ADAPTATION ACTION PLAN FOR THE IMPROVEMENT OF AIR QUALITY IN THE ŠALEK VALLEY

Velenje, July 2014

WP4: Adaptation Action Plans and Transnational Platform

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EXECUTIVE SUMMARY

The Šalek Valley used to be one of the most polluted areas in Slovenia in the second half of the 20th century. After extensive injuries of forests in the valley in the middle of the 80s of last century, intensive activities for the prevention of air pollution in the valley began. In 1986 a number of public discussions on environmental pollution were organized, which ended with a public forum in June 1986. Numbers of strategic documents, that contained the programs of actions to reduce air pollution, were after then adopted. The most important actions were decreasing of emission from industry by building of desulphurization devices on Šoštanj Thermal Power Plant (ŠTPP) and by introducing the BAT techniques at industry devices, and also the decreasing of emissions from winter heating by connection of 90 % of residents to the district heating energy from the ŠTPP. Very important action was establishment of the *Environmental Information System* (EIS) for the measurement of emissions and the level of air pollution in the impact area of ŠTPP, what enabled insight into the pollution level in the valley. Considerable effort was invested in increased level of information and awareness of the population. After 1991 the traffic density in the valley began to rise, but on the other side the decrease in the use of public transport and bicycles was detected. For this purpose the Municipality of Velenje carried out several projects in which it encouraged the use of public transport and bicycles. A major step in the field of public transport has been made with the introduction of free public transport - LOKALC.

All those actions, especially actions relating to reduction of emissions from industry and actions for reducing emissions from heating, have contributed to significant improvements of air quality in the valley. Average SO_2 emission concentrations in the period 2006-2012 did not anymore exceed the limit value for the protection of ecosystems at any of the locations/monitoring stations, what was a problem before 2004. Only in 2006, the concentration of SO_2 at the location Veliki Vrh was equalized to this value. Emission concentration of SO_2 after 2006 did not exceed the limit values for the protection of ecosystems and human health. The same was also true for NO_x, as in the period 2006-2012 the annual average NO_2 emission concentration did not exceed limit value for plant protection and for the protection of human health. Average annual concentrations of PM_{10} during the period 2006-2012 did not exceed the threshold for human health, but the lower assessment threshold (20 µg/m^3) was exceeded. This concentration (20 µg/m^3) is also the limit average annual concentrations recommended by World Health Organization (WHO). Number of days with exceeded maximum 24-hour concentration was smaller than it is prescribed. With the exception of the year 2008, the number of cases of exceeded threshold for 8-hour ozone concentration at the sampling points Zavodnje and Velenje was higher than it is the limit value for the protection of human health. The number of exceedances was particularly high in 2006 and 2007. Even otherwise, the ozone concentrations were excessive all over Slovenia.

Analysis of impact of the reduction of air pollution in the valley on mortality showed that the reduction of concentration of PM particles can contribute to lower number of the premature

deaths. The number of avoidable premature death cases was computed according to the APHEKOM methodology through different scenarios, where the level of ozone, PM_{10} and $PM_{2.5}$ was lower as it was measured in the environment. Short-term effect of PM_{10} concentrations, which in the period 2006-2010 exceeded the threshold of 50 $\mu g/m^3$, was very low on mortality in the Šalek Valley. To them two to four deaths per million populations can be attributed. In the case that the concentration of PM_{10} was reduced to 20 $\mu g/m^3$ on days when the actual value was above 20 $\mu g/m^3$, this reduction would prevent one to two deaths per 100,000 populations. Slightly larger is the impact of $PM_{2,5}$. Concentration of the latter was calculated from the known concentration of PM_{10} (factor 0.7), because measurements of $PM_{2.5}$ have not been performed. Long-term reduction of $PM_{2.5}$ by 5 $\mu g/m^3$ would prevent 26 to 31 deaths per 100,000 populations per year in the case of the examination of total mortality without external causes. Reduction of $PM_{2.5}$ to 10 $\mu g/m^3$ would prevent 14 to 20 deaths per 100,000 populations per year. Negligible effect on annual mortality due to the ozone in the air (0-1 cases per 100 000) was calculated.

Considering the above findings, we conclude that despite the fact that emissions of SO_2, NO_2 and total dust from industrial installations in the Šalek Valley declined, dust particles remains relatively problematic in terms of protection of human health. The main goal of recent action plan is to reduce the annual average concentration of PM_{10} to the recommended value of the World Health Organization WHO – 20 $\mu g/m^3$. Road traffic was specified as the most important local source of emissions of particulate matter in the Šalek Valley in the study "*Model calculations of the spreading of PM_{10} in the Šalek Valley*" (Ivančič and Vončina, 2014). Although the quantity of dust emissions were lower from traffic in comparison with the energy sector, the contribution of traffic to overall pollution was greater, due to the worse dispersion conditions. The main challenge and vision of the municipality of Velenje is thus reducing of emissions from transport by reducing the use of cars and to popularize the use of public transport, bicycles and walking paths. For this reason new actions for decreasing the level of pollution of air are planned within this Action plan. Actions are divided into 4 groups: (i) actions for reducing emissions from industry, (ii) actions for reducing emissions from transport, (iii) actions for the promotion of energy efficiency and renewable energy sources and (iv) actions in the field of education and awareness. The most important projects, which are the part of national strategy, are the *Construction of Unit 6 of ŠTPP* and the *construction of the ring road - highway through the valley*. The implementation of those two projects will contribute substantial to the improvement of the air quality. With the entry of ŠTPP Unit 6 into operation, the production on the other blocks will be ceased. The expected emissions from the block 6 will be considerably lower than were from the other blocks. The construction of highway will redirect the traffic (especially freight transport) from the centre of the town. Other planned actions will have lower impact on the decreasing level of pollutants in the air in the valley and they are relating to the improvement of insulation of buildings, introduction of district cooling, promoting of the use of renewable energy sources, promoting of biking and using of public transport, etc. However, the realization of these measures will contribute to the sustainable development of The Šalek Valley.

1 INTRODUCTION

Adaptation action plan for the improvement of air quality in the Šalek Valley was made within the project »Take *a Breath! Adaption actions to reduce adverse health impacts of air pollution (TAB)*«, funded by the European Regional Development Fund (ERDF) through the European territorial cooperation and CENTRAL EUROPE Programme.

1.1 NATIONAL AND REGIONAL AIR QUALITY REGULATIONS

1.1.1 Slovenian legislation on ambient air quality

The Slovenian legislation adopted all of the European Community legislation in the field of air, which relates to various pollutants and setting limits or concentration levels above which actions are required to reduce concentrations.

The Regulation on ambient air quality (Official Gazette of RS, no. 9/11), which is in accordance with *Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008*, provides maximum levels for all pollutants mentioned, threshold values for sulphur dioxide and nitrogen oxides, long-term oriented values for particulate matter and the associated rate of reduction of air pollution and other compulsory actions.

Legislation on ambient air quality:

- Regulation on ambient air quality (Official Gazette of RS, no. 9/11),
- Regulation of arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air (Official Gazette of RS, no. 56/06)
- Decision on designation of areas and degree of pollution due to sulphur dioxide, nitrogen oxides, particulate matter, lead, benzene, carbon monoxide and ozone in ambient air (Official Gazette of RS, no. 72/03)
- Rules on the monitoring of ambient air quality (Official Gazette of RS, no. 36/07)
- Decree on the emission of substances into the atmosphere from stationary sources of pollution (Official Gazette of RS, no. 31/07).

Those Regulations provide, which pollutants must be monitored; their limit, target, informative and alert thresholds, a minimum number of measurement points, types of measurement points, the density of the monitoring network, reference methods of measurement and calculation of statistical values and exchange and presentation of data. Review of specified values is given in the Table 1.

Table 1: Limit, alarm, permitted and target values for SO_2, NO_2, O_3 and PM_{10} (Regulation on ambient air quality (Official Gazette of RS, no. 9/11)).

Pollutant	**1 hour**	**3 hours**	**8 hours**	**24 hours**	**winter**	**year**
Sulphur dioxid ($\mu g/m^3$)	350 (LV)[1]	500 (AL)		125 (LV)[3] 75 (UAT)[3] 50 (LAT)[3]	20 (CV) 12 (UAT) 8 (LAT)	20 (LV)
For protection:	health	health		health	plant	ecosystems
Nitrogen dioxid ($\mu g/m^3$)	200 (LV)[2] 100 (LAT)[2] 140 (UAT)[2]	400 (AL)				40 (LV) 26 (LAT) 32 (UAT)
For protection:	health	health				health
Nitrogen oxides ($\mu g/m^3$)						30 (CV) 19,5 (LAT) 24 (UAT)
For protection:						plant
Ozone ($\mu g/m^3$)	180 (IT) 240 (AL)		120 (TV)[5]			40 (LV)
For protection:	health		health			materials
PM_{10} ($\mu g/m^3$)				50 (LV)[4] 25 (LAT)[4] 35 (UAT)[4]		40 (LV) 20 (LAT) 28 (UAT)
For protection:				health		health

[1] - value can be exceeded 24 times within a year
[2] – value can be exceeded 18 times within a year
[3] – value can be exceeded 3 times within a year
[4] – value can be exceeded 35 times within a year
[5] – value can be exceeded 25 times within a year (target value for year 2010)
LV – limit value
CV – critical value for plant protection
AL – alert level
TL – target 8-hour value
IT – Information 1 hour treshold
LAT – lower assessment treshold
UAT - upper assessment treshold

Limit value (LV): a level fixed on the basis of scientific knowledge, with the aim of avoiding, preventing or reducing harmful effects on human health and/or the environment as a whole, to be attained within a given period and not to be exceeded once attained.
Critical level (CV): a level fixed on the basis of scientific knowledge, above which direct adverse effects may occur on some receptors, such as trees, other plants or natural ecosystems but not on humans.
Alert level (AL): a level beyond which there is a risk to human health from brief exposure for the population as a whole and at which immediate steps are to be taken by the Member States.
In the case of ozone informative 1-hour threshold (IT) and the target 8-hour value (TV) were defined, which should be achieved by 2010.
Target value (TV): a level fixed with the aim of avoiding, preventing or reducing harmful effects on human health and/or the environment as a whole, to be attained where possible over a given period.
Information threshold (IT): a level beyond which there is a risk to human health from brief exposure for particularly sensitive sections of the population and for which immediate and appropriate information is necessary.
At some pollutants **lower and upper assessment threshold concentration (UAT and LAT)** are defined. If measured concentrations of some pollutants during a specified period were under the LAT, only model calculations and expert reviews may be used to further assessment of the situation. If measured values are between the LAT and UAT, a combination of measurements and model calculations can be used. If concentrations within a specified time period excess UAT, it is necessary to carry out continuous measurements of air quality. (Environmental Agency, 2011; *Regulation on ambient air quality* (Official Gazette of RS, no. 9/11)).

1.1.2 Strategic documents

1. Operational program for reduction emissions into the air from large combustion plants

Operational program for reducing emissions into the air from large combustion plants is a basic document for the reduction of emissions of SO_2, NO_x, CO and dust from such devices. Operational program for reducing emissions into the air from large combustion plants sets out the restrictions and measures device operators to:

- reduce emissions of SO_2, NO_x, CO and dust from large combustion plants in Slovenia and
- limiting the amounts of the annual emissions of SO_2, NO_x, CO and dust.

2. Operational programme for protection of ambient air from pollution by PM_{10} (3. 11. 2009)

Operational program for protection of ambient air from pollution by PM_{10} includes guidelines for the preparation, adoption and implementation of programs of actions to improve air quality in the zones and agglomerations, which are due to exceeding the maximum concentrations of PM_{10} in ambient air defined as degraded areas. The program of actions in areas where limit values of PM_{10} are exceeded is regulation, which is for each area separately adopted by the Government in accordance with paragraph 24 of the Act on the Protection of environment. Municipality in the region or part of zones or agglomerations, where sources of pollutants have a significant impact on ambient air pollution are included in the preparation of the program of actions.

This operational program provides starting points for areas, where it is necessary to implement actions to prevent air pollution with PM_{10}:

- determination of the sources of ambient air pollution, which most contribute to the exceeded concentrations of PM_{10} in the ambient air;
- determination of the deadlines, when reducing of PM_{10} emissions must be achieved;
- determination of the level of reduction of PM_{10} emissions for each type of pollution sources;
- evaluation of the costs of actions for reducing PM_{10} emissions.

Within this operational programs for urban areas are described the most appropriate actions to reduce PM_{10} emissions from combustion and industrial installations, which should be provided at the national and the local level.

Emissions from combustion plants, individual furnaces and industrial sources of pollution
At the national level it was planned to restore state incentive program, which will allow faster replacement of obsolete boilers on wood. In the context of achieving the objectives of the climate and energy package of legislation, incentives for the replacement of boilers on fossil energy sources with modern devices using wood biomass are necessary.

In the context of actions to reduce local emissions of PM_{10} in the urban environment to ensure the phasing out of the use of furnaces (fireplace, furnace, such as a baker's oven, etc.) and the stoves fired by solid fuel, and limit the use of solid fuels for heating in areas fitted for connection to district heating or for connection to the grid for distribution of gaseous fuels.

Emissions from road transport

Within this operational program is for emissions from road transport at the national level planned the introduction of environmental criteria for assessing the amount of tax on motor vehicles, and for assessment of the amount of the annual charge for the use of vehicles on the roads. Emphasis is also on the introduction of green public procurement on the basis of environmental criteria.

In the context of actions to reduce the local emissions of PM_{10} it will be in the urban environment necessary to ensure restriction of the use of heavy vehicles and light commercial vehicles, which do not meet latest EURO emission levels. It will be also necessary to replace the vehicle public road passenger transport with vehicles, which are manufactured in accordance with latest EURO standards.

The main actions for reducing emissions of particles in urban environments are definitely parking arrangements for vehicles at the entrance into the urban environment and the integration of these parking areas in the network of public passenger road transport, improving of public transport, creating ecological zones in the urban environment and speed limit for vehicles on bypass during the winter days, when limit values for PM_{10} are exceeded. It is also planned to implement actions to reduce dust emissions during construction works.

3. Action Plan for Renewable Energy 2010-2020, Slovenia (July 2010)

In this plan, the Slovenian national targets for the share of renewable energy sources in gross final energy consumption for heating and cooling, the electricity consumption and in transport in 2020. Action plan for renewable energy includes:

- National Policy of renewable energy sources,
- the expected usage of the gross final energy consumption in the period 2010-2020,
- objectives and guidance concerning renewable energy,
- actions for achieving the mandatory targets of renewable energy sources,
- estimates of the contribution of each technology to the achievement of the targets of renewable energy sources and estimates of the costs of actions, environmental impact and on job creation.

1.2 GENERAL INFORMATION

1.2.1 Study site

The Šalek Valley is located in the northern part of Slovenia and covers an area of 197.3 km^2, where 44,925 inhabitants lived in this area in 2010. The population density was therefore 227.7 inhabitants/km^2.

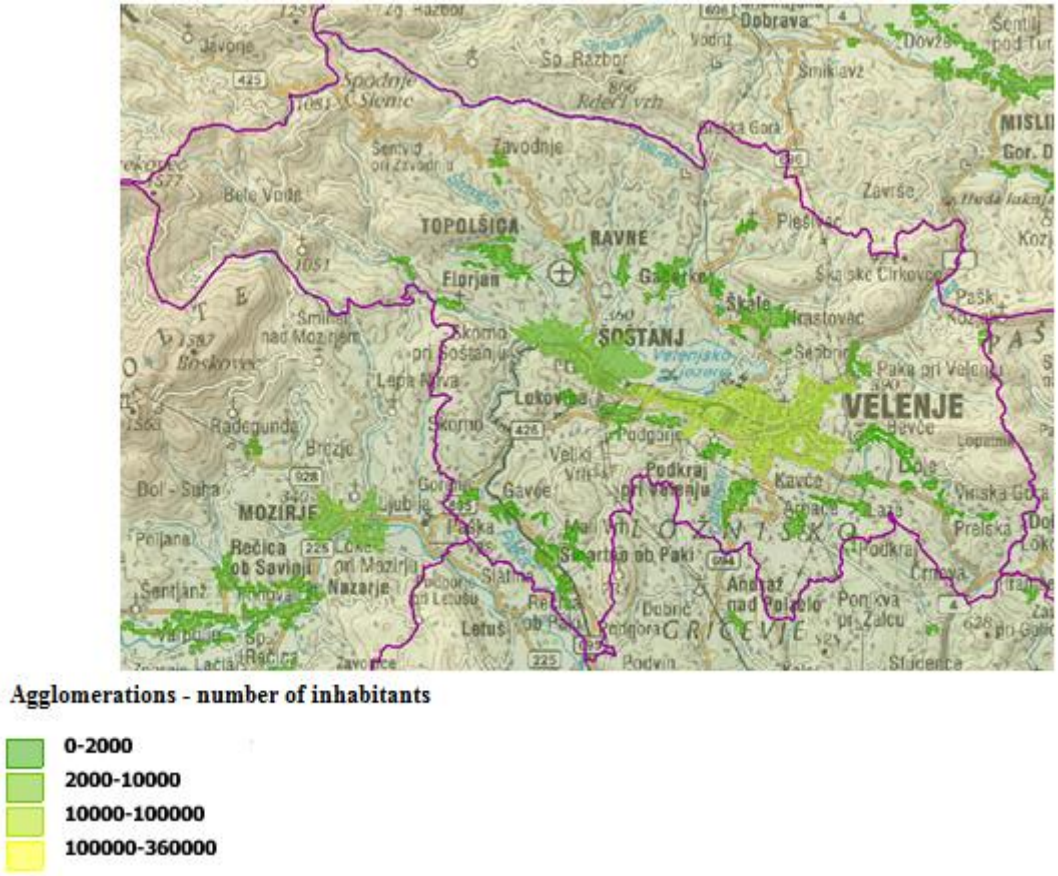


Figure 1: Area of the Šalek Valley - presentation of the population density (agglomerations) (Slovenian Environment Agency: Atlas of the environment).

