Environmental Report 2017

The environmental report of the company Galantaterm s.r.o. was elaborated with a purpose of providing information to the shareholders, the bodies of the company and the public about influence of the company's activities on environment.
Our company elaborates an internal environmental report on the impacts of its activity every year. The report is based upon the reports of previous years and periodically updates data on those components of environmental protection which are being monitored regularly and which are regarded to be the key components of air pollution and pollution of surface waters. The data used in this report are included in information systems of the company, they were collected by the employees of the company and provided by accredited laboratories. The data reflect the impacts of company's activity on the environment reliably.

Foundation and Shareholders of the Company

The founders and first shareholders of Galantaterm s.r.o. were the Municipality of Galanta, Slovenský plynárenský priemysel a. s., Bratislava (Slovak Gas Industry), Orkuveita Reykjavíkur, Iceland, Slovgeoterm, a.s. Bratislava and Nordic Environment Financial Corporation (NEFCO) Helsinki. The company was founded in 1995 and at that time it was the first company in Slovakia using geothermal energy for district heating by central heat supply.

From the foundation of the company we have been registering two changes in the owners´ structure. In 2007 NEFCO sold its shares to the Municipality of Galanta.
In 2014, the initial shareholder Slovenský plynárenský priemysel a.s. (SPP, a.s.) transferred its shares to its 100% daughter company SPP Infrastructure a.s.
This change did not have any influence on the portion of ownership.
Municipality of Galanta is the majority shareholder with 77.50% of shares, the other shareholders are: SPP Infrastructure a.s. Bratislava with 17.50% of shares, Orkuveita Reykjavíkur, Reykjavík, Iceland with 4.50% of shares and Slovgeoterm, a.s. Bratislava with 0.50% of shares.

Short Description of the Company's Activity

The company has been operating two geothermal wells (FGG- 2 and FGG-3) of the depth 2 101 and 2 102 m which serve as primary sources of energy. The maximum extraction of geothermal water from the wells is limited to 15.8 l/s and 18 l/s with regard to the protection of natural source and minimization of pressure decline in the wells. This heat potential covers the heat demand until – 2°C of outside temperature. In case of lower temperatures, the needed energy is supplied by the reserve/auxiliary source of heat – a peak-load gas boiler plant. It consists of four hot water boilers fuelled by natural gas which serve for supplying the needed energy - in addition to the geothermal water. The gas boilers also serve as a100% reserve source in cases when the production from geothermal wells is stopped for some reason.
The production of geothermal water from the wells is controlled by a computer according to the actual need of heat. The geothermal water is exploited by pumps and is conducted from the wells into a separation station where it is degassed, and the sand particles are separated. After that it is conducted to the heat exchanger station of the Energycentre by a pre-insulated pipeline. The geothermal heat exchanger station is the basic station for transferring the heat energy of geothermal water into the distribution system of secondary circuit. The geothermal water is conducted into a collector and goes through a system of counter-current plate heat exchangers and gradually transfers heat energy into the individual heating systems of the housing estate Sever and Hospital of St. Lucas Galanta.

From 1 January 2014, the thermally used geothermal water has been discharged into the reservoir of Hydroelectric Power Plant Kráľová through a pumping station at Kaskady. On the route of waste water pipeline the heat remained in the waste geothermal water is utilized by thermal centre Galandia for energetic purposes.

Heat Production in the Year 2017

In 2017, there were not any changes in the production process. As in the previous years the main inputs into the process of heat production and preparation of hot tap water were geothermal water from the wells FGG-2, FGG-3, drinking water supplied by the company Západoslovenská vodárenská spoločnosť and natural gas supplied by SPP a.s.

The drinking water is used as heat-transfer fluid (after chemical treatment, as system water) circulating in the heating system and for production of domestic hot water for the consumers. This water is heated by the natural source of heat (geothermal water) by heat exchangers.

