn, combine with atmospheric water vapor to form sulfuric acid:

$$SO_3 + H_2O \rightarrow H_2SO_4 \quad (2)$$

reaching in times of fog or very wet days, a degree of conversion of up to 15.7%. [6].

For Targu Jiu town the level of sulfur dioxide in ambient air is highlighted with a automatic monitoring stations, located in the NV to the downtown area. At the same time, they are subject to continuous monitoring of nitrogen oxides, carbon monoxide, ground-level ozone and airborne particles, PM10 fraction. For a better idea of the content of sulfur dioxide in the ambient air in Targu Jiu town will analyze the results of measurements conducted during 2010-2014 by the Environmental Protection Agency Gorj. Interpretation of results on concentrations of sulfur dioxide in the air was made under Law 104/2011 regarding the ambient air quality.

According to [11] the daily limit value for protection of human health is 125 g / m^3, provided it does not Exceed more than 3 times a calendar year. Analyzing the number of daily average values for each individual Shows That year it is very different. Reporting the number of average daily concentrations at the number of calendar days in the year, most were made in 2010 (99.75) and the fewest in 2014 (42.7%) and has shown in Fig. 4.3. - 4.6.

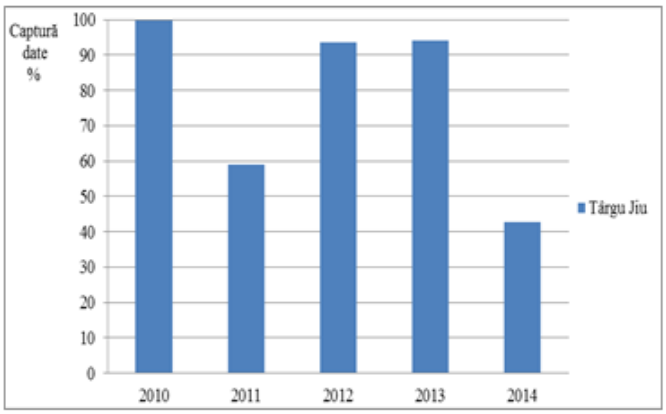

Fig. 4.3. Data capture for SO_2 (2010-2014)

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This is due to technical failures occurred automatic monitoring station or sulfur dioxide analyzer, during each year. As a general observation is that during the five years of study there was only one exceedance value - limit occurring in this 11 October, 2010, which represented a rate of 0.3% for overruns year. Daily average concentration recorded for that date was located 37% above the limit. In other years the frequency of exceedances was zero.Comparing the monthly average concentrations of sulfur dioxide can see that in most cases they have higher values in the winter months of the year belonging to or close to it. (Fig. 2.4.). The highest monthly average concentration was recorded in 2013, from January to March, and represented 23 to 28% of the value - limit.

For 2010 levels monthly highest value reached 13% of daily limit allowed and were recorded in October and November in 2011, it was calculated for December and represented 26% of the limit value for 2013 January and December accounted for 12% and 13%, and in December 2014, accounting for 19%.

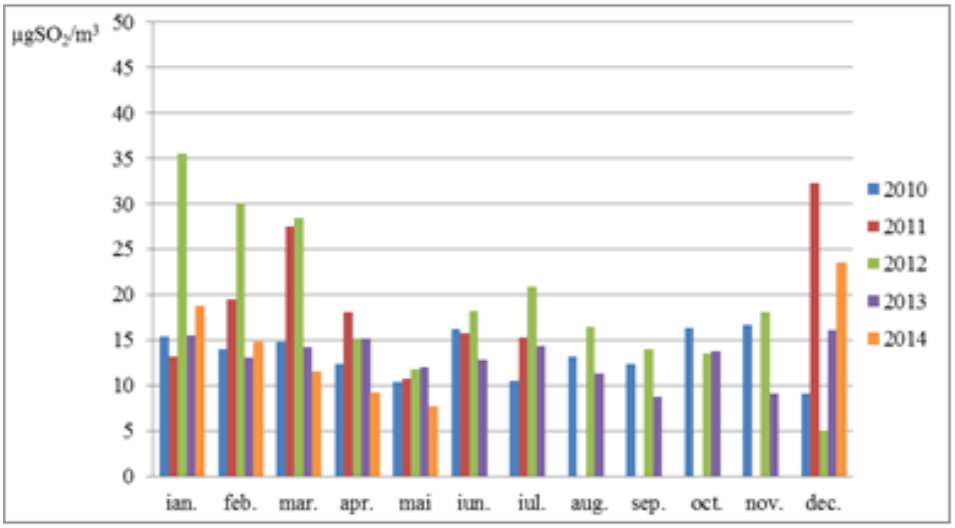

Fig. 4.4. Average monthly changes in concentrations of SO_2 in Targu Jiu Municipality