The Šalek Valley has a temperate continental climate and belongs to the central Slovenian climate area. Summers are moderately warm, winters are cold. The average annual temperature in Velenje is about 9°. The coldest month is January (- 1.0 °C), the warmest is July (18.8 °C). The average annual temperature for the period 1960 to 1990 was in Velenje 9.2 °C. Temperature inversion at quiet and clear weather occur all year round, but are more pronounced in winter and last longer. According to the literature the height of ground inversions is maximum of 60 to 100 m (Šalej, 1999; Pavšek, 2000).

The Šalek Valley lies outside the areas of pronounced precipitation belts, which are in this part of Slovenia extended across the Savinja Alps and Pohorje. The average annual rainfall in Velenje is 1250 mm. Town Velenje, which is situated in the Šalek Valley, has expressed continental precipitation regime with peaks in summer and minimum of rainfall in winter. Although the largest deficit of rainfall over evaporation is in summer, summer rainfall often represent a natural storm in the form of showers and thunderstorms, which are often accompanied by hail and strong wind (Pavšek, 2000).

In 7.7%, the area of Velenje is without wind; most often in September and October. West-northwest (WNW) winds (12.2%) blow most often, second the most common are east-southeast (ESE) winds. On average, the strongest are north-northwest (NW) winds (1.4 m/s), and the north (N) winds (1.1 m/s). The largest average half-hour speed was recorded for the winds from the west (W) (7.0 m/s) and north-northwest (NNW) (6.3 m/s). However, the occurrence of strong winds is extremely rare. Maximum wind gusts were never exceeded a speed of 20 m/s, values over 19 m/s were measured several times during different months and from different directions. Wind blows more often in Šoštanj than in Velenje. It was observed that the area of Šoštanj is without wind only in 0.6% of time.

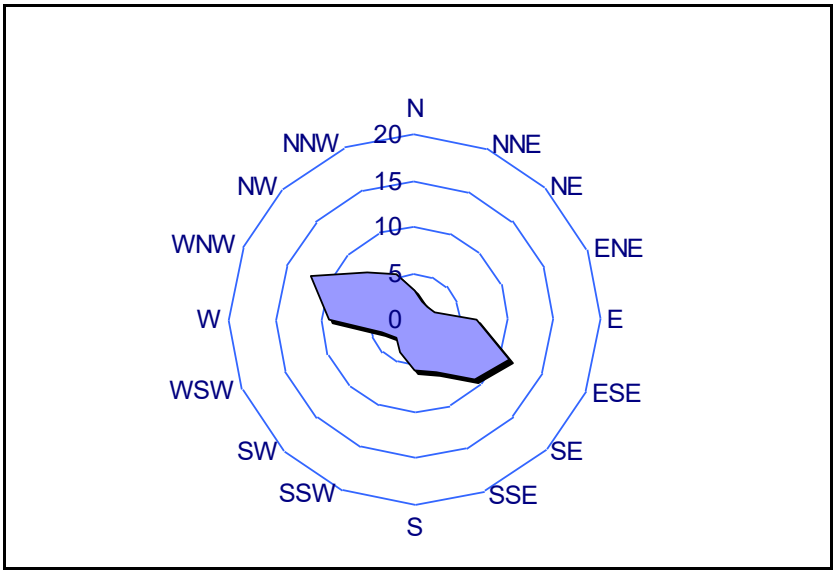


Figure 2: The wind rose for automatic measuring station Velenje (source: Pavšek, 2000).

The most common winds in town Šoštanj (as in Velenje) were winds from the west-northwest (WNW) direction (20.3%), followed by winds from the southeast (SE) (7.2%). On average, the strongest winds were from the southwest (SW) (2.1 m/s). The largest recorded half-hourly average speed was the winds from the north (N) and north-northeast (NNE) direction (7.7 m/s). As for Velenje, weak winds are also specific for Šoštanj. Half-hourly values of winds, stronger than 5 m/s, occur very rarely (Pavšek, 2000).

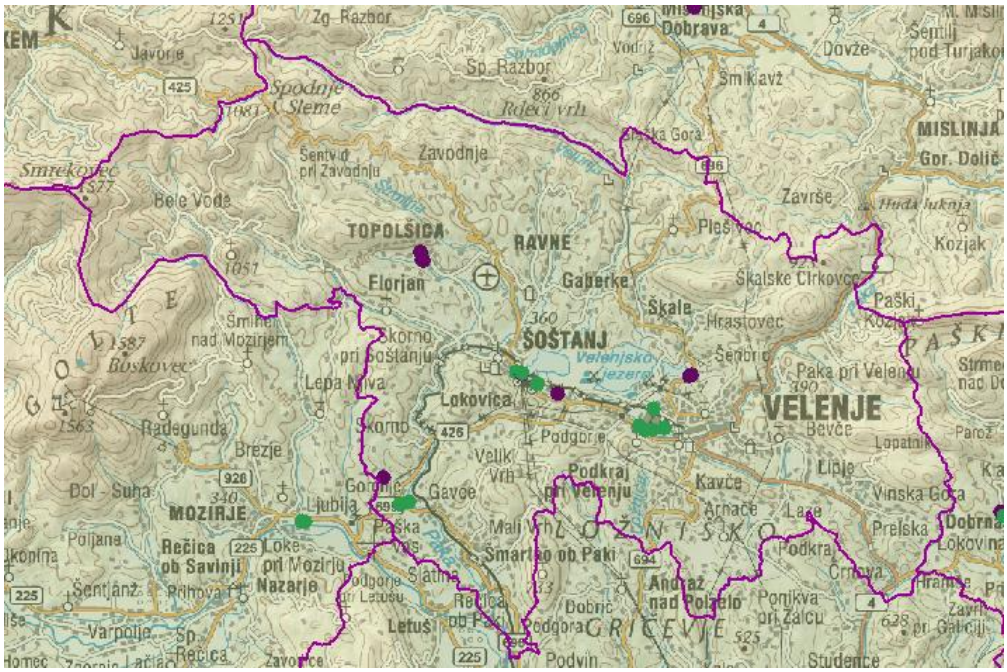
2 AIR QUALITY IN THE ŠALEK VALLEY

2.1 THE MAIN SOURCES OF POLLUTANT EMISSIONS

The most important source of air pollution in the Šalek Valley are industry and traffic, while small individual furnaces have no significant impact on air quality, since in the Šalek Valley district heating system is arranged.

2.1.1 Industry

Mayority industrial plants in the valley lie in the area between Velenje and Šoštanj (Figure 3). The Figure 4 shows the emissions of SO_2, NO_2 and total dust from industrial plants, which were in operation in the ŠalekValley in the period 2006-2012. The largest industrial plant is Thermal Power Plant, which in comparison with other industrial plants in the same period emited the largest quantities of air pollutants: about 99.9% of SO_2, NO_2 and total dust.



Industrial devices

- **environmental license has been issued**
- **environmental license has not been issued**

Figure 3: Location of industrial facilities in the Šalek Valley (source: Slovenian Environment Agency: Atlas of the environment).

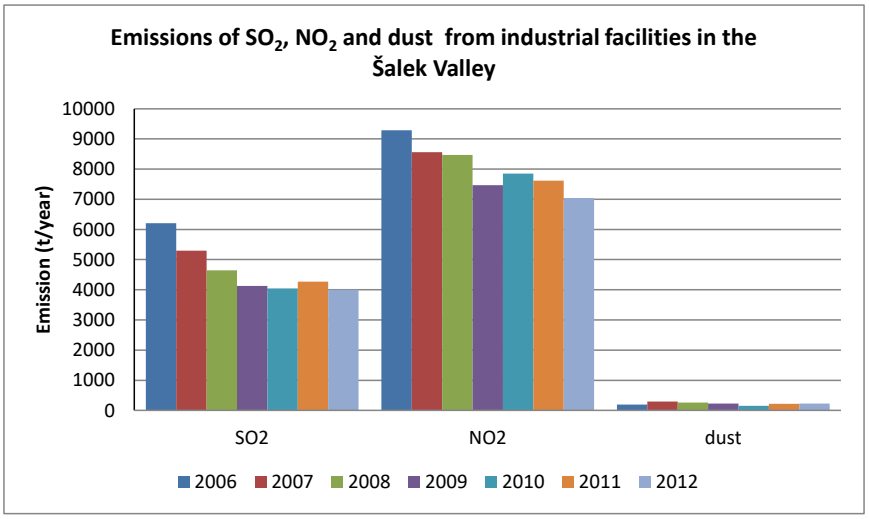


Figure 4: Emissions of SO_2, NO_2 and dust from industrial facilities in the Šalek Valley.

In general, emissions of SO_2 and NO_2 from industry in the period 2006-2012 decreased (SO_2 from 6.1967 t/year to 4,001 t/year, NO_2: from 9,203 t/year to 7,041 t/year). Total dust emissions have remained the same: an average of 200 t/year (fluctuations between years) (Fig 4). Table 2 gives detailed information on dust emissions from industry in 2012 (Environmental Agency, 2014).

Table 2: Emissions of particulate matter from industry (Ivančič in Vončina, 2014).

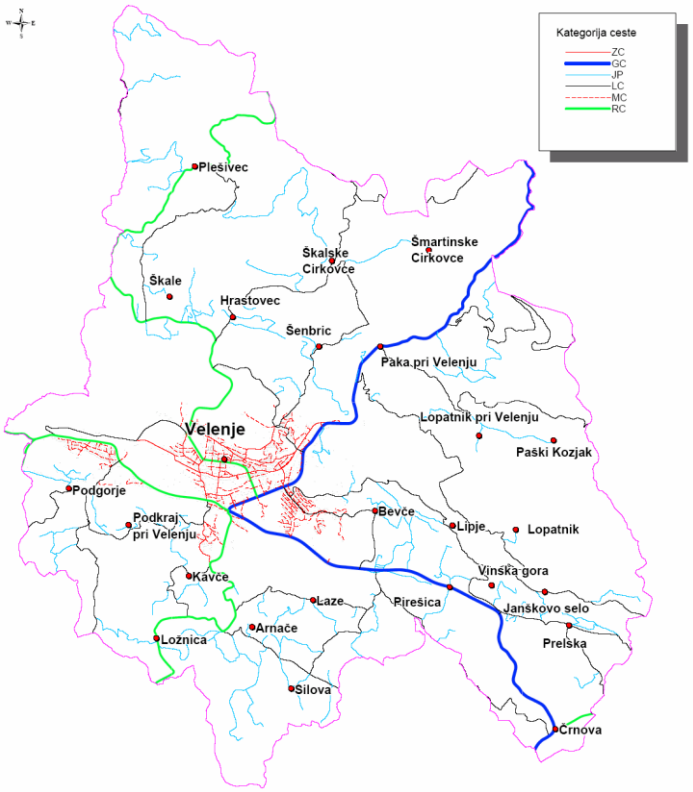
	Total emissions of particulate matter (kg/h)
ŠTPP (captured emissions)	27.38
ŠTPP (diffuse emissions)	0.04
Other industrial facilities	0.29
TOTAL	**27.71**

2.1.2 Traffic

Two important, inter-regional road links pass through the Šalek Valley. One road connects village Arja vas (entrance into the highway) with Velenje and Koroška region) and second important road links Velenje with the Upper Savinja Valley. Through the Municipality of Velenje, state and municipal roads take place. There are also local roads and public paths within settlements (Figure 5).

Emissions of the gas from the traffic are not measured as a part of regular national monitoring, and assessment of the quantity of air pollutants emitted from traffic can not be

given. Based on the data on traffic loads on individual road segments (Slovenian Road Agency, 2014) we can assume the trend of pollution caused by traffic. From Fig. 6 it can be seen that the traffic remains approximately at the same level in the period 2006-2012, but in comparison with the year 2000 the traffic has been increased by more than 20%.



Legend: RC – regional road, GC – main road, LC - local road, JP – public path, ZC - aggregated city or town road within setlements (street sytem), MC - city or town road.

Figure 5: Municipality of Velenje with state and local road network (source: Traffic study of Municipality Velenje, 2007).

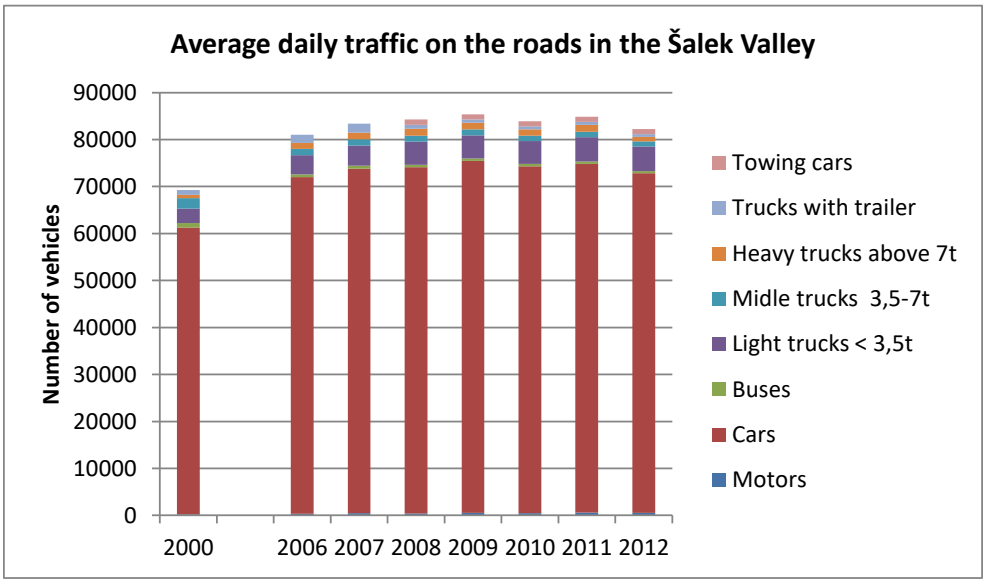


Figure 6: Average daily traffic load on the roads in the Šalek Valley with different types of vehicles in the year 2000 and in the period 2006-2012 (Slovenian road Agency, 2014)

Because of lack of data on emissions, various studies were made to estimate emissions of pollutants from transport. Within the project GUTS, emissions of various air pollutants (CO, hydrocarbons, NOx and particulates) from the bus and freight traffic, passing through the city center on a business day, were assessed. In this case, data on the number and age of buses, the average annual emissions (measured in accordance with standard EURO), the annual average number of vehicles and average annual distance traveled in the area was taken into account. Table 3 presents estimation of emissions of dust particles. The results show, that the bus and freight traffic, passing through the center of Velenje, contributed a total of 160 kg of dust per year (Project GUTS, Municipality Velenje).

Table 3: PM emissions from bus and road freight traffic in the Municipality of Velenje (GUTS, Municipality Velenje, Report 2012).

PM emissions	
Bus Lokalc	1.3 kg/ leto
Bus- random traffic	34.7 kg/ leto
Trucks	123.9 kg/ leto
TOTAL	**159.9 kg/leto**

Within the study *Model calculations of the spread of PM_{10} in Šalek Valley* (Ivančič and Vončina, 2014) emissions of dust particles, which were emitted into the air from all type of traffic crossing the valley, were calculated. The model NEMO (Rexeis and Hausberger, 2009), which takes into account data on the quantity and spatial distribution of traffic and different types of roads, was used. Estimation of the quantity of emissions for each road is

shown in Table 4. The largest emissions were on the most traffic loaded regional roads Velenje - Arja vas and Velenje – Mislinja. Šaleška cesta, Cesta Fračiška Foita and Partizanska cesta are the most loaded roads with the traffic amongst the roads in the centre of the Velenje.

Table 4: Assessment of particulate matter emissions, that occur as a result of road traffic, with a model NEMO (Rexeis and Hausberger, 2009; Ivančič and Vončina, 2014).