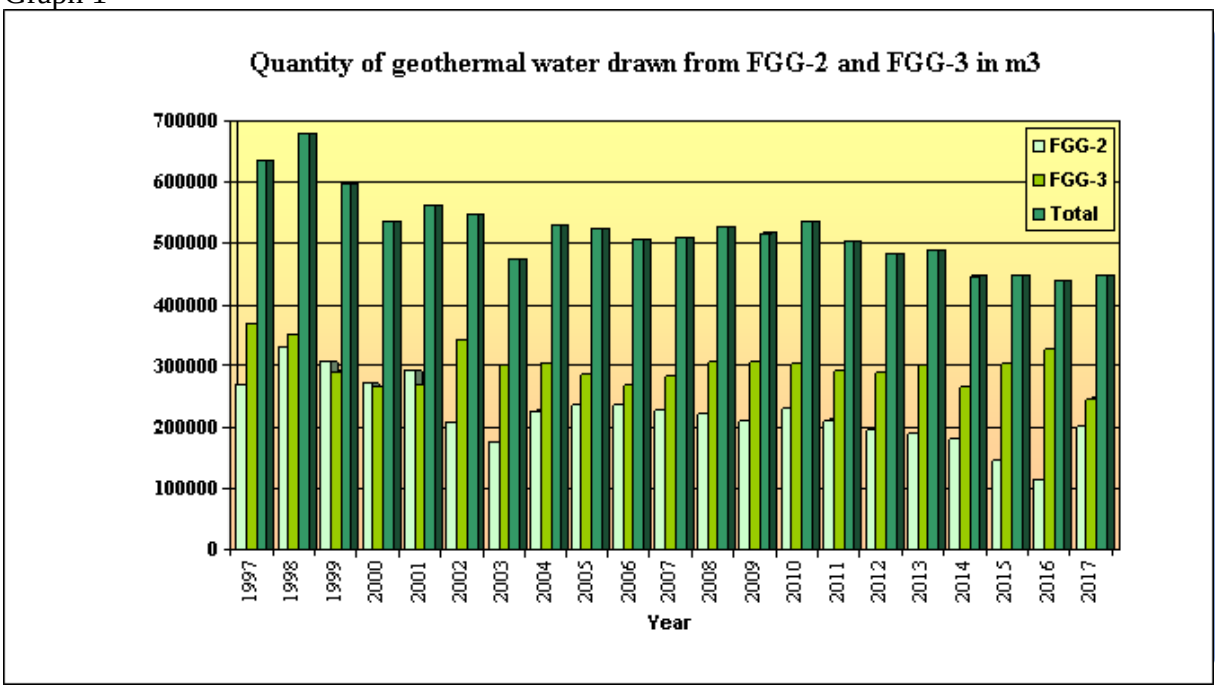
The production of heat and hot water is controlled by the control system consisting of autonomous regulators which drive the technological equipment of heat exchanger station and the wells and ensure the optimal heating according to equithermic curves.

Consumption of Geothermal Water

In 2017, the total volume of exploited **geothermal water** from the two wells was **448 678 m^3**. This volume is 7 925 m ^{3} more than the volume consumed in the year 2016 (**440 753 m ^{3}**).

Graph 1 shows exploitation of geothermal water from the wells FGG-2, FGG-3 in the period from 1997 to 2017