Regarding the monthly average concentrations with the lowest values they were recorded in several seasons over the five years studiu.Astfel in 2010, the monthly average concentration of the lowest value was recorded in December and the accounted for 7% of the value - limit.

For the following year, 2011, the monthly average concentration of the lowest value was calculated as of May, and represented approx. 9% of the limit value. Also in May were the lowest values recorded in 2012 and 2014, representing 9% and 6% from the permissible limit. In 2013 limit values were lowest during the fall season, in september and n ovember when monthly averages represented 7% of the limit.

Based on monthly average concentration values can be calculated trend average, an indicator that expresses the evolution of pollution every month in order to reduce or ease pollution versus previous month . Average trend is calculated by dividing the average monthly concentration (x) and monthly average concentration of the previous month (x '). When the value ratio <1, there is a reduction of pollution, and if the ratio> 1 there is an increase in pollution.

The most obvious period in which the evolution of pollution with sulfur dioxide was favorable (downward) occurred in 2012, during January-May report showing values below par. (Fig. 4.5.).

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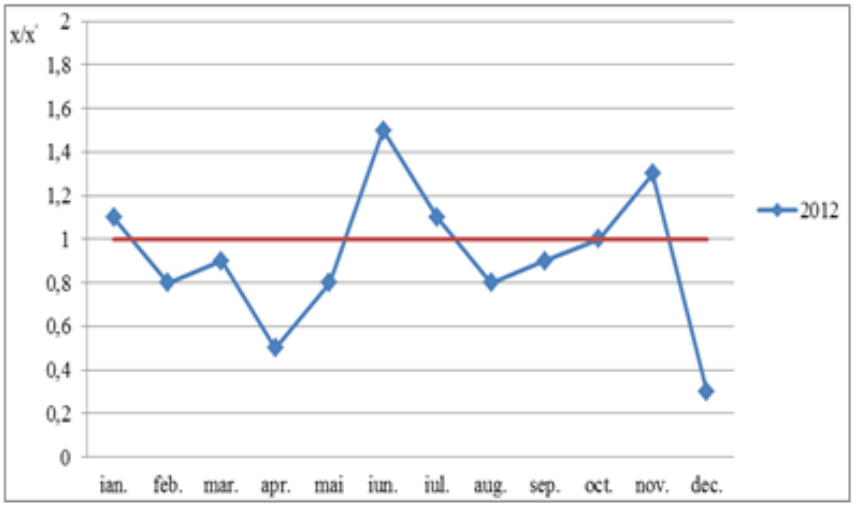

Fig. 4.5. Variation average trend ($\frac{x}{x'}$) *for* SO_2

Also found a downward trend in the period January-May 2014, but this year the monitoring was not performed throughout the year.În other periods of growth alternated with sulfur dioxide pollution, with periods of reduction, without an interval of several months to predominate in a row in one period.

4.2. Air pollution by oxides of nitrogen

In terms of environmental protection two of nitrogen oxides, nitrogen monoxide and nitrogen dioxide are a special importance. Nitric oxide is formed under conditions of high temperature combustion of fossil fuels (gas, oil, coal) into the air. Pressure balance is independently:

$$N_2 + O_2 \rightleftharpoons 2NO. \qquad (3)$$

High temperature oxide formed dissociates quickly. However, if the cooling rate exceeds the rate of decomposition of nitrogen monoxide is stable.

Nitric oxide thus formed may react with oxygen to form nitrogen dioxide according to the reaction:

$$2NO + O_2 \rightleftharpoons 2NO_2. \qquad (4)$$

While the formation of nitrogen monoxide is favored by high temperatures, oxidation is a reaction of nitrogen dioxide at lower temperatures favored. As a result, the combustion at high temperatures, the rapid cooling and dilution of the gas favors the emission instant of high concentrations of nitric oxide and the low concentrations of nitrogen dioxide.