The name of road	Road type	length of the road section (km)	Particulate matter emissions (kg/h)
Velenje - Arja vas	Main road I.	10.34	0.3085
Šaleška cesta	Main road I. order	2.89	0.0945
Velenje - Mislinja	Main road I. order	8.52	0.1398
Cesta Lole Ribarja (Šoštanj)	Regional road II. order	2.48	0.0558
Šoštanj - Šmartno ob Paki (Lokovica)	Regional road II. order	6.04	0.0718
Šoštanj-Zavodnje	Regional road II. order	10.41	0.0304
Kidričeva cesta + cesta pod Parkom	Regional road III. order	3.15	0.0240
Velenje - Šmiklavž (Škale)	Regional road III. order	11.74	0.0114
Velenje - Polzela	Regional road III. order	8.51	0.0448
C. Fračiška Foita + Partizanska c.	Regional road II. order	3.79	0.1031
Tomšičeva cesta	Urban road	0.96	0.0296
Cesta talcev	Urban road	0.50	0.0152
Koroška cesta	Urban road	0.22	0.0067
Rudniška cesta	Lokal road	1.79	0.0643
Cesta Simona Blatnika	urban road	1.20	0.0260
Jenkova cesta	Urban road	0.57	0.0087
Kajuhova cesta	Urban road	0.27	0.0041
Prešernova cesta	Urban road	0.42	0.0063
Rudarska cesta	Urban road	0.21	0.0031
Cesta na griču	Urban road	0.87	0.0066
Šalek	Urban road	1.42	0.0144
Stanetova cesta	Urban road	1.08	0.0082
Goriška cesta	Lokal road	0.37	0.0064
Kanovska + Ulica Dušana Kvedra	Lokal road	0.76	0.0041
Koroška cesta	Lokal road	1.01	0.0077
Sončni Grič (Goriška cesta)	Urban road	0.67	0.0118
Total		**80.17**	**1.1074**

2.1.3 Individual furnaces

In the Šalek Valley there is a constructed system of remote heating supply (Fig. 7, left), which provides hot water and heating to residential buildings as well as to the business, administrative and industrial buildings. 90% of the population of the Šalek Valley is connected to this system (Pavšek, 2004). Additionally, some households and other buildings are heated with natural gas (Fig. 7, right). There are only a few common boilers, while small

furnaces are mainly in settlements in the hilly areas of the Šalek Valley. It can be therefore concluded that individual furnaces in the Šalek Valley do not contribute significantly to air pollution.

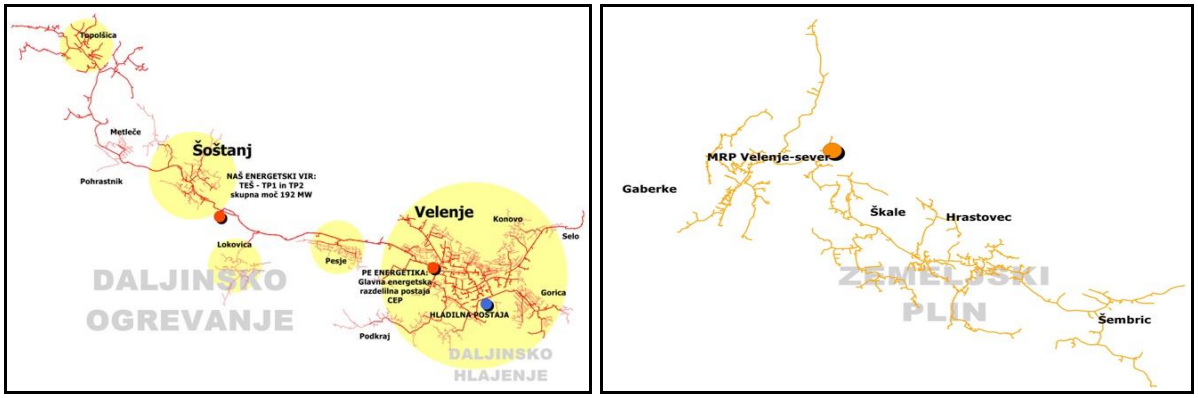


Figure 7: Display of the remote heating supply (left) and of the heating systems with natural gas (right) in the Šalek Valley (Source: The Communal company Velenje).

2.1.4 Estimated total particulate matter emissions from known sources

Table 5 shows the distribution of dust emissions from all known sources of the Šalek Valley (Ivančič and Vončina, 2014). The largest share of particulate matter came from the production of ŠTPP (95%), 4% of known emission were a result of road traffic, while industrial facilities contribute 1% of particulate matter emissions.

Table 5: Estimated total particulate matter emissions from known sources in the area of the Šalek Valley (Ivančič and Vončina, 2014).

	Dust emissions [kg/h]	Share
Industry	0.285	1%
Energetic sector	27.421	95%
Road traffic	1.107	4%
TOTAL	**28.813**	**100%**

2.2 AIR POLUTION TREND IN THE ŠALEK VALLEY

2.2.1 Air pollution monitoring sites

Continuous monitoring of air quality has been in the Šalek Valley established since 1990. There are nine automatic monitoring stations and two mobile stations (for PM_{10} and O_3) in the

area of the Šalek Valley. SO_2 is measured at all measurement sites, NO_x at locations Zavodnje and Škale, PM_{10} at the locations Škale, Pesje, Šoštanj (since 2010) and Velenje (since 2011) and ozone at the sampling sites Zavodnje and Velenje. At the 5 fixed sites (Šoštanj, Velenje, Pesje, Škale and Subsidence (intermediate storage)) measurements of PM_{10} are also carried out.

Figure 8: Location of monitoring sites and their distribution in the area of the Šalek Valley (http://www.okolje.info/).

2.2.2 Imission concentrations of air pollutants at monitoring stations in the Šalek Valley

Average SO_2 emission concentrations in the period 2006-2012 did not exceed the limit value for the protection of ecosystems at any of the locations/monitoring stations. Only in 2006, the concentration of SO_2 at the location Veliki vrh was equalized to this value. At the same time the number of exceedances of the hourly limit concentration for health protection was higher than it is permitted. Emission concentration of SO_2 after 2006 did not exceed the limit values for the protection of ecosystems and human health. The same was also true for NO_x, as in the period 2006-2012 the annual average NO_2 emission concentration did not exceed limit value for plant protection and for the protection of human health.

Average annual concentrations of PM_{10} during the studied period did not exceed the threshold for human health. Number of days with exceeded maximum 24-hour concentration was smaller than it is prescribed, but the upper assessment threshold was exceeded. With the exception of the year 2008, the number of cases of exceeded threshold for 8-hour ozone

concentration at the sampling points Zavodnje and Velenje was higher than it is the limit value for the protection of human health.

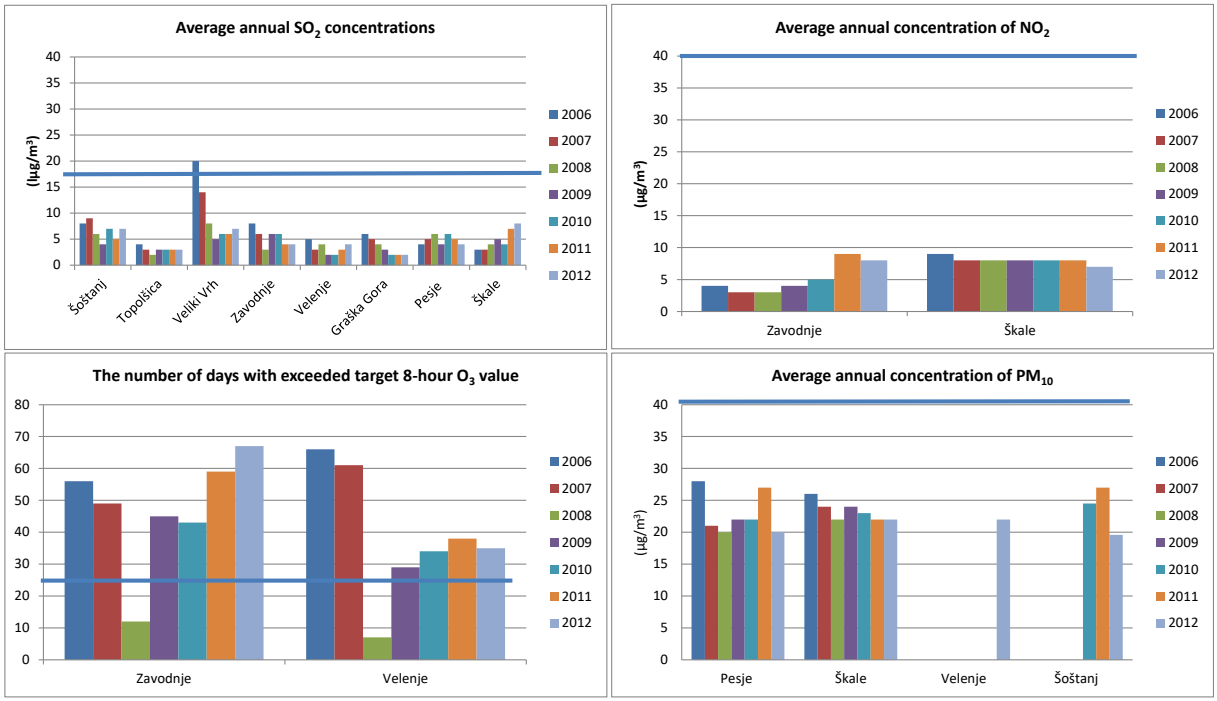


Figure 9: Average imission concentrations of different pollutants (SO_2, NO_2, O_3 and PM_{10}) in the Šalek Valley.

2.2.3 Influence of emission sources on air pollution with particulate matter PM_{10}

In the study *Model calculations of the spreading of PM_{10} in the Šalek Valley* (Ivančič and Vončina, 2014), the model's calculations (CALPUFF model) of spreading of pollutants in the ambient air through the quarterly period from 1 November 2013 to 1 February 2014 have been made.

This period was chosen, because at the same time, measurements of PM_{10} were carried out at two additional locations (Villa Bianca and Care and training center unit Ježek) and because we assumed that during this period, the air was the most burdened with dust particles. On Figure 10, the results of measurements of PM_{10} at monitoring sites in the valley during the period 1 November 2013 to 1 February 2014 are present.

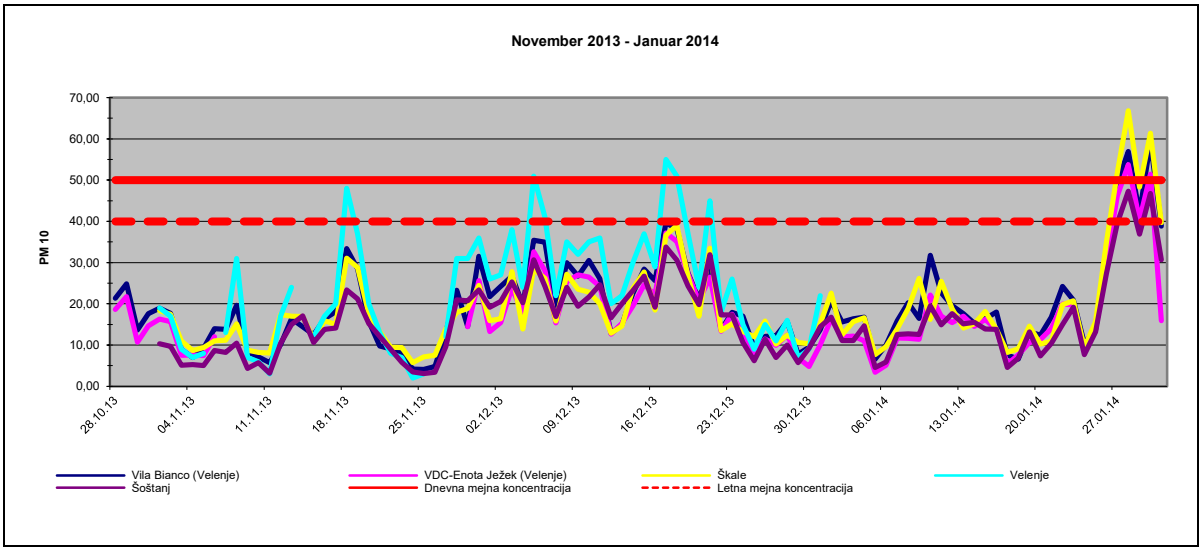


Figure 10: Results of measurements of PM_{10} at monitoring sites in the valley during the period 1 November 2013 to 1 February 2014.

In Figures 11-13 calculations of spreading of PM_{10} in the area of the Šalek Valley, namely the calculated annual average concentrations and maximum daily concentration of PM_{10} as a result of the operation of the energy and industrial plants and road traffic are presented. For each emission sector, model results are shown by two figures: the spatial distribution of average concentrations during the period and the distribution of the daily maximum concentration. Since the highest values of PM_{10} are difficult to read from individual images, those values are collected in Tables 6 and 7. For all the spatial results of the spreading of contaminants, uniform color scale, which is prescribed by the Agency of environment RS, was used:

- green color shows the lower calculated values than is the lower assessment threshold,
- blue color shows values between the lower and upper assessment threshold,
- yellow color shows calculated values above the upper assessment threshold and below the threshold,
- red color is used for values that are higher than the limit value.

The limit values are given in Tables 6 and 7.

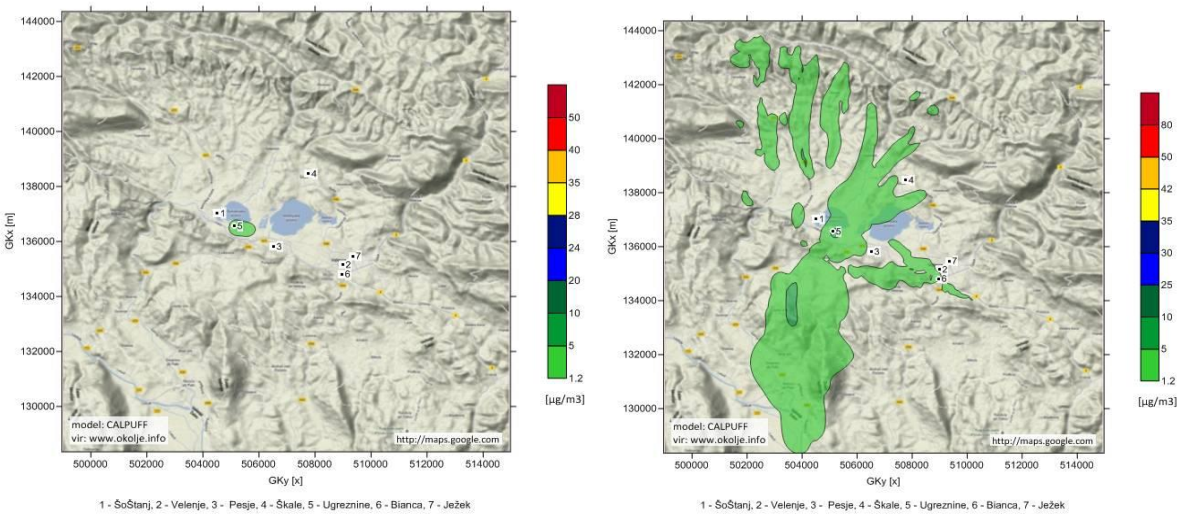


Figure 11: Calculated annual average concentrations (left) and maximum daily concentration (right) of PM_{10} as a result of the operation of the energy and of industrial plants (Ivancic and Vončina, 2014).

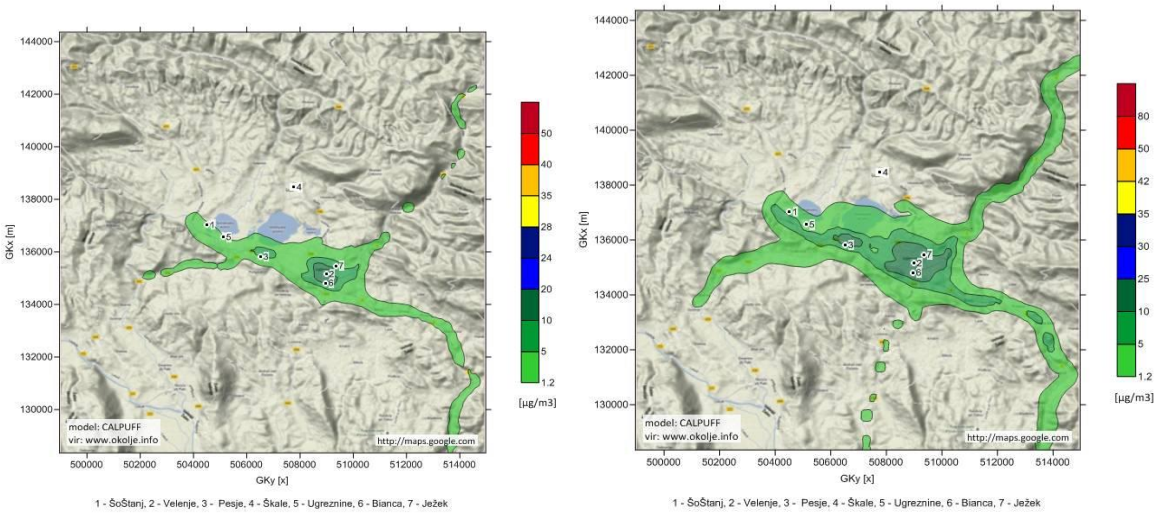


Figure 12: Calculated annual average concentrations (left) and maximum daily concentration (right) of PM_{10}, which arise from road traffic (Ivančič and Vončina, 2014).