Graph 1

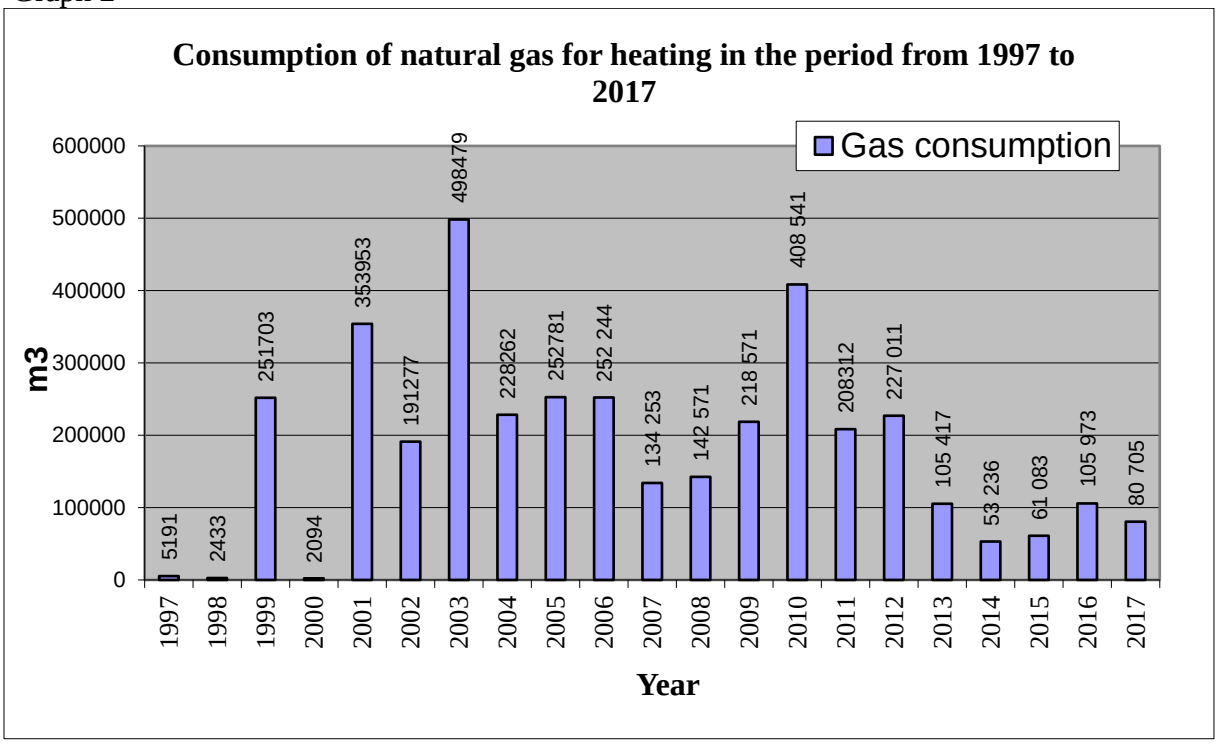


Consumption of Natural Gas

In **2017,** the company used **80 705 m³** of **natural gas** for additional heating. This quantity shows a **decrease by 25 268 m³** in comparison to the consumption of the year 2016 when **105 973** m^3 of natural gas was consumed.

Graph 2 shows consumption of natural gas for additional heating in the period from 1997 to 2017.

Graph 2



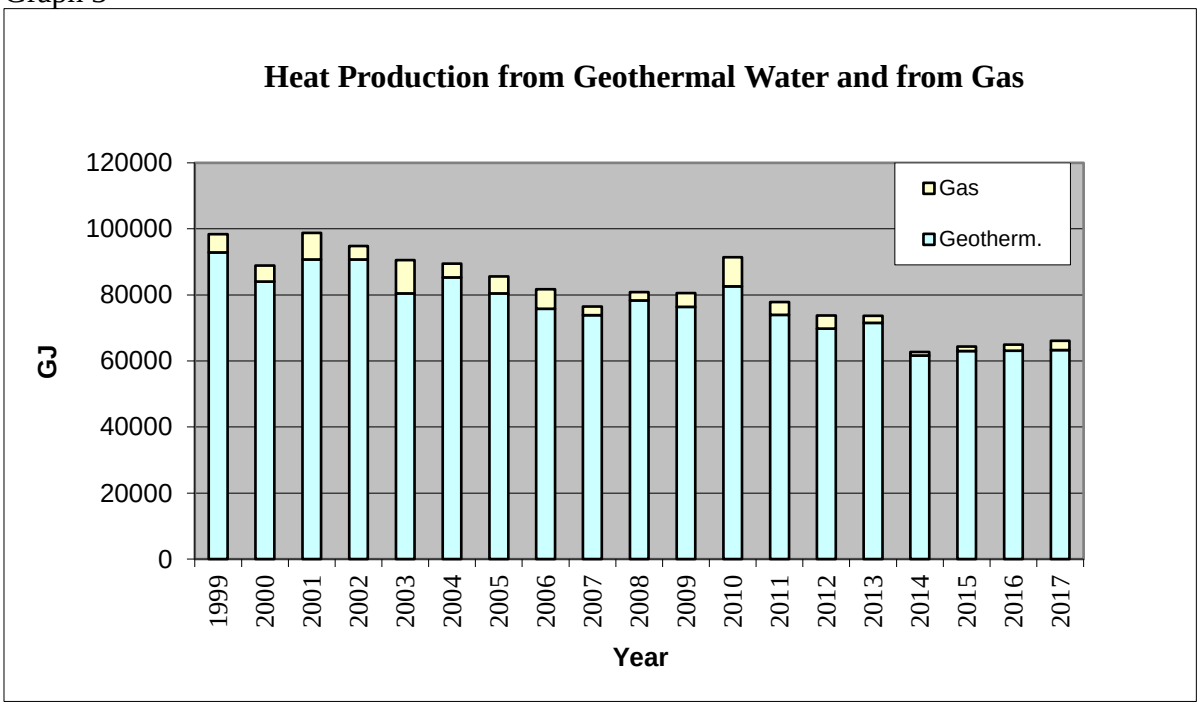
From the above quantities of geothermal water and natural gas **66 075 GJ** (18 354.17MWh) **of energy** was produced. From that **63 345 GJ** (17 595.83 MWh) was generated **from geothermal water** and 2 730 **GJ** (758.33 MWh) was gained **from natural gas**.
Expressed in percentages: the **95.87** % of energy was produced from geothermal water and **4.13** % from natural gas.