The oxidation of nitrogen monoxide to nitrogen dioxide and oxygen has a certain peculiarity, that the rate of formation decreases with increasing temperature. The rate of oxidation at high temperatures than explains in part, negligible amounts of nitrogen dioxide commonly found in the hot combustion gases.

At the point of discharge from anthropogenic sources, nitrogen monoxide is the predominant form of nitrogen oxides. Being unstable, it is rapidly converted to nitrogen dioxide, a stable form at low temperature, but much more harmful. This is why the two gases are taken together and their content is expressed in NO_2 equivalent.

To establish pollution by nitrogen dioxide in the Targu Jiu, will be analyzed measurements of nitrogen dioxide during 2010-2014. For nitrogen dioxide Law 104/2011 on air quality limit value as an hourly average of 200 mg / m3, with specification of not to exceed more than 18 times in a

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calendar year and 40 mg / m3 annual averaged. Year 2011 showing a small number of measurements (13%) has not been studied.
The biggest catch data was recorded in 2012 and 2013, this representing 90% and 95% respectively. In other years presented data capture much lower, 53% in 2010 and 46% in 2014.Ca in the case of sulfur dioxide, higher concentrations of nitrogen dioxide were recorded in 2012 (Fig. 4.6.).

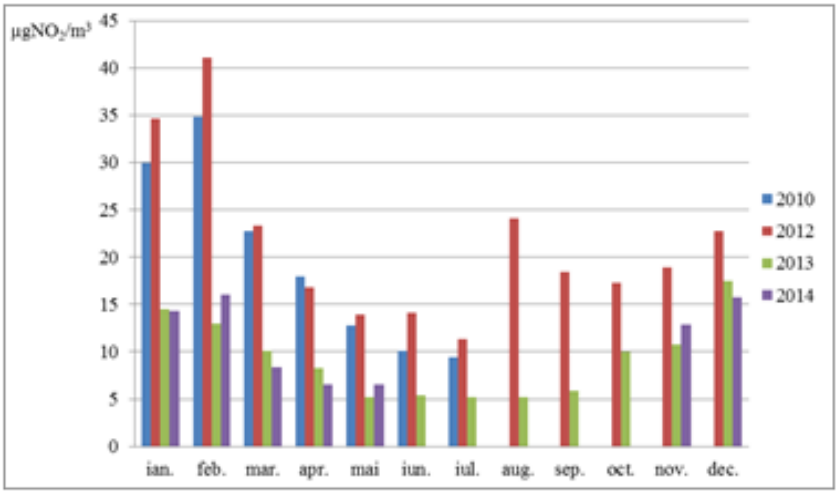

Fig. 4.6. Average monthly changes in concentrations NO_2.

At the opposite pole was located in 2013, with the lowest concentrations of nitrogen dioxide. As a general observation is that during the four years of study higher concentrations of nitrogen dioxide were recorded in winter, when the number of sources of air pollution is higher.

In terms of annual average concentrations, they have not exceeded the limit set by law. (Fig. 4.7.).