Table 6: Model-calculated values of PM_{10} in the point with the highest concentration of PM_{10} as a result of the operation of the industrial sector and road transport (Ivančič and Vončina, 2014).

	PM_{10} - annual average concentrations (µg/m^3)	**LV(µg/m^3)**	**PM_{10} - max daily concentration (µg/m^3)**	**LV(µg/m^3)**	**N**	**LV**
Industry	**5.2**	40 28 (UAT) 20 (LAT)	**9.0**	50 35 (UAT) 25 (LAT)	0	35
Traffic	**19.9**		**42.0**		0	35

Legend: LV – limit value, N – number of days with exceeding daily value 50 µg/m^3, LAT – lower assessment threshold, UAT - upper assessment threshold.

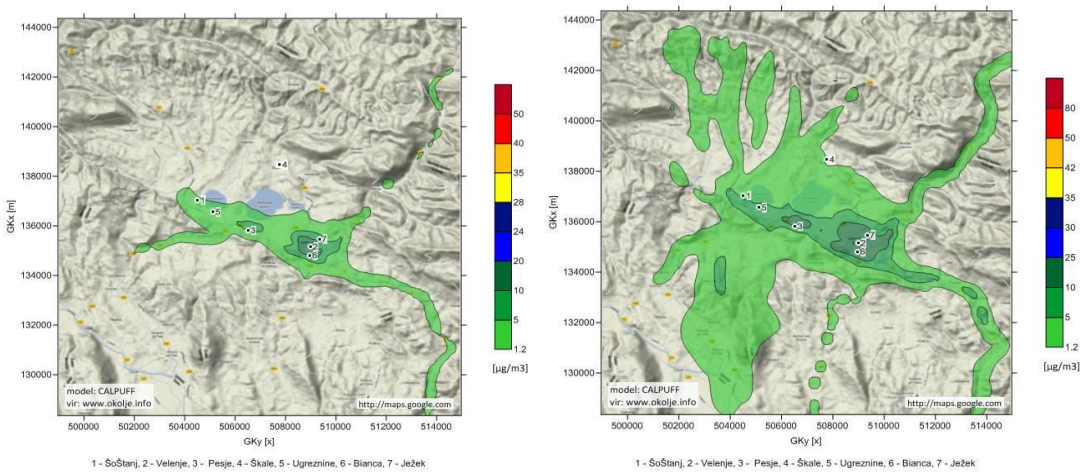


Figure 13: Calculated annual average (left) and maximum daily concentration (right) of PM_{10} as a result of the cumulative contribution of all identified sources (Ivančič and Vončina, 2014).

Table 7: Model-calculated values of PM_{10} in the point with the highest concentration of PM_{10} as a result of the all sources (Ivančič and Vončina, 2014).

	PM_{10} - annual average concentrations ($\mu g/m^3$)	**LV($\mu g/m^3$)**	**PM_{10} - max daily concentration ($\mu g/m^3$)**	**LV($\mu g/m^3$)**	**N**	**LV**
TOTAL	**20.1**	40 28 (UAT) 20 (LAT)	**42.0**	50 35 (UAT) 25 (LAT)	**0**	35

Legend: LV – limit value, N – number of days with exceeding daily value 50 $\mu g/m^3$, LAT – lower assessment threshold, UAT - upper assessment threshold.

The energy sector in the area of the Šalek Valley caused the maximum amount of particulate matter emissions (Table 5) but the contribution of traffic to overall pollution was greater, due to the worse dispersion conditions (Ivančič and Vončina, 2014). Very important natural sources of PM_{10} are wind erosion from bare and arid soil and Saharan dust transport. The contribution of those sources are hardly estimated and are considered as background. Within the background, all the sources, which can not been evaluated are included. The contribution of background was calculated on the basis of measurements of ambient air quality at the station, which is far away from all local emission sources.

Fig. 14 shows the proportion of contribution of each emission source to the cumulative pollution at each measuring station. At all measuring points estimated background represented more than 50% of the total measured PM_{10}.

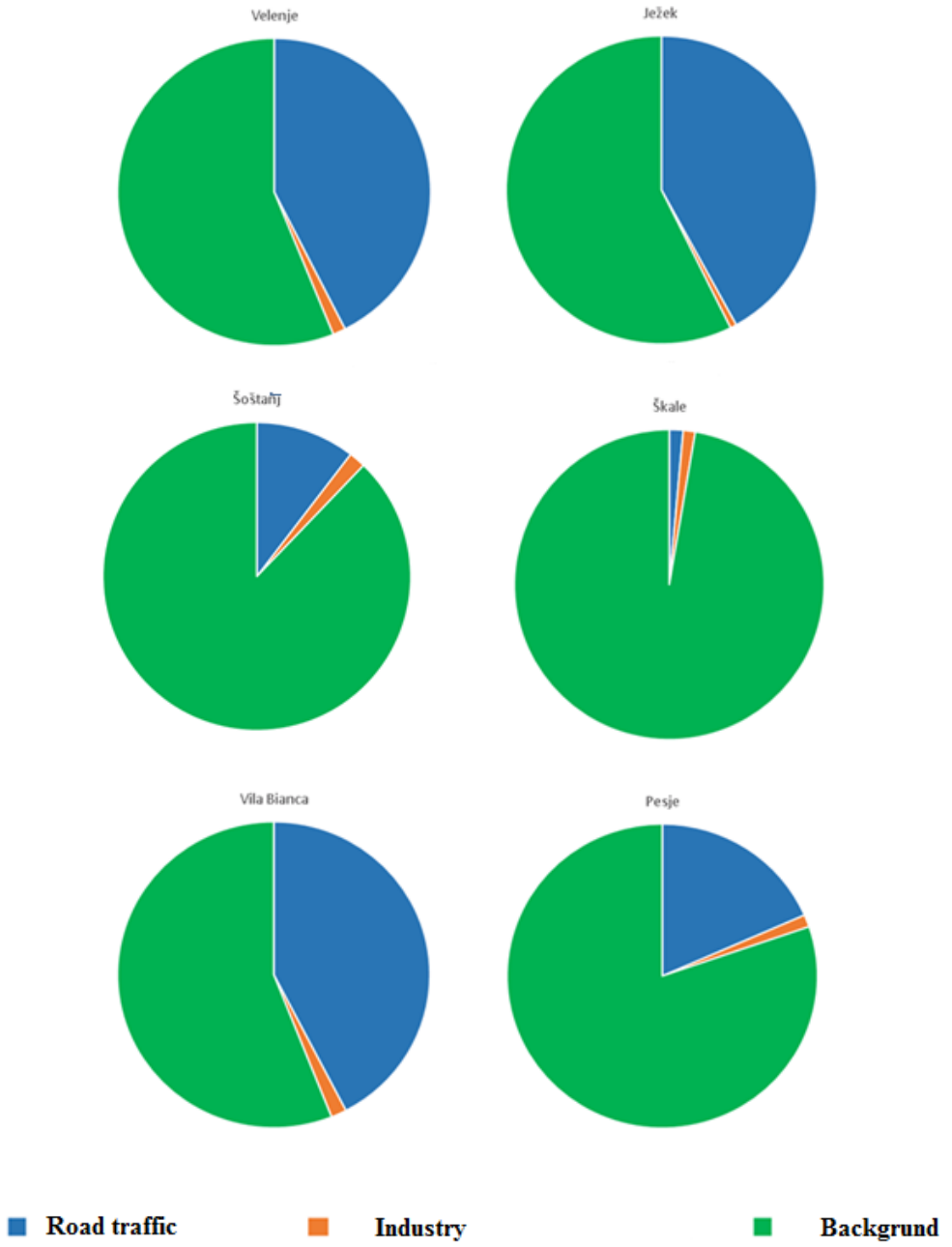


Figure 14: The proportion of contribution of each emission source to the cumulative pollution with PM_{10} at each measuring station (Ivančič and Vončina, 2014).

The contribution of different sources of PM_{10} was similar at the measuring points near the roads (Velenje, Ježek, Vila Bianca): road traffic – around 40%, industry - around 1%, background – about 60%. Measuring points Šoštanj and Pesje are away from busy roads, thus

road traffic contribute 10% (Šoštanj) and Pesje (18%) to whole amount of PM_{10} in the environment. The contribution of background was high; 90% and 82%.

The highest contribution of background was calculated in the measuring point Škale – 97%. In Škale, there is no constructed system of remote heating supply thus it can be expected that in this area, individual furnaces may represent an important local source of emissions of particulate matter. The latter was not included in the model-based calculations (Ivančič and Vončina, 2014).

2.2.4 Definition of area(s) with increased imission level of pollutants

Average annual concentrations of air pollutants SO_2, NO_x, NO_2 and PM_{10} in the years 2006 to 2012 in the Šalek Valley did not exceed legally defined limits. The exception was ozone. From the perspective of human health the most potentially problematic were dust particles. Therefore the model-based values for the annual average and maximum daily concentrations of PM_{10} were calculated and areas, where these values occur were defined (Ivančič and Vončina, 2014). From Figure 15 it is evident that the city center Velenje and Pesje were the most burdened areas with dust particles in winter 2013-2014. This is confirmed by the measured emission concentration of PM_{10} at monitoring stations in the Šalek Valley.

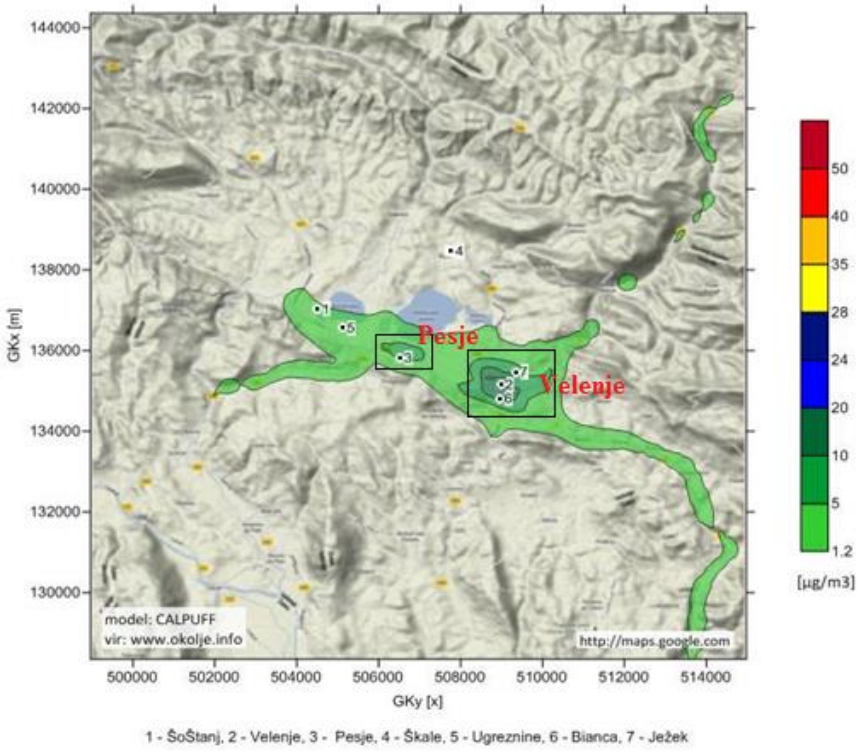


Figure 15: Area in the valley with increased concentrations of air pollutants, established on the basis of modeling of the maximum daily concentrations of PM_{10} as a result of the cumulative contribution of all identified sources (Ivančič and Vončina, 2014).

2.3 HEALTH AND AIR QUALITY

2.3.1 Mortality in the Šalek Valley

This chapter presents data from a study "*Vulnerability Assessment for The Šalek Valley*", which was made for the period 2006-2010 (Al Sayegh Petkovšek et al., 2012). According to the age structure of the population, the Šalek Valley ranks among the areas of the old population, since there were more than 13.3% of the population aged over 65 years (58.6% were women) in 2010. Specific mortality in a population of the Šalek Valley slightly increased in the period 2006 to 2010. The reason is probably in aging of the population, as the proportion of deaths in the age group above 85 years in 2010 was considerably higher in comparison with the year 2006.

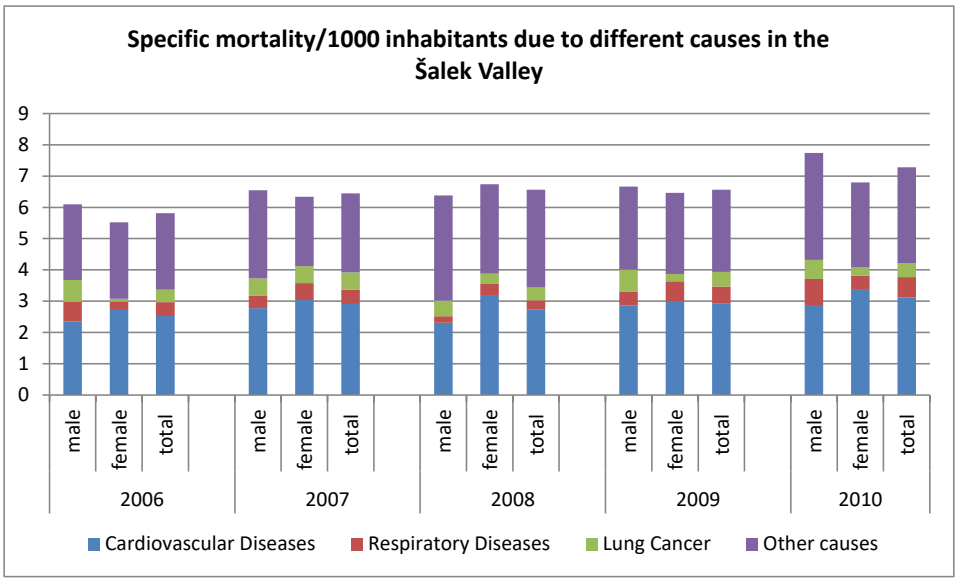


Figure 16: Specific mortality per 1000 inhabitants due to different causes in the Šalek Valley in the period 2006–2010 (Konec Juričič, 2012).

Table 8: Changes of mortality in time: standardized death rates 2006-2010/100 000 inhabitants, Velenje

Health outcome	ICD10	2006	2007	2008	2009	2010
All causes*	A00-R99	410.8	443.6	487.4	448.4	453.0
Cardiovascular mortality	I00-I99	143.1	181.3	200.3	219.8	208.1
Respiratory mortality	J00-J99	27.83	35.86	28.36	28.2	35.68
Lung cancer mortality	C33-34	28.92	28.98	28.3	26.65	20.51

Standard: European population, 1976

Mortality in the administrative unit (AU) Velenje was compared with some other areas or administrative units in Slovenia in such a way that the data were standardized and thus nullify the impact of the age structure and size of the population. Overall mortality in AU Velenje was comparable to the average for Slovenia in 2007 and 2009, or lower in 2006. On the contrary, higher mortality than was the Slovenian average was recorded in 2008 and 2010. In these two years, the overall mortality in the AU Velenje was equated with the average for the Celje region, in other years it was lower (Table 9, Al Sayegh Petkovšek et al., 2012).

Table 9: Age-standardized mortality/100.000 population from all causes in certain administrative units in Slovenia, Celje region and in Slovenia in the period 2006-2010.

	Age-standardized mortality/100.000 population from all causes				
	2006	**2007**	**2008**	**2009**	**2010**
Brežice	842	739	628	646	694
Celje	701	647	602	621	587
Hrastnik	540	690	750	630	710
Laško	832	763	784	877	759
Ljubljana	680	540	490	500	550
Mozirje	770	650	760	770	760
Ribnica	790	680	560	810	710
Sevnica	787	933	893	885	809
Slovenske Konjice	673	771	724	710	651
Šentjur	841	735	740	736	571
Šmarje pri Jelšah	778	754	783	710	739
Trbovlje	890	690	730	660	740
Velenje	620	650	690	620	660
Zagorje ob Savi	860	690	620	620	690
Žalec	753	675	621	640	600
CELJE REGION	743	707	690	691	662
SLOVENIA	681	669	632	626	600

Within the research of health inequalities (Buzeti et al., 2011) was also examined overall mortality in Slovenia in the period 2005-2009 (Fig. 17). Taking into account the calculated average, AO Velenje was regarding mortality rate classified into second class amongst five (fifth class is the class with the highest total mortality). Lower mortality was recorded only in administrative units Ljubljana, Vrhnika, Škofja Loka, Kranj, Koper and Piran. This confirms previous findings that mortality in AO Velenje was comparable with areas with lower levels of total mortality.