If we compare production data of the years 2016 and 2017 we can state that the heat production in 2017 increased by 1 159 GJ (321.94 MWh). This was constituted of 249 GJ more heat from geothermal water and 910 GJ more heat from natural gas.

In **2017,** the percentage of energy produced from natural gas increased by 1**.33 %** (in the year 2016 this percentage was 97.20 % from geothermal and 2, 80 % from gas).

Graph 3 shows the development of heat production from geothermal water and from natural gas in the period from 1999 to 2017

Graph 3



Consumption of Drinking Water

In the year 2017, the company consumed **54 458.98 m^{3}of drinking water**. From that **414 m^3** was chemically treated and used as system water circulating in the heating system and **54 044.98 m^3** was used for production of hot tap water supplied to the consumers.

Consumers

Energy produced from the above inputs was supplied to the consumers of Galantaterm s.r.o. Heating was provided during the heating period; domestic hot water was supplied all the year.

In 2017, we had the following consumers:
Bysprav s.r.o. Galanta (a housing company)
Technospol Slovakia s.r.o.
Anna Hauková
Gastrocentrum s.r.o
Materská škola – Óvoda Sever (a kindergarten)
Hospital of St.Lucas in Galanta a.s.
Patria –Retired People's Home in Galanta
Regional Office of Public Health, Galanta
SBD Sládkovičovo a Galanta (a housing cooperative)
Pohoda seniorov s.r.o. (an old people's home)
Elementary School of Gejza Dusík, Galanta
KOI CARP SLOVAKIA s.r.o.
Facility Group (administrator of residential buildings)
Contesta spol. s r.o (administrator of residential buildings)
Skyfit s.r.o. Duba Juraj (a fitness centre)

Jozef Bugyi
TRIMONT Slovakia s.r.o.
Kaskády s.r.o

Supply of thermally used geothermal water to Galandia s.r.o. is suspended due to temporary cessation of its operation.

Environmental Impact of Our Activity

One of the main objectives of establishment of our company was the reduction of old environmental burdens but this ecological way of heat production also produces minimalised but measurable and carefully monitored pollution of the air which derives from two sources: from geothermal water and from natural gas.

Emissions from Geothermal Water

Gases included in the geothermal water are eliminated in separation tanks. Their analyses are performed twice a year, one analysis is made in summer period, when the production of geothermal water is lower, and one analysis is carried out during the main heating season in winter.
Table 1 shows the results of analyses of gases included in the geothermal water in the year 2017.

Table 1

Well	FGG-2	FGG-3	
Date of sampling	23.02.2017	23.02.2017	28.07.2017
Analysis No.	170302/008	170302/008	170803/005
Composition	% vol.	% vol.	% vol.
Methane	27.31	57.71	47.56
Ethane	0.37	1.85	1.4
Propane	0.13	0.55	0.41
i-Butane	0.05	0.12	0.08
n-Butane	0.02	0.07	0.05
i-Pentane	0.02	0.03	0.02
n-Pentane	<0,01	0.01	0.01
Cont.of hydrocarbon > n-Pentane	0.01	0.02	0.0300
Oxygen	0.37	0.18	0.2
Nitrogen	56.81	22.65	21.3
CO_2	14.90	16.81	28.94
He			
Sulphur	<0,003	<0,003	0.003

CO_2 Emissions from Geothermal Water in 2017

Emissions of CO_2 from geothermal water are calculated on the on the basis of water/gas ratio in the geothermal water, percentage of CO_2 in the gas and the quantity of geothermal water produced from the wells. (Table2)

Table No.2

Well	**FGG-2**	**FGG-3**
Quantity of water (m³)	201846	246832
CO2 (vol. %)	14.90	22.88
Water/Gas ration	0.0832600	0.0922268
Average temp. (°C)	78.71	76.00
	3.82	**8.00**

In the year 2017 **CO_2** emissions from geothermal water amounted to **11.82 t/y**.

CO_2 Emissions from Natural Gas in the Year 2017

Emissions of CO_2 from natural gas are calculated by the formula:

Emission CO_2 [t/y] = consumed gas x **heat value** x **emission factor** x **oxidation factor**

Calculation of CO_2 emissions from natural gas in the period 1997 – 2017 (for Energycentre) is shown in Table 3.

