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THE EFFECT OF SO_2 POLLUTION ON FOREST IN TURKEY ORIGINATED FROM COAL CONSUMPTION AT EAST – CENTRAL – SOUTH EUROPEAN COUNTRIES

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Abstract. The contribution of solid fuels (hard coal and brown coal) to energy consumption and transportation of air pollution largely depends on several factors for environmental requirements. All of these factors could be associated with consumption quantity and quality of coal, combustion and conversion technologies, and atmospheric conditions. In this study firstly, SO_2 emission factor has been calculated for each of total 18 different east – central – south-east countries due to coal consumption, sulphur content of coal, ash content of coal. Later on, this SO_2 emission factor has been related to atmospheric conditions. Especially, large amount of SO_2 has been determined through the atmosphere from central – east and south-east parts of Europe (the Balkans). This polluted air coming over the Iceland – Baltic sea and the Ukraine – Tuna Valley and Black sea which is transported by depression winds to Turkey. Biga Peninsula is one of the mounting area (Biga mountain – Kaz mountain) exposed to these winds. The wind with velocity of 3 m/s can possibly arrive from Sofia (250 km) to Biga Peninsula for 24 h, from Bucharest (500 km) to Biga Peninsula for 48 h, from Kiev (1250 km) to Biga Peninsula for 120 h. It has been found that the limit value of SO_2 should be 30-50 $\mu g/m^3$ in order to protect the forest. This is the vital range that forest trees can stand. The decrease in the chlorophyll content in leaves under the effect of air pollution causes important recession in the raw timber production and its economical value. It is clearly that Turkey faces seriously economical lost (million dollars) due to this import SO_2 pollution.

Keywords: air pollution, coal consumption, atmospheric transboundary layer.

AIMS AND BACKGROUND

The atmosphere is main recipient for gaseous waste from the industrialized society. The combustion of fuels for heating electricity production, industrial processes and transportation is the most important source of atmospheric pollutants. Both industrial manufacturing, and agriculture also cause significant atmospheric emissions.

The atmosphere plays a crucial role in the distribution and impact of air pollutants. Understanding and quantifying the relationships between source and receptors, and the effect occurring at the receptors have become one of the most important tasks in the development of abatement strategies, and for national and international decisions on the control of the emissions[1].

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Regional air pollution problems are closely connected in several ways and to reduce the impact of one regional pollution effect, often more than one pollutant needs to be controlled. Moreover, measure taken to control any of the regionally distributed pollutant may affect other environmental problems, not only on a regional scale but also on local and global scales.

It is in a report of the World Energy Committee that coal will be first energy source in the years to 2000 because of reserve capacity and widespread existing of coal geographical region. Especially, solid fuels are increasingly used for primarily electricity generation (from 54% total input in 1980 they reached an increase of 66% in 1997) and in a few key industrial sectors, such as steel, cement and chemical. However, since 1990, coal consumption in the European Union was declining due to the restructuring coal industry. It was the only part of the world, except for the "CIS and Central-Eastern Euriope" for other reason (economical and political reforms), in which such a trend was observed. These scientific evidences and observations indicated that coal will be the most favoured energy source of next century in spite of the decreasing economic petroleum reserves. Besides of this, according to environmental problems, the technologies of coal preparing, washing, and combustion for obtaining appropriate methods and limits show a significant approvement.

RESULTS

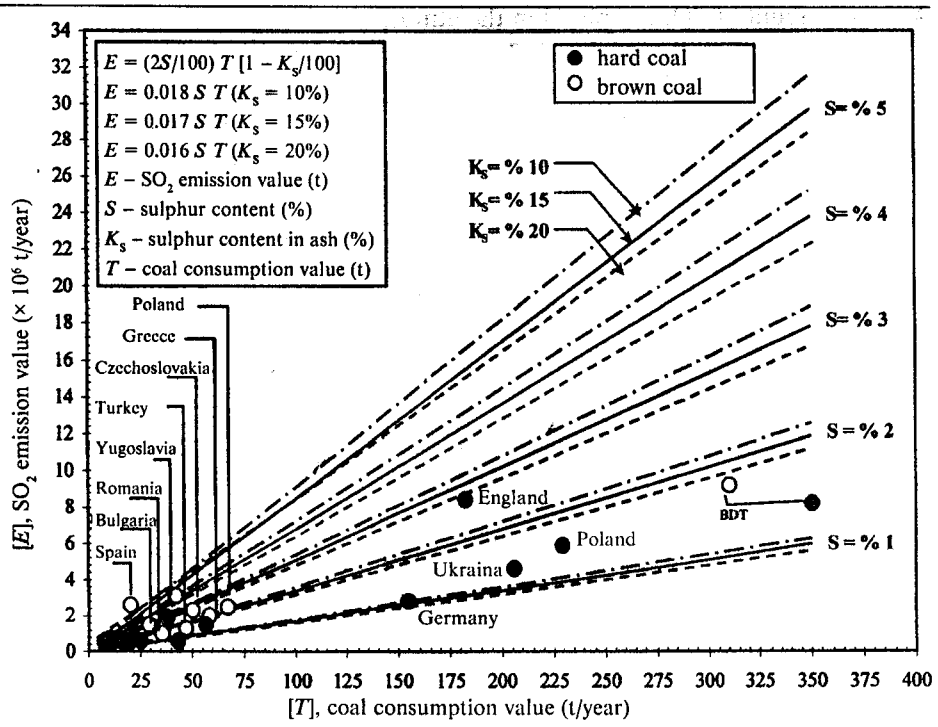
A large amount of SO_2 is emitted in the atmosphere from middle-east and south-east parts of Europe (the Balkans). To provide a numerical information on fundamental SO_2 value, a nomogram is derived from coal technological parameters ("coal (hard and brown coal) consumption (t)" "sulphur content, %" and "ash content %")[2,3]. This study was illustrated in Table 1 as a pattern of nomogram[4].