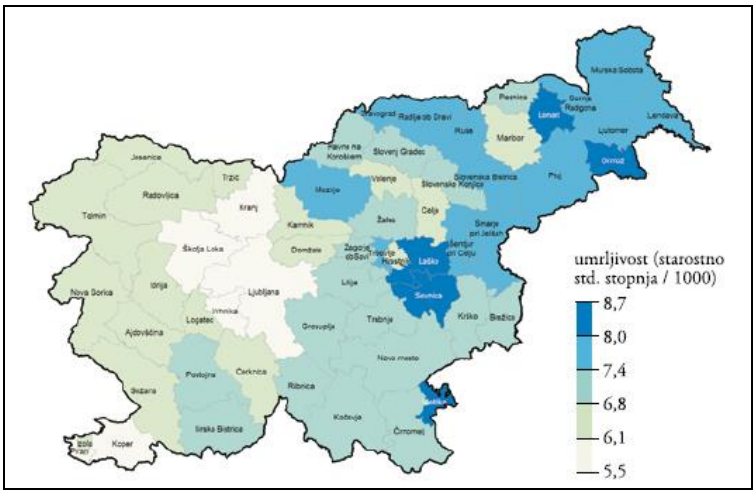


Figure 17: Age-standardized mortality rates in administrative units of Slovenia in the period 2005-2009 (Buzeti et al., 2011).

2.3.2 Health impact assessment of the benefit of the reduction of air pollutants

Impact of air pollutants (PM_{10}, $PM_{2.5}$ and ozone) on the totally mortality was performed by the use of the protocol elaborated by the APHEKOM project (Pascal et al., 2011). By using the distribution frequency of the 24-hourly average PM_{10} ($PM_{2.5}$) and 8 hours-daily ozone concentrations, the risk ratio calculated in international studies (Pope et al., 2002; Anderson et al., 2004; Gryparis et al., 2004; WHO 2004) and using the mortality data of the Šalek Valley, the short- and long-term excess mortality attributable to air pollution in the period of 2006-2010 was calculated according. For the impact assessment of reducing pollution on mortality, data on the daily average concentrations of air pollutants, measured at the sampling points Velenje and Škale were used (Table 10). For long-term predictions for assessing impacts of $PM_{2.5}$ exceedances on the mortality of people, measured concentrations of PM_{10} was multiplied by a factor of 0.7 (Pascal et al., 2011; Paldy et al., 2012).

For determination of the link between daily concentrations of PM_{10}, $PM_{2.5}$ and O_3 and total mortality (excluding external causes of death) different scenarios, which are presented in detail in next sections, were used.

Table 10: Average annual concentration of PM_{10} and O_3 ($\mu g/m^3$), measured at the measuring sites Velenje (O_3) and Škale (PM_{10}) (ARSO, 2013).

	2006	2007	2008	2009	2010	2011	2012	MV
Velenje (O_3)	54*	51	42	49	51	48	52	**40**
Škale (PM_{10})	23	24	22	23	23	22	22	**40**

Notes: * - with red color the concentrations that are higher than the annual average limit value (MV) are shown.

2.3.2.1 Assesssment of excess mortality on days when daily PM_{10} concentration exceeded the limit value (50 µg/m³)

Table 11 present the excess mortality in the period 2006-2010 due to different causes on days when the daily PM_{10} concentration was >50 µg/m³. Calculation show that the short term impact of PM_{10} concentration on mortality on days with daily values exceeding the limit value is very negligible in Velenje. Considering the impact on total mortality 2-4 cases per 1 million inhabitants could be attributed to "peak days". In case of cause specific mortality the impact is even lower (0-2 cases per 1 million).

Table 11: Attributable deaths (total mortality (excluding external causes)) on days, when daily PM_{10} level was above 50 µg/m³. Absolute number and number per 100 000 inhabitants attributable to the acute effects of PM_{10}.

Year	Number of days per year exceeding 50 µg/m³	Number of deaths	Number of deaths per 100 000
2006	19	0.2	0.4
2007	10	0.1	0.2
2008	12	0.1	0.2
2009	13	0.2	0.4
2010	13	0.1	0.2

2.3.2.2 Short-term predictions to assess impacts of PM_{10} exceedances on the mortality of people

The daily mean PM_{10} concentration was at the measurement station Škale in the period 2006-2010 between 21.8-25.4 µg/m³. Its reduction to 20 µg/m³ could prevent 1-2 death cases per 100 000 residents due to non-external total mortality. The reduction by 5 µg/m³ of all the 24-hour values of PM_{10} would prevent similar amount of death cases (2 cases per 100 000).

Table 12: Potential reduced total mortality (excluding external causes) due to reduced annual rate of PM_{10} pollution to 20 µg/m³ or due to the reduction of 24-hour PM_{10} levels by 5 µg/m³.

Year	Scenarios	Total annual number of deaths	Annual number of deaths per 100 000
2006	Decrease by 5 µg/m³	0.8	1.7
2006	Decrease to 20 µg/m³	0.9	1.9
2007	Decrease by 5 µg/m³	0.9	1.9
2007	Decrease to 20 µg/m³	0.7	1.4
2008	Decrease by 5 µg/m³	0.9	2.0
2008	Decrease to 20 µg/m³	0.3	0.7
2009	Decrease by 5 µg/m³	0.9	2.0
2009	Decrease to 20 µg/m³	0.6	1.4
2010	Decrease by 5 µg/m³	1.0	2.2
2010	Decrease to 20 µg/m³	0.6	1.2

2.3.2.3 Long-term predictions to assess impacts of $PM_{2.5}$ exceedances on the mortality of people

The long term reduction of $PM_{2.5}$ concentration by 5 µg/m^3 would prevent 26-31 death cases /100 000 people per year of all causes mortality, a reduction of $PM_{2.5}$ to 10 µg/m^3, would prevent similar number of cases (14-25 death cases /100 000 people per year). Similar benefits could be gained concerning cardiovascular mortality.
The benefits can also be expressed in the gains of life expectancy for a person of 30 years old due to reduced risk of death from all causes. If annual $PM_{2.5}$ levels in the Šalek Valley decrease by 5 µg/m^3, gain in life expectancy would be about 0.2-0.3 years, while annual $PM_{2.5}$ levels decrease by 20 µg/m^3, gain in life expectancy would be about 1.6-2.6.

Table 13: Potential benefits of reducing annual $PM_{2.5}$ levels on total mortality and on life expectancy.

Year	Scenarios	Total annual number of deaths postponed	Annual number of deaths postponed per 100 000	Gain in life expectancy (year)
2006	Decrease by 5 µg/m^3	8	26	0.2
2006	Decrease to 10 µg/m^3	7	24	2.6
2007	Decrease by 5 µg/m^3	8	29	0.3
2007	Decrease to 10 µg/m^3	4	14	1.5
2008	Decrease by 5 µg/m^3	9	29	0.3
2008	Decrease to 10 µg/m^3	4	14	1.5
2009	Decrease by 5 µg/m^3	8	29	0.3
2009	Decrease to 10 µg/m^3	6	20	2.3
2010	Decrease by 5 µg/m^3	9	31	0.3
2010	Decrease to 10 µg/m^3	5	17	1.8

2.3.2.4 Short-term predictions to assess impacts of O3 exceedances on the mortality of people

Data of ozone concentrations were provided from the measuring point Velenje. The number of days with exceeded target 8-hour O_3 value (120 µg/m^3) at sampling point Velenje exceeded the limit number of days per year (Official Gazette of RS, no. 9/11) in the period 2006-2010, except in the year 2008 (Fig. 9). The annual average daily value was 45.0 µg/m^3 (2006), 51.0 µg/m^3 (2007), 42.3 µg/m^3 (2008), 48.7 µg/m^3 (2009) and 50.8 µg/m^3 (2010). Value of 160 µg/m^3 was exceeded 33 times in the year 2006, 20 times in 2007 and 2 times in 2010. Table 14 shows potential reduction of the total mortality (excluding external causes) due to scenario, where all daily values (average 8-hours concentration) above 160 µg/m^3 were reduced to WHO-IT (160 µg/m^3), then a scenario where all daily values above 100 µg/m^3 were reduced to WHO-AQG (100 µg/m^3), and lastly a scenario where the daily mean is decreased by 5 µg/m^3. In spite of the exceedance, the calculated effect of ozone on mortality is negligible.

Table 14: Potential reduction of the total mortality (excluding external causes) due to different scenarios.

Year	Scenarios	Total annual number of prevented premature deaths	Annual number of prevented premature deaths per 100 000
2006	Decreased to160 µg/m^3	0	0
2006	Decreased to 100 µg/m^3	0	0
2006	Decreased by 5 µg/m^3	0	1
2007	Decreased to160 µg/m^3	0	0
2007	Decreased to 100 µg/m^3	0	0
2007	Decreased by 5 µg/m^3	0	1
2008	Decreased to160 µg/m^3	0	0
2008	Decreased to 100 µg/m^3	0	0
2008	Decreased by 5 µg/m^3	0	1
2009	Decreased to160 µg/m^3	0	0
2009	Decreased to 100 µg/m^3	0	0
2009	Decreased by 5 µg/m^3	0	1
2010	Decreased to160 µg/m^3	0	0
2010	Decreased to 100 µg/m^3	0	0
2010	Decreased by 5 µg/m^3	1	1

2.4 SWOT ANALYSIS

SWOT analysis was made within the project »Take a Breath! Adaption actions to reduce adverse health impacts of air pollution (TAB)«. It was made on the basis of *Vulnerability assessment of the Šalek Valley* (Al Sayegh Petkovšek et al., 2012) and comments of members of Environmental Platform of the project TAB.

The present SWOT analysis includes identification of internal and external factors that are favorable and unfavorable to achieving the objective of the project, which is improving of air quality and consequently human health.

Internal factors

	Strengths	Weaknesses
Internal origin	• Industrial devices use available technologies to ensure the lowest possible emissions. • Favourable geographical and geomorphological structure of the landscape (shallow and windy valley). • There is regularly monitoring of air quality. • The number and location of monitoring sites are suitable for a realistic assessment of air quality. • Emissions of SO_2, NO_2 and dust decrease over the period considered. • There is an alarm system and forwarding recommendations on the measured high concentrations of pollutants (alert threshold exceeded). • The concentrations of SO_2 and NO_2 at the measuring locations did not exceeded limit values during the period considered. • Residential heating methods have low environmental impact. • The use of vehicles is according to emissions regulated. • There is free of charge local public transport • There is railway transport. • Bike lanes already exist and bicycle rental is free of charge. • There are possibilities to use electrical vehicles. • Usage of solar and wind energy or other renewable energy increase. • The health care system is well organized. • The promotion of a healthy lifestyle. • There is an environmental data base and permanent access of citizens to information. • There some completed studies regarding the problematic of air pollution in the study area. • The proportion of green areas in the study area is high.	• Large industrial facilities are present in the study are. • Occasionally limit value of 24-hour concentrations of PM_{10} has been exceeded. • Occasionally warning and target 8-hour ozone values have been exceeded. Occasionally, there is the occurrence of temperature inversions and smog. • There are roads with heavy traffic in the settlements (routed through the town centres). • The emissions from traffic have not been regularly measured. • Insufficient use of the city bus and railway transport instead of cars. • The opportunity to use electrical vehicles has not been exploited in a sufficient degree. • Insufficient share of renewable energy sources.

External factors

	Opportunities	Threats
External origin	• The national legislation in the field of air quality is regulated. • The national legislation entirely implements EU legislation. • There are no problems of air pollution in the neighbouring region. • The trends in Slovenia are limiting the use of fossil fuels. • There is financial support for using of renewable energy sources. • There are some action plans at the state level for reduction of emissions from industry, traffic and other sources of air pollutants. • TAB project and other projects related to air pollution. • Upgrading of the existing network of monitoring stations • Supportive institutional environment. • Increased investment in awareness - preventive health care services. • Construction of highway.	• There are negative trends in the development of the economy. • Increasing of the density of the traffic. • A global problem of polluted air (its long-range transport). • Potential impact of climate change on the micro-climate of the Šalek Valley. • Use of fossil fuels. • Replacement of existing heating with individual heating appliances, which are technical unsuitable. • Sealing of green areas in cities.

3 OBJECTIVES AND ACTIONS

3.1 STRATEGIC VISION AND OBJECTIVES

Air quality has a significant impact on human health and quality of life. Since 1986, a number of actions, which are described in more detail in the next chapter, have been implemented in The Šalek Valley. Consequently, the improvement of air quality was substantial and the quality of life of its inhabitants has been improved as well.

The criteria for evaluation of ambient air quality depend on the statutory limit values in the Directive on Ambient Air Quality Directive (Directive 2008/50/EC). Further on, *World Health Organization WHO* recommended stricter limit levels (WHO, 2005). It is known, that for the dust particles, there is no thresholds below which, there would be no risk to human health (Otorepec, 2012). **The main goal of present Action plan is to achieve the reduction of the annual average concentration of PM_{10} to the recommended value of the WHO, 20 $\mu g/m^3$.**

Average daily concentration of PM_{10} was in the period 2006-2012 between 21 $\mu g/m^3$ and 27 $\mu g/m^3$ at the measuring points in the valley. Model-calculated values for the winter period 2013-2014 were slightly higher than the WHO guideline values, 20.1 $\mu g/m^3$. Based on these data, we assume that this target value would be achieved by two major projects. Significant impact on the reduction of pollution is expected after the start of the production of electricity by the block ŠTPP 6 (2015) and by stopping of old blocks. Impact on air quality is also expected by construction of newly highway, because freight traffic from the city center Velenje will be shift on this highway. This project is still in the planning stage.

Additionally, other measures, which are planned and implemented by Municipality of Velenje (the above-mentioned projects are mainly national project), will contribute to reduce emissions from transport. Road traffic was namely specified as the most important local source of emissions of particulate matter in the Šalek Valley in the study "*Model calculations of the spreading of PM_{10} in the Šalek Valley*" (Ivančič and Vončina, 2014). **The main challenge and vision of the municipality of Velenje is thus reducing the use of cars and popularizing the use of public transport, bicycles and walking paths.** In addition, the Municipality of Velenje will implement projects in the area of promoting energy efficiency and renewable energy, education and raising awareness of citizens.

3.2 ACTIONS FOR IMPROVEMENT OF THE QUALITY OF THE AIR

3.2.1 Strategic documents and action for the protection of air that have already implemented or in the phase of implementation

After 1986, number of strategic documents, that contained the programs of actions to reduce air pollution, was then adopted. Until 1995 three recent municipalities in the Šalek Valley: Velenje, Šoštanj and Šmartno ob Paki were united in a joint Municipality of Velenje. All documents of Municipality Velenje from the time before 1995 were thus related to the whole area of valley.

Strategic documents of Municipality of Velenje that contained the aims and actions for improving the air quality:

- The implementation plan of tasks in the field of environmental protection (1987)
- Decree on the protection of the environment in the Municipality of Velenje (1988)
- Municipal remediation program for the field of air (1993)
- Local Agenda 21 (LA 21) (2004)

In 1987, the Municipality of Velenje prepared and adopted the first "**The implementation plan of tasks in the field of environmental protection**", which are updated annually. The annual plan contained specific tasks with the responsible actors and deadlines. ŠTPP was the holder of a number of tasks, amongs which was also the establishment of the **Environmental Information System (EIS)** for the measurement of emmissions and the level of air pollution in the impact area of ŠTPP. Activities for its establishment began in 1986 in collaboration between the Municipality of Velenje, ŠTPP, the Republic Hydrometeorological Institute and the Institute Jozef Stefan. The first station for the measurement of air pollution was placed at the sampling site Zavodnje at the same year. In 1988, the monitoring stations were placed at locations Velenje and Veliki vrh. The EIS for measuring of air pollution in the valley with six measuring stations (Zavodnje, Velenje, Veliki vrh, Šoštanj, Topolšica, Graška gora) was officially established in 1990. The results obtained from those stations showed high concentrations of SO_2 in the air, which occasionally exceeded the hourly value of 3000 $\mu g/m^3$, daily values accasionally reached also over 1,000 $\mu g/m^3$.

Šoštanj Thermal Power Plant was established in the plan as a holder of other tasks in the area of improving the air quality:

- Reconstruction or installation of electrofiltres on the units, where the emission of particulate matter concentration exceeded 50 $\mu g/m^3$.
- Implementation of desulphurisation process with additive method in all units of ŠTPP until the construction of desulphurisation devices would be completed.

- Installation of a pilot device for flue gas desulphurisation and beginning with work for the construction of desulphurisation facility.

Desulphurization devices were built on Šoštanj Thermo Power Plant (at Unit 4 in 1995, at Unit 5 in 2000, partly desulphurisation of flue-gases from units 1-3 was beginning in the treatment plant unit 4 in 2001). In 2008, the Unit 2 (30 MW) of the ŠTPP was shut down, while Unit 1 (30 MW) was shutdown in 31.03.2010. Unit 3 (75 MW) still operates without treatment plant and will be shut down in 2014. The installation of treatment plants greatly reduced the emission of pollutants into the air.