Table 3

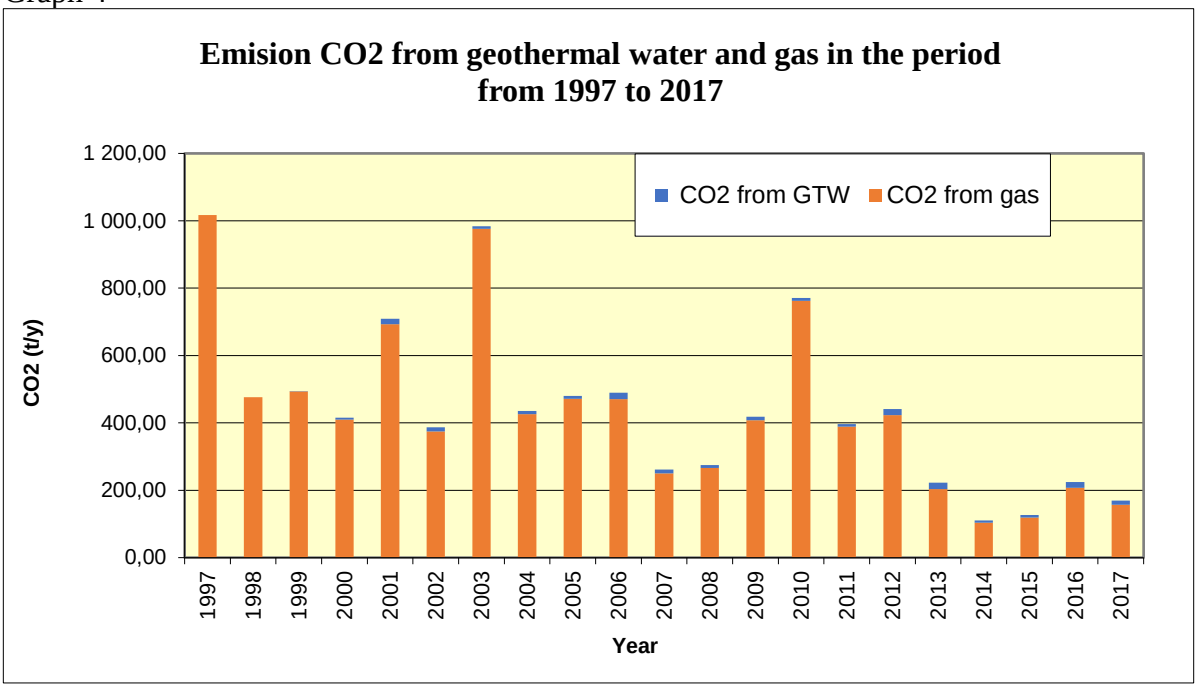
Year	Consumed gas mill m³	Heat value MJ/m³	Emission factor tCO_2/TJ	Oxidation factor	Total CO_2 (t/y) Energycentre
1997	0.5191	33.411	58.92	0.995	1 016.78
1998	0.2433	33.411	58.92	0.995	476.56
1999	0.251703	33.411	58.92	0.995	493.02
2000	0.2094	33.411	58.92	0.995	410.16
2001	0.353953	33.411	58.92	0.995	693.3
2002	0.191277	33.411	58.92	0.995	374.66
2003	0.498479	33.411	58.92	0.995	976.39
2004	0.228262	33.411	56.1	0.995	425.71
2005	0.252781	33.411	56.1	0.995	471.43
2006	0.252 244	33.411	56.1	0.995	470.42
2007	0.134 253	33.441	56.1	0.995	250.37
2008	0.142 571	33.441	56.1	0.995	266.13
2009	0.218 571	33.441	56.1	0.995	407.62
2010	0.408 541	33.441	56.1	0.995	762.61
2011	0.208312	33.441	56.1	0.995	388.48
2012	0.227011	33.441	56.1	0.995	423.45
2013	0.105417	34.686	55.53	1.00	203.05
2014	0.053236	34.85	55.76	1.00	103.45
2015	0.061083	35.0541	55.7483	1.00	119.37
2016	**0.089664**	**35.0778**	**55.7810**	**1.00**	**207.35**
2017	**0,080705**	**34,9548**	**55,7810**	**1,00**	**157,3597**

The total of **CO_2** emissions from gas in the year 2017 was **157,36 t/y.**

The total of CO_2 emissions from the activity of Galantaterm s.r.o. Galanta was 169.18 t/y in 2017, from that 11.82 t/y was from geothermal water and 157.36 t/y from natural gas.