This nomogram contains 18 different Central, Eastern and Western countries of Europe (1993). It is obvious that large coal consumers the are also countries large amount of SO_2 production, for example, SIC (8.85×10^6 t), Ukraine (4.2×10^6 t), Poland (3.11×10^6 t), Germany (2.3×10^6 t), Chehoslovakia (2.27×10^6 t).

Thus polluted air over the Iceland-Baltic sea and the Ukrainian Tuna Valley and Black sea transported by depression winds to Turkey. Biga Peninsula is one of the mounting area (Biga mountain – Kaz mountain) exposed to these winds. The wind with velocity of 3 m/sec can possibly arrive from Sofia (250 km) to Biga Peninsula for 24 h, from Bucharest (500 km) to Biga Peninsula for 48 h, from Kiev (1250 km) to Biga Peninsula for 120 h[3]. The half life of SO_2 is 24 h within the air. As the wind velocity increases SO_2 value arriving to Biga Peninsula increases, too. In addition, air quality expressed as trends in annual SO_2 and NO_2 concentrations[5] for selected cities is shown in Fig. 1. In the longer term, indicators should focus on population exposure to air pollution. They should be complemented with the information on ground-level ozone and other air pollutants.

Table 1. Prediction of SO_2 value originated from coal consumption at some European countries

Countries	Consumption value (× 1000 t/year)		Sulphur content (%)		LHV (kcal/kg)
	hard coal	brown coal	hard coal	brown coal	brown coal
Germany	155 768	226 086	0.7-1.0	0.3-2.5	2050
Austria	—	1.355	-	0.5	2540
Belgium	24 864	0.226	1.0	1.0	5024
Bulgaria	9880	29 018	4.1	2.0	1514
Czechoslovakia	18 251	49 508	1.5	1.5-3.0	2920
France	42 818	1 718	1.0	2.3	4007
Holland	8 442	0.078	1.0	1.0	4660
Spain	17 865	56 350	1.0	5.3-2.3	4475
Italy	35 388	0.995	2.0	6.0	2438
Hungary	3 910	15 250	3.0	3.0-4.0	2194
Poland	67 220	229	2.2	2.5	1996
Romania	11 330	70 439	4.8	1.0-2.0	1749
Yugoslavia	—	690	1.5	2.5	1980
Greece	—	205 540	1.0	—	1267
Turkey	4 500	55 170	1.0	2.3	2085
Ukraine	205 540	47 340	1.0-1.5	2.0	1565



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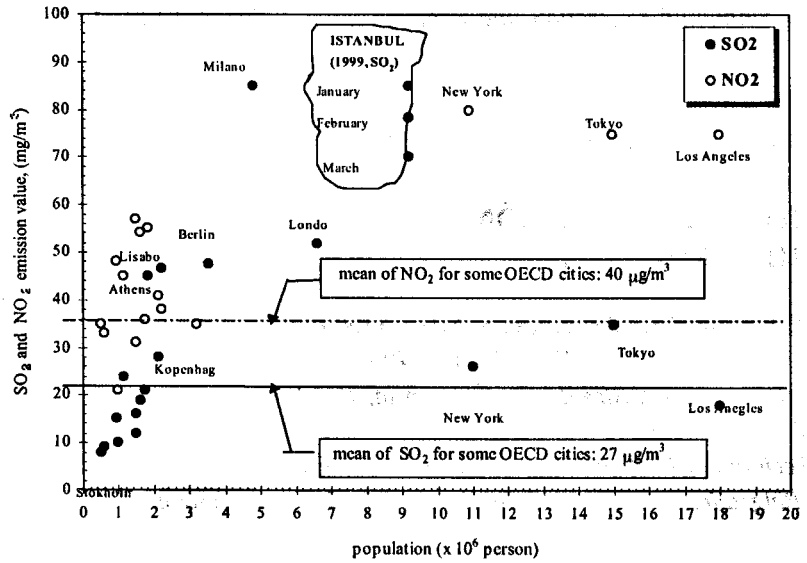

Fig. 1. Trends in annual SO_2 and NO_2 concentrations for selected OECD cities

CONCLUSIONS

Atmospheric pollutants from energy transformation and energy consumption as well as from industrial processes are the main contributors to regional and local air pollution.

Major concerns relate to their effect on human health and ecosystem. Air pollution may also damage ecosystems, buildings and monuments, for example through acid precipitation and deposition. State of the art technologies should be used for commonly preventing air pollution.

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