The implementation plan of tasks in the field of environmental protection also included the adoption of a program of research studies, which allegedly showed correlation between the environmental pollution and human health. Till today, a large number of research projects and studies have been made in the valley, which results were also important for determination of the necessary corrective measures for improving the environment, as well as their results reflected the success of remedial actions.

In the plan of implementation of tasks in the field of environmental protection was also the making of cadastre of environmental contaminants, which served as the basis for preparing the proposals for the companies, which were liable to make remediation programs, because of the excessive environmental pollution. Till today, industry of the Šalek Valley already has introduced BAT technology, thus ensuring minimizes environmental pollution.

In 1988, the first "**Decree on the protection of the environment in the Municipality of Velenje"** (Uradni Vestnik, Municipality of Velenje 15/88, 3/91, 11/91) was adopted, which was the base for the actions in the case of exceeding the concentrations of SO_2 at any of the measuring stations located in Šoštanj or Velenje:

- Informing and alerting the population at risk with instructions for protection.
- Reduction of production in the ŠTPP and other industry emitters in the valley (reducing emissions between 30 and 70%).
- Introduction of a prohibition of traffic in the city center of Velenje and Šoštanj.

In 1993, the municipality of Velenje prepared and adopted the "**Municipal remediation program for the field of air",** where the program of actions were proposed. Program was realized in the next years. The list of proposed actions:

- Remediation of small furnaces and boiler rooms by replacing coal with gas or by using the energy from ŠTPP. Velenje, Šoštanj and some of the surrounding villages had already been connected to the district heating energy from the ŠTPP.
- For the ŠTPP as the largest air polluter in the area was required: (1) reduction in emissions of SO_2 concentration from 8000 $\mu g/m^3$ to below 400 $\mu g/m^3$, (2) reduction in NOx emission concentration from 950 $\mu g/m^3$ to 300 $\mu g/m^3$ and (3) the reduction of dust emission concentrations to 50 $\mu g/m^3$.

- The ash (from the ŠTPP) landfill must be implemented in the way to prevent dusting of the surrounding area and to ensure continuous monitoring of environmental pollution with measurements;

In 1994 – establishment of the "**Fund for the Environment Municipality of Velenje"**, as a financial institution for financing, co-financing and loans for investments in ecological remediation programs, other investments in the field of protection of the environment and for promotion environmental protection activities of municipal importance.

All documents listed above is constantly monitored and were transferred into the framework of Local Agenda 21 (LA 21) for the Municipality of Velenje, adopted in 2004 (Uradni Vestnik MOV no. 6/2004). Local Agenda 21 represents a program of the sustainable development of the municipality. Evaluation of the program has been carried out every four years, when the performance of the agenda was evaluated and on this basis, re-adjusting and / or modifing of objectives for the next period were made. First evaluation was carried out in 2008 and the second in 2012. The aims of the agenda are in its constant tendency to the progress towards sustainable development, the continuous improvement of the environment, the economy and raise the quality of life. Based on this analysis, revised and new objectives are determined in LA 21 for the period from 2012 to 2016.

In 2010, three municipalities (Velenje, Šoštanj, Šmartno ob Paki) adopted a joint "**Decree of the information system in the field of air"** (Uradni Vestnik Municipality of Velenje no. 06/10). The decree is committed to:

- **Regular monitoring** and control of air quality in the region.
- **Informing** the public about the results of measurements and municipal leaderships of activities in the field of providing air quality.
- **Action in cases of excessive levels of measured pollutants** in the air that could pose a risk to health and the environment.

The above mentioned actions in the strategy papers were carried out in accordance with the programs; as well additional actions were implemented. Table 10 presents a detailed list of actions already implemented in the area of improving air quality in the valley. The actions are divided into three groups:

- Actions for reducing emissions from industry.
- Actions for reducing emissions from heating.
- Actions for reducing emissions from transport.
- Actions in the field of information and awareness.

In the period from 1995 to 2010, SO_2 emissions decreased significantly. Significant reduction of SO_2 immission concentrations measured at the sampling points within the Šalek Valley were also observed ((Fig. 9, Fig. 18). Exceeded limit values for the protection of ecosystems

at locations Veliki Vrh, Šoštanj and Zavodnje were measured in the years 2001 and 2002. Since 2002 locations Šoštanj and Veliki Vrh have still remained problematic (up to 2003 and 2006 respectively). After 2006, the limit values for the protection of ecosystems were not exceeded anymore.

Foremost measures for reducing emissions from industry and measures for reducing emissions from heating contributed to significant improvements of air quality in the valley in the past. In the period from 1995 to 2010, SO_2 emissions from ŠTPP were significantly reduced (emissions in year 2010 (4,038 t) reached only 3% of emissions in year 1983 (120,000 t), and 5% of emissions in year 1991 (80,390 t). Appropriate it was also observed a significant reduction in the pollutant concentrations measured at monitoring sites in the valley (Fig. 18). Emissions of nitrogen oxides from ŠTPP evenly and steadily diminishing. In 2010, they amounted 70.7% of emissions from 1991 (11,057 t) and 61.2% of emissions from 2002 (12,776 t). The annual quantities of dust emitted from ŠTPP constantly decreased. In 2010, emissions from ŠTPP amounted to 2% of emissions in 1991 (7,495 t), or 23.4% of emissions in 2002 (Environmental Agency, data on emissions from industrial installations).

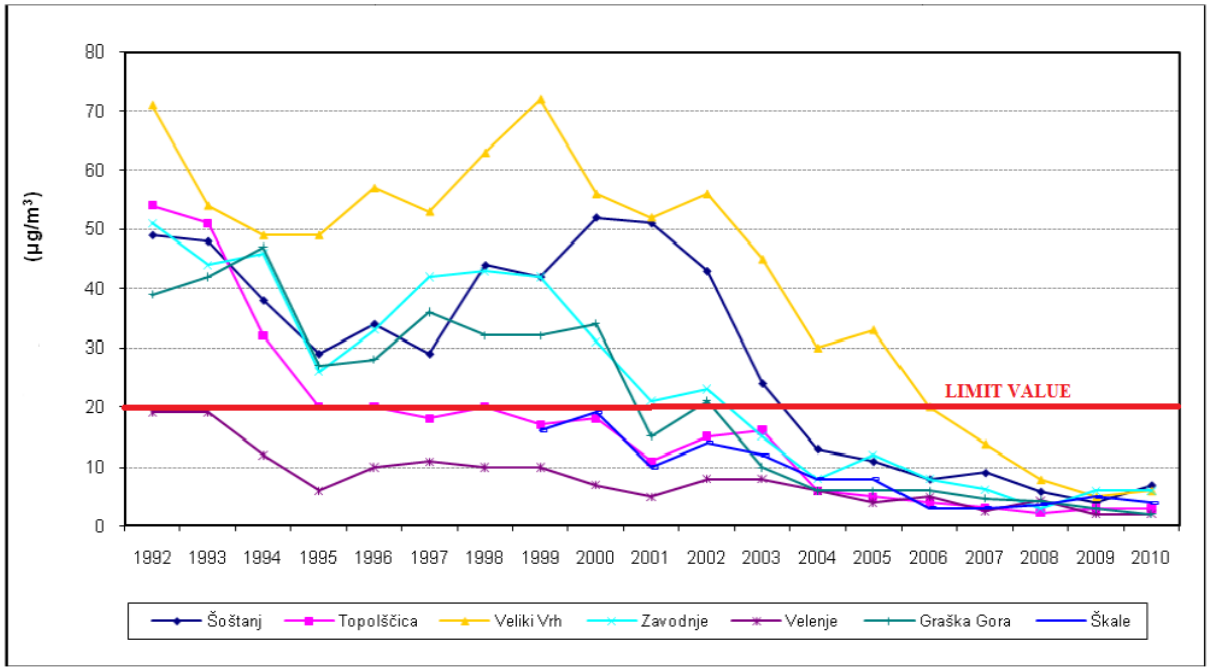


Figure 18: Annual average SO_2 concentrations at the sampling points of ŠTPP within the period 1992-2010. Limit value for the protection of ecosystems is 20 µg/m^3 (*Regulation on ambient air quality* (Official Gazette of RS, no. 9/11) (source: Slovenian Environment Agency, 2011).

Table 15: List of actions, already implemented in the Šalek Valley.

Action	Description	Time period	Air quality impact (1-3)	Wider impact
ACTIONS FOR REDUCING EMISSIONS FROM INDUSTRY				
Decreasing of emission from industry	Industry in the area of the Šalek Valley has already introduced the BAT techniques. Desulphurization devices were built on Šoštanj Thermo Power Plant (at Unit 4 in 1995, at Unit 5 in 2000, partly desulphurisation of flue-gases from units 1-3 was beginning in the treatment plant Unit 4 in 2001). In 2008, the operation of Unit 2 (30 MW) was stopped, while in 2010 there were no production on Unit 1 (30 MW). Unit 3 (75 MW) still operates without treatment plant. It is expected that Unit 6 will start to fully operate In 2015, when the rest of the units will be stopped (Unit 5 will be in cold reserve).	1995-today	3	Lower emissions of pollutants. Lower pollution of other segments of the environment: soil, water, plants, animals, etc. Positive impact on human health.
ACTIONS FOR REDUCING EMISSIONS FROM HEATING/COOLING				
A constructed system of remote heating supply	90% of the population of the Šalek Valley is connected to a system of remote heating supply, which provides hot water and heating to residential buildings as well as to the business, administrative and industrial buildings. In addition, some households and other buildings are heated with natural gas via a pipeline network. There are some common boiler rooms. Small furnaces are mainly in settlements in the hilly part of the valley and coal as fuel gas was replaced with fuel oil or biomass. Individual furnaces in the valley do not contribute significantly to air pollution.	1959-today	3	Lower costs for heating. Smaller energy losses.
Connecting the office building Velenje and objects of Bus station to district cooling system	Communal Company of Velenje built an absorption chiller station, reconstructed the existing thermal station TPP 324 and built a cold water distribution from the cooling station to the office building Velenje in 2008. In 2010, object of Bus station was connected to district cooling system. In the long term, this means less power consumption and hence lower emissions of pollutants into the air.	2008-2010	1	Nicer aesthetic appearance of the building.
ACTIONS FOR REDUCING EMISSIONS FROM TRANSPORT				
The speed limit within the settlements and the closure of the strict center of Velenje for motor traffic	Within all settlements in the valley, the speed limit is 50 or less. Limit also applies to the main road that connects Velenje and Šoštanj. In the strict center of the city, traffic is allowed only to vehicles with permits. Using of parking is chargeable.	Already implemented	1	Lower emissions of pollutants from traffic Providing of greater traffic safety.
EU project BICY - "Cities and Regions of Bicycles"	The aim of project is to develop an integrated and sustainable planning of cycle policy in urban areas and at the same time promoting healthy and environmentally friendly mobility. The system BICY is FREE automated system for bike rental. BICY system includes 40 bicycles. At nine stations around the city, bicycles can be rented for use in an urban environment. Borrowed bike can return to any station or free BICY rack system. Bicycles can be used by one user 14 hours per week. After 14 hours a user card is blocked. At new week the customer card is released again for 14 hours. In the testing phase in the years 2010-2012, the use was free.	2010-today	1	Promotion of health way of life
Free of charge local public transport	Free of charge local public transport can be used since September 2008. Local bus in Velenje drives on five lines: red, yellow (a circular one way), blue, green and orange. Offside slopes are 43 bus stops.	2008-today	2	Lower emissions of pollutants from traffic. Smaller number of cars.
GUTS- Green Urban Transport Systems -	Guts project was based on three pillars - institutional, economic and ecological - technical. By introducing innovation and advanced solutions within these fields, project	2010-2013	1	

Action	Description	Time period	Air quality impact (1-3)	Wider impact
Introduction of innovative solutions to public transport	partners with the help of universities and institutes contributed to more user-friendly, economically efficient and less burden to the environment public transport. Public transport in Velenje, which is based on a free bus transports approximately 400,000 passengers per year. The main challenge of Municipality of Velenje is to reduce the increasing use of personal vehicles and to increase the use of public transport and soft mobility - walking and cycling. Within the project awareness of citizens and participation in the local transport sector was increased and the public-private participation in the provision of public passenger transport system was improved. Mobile application for planning routes around the city by bus and system BICY was the most accepted by their users.			
Building of a new central bus station	A new central bus station was built to achieve higher quality public transport.	2009	1	Lower emissions of pollutants from traffic. Smaller number of cars. Better use of urban space.
Making of the Traffic study	The traffic study proposes integrated transport scheme of Velenje, resulting from the scope of urban plan of the city of Velenje. The basic objective of the traffic study is to regulate traffic within the scope of urban plan of the city of Velenje with the presentation of variant solutions, and a rough estimation of those solutions. The results of the tasks are proposals regime of: road network, stationary traffic, comprehensive traffic arrangements in the city center, public bus transport, bicycle and pedestrian traffic. The study also includes verification of the effects of three variants of the highway passing Velenje.	2007	2	Obtaining of basic data for optimal traffic regulation.
The construction of roundabouts	Before the construction of 7 roundabouts, the traffic was compacted in the crossings in peak periods, what slowed down the traffic significantly.	2008-2009	1-2	Lower emissions of pollutants from traffic Faster flow of traffic.
Traffic slow down	Installation of stationary radar and countdowns at traffic lights	2011	1	Lower emissions of pollutants from traffic.
Increase of the number of parking spaces	Two parking garage (Mercator Centre and in the building of the Bus Station) were built and several new parking spaces in the city center were available.	2009	1	Lower noise. Better use of space. More pleasant arrangement to the inhabitants.
The construction of bike routes within the city center of Velenje and walking cycling links between Šoštanj and Velenje	Cycling links in Velenje are to some extent already regulated. Existing cycle routes are otherwise well-designed, but not concluded and closed.	Permanent task	1	Lower emissions of pollutants from traffic. Healthy lifestyle.
ACTIONS IN THE FIELD OF INFORMATION AND AWARENESS				
The establishment of the Environmental Information System (EIS) for the measurement of air pollution	There are nine automatic monitoring stations and two mobile stations (for PM_{10} and O_3) in the area of the Šalek Valley. SO_2 is measured at all measurement sites, NOx at locations Zavodnje and Škale, PM_{10} at the locations Škale, Pesje and Velenje (since 2011) and ozone at the sampling sites Zavodnje and Velenje.	1986-today	*/	The population's awareness of air quality.

Action	Description	Time period	Air quality impact (1-3)	Wider impact
Increasing of the number of monitoring stations for measuring PM_{10}	PM_{10} has been regularly measured at measuring site Škale since 1998, in Pesje since 2002, and in the city Velenje at the site near the primary school of Anton Aškerc since 2011.	1998-today	*/	Database on air quality - a basis for actions.
Informing of citizens about air quality	Data from measuring stations are monitored regularly, and are continuously and regularly transferred to an inter-municipal body of Municipality Velenje: Inter-municipal inspection, Warden Service and department of environmental protection. The public is continuously informed about results of measurements: on web pages of Municipality of Velenje, Environment Ageny, ŠTPP; weekly local newspaper Naš čas (report of the values of SO_2 in the air); through monthly and annual reports.	1986-today	*/	The population's awareness of air quality.
Informing of citizens in case of exceedances of pollutants	In cases of excessive levels of measured pollutants in the air that could pose a risk to health and the environment, the transmission of information to the citizens about the current situation would be carry out through the media. Also the instructions for the protection of health, especially for sensitive population groups (children, patients ...) would be provided. Practice exercise of informing the citizen in the cases of excessive levels of pollutants in the air is made every year.	1986-today	*/	The population's awareness of air quality.
Elaborating of a number of research projects	The results of research projects are providing important information for determination of the necessary corrective actions for improving the quality of the environment. Their results also reflect the effectiveness of remedial actions.	1986-today	*/	Awareness of the population about the quality of the environment in which they live. Important information for emitters and planners of actions.
Information display in the center of Velenje	Display of data with an automatic refresh on a large information display in the center of the city of Velenje: interpretation and display of weather data, level of measured pollutants in the air, display of informative data in the field of tourism, events and projects in Municipality of Velenje.	2013	*/	Raised awareness of the citizens on air quality.
ACTIONS IN THE AREA OF PROMOTING ENERGY EFFICIENCY AND USAGE OF RENEWABLE ENERGY				
The first local energy concept (LEC)	LEC is the concept of the development of local communities in the field of energy use and supply, which in addition to the plans of the future energy supply also includes actions for energy efficiency, co-generation of heat and electricity, and the usege of renewable energy sources. The local community should annually report about the implementation of local energy concept to the responsible ministry.	2004	*/	Less energy use. Lower energy costs. Lower greenhouse gas emissions. Raised awareness and informing of energy users.
Establishment of the Energy Agency KSSENA	The Institute Energy Agency for the Savinjska, Šaleška and Koroška regia (KSSENA) was established within the framework of the project "Establishment of local and regional energy agencies" in the context of the European program "Intelligent Energy Europe". KSSENA facilitates the promotion and implementation of actions in the field of renewable energy and energy efficiency and sustainable urban transport. The program follows the aims and development of national and European energy policy and favor of social, economic and environmental development at local level.	2006	*/	Less energy use. Lower energy costs. Lower greenhouse gas emissions. Increasing of population's awareness of energy efficiency and usage of renewable energy.