The development of CO_2 emissions from 1997 to 2017 is shown in Graph 4.

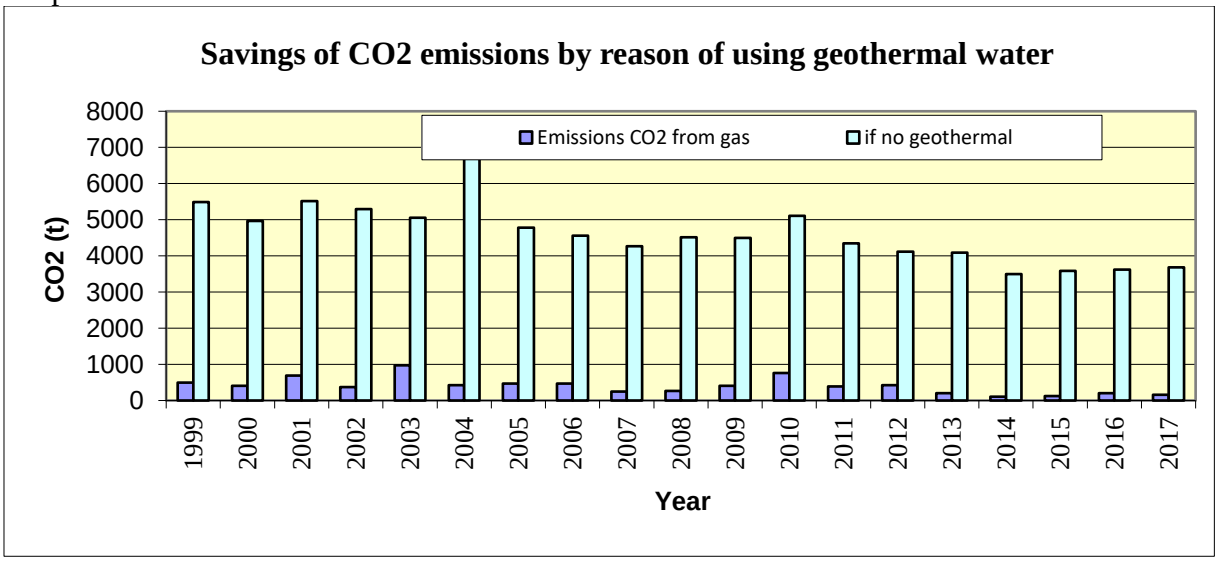
Graph 4



Savings of CO2 Emissions by Reason of Using Geothermal Water

The main source of CO_2 emissions in Galantaterm is natural gas used for additional heating if needed. Graph shows the actual volume of CO2 emissions from natural gas by the individual years. Emission of CO_2 would be much higher if geothermal water was not used and all the volume of produced energy would be generated from natural gas Savings by reason of producing the bulk of energy from geothermal water are on average above 3 500 -5 000 t/y.