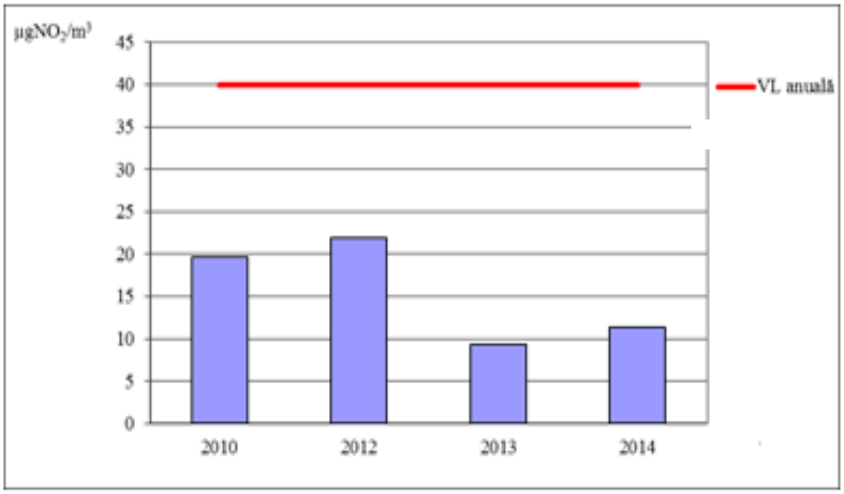

Fig. 4.7. Variation of average annual concentrations of NO_2

Annual average concentration with the highest value was registered in 2012, representing 53% of this limit. Follow 2010 with an average annual value which represented 49% of the allowed limit, while the lowest was calculated for 2013 and represented 23% of the limit.

Analyzing the trend mean for NO_2, 2013 presented the longest period (January to August) the ratios were lower or equal to 1, while the period from September to December presented above par value. (Fig. 4.8.).

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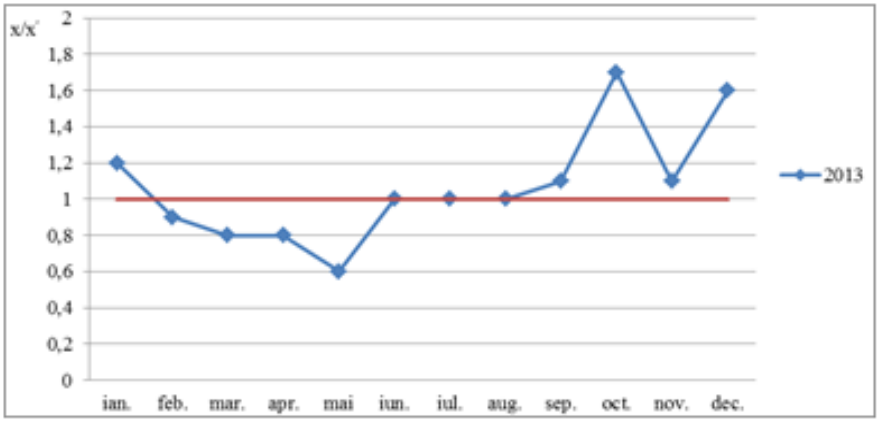

Fig. 4.8. Variation average trend ($\frac{x}{x'}$) for NO_2 in 2013.

In 2012 growth periods alternated with periods of pollution reduction.In 2010 and 2014 there was a trend of decreasing pollution but data capture accounted for only 50% of a calendar year.

5. CONCLUSION

On this basis, and other analyzes can draw some conclusions.
Along with climate change, stratospheric ozone abatement, biodiversity loss etc., acidification of the environment is one of humanity's major problems.
Participation natural sources to produce acid rain is sporadic and isolated one, whereas anthropogenic pollution is a chronic problem.The main anthropogenic sources of sulfur dioxide are plants burning fossil fuels with high sulfur content (coal, oil), some steel factories and chemical plants.
The most important anthropogenic sources for the production of nitrogen oxides are fixed or mobile installations where there are combustion processes and chemical plants.
The dispersion in the atmosphere of sulfur dioxide and nitrogen oxides and their product transformation takes place under the action of wind and vertical movements of air, thus raising the possibility of extending them at great distances from the sources of emission can reach virtually all troposphere.
In the county of Gorj there was a significant decrease in the levels permitted by the regulations in vigor, emissions and immissions of sulfur dioxide and nitrogen oxides, the main acidifying gases.
Reducing emissions and immissions of sulfur dioxide and nitrogen oxides is a result of measures implemented by the two power plants, on gas desulfurization and improvement of burning coals. Given the large number of existing power blocs and especially the high costs of remediation facilities, the process of modernizing the two power plants is being finalized.
For reducing NOx emissions from auto transport in Targu Jiu the municipality have taken measures traffic flows through the creation of roundabouts in major intersections and traffic one way through the crowded streets. Other recommended measures to control emissions of pollutants such as increased intake of other forms of clean energy, energy conservation, increasing energy efficiency of facilities, use of low sulfur fuels etc.
When present acidic precipitation negative impact on all environmental factors both natural and man. Effects on humans occurs either directly through increased frequency of cardio-respiratory certain diseases, or indirectly through the degradation of its living environment.

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