Action	Description	Time period	Air quality impact (1-3)	Wider impact
The study of renovation of public lighting	Street lighting is one of the major consumer of electricity. When deciding on specific actions, Regulation on maximum light pollution must be taken into account. The ultimate goal of this study was an appropriate and energy-efficient street lighting.	2008	*/	Less usega of electricity. Lower energy costs. Lower greenhouse gas emissions. Reducing of light pollution and consequently reducing of negative impacts on people.
The construction of three small solar power plants	In the field of usage of renewable energy sources, most important projects were the construction of small solar power plants in the administrative building of the Municipality of Velenje and buildings of primary schools Livada and Gustav Šilih. Primary schools were connected to the grid on 23 December 2010, administrative building of Municipality of Velenje, a few days earlier.	2010	*/	Less energy use. Lower energy costs. Lower greenhouse gas emissions. Increasing share of usage of renewable sources of energy.
New local energy concept (LEC)	Improvement of the first local energy concept (LEC). LEC shall be made for a period of ten years. At the latest five years, it must be adjusted, supplemented or improved or even a new concept could be made.	2012	*/	Less energy use. Lower energy costs. Lower greenhouse gas emissions. Raised awareness and informing of energy users.

Legend:
Air quality impact (Score 1-3): 1- small, 2- middle, 3 - high
*/: Only an indirect impact that may affect the action.

3.2.2 Strategic documents and action for the protection of air in the future

Stratetic documents of Municipality of Velenje, which include aims and actions in the field of improving air quality:

- The Local Development Strategy for the municipalities Velenje, Šoštanj and Šmartno ob Paki (2008)
- The municipal environmental protection program of the Municipality of Velenje 2010-2015
- Local Agenda 21 in the Municipality of Velenje
- Local energy concept (2004, 2012)
- Sustainable Energy Action Plan - SEAP (2011)

The Local Development Strategy for the Municipalities of Velenje, Šoštanj and Šmartno ob Paki (2008)

Within The Local Development Strategy for the municipalities of Velenje, Šoštanj and Šmartno ob Paki (2008) is in the context of development objective Competitive agriculture and the development of new economic activities under the priority given Action 2: Promoting of the use of renewable energy sources. For implementation of this action, the following activities are given:

• Preparation and implementation of a comprehensive energy management
• Preparation and implementation of effective programs for the exploitation of renewable energy sources: solar, wind, water, biomass, biogas
• Construction of a demonstration models of energy efficiency and usage of renewable energy
• Construction of an individual renewable energy

The municipal environmental protection program of the Municipality of Velenje 2010-2015

In 2010, **"**The municipal environmental protection program of the Municipality of Velenje 2010-2015" was published in Uradni vestnik MOV no. 12/2010. Within it, there is a strategic objective C: Air protection and adaptation to climate change. To achieve this goal, the municipal environmental protection program specified sistematic and operative actions.

System actions:

- Participation in the preparation of planning documents for highway
- Upgrading of the Energy Strategy MOV with an emphasis on efficient use of energy and use of renewable energy sources
- Developing a comprehensive energy systemic solutions for suburban local communities (natural gas or biomass or cogeneration ...)
- Feasibility study of district cooling in densely built-up areas

- Elaboration of expert groundwork for public transport management at the municipal and inter-municipal level, in accordance with pre-made traffic study (2007) regarding the use of bio and alternative fuels
- First measurement and monitoring of noise and preparation of noise maps
- Creating of program of replacement of existing lamps of public lighting

Operational objectives:

- The construction of the ring road - highway through the valley (national project), and consequently the reduction of road traffic through the city - improvement of air quality in the city center.
- Construction of the VI. Unit of ŠTPP (national project), and consequently improve air quality in the area of MOV
- Monitoring of air quality and improvement of public informing
- Sustainable local traffic
- Reducing of the usage of energy in buildings
- Expansion of district cooling in the cooling island 01
- The construction of the southern branch of the gas pipeline
- Replacement of existing lamps of public lighting according to the adopted program

Local Agenda 21 in the Municipality of Velenje

Table 16: A set of the problems, goals and proposed actions for the improvement of air the period from 2012 to 2016, given in the II. report on the implementation of Local Agenda 21 in the Municipality of Velenje (Šterbenk, 2012).

	Problems	Goals	Proposed actions, studies	Operator
1.	Increasing of transport causes air pollution	Improvement of air quality in the city and suburban areas	• Edit the network of the cycle paths and the footpaths • Seeking of the new financing sources for the public transport • immission control to determine the impact of transport • Education and awareness of the population to reduce emissions from transport • Project TAB (EU project) • Redirection of transit traffic from the city center	MOV TIC Velenje TD Vinska Gora ERICo d.o.o.
2.	Non-fluent traffic	More fluent traffic	• construction of the highway • construction of the roundabouts	
3.	Emissions from different sources	Reduction of emissions	• The construction of Unit VI of ŠTPP - the continuation of environmental rehabilitation • The reduction of emissions / odors from coal dump and air shafts of Premogovnik Velenje • The reduction of the emissions from industry (e.g. company Veplas) • The reduction of emissions from agriculture • Improvement of the monitoring • The reduction of the emissions in the field of energy efficiency and use of renewable energy	

Local energy concepts for Municipality of Velenje (2004, 2012)

The energy concept is an important document for the planning of sustainable energy development of the municipality, because in determining of the energy guidelines, the short-term and long-term development plans of the municipality, not only in the field of the usage and supply of energy, but also in all other areas of development, are taking into account. The aim of the energy concept is also to increase the awareness and informing of the population, especially in the field of energy efficiency and the use of renewable energy sources.
LEC contains:
• analysis of energy use and fuels within individual areas (housing, public buildings, businesses and public lighting) and local communities,
• analysis of energy supply,
• analysis of emissions,
• identifying of weak points within energy supply and consumption in terms of stability and environmental acceptability,
• assessment of the expected energy consumption and guidance for future energy supply,
• analysis of the possibilities of efficient energy use and analysis of the potential of renewable energy sources,
• setting targets for energy planning in the local community,
• analysis of possible actions,
• an action plan that is timely and financially defined in 2020 and
• guidance on the implementation of the concept.

LEC Municipality of Velenje is also an upgrading document of the document Sustainable Energy Action Plan - SEAP.

Sustainable Energy Action Plan - SEAP (2011)

Municipality of Velenje joined the Initiative of the European Commission - the Covenant of Mayors. The Covenant obliges mayors and other decision-makers that on their area, reduced CO_2 emissions by 20% by 2020.

SEAP provides guidelines for achieving of set energy objectives and it is focused mainly on reducing CO_2 emissions in the Municipality of Velenje up to 2020. Actions in this Action Plan must be constantly adapted to market conditions, the ability of responsible for the implementation, and in particular to objectives and strategies of the European Community, the Republic of Slovenia and the Municipality of Velenje.

Table 17 presents in detail the proposed actions in the area of improving of air quality, which have already carried out or will be implemented in the future in the Šalek Valley.

Table 17: List of proposed actions in the area of improving of air quality, which have already carried out or will be implemented in the future in the Šalek Valley.

Action	Description	Stakeholders	The time frame	Potential air quality benefit	Other environmental benefits, risk factors, social impacts
ACTIONS FOR REDUCING EMISSIONS FROM INDUSTRY					
The operation of ŠTPP Unit 6	In the Strategic Development Plan of Thermal Power Plant (June 2004), it was agreed that the Unit 6 (an alternate manufacturing facility of best technologies) with 600 MW will gradually replace technologically obsolete and economically onerous units 1,2,3,4 and 5. To produce the same quantity of electricity as produced by the existing units, ŠTPP will spend up to 30% less coal and emissions of pollutants will be reduced.	ŠTPP, State of Slovenia	2015-	Due to the operation of Unit 6 of ŠTPP, CO_2 emissions will be reduced by 35%, SO_2 emissions will be reduced from 400 to 100 mg/Nm and NOx emissions from 500 to 150 mg/Nm^3. The level of dust and noise will also be reduced.	Positive impact on human health. Providing at least 3,500 jobs over the next 40 years.
ACTIONS FOR REDUCING EMISSIONS FROM TRANSPORT					
The construction of the 3rd development axe	The third development axis is the project name for the four band highway, which will connect regional centers in Austria (Villach), Slovenia (Dravograd, Slovenj Gradec, Velenje and Celje, Novo mesto, Metlika) and Croatia (Karlovac). The process of spatial positioning of section from Šentrupert to Velenje is expected to be completed in 2014. For stretch from Velenje to Slovenj Gradec procedure is completed.	The institute of public-private partnership.	Unidentifiable. Implementation of the project will depend on the possibility of providing financial resources.	Transit traffic will be diverted from the main road to the highway. Lower air emissions in the center of Velenje.	Positive impact on human health. Better opportunities for economic development of the valley. Reduction of noise.
Construction of national cycle routes	Promoting of the construction of national cycling infrastructure, cooperation in the process of locating of the routes and their implementation and in obtaining of project documentation.	Municipality of Velenje Slovenian Road Agency	2014-2020	The replacement of road traffic. Lower air emissions from traffic.	Promotion of healthy lifestyles, the development of cycling tourism.
Construction of the regional cycling network	Cooperation with Development Agency Savinja region and other municipalities in the planning, construction and promotion of the regional cycling network.	Development Agency Savinja region, Municipality of Velenje	2014-2020	The replacement of road traffic. Lower air emissions from traffic.	Promotion of healthy lifestyles, the development of cycling tourism.

Action	Description	Stakeholders	The time frame	Potential air quality benefit	Other environmental benefits, risk factors, social impacts
Completion of the municipal bicycle network	Construction and arrangement of missing sections of the municipal cycling network.	Municipality of Velenje	2014-2020	The replacement of road traffic. Lower air emissions from traffic.	Promotion of healthy lifestyles, the development of cycling tourism.
Editing of cycling infrastructure	Construction of parking areas, carports and other necessary infrastructure.	Municipality of Velenje	2014-2020	The replacement of road traffic. Lower air emissions from traffic.	Ensuring of effective and good infrastructure for the use of bicycles. Promotion of healthy lifestyles, the development of cycling tourism.
Promoting of sustainable tourism	Sightseeing tour by bike, cycling tourism, cycling hotels	Municipality of Velenje, TIC, MC hostel, hotels	Permanent task	The replacement of road traffic. Lower air emissions from traffic.	Additional tourist offer. Promotion of healthy lifestyles, the development of cycling tourism.
Maintenance and expansion of the system BICY	Adding of new stations, bikes, servicing and maintenance of the existing bike network, linking routes with neighboring municipalities.	Municipality of Velenje, municipalities in neighborhood	Permanent task	The replacement of road traffic. Lower air emissions from traffic.	Ensuring of effective and good infrastructure for the use of bicycles. Promotion of healthy lifestyle.
Editing of attractive and safe walking routes	Editing of new routes, editing of existing routes for a more attractive pedestrian walking. Concern for pedestrian safety.	Municipality of Velenje, sosednje občine	Permanent task	The replacement of road traffic.	Promotion of healthy lifestyle. Attractive environment.
Editing of the city center	Editing of the environment of the centre of city in order to promote walking and cycling, because the city center is accessible only to pedestrians and cyclists. Ensuring and promoting the introduction of delivery bikes for the locales in center, the marketplace, etc.	Municipality of Velenje, cafes and shops in the center of city	Permanent task	The replacement of road traffic. Lower air emissions from traffic in town centre.	Promotion of healthy lifestyle. Attractive environment.
Improvement of public transport	Production of expert groundwork for the regulation of public transport at the municipal and inter-municipal level, in accordance with pre-made 2007 traffic study regarding the use of bio and alternative fuels. An extension of the length of the routes and frequency of trips to the extra-urban settlements.	Municipality of Velenje	Permanent task	Reduction of emissions from traffic. Lower air emissions from traffic.	Sustainable development. The advantage of using public transport during peak hours.
System P + R (park and ride)	Promoting of regime: park and after that ride free bus Lokals or a bike (BICY).	Municipality of Velenje	Permanent task	Reduction of emissions from traffic. Lower air emissions from traffic.	Sustainable development.
Stimulating parking policy	Higher prices of parking in the city center and lower on the outskirts.	Municipality of Velenje /operator of parking facilities	2014-2020	Reduction of emissions from traffic in the centre of city.	Sustainable development.

Action	Description	Stakeholders	The time frame	Potential air quality benefit	Other environmental benefits, risk factors, social impacts
Calming of traffic at critical points	Calming of traffic at areas, where a lot of pedestrians and cyclists are or where there is no guaranteed separate secure infrastructure for pedestrians and cyclists.	Municipality of Velenje / concessionaire	2014-2020	Reduction of emissions from traffic in the centre of city.	Sustainable development.
ACTIONS IN THE AREA OF PROMOTING EFFICIENCY USE OF ENERGY AND RENEWABLE SOURCES OF ENERGY					
Report on the achievement of objectives in accordance with SEAP Velenje	By signing the *Covenant of Mayors*, the municipality undertake to elaborate *Sustainable Energy Action Plan* (SEAP), which will set out the actions and activities necessary to achieve the final goal - a reduction of CO_2 emissions by at least 20% by year 2020. Monitoring of the implemented measures and activities, and reporting about results is a very important part of the process of preparation and implementation of the Action Plan. All the signatories of the *Covenant of Mayors* have an obligation to prepare and to submit the report to the European Commission every two years. The topic of the report is the implementation of the Action Plan, which describes in detail all the actions carried out and the activities and results achieved. Municipality of Velenje is committed to reducing CO_2 by 23.1% in year 2020 compared to the reference year 2003.	Municipality of Velenje	2014	Lower emissions of CO_2.	Efficient use of energy. Sustainable development.
Preparation of comprehensive energy solutions for the suburban local communities	To draft comprehensive energy solutions for the suburban local communities (natural gas, renewable energy sources, cogeneration ...)	Municipality of Velenje	2014-2020	Reduction of emissions	Efficient use of energy. Sustainable development.
Expansion of a district cooling system	With regard to sufficient high temperature of hot water in the summer, the possibility of its application to drive an absorption chiller (AH) and therefore the implementation of a pilot district cooling system with heat can be occured. Usage of hot water in the summer season for production of cold with environmentally friendly cooling method uses five times less electricity than a local electric booster sets.	Municipality of Velenje, owners and users of buildings in the cooling island 1	2015	Reduction of emissions	Efficient use of energy. Aesthetic appearance - a building without external arresters of air conditioners. Sustainable development.
Additional thermal insulation and replacement building furniture	Encouraging citizens through subsidies to the construction of additional thermal insulation and replacing building furniture	Municipality of Velenje	2015	Reduction of emissions	Efficient use of energy. Sustainable development.

Action	Description	Stakeholders	The time frame	Potential air quality benefit	Other environmental benefits, risk factors, social impacts
Austerity actions (determination of temperature regimes)	Promote the implementation of energy efficiency measures (heat and electricity) in buildings (residential and public). The situation can be significantly improved by simply informing users about the energy efficiency measures.	Municipality of Velenje	Permanent task	Reduction of emissions	Efficient use of energy. Sustainable development.
Energy efficient reconstruction of public lighting	In accordance with the Strategy Plan for public lighting and Plan of public lighting it is required, in relation to the Regulation on limit values for light pollution, adjustement and replacement all inadequate lamps until 2020, and with the expansion of the city and changing of traffic regime illumination of some new sections.	Municipality of Velenje	2016	Lower emissions of CO_2. Reduction of light pollution.	Reducing of negative impact on people. Sustainable development.
ACTIONS ON EDUCATION AND RAISING AWARENESS					
Informing the inhabitants about air quality	The public is continuously informed about the results of measurements: on web pages (last measured hourly values of air pollutants); weekly newspaper Naš čas (Report on the values of SO_2 in the air); through monthly and annual reports. Reports are also published on the website of the Municipality of Velenje.	Municipality of Velenje	Permanent task	*/	The population's awareness of air quality.
Promotion of cycling (driving to work, school, activities) and walking	Implementation of various promotional activities to promote the use of bicycles for everyday activities, for example “Mobility Week” and other campaigns.	Municipality of Velenje, SPV, schools, organizations	Permanent task	Reduction of emissions from traffic.	Increasing population’s awareness of the importance of the use of alternative means of transport; improved health status of the population due to regular exercises.
The incentives for employers in the use of bicycles for driving to work, and during the work	Encouraging employers to stimulative policy in connection with transport to work.	Municipality of Velenje, gospodarstvo	Permanent task	Reduction of emissions from traffic.	Increasing population’s awareness of the importance of the use of alternative means of transport; improved health status of the population due to regular exercises. less absenteeism, greater efficiency at work

Action	Description	Stakeholders	The time frame	Potential air quality benefit	Other environmental benefits, risk factors, social impacts
Informing in case of exceedances of pollutants	In the case of excessive levels of measured pollutants in the air that could pose a risk to health and the environment, the transmission of information to the public about the current situation and with the guidance how to protect health and reduce pollution will be published through the media. Further, institutions, which keep the sensitive population groups (children, patients ...) would be informed via e-mail notices. Each year an exercise of such informing is implemented.	Municipality of Velenje	Permanent task	*/	The population's awareness of air quality.
Making of energy certificates	The energy certificate of a building is required a public document with information on energy efficiency of buildings and recommendations for increasing energy efficiency. It must be obtainable in the case of saling of building or renting a building into a new lease. The energy certificate is also required for all new buildings and for all public buildings with an area greater than 500 m^2. The validity of the energy certificate is 10 years.	Municipality of Velenje, owners and users of buildings	2015	Reduction of emissions.	The population's awareness of energy efficiency. Efficient use of energy. Sustainable development.