Graph5

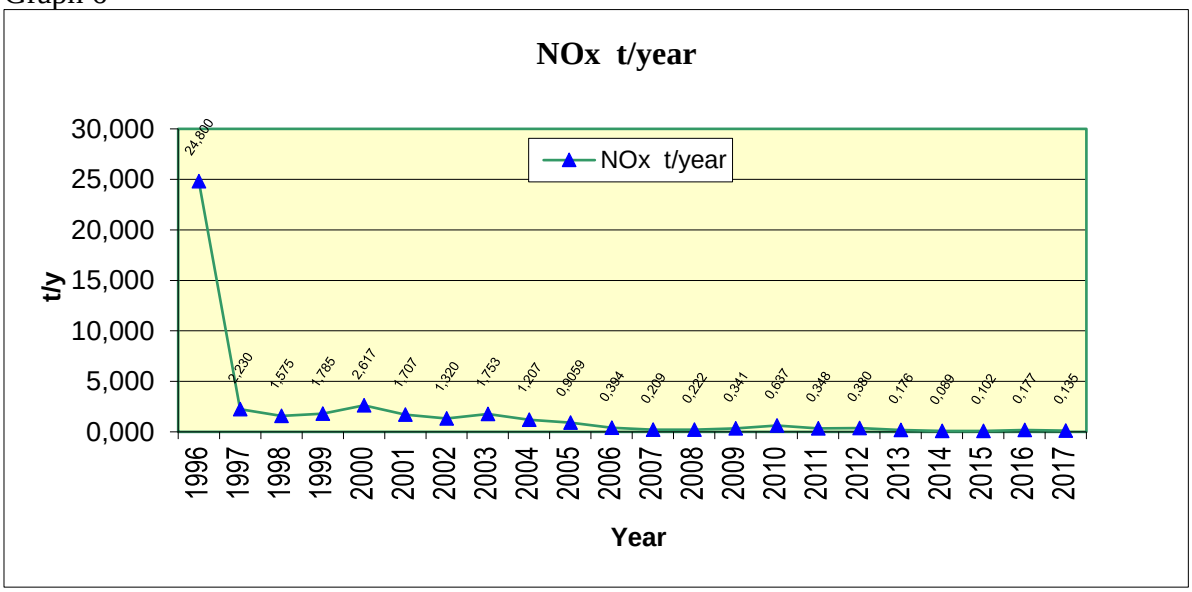


Other components of air pollution: NO_x, SO_2 and solid particles/dust (from natural gas):

Development of NO_x Emissions

In 2017, the quantity of **NO_X** emissions was **0.1349** t/y.
Graph 6 shows the development of NO_x emissions in the period from 1996 to 2017

Graph 6

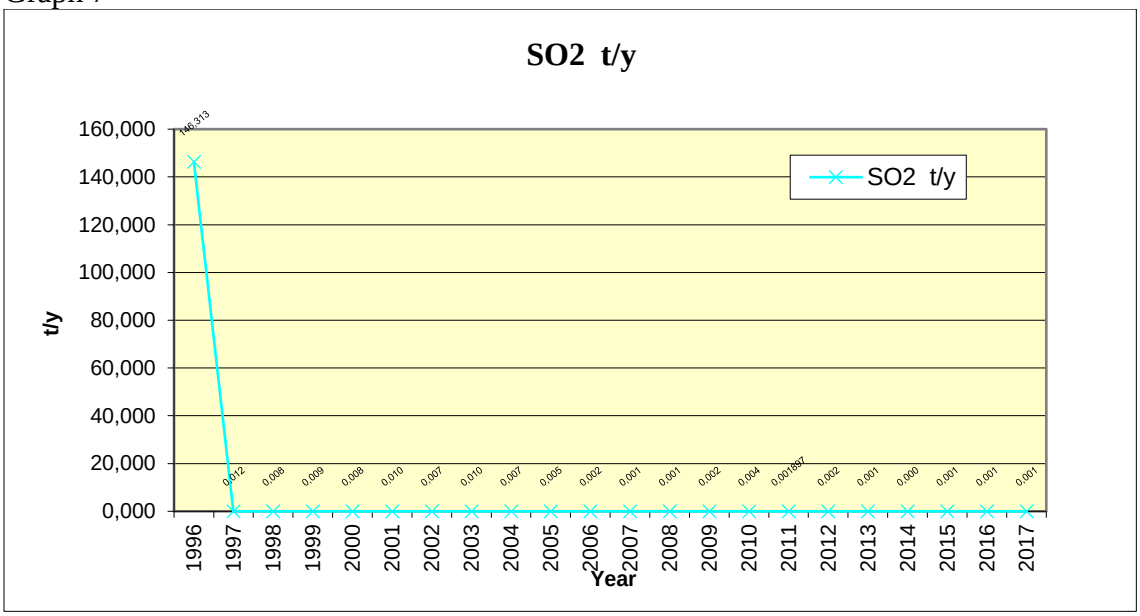


Development of SO_2 Emissions

In 2017, the quantity of **SO_2** emissions was **0.00073** t/y.

Graph 7 shows the development of SO_2 emissions in the period from 1996 to 2017.