Legend:
*/: Only an indirect impact that may affect the action.

3.3 TIME SCHEDULE

For each planned action, time schedule is given in the table 18. Content of actions is described in detail in Table 17.

Table 18: Framework time schedule of implementation of the proposed actions to improve air quality in the valley.

Z. Št	Action	2014	2015	2016	2017	2018	2019	2020	2021
1	The operation of ŠTPP Unit 6		■	■	■	■	■	■	■
2	The construction of the 3rd development axe	An unidentifiable Implementation							
3	Construction of national cycle routes	■	■						
4	Construction of the regional cycling network	■	■	■	■	■	■	■	■
5	Completion of the municipal bicycle network	■	■	■	■	■	■	■	■
6	Editing of cycling infrastructure	■	■	■	■	■	■	■	■
7	Promoting of sustainable tourism	Permanent task							
8	Maintenance and expansion of the system BICY	Permanent task							
9	Editing of attractive and safe walking routes	Permanent task							
10	Editing of the city center	Permanent task							
11	Improvement of public transport	Permanent task							
12	System P + R (park and ride)	Permanent task							
13	Stimulating parking policy	■	■	■	■	■	■	■	■
14	Calming of traffic at critical points	■	■	■	■	■	■	■	■
15	Report on the achievement of objectives in accordance with SEAP Velenje	■							
16	Preparation of comprehensive energy solutions for the suburban local communities	■	■	■	■	■	■	■	■
17	Expansion of a district cooling system		■						
18	Additional thermal insulation and replacement building furniture	Permanent task							
19	Austerity actions (determination of temperature regimes)	Permanent task							
20	Energy efficient reconstruction of public lighting		■						
21	Informing the inhabitants about air quality	Permanent task							
22	Promotion of cycling (driving to work, school, activities) and walking	Permanent task							
23	The incentives for employers in the use of bicycles for driving to work, and during the work	Permanent task							
24	Informing in case of exceedances of pollutants	Permanent task							
25	Making energy certificates		■						

4 STAKEHOLDERS PARTICIPATIONS

Key stakeholders (decision-making bodies)

- The State of Slovenija
- Municipality of Velenje
- Municipality of Šoštanj
- Municipality of Šmartno ob Paki

Expert support:

- Energy Agency for the Savinjska, Šaleška and Koroška regia - KSSENA
- Health Centre of Velenje
- National Institute for Public Health (NIJZ), Celje Unit
- The Milan Vidmar Electric Power Research Institute
- ERICo Velenje, Environmental Research and Industrial Co-operation Institute

The link between the profession and the educational process:

- Environmental Protection College Velenje

Industry:

- Šoštanj Thermo-electric plant
- Gorenje
- Mine Velenje
- Esotech

For the implementation of the actions, the most important will be decision-making bodies, which are the competent authorities of the Republic of Slovenia, Municipality of Velenje and municipalities Šoštanj and Šmartno ob Paki. Professional support will be provided by Energy Agency for the Savinjska, Šaleška and Koroška regia, Health Centre of Velenje, National Institute for Public Health (NIJZ) - Celje Unit, The Milan Vidmar Electric Power Research Institute and ERICo Velenje, Environmental Research and Industrial Co-operation Institute. These institutions are important as co-workers in potential awareness campania for the population and for making an expert groundworks on which key stakeholders can make decisions. Another important stakeholder is also an industry that is committed to the use of BAT technologies and thereby it is obligated to minimize the negative impact on environment.

5 COST AND FINANCIAL RESOURCES

The estimation of the costs and potential sources of funding for the implementation of the proposed actions to improve air quality in the valley is presented in the table 19. Estimates of investment at this stage can not be given.

Table 19: The estimation of the costs and potential sources of funding for the implementation of the proposed actions to improve air quality in the Šalek Valley.

No	Action	Investment Evaluation	Funding sources	Posible Risks
1	The operation of ŠTPP Unit 6	*	ŠTPP, State of Slovenia	Lack of financial resources.
2	The construction of the 3rd development axe	*	The institute of public-private partnership.	Lack of financial resources, extended search for suitable route
3	Construction of national cycle routes	*	Municipality of Velenje Slovenian Road Agency	Lack of financial resources.
4	Construction of the regional cycling network	*	Development Agency Savinja region, Municipality of Velenje	Lack of financial resources.
5	Completion of the municipal bicycle network	*	Municipality of Velenje	Lack of financial resources.
6	Editing of cycling infrastructure	*	Municipality of Velenje	Lack of financial resources.
7	Promoting of sustainable tourism	*	Municipality of Velenje, TIC, MC hostel, hotels	Lack of financial resources.
8	Maintenance and expansion of the system BICY	*	Municipality of Velenje, neighboring municipalities	Lack of financial resources.
9	Editing of attractive and safe walking routes	*	Municipality of Velenje, neighboring municipalities	Lack of financial resources.
10	Editing of the city center	*	Municipality of Velenje, cafes and shops in the center of city	Lack of financial resources.
11	Improvement of public transport	*	Municipality of Velenje	Lack of financial resources.
12	System P + R (park and ride)	*	Municipality of Velenje	Lack of financial resources.
13	Stimulating parking policy	*	Municipality of Velenje /operator of parking facilities	Lack of financial resources.
14	Calming of traffic at critical points	*	Municipality of Velenje / concessionaire	Lack of financial resources.
15	Report on the achievement of objectives in accordance with SEAP Velenje	*	Municipality of Velenje	Lack of financial resources.
16	Preparation of comprehensive energy solutions for the suburban local communities	*	Municipality of Velenje	Lack of financial resources.
17	Expansion of a district cooling system	*	Municipality of Velenje, owners and users of buildings in the cooling island 1	Lack of financial resources.
18	Additional thermal insulation and replacement building furniture	*	Municipality of Velenje	Lack of financial resources.
19	Austerity actions (determination of temperature regimes)	*	Municipality of Velenje	Lack of financial resources.
20	Energy efficient reconstruction of public lighting	*	Municipality of Velenje	Lack of financial resources.
21	Informing the inhabitants about air quality	*	Municipality of Velenje	/
22	Promotion of cycling (driving to work, school, activities) and walking	*	Municipality of Velenje, SPV, schools, organizations	Lack of financial resources.
23	The incentives for employers in the use of bicycles for driving to work, and during the work	*	Municipality of Velenje, gospodarstvo	Lack of financial resources.
24	Informing in case of exceedances of pollutants	*	Municipality of Velenje	/
25	Making energy certificates	*	Municipality of Velenje, owners and users of buildings	Lack of financial resources.

Note: *: Estimates of investment at this stage can not be given.

6 MANAGEMENT AND MONITORING OF PLANNED ACTIONS

6.1 MANAGEMENT OF PLANNED ACTIONS

Management and monitoring of projects will be the task of project holders. Involved stakeholders for each action are listed in Table 17. For each planned action, an evaluation of the realization of action will provided once a year following Table 20.

Table 20: Assessment of the progress of the implementation of the proposed actions to improve air quality in the Šalek Valley.

Evaluation year:						
No	**Action**	**Project holder(s)**	**Timeframe to implement the action**	**Tasks in the evaluation year**	**% realization of the set tasks**	**Lower realization / Not implemented CAUSES**
1	The operation of ŠTPP Unit 6					
2	The construction of the 3rd development axe					
3	Construction of national cycle routes					
4	Construction of the regional cycling network					
5	Completion of the municipal bicycle network					
6	Editing of cycling infrastructure					
7	Promoting of sustainable tourism					
8	Maintenance and expansion of the system BICY					
9	Editing of attractive and safe walking routes					
10	Editing of the city center					
11	Improvement of public transport					
12	System P + R (park and ride)					
13	Stimulating parking policy					
14	Calming of traffic at critical points					
15	Report on the achievement of objectives in accordance with SEAP Velenje					
16	Preparation of comprehensive energy solutions for the suburban local communities					
17	Expansion of a district cooling system					
18	Additional thermal insulation and replacement building furniture					
19	Austerity actions (determination of temperature regimes)					
20	Energy efficient reconstruction of public lighting					
21	Informing the inhabitants about air quality					
22	Promotion of cycling (driving to work, school, activities) and walking					
23	The incentives for employers in the use of bicycles for driving to work, and during the work					
24	Informing in case of exceedances of pollutants					
25	Making energy certificates					

6.2 MONITORING OF PLANNED ACTION

Progress and realization of actions will be measured using indicators. On the Table 21 indicators for each action are defined and their source of information. At the completion of each action, the effectiveness of action, based on indicators will be carried out.

Table 21: Indicators of progress of implementation of the proposed measures to improve air quality in the Šalek Valley.

No.	Actions	Indicators	Source of informaton
1	The operation of ŠTPP Unit 6	Lower emissions and immission of pollutants.	Measured concentrations of pollutants.
2	The construction of the 3rd development axe	Number of vehicles on regional roads of the valley. Lower emissions and immission of pollutants.	Counting of the traffic.Measured concentrations of pollutants.
3	Construction of national cycle routes	The number of cyclists on a cycling path. Length of cycle paths	Counting of cyclists. Poll.
4	Construction of the regional cycling network	The number of cyclists on a cycling path. Length of cycle paths.	Counting of cyclists. Poll.
5	Completion of the municipal bicycle network	The number of cyclists on a cycling path. Length of cycle paths.	Counting of cyclists. Poll.
6	Editing of cycling infrastructure	The number of cyclists on a cycling path. Length of cycle paths.	Counting of cyclists. Poll.
7	Promoting of sustainable tourism	Number sightseeing by bicycle, the number of bicycle hotels	Report.
8	Maintenance and expansion of the system BICY	The number of stations, number of bicycle rental and occupancy.	Announcements on the website of the Municipality of Velenje
9	Editing of attractive and safe walking routes	Path length, orderliness of paths.	Announcements on the website of the Municipality of Velenje
10	Editing of the city center	Number of introduced delivery bike.	Announcements on the website of the Municipality of Velenje
11	Improvement of public transport	Length of bus routes, frequency of service to the locals, the number of passengers.	Announcements on the website of the Municipality of Velenje
12	System P + R (park and ride)	Number of P + R parking.	Announcements on the website of the Municipality of Velenje
13	Stimulating parking policy	The number of cars parked on the outskirts of cities	Announcements on the website of the Municipality of Velenje
14	Calming of traffic at critical points	Speed car at critical points.	Announcements on the website of the Municipality of Velenje
15	Report on the achievement of objectives in accordance with SEAP Velenje	Report.	Report.
16	Preparation of comprehensive energy solutions for the suburban local communities	Made solutions.	Report.
17	Expansion of a district cooling system	The number of connected buildings on a district cooling system	Announcements on the website of the Municipality of Velenje
18	Additional thermal insulation and replacement building furniture	The number of buildings with replacement of building furniture.	Announcements on the website of the Municipality of Velenje
19	Austerity actions (determination of temperature regimes)	Number of new buildings by improving energy efficiency (number of awarded grants).	Announcements on the website of the Municipality of Velenje
20	Energy efficient reconstruction of public lighting	Number of suitable lamps.	Report.
21	Informing the inhabitants about air quality	Execution of campaigns, workshops, publishes informational brochures, reports in local newspapers, the Internet and information point in the center of town	Announcements on the website of the Municipality of Velenje
22	Promotion of cycling (driving to work, school, activities) and walking	Number of actions undertaken.	Announcements on the website of the Municipality of Velenje
23	The incentives for employers in the use of bicycles for driving to work, and during the work	Number of residents who commute to work by bicycle city	Report.
24	Informing in case of exceedances of pollutants	Conducted an exercise to inform residents.	Announcements on the website of the Municipality of Velenje
25	Making energy certificates.	Number of issued energy performance certificates.	Report.

7 APPENDIXES

APPENDIX 1: PILOT ACTION 1 – AWARENESS RAISING INITIATIVES

The aim of Pilot action 1 "Awareness raising initiatives" was to raise awareness of citizens and the stakeholders of Velenje by their continuously informing of the quality of air in the city and about negative implications for the human health. To achieve this aim, the budget sources of project TAB was used for upgrading of the information system by establishment of so called "Information point of Velenje". Two sided monitor was located in the centre of Velenje. Visitors can get information about the content and progress of project TAB, data on the level of air polutants from measuring station (SO_2 and O_3) and some meteorological data: temperature, moisture and wind. The level of SO_2 and O_3 are also shown in a friendly graphical form (sun flowers) to attract the population. On such a way, citizens are immediately informed in a case of increased values of pollutants. The opening ceremony of Information point was in September 2013, when major awareness raising campaign in city Velenje was carried out. Brochures and some promotion materials with the information about TAB project and negative implications of polluted air on the human health were distributed to the participants. Qualified personnel from Health center of Velenje conducted a lecture of the using of defibrillator, which is stored within the display bracket.

Figure 19: Great campaign for the awareness of population in the city of Velenje, September 2013 (left) and "Information Point of Velenje" (right).

APPENDIX 2: PILOT ACTION 2 – INTERVATIONS IN TRANSPORT, HOUSEHOLD HEATING AND INDUSTRY

In the pilot action 2, we focused on the analysis of the spread of dust particle emissions and the determination of their resources in The Šalek Valley, since dust particles was identified as relatively problematic in terms of human health (Al Sayegh Petkovšek et al., 2012). The pilot 2 was performed on the basis of measurements of PM_{10} and airborne metals at the additionally selected measuring points near traffic roads (Vila Bianca and VDC Ježek) in winter period 2013/2014 (Al Sayegh Petkovšek et al., 2014) and on modelling PM_{10} dispersion in the Šalek Valley in the same period (Ivančič and Vončina, 2014).

The largest concentrations of PM10 were measured at the measuring point Velenje in December 2013 (27.9 g/m3) and in January 2014 (26 g/m3). At this measuring point the maximum daily concentration was exceeded in December three times and in January five times. Excessive concentrations on other locations were only in December at the measuring point Vila Bianca (three times) and VDC: Ježek (twice) (Graf. 5). Increased concentrations of chromium, cobalt and zinc were found in the exposed filters from above mentioned measuring points, which can be related to emissions from traffic, since these metals are typical for emissions from road transport (Al Sayegh Petkovšek et al., 2014).

Figure 20: Measuring station SKYPOST PM at the measuring point in Velenje Vila Bianca (left) and publicizing the results in a poster at the conference "Towards Cleaner Air and Better Health in Central Europe" in Katowice, Poland (right).

Road traffic was specified as the most important local source of emissions of particulate matter in the Šalek Valley in the study "*Model calculations of the spreading of PM10 in the Šalek Valley"* (Ivančič and Vončina, 2014). Although the quantity of dust emissions were lower from traffic in comparison with the energy sector, the contribution of traffic to overall pollution was greater, due to the worse dispersion conditions. Road transport contributed the largest share to the overall pollution at the monitoring sites Velenje, Vila Bianca and Ježek, because those sites were located relative close to important road links.

Emissions of particulate matter from industrial and energy sector cause relatively low level of contamination by dust particles, because those facilities needed to install techniques to reduce exhaust emissions into the air in order to adapt to the requirements of the European Union. In 2016 a new European Directive (Directive 2010/75/EU), which will set more strict emission limits will come into force. As a result we can expect a further reduction of emissions from those two sectors.

Ambient air pollution with dust particles can not be completely prevented, because in addition to local pollution emission sources, the polution with dust particles can be a consequence of their long-range transport from distant places. In addition, contamination by dust particles also occurs naturally (wind erosion from denuded and arid soils, transportation of Saharan dust). The mentioned contamination is difficult to quantify, and it is treated as a background. The proportion of background can be determined on the basis of measurements of the level of dust particles at the measurement station, which is far away from all local emission sources. At all measuring points in the Šalek Valley, background represented more than 50% of the total captured PM_{10}.

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