Graph 7

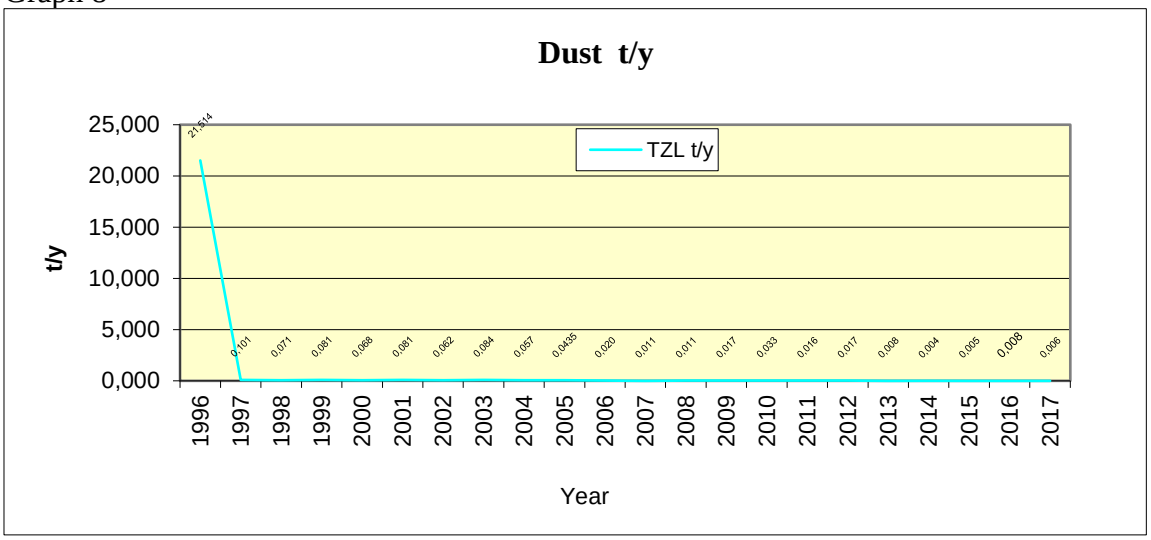


Solid Particles/Dust

In 2017, the quantity of **solid particles/dust** was **0.0061 t** /y.

Graph 8 shows emissions of solid particles in the period from 1996 to 2017

Graph 8



Treatment of Geothermal and System Water

Geothermal Water

Before its utilization for energetic purposes the geothermal water is treated with inhibitor of corrosion and scaling. Inhibitor CRW 80010 is not produced any more, it was substituted by inhibitor of corrosion CRW85218. From August 2017 this type of inhibitor has been used for FGG-3. The composition, dosage and the total consumption of this inhibitor is included in Table 4.

Tab.4

Type	Sort of material	Composition	Dosage
CRW 80010	Corrosion Inhibitor	Amide/imidazolines (amid/imidazolín)	2 mg/l
		methanol (metanol)	
		propan-2-ol	
		quaternary ammonium salts (kvartérne amóniové soli)	
CRW 85218	Corrosion Inhibitor	salts of imidazolines (soli imidazolínu)	2 mg/l
		methanol (metanol)	
		2-mercaptoethanol (2-merkaptoetanol)	
		quaternary ammonium salts (kvartérne amóniové soli)	

The overall consumption of inhibitors in the year 2017 was as follows:
529.42 kg of CRW80010
367.94 kg of CRW85218

Treatment of System Water

The system water is softened by sodium chloride (NaCl) and treated by sodium sulphite Na_2SO_3 and sodium phosphate Na_3PO_4.

The consumption of chemicals for treatment of system water in the year 2017 is shown in Table 5.

Table 5

Chemicals	Quantity (kg)
Na_3PO_4	50
Na_2SO_3	55
NaCl	675

Thermally Used Geothermal Water

After its utilization in Energycentre the thermally used geothermal water has been discharged into the reservoir of Hydroelectric Power station Kráľová from 1 January 2014.
For this purpose, a pumping station was erected including two pumps for pumping the water over the dam.
In the year 2014, an outlet facility was built into the water course Derňa at the intersection of road Galanta – Kolónia on the right side of the flow. This facility serves as an emergency outlet of geothermal water from discharge pipeline (only for provisional, short-time employment in case of failure or shortage of electricity in the pumping station). These measures secure the reliable, effective, ecological and environmentally friendly disposal of used geothermal water.

Discharge of used geothermal water was permitted by Environmental Department of the District Office Trnava, in Decision No. OU-TT-OSZP-2015/036146/Gl.
According to this permission the following characteristic indicators have to be monitored in the samples taken from behind the heat exchangers in the Energycentre:
pH (6.5 - 8.5)
DS_{105} (4 600 mg/l)
The measurings are made by accredited laboratories.
The periodicity of measurings is 3 times a year, twice in the heating period and once in summer period. The results of these measurings are submitted to the competent body of state water administration once a year.

This regulation is fully respected and observed by the company.

Table 6 shows the values of used geothermal water discharged into the recipient river Váh measured in the year 2017:

Measured parameter	Unit/Date	16/03/2017	2/.07/2017	22/11/2017	Concentration	Balance value
pH	-	7.51	7.39	7.55	6.50-8.50	-
DS at 105 °C	mg/l	4550	4450	3790	4600	3038.2 t/year