Interreg - IPA CBC

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TRAP

Identification of emission sources
Delivery 3.4.1.

TRAP

Transboundary Air Pollution Health Index Development and Implementation

July, 2019

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1. Introduction

1.1. Project Overview

Information on real time air pollution levels is now more necessary than ever before. At present, air pollution is one of the most significant factors posing threat to the health of individuals worldwide. It is associated with a range of diseases, symptoms and conditions that impair health and quality of human life. According to the WHO, outdoor air pollution was responsible for the deaths of some 3.7 million people under the age 60 around the world in 2012 , representing 6.7% of the global disease burden while outdoor air pollution combined are among the largest risks to health worldwide. Apart from habitants air quality impacts natural environment and biodiversity. The main sources of air pollution at both countries are mainly caused by industrial activities, transportation and heating.

Air Pollution has been recognized as of the most pressing problems in both Greece and the Former Yugoslav Republic of Macedonia, following the economic and social development of the two countries the sources of air pollution are mainly industrial activities, transport and central heating. The major challenges of transport in urban areas are the rising number of vehicles, their increased average age and traffic congestion. Air quality problems from industrial sources mainly concern areas with thermos-electrical power stations and industrial units located close to residential areas. Air quality is strongly influenced by pollutants trapped due to thermal inversions caused by from land local breezes and thermal internal boundary layers.

TRAP developed on the necessity for developing ICT applications in environmental protection, monitoring and management of the eligible areas. Environmental initiatives is a privileged field for developing cooperation in the cross-border area contributing significantly to economic and social development of the population and public health, therefore, the opportunity for mutual cooperation and understanding between public authorities, scientific institutions and residents of the area. The major challenge is the development of an integrated approach including air quality monitoring with providing health indicator for vulnerable groups of the population. TRAP project addresses a series of issues, such as:

- Identification of the emission sources and development of regional and CB emission for vulnerable groups of the population
- Assessment of each emission source
- Development of air quality plans
- Monitoring data, validation and analysis
- Basic demographic, health and public health profile
- Air quality and Health Indicators
- Joint CB comparative analysis
- Capacity Building at user level (Health and authority stakeholders)
- Air quality and health sensitization campaigns
- Protection of human health
- Citizen involvement
- Implementation of air quality directives

Partners aim to improve management and protection of areas in both countries by establishing air quality monitoring networks. The measurements of all station in areas

involved in this project will create a system that will display real-time measurements through the internet. Moreover, epidemiological indicators and indicators of air quality, based on the effects of air pollution on human health, will be calculated and displayed on the web. The best way for someone to use an Air Pollution Health Indicator (APHI) is to regularly check the current index value, to pay attention to personal symptoms and self –calibrate to personal symptoms and self-calibrate to the report current APHI value. Therefore, the strategic objective of TRAP project is the creation of an ICT application integrating Air Quality Monitoring with Air Pollution Health Indicator) (APHI) in CB area.
The specific sub-objectives of the project are to:

- Develop and evaluate emission inventories at partner areas
- Assess the health risk related to air quality measurements
- Create integrated ICT tool including air quality information correlated to possible health impacts and providing emergency mechanism to policy makers and vulnerable groups
- Evaluate the CB conditions regarding air quality and transported pollution in CB areas
- Engage relevant stakeholders in order to inform them on the created tool operation and indexes
- Disseminate and communicate the project results to key stakeholders as well as to the general public and vulnerable groups

TRAP project results will positively affect and contribute to the programmes result indicator for ecosystems with improved protection status for the eligible areas of Florina, Bitola and Gevgelija where the monitoring stations will be placed. The innovative character of TRAP is served by its approach that favors the interaction and exchange of ideas as well as the knowledge diffusion and integration among the targeted stakeholders. Many of the projects activities will be jointly implemented creating unified framework for problem resolutions and providing added value to the CB area as a total. The expected results are focused on the development of an ICT tool for better air quality monitoring in CB area integrated with Air pollution Health Indicator.

1.2. Purpose of this deliverable

This document has been developed in order to provide a strategy for improving air quality in the eastern zone agglomeration, which covers only the municipalities within the Southeast Planning Region, namely Gevgelija, Strumica, Valandovo, Dojran, Radovish, Konche, Bogdanci, Bosilovo, Vasilevo, Novo Selo.

This document identifies the air emissions sources in the Southeast region of the Republic of Northern Macedonia, which is the basis for preparing the air emission inventory. Both, this document and the inventory are being prepared for the needs of the Municipalities in the region in order to define and plan measures to improve air quality in cooperation with the Ministry of Environment and Physical Planning.

The preparation of these documents will be the basis for defining and make priritizetions of possible measures to reduce emissions and their impact on air quality. Measures can be

classified as short-term and long-term measures. Short-term measures should be adopted as soon as possible in order to reduce the concentrations of the most critical pollutants. It takes a long time to implement long-term measures, mainly due to the need for serious planning and significant financial resources.

1.3. Scope of the deliverable

Main aim of this activity is to identify all emission sources in the Southeast Region. The identification consists of assessing the A and B-IPPC installation, smaller capacities, households and administrative capacities (schools, faculties, hospitals, hotels etc.), including mobile sources. The identification also encompass identification of pollutants and type of emissions released from the identified sources. The emissions are limited only to emissions into the air and include sources not limited only to potential emission of CO, SO2, NO2, Polycyclic aromatic hydrocarbons (PAH), heavy metals (Cd, Pb, Hg) but all pollutants that arise from the identified activities (sources) in the region. For the purposes of preparation of this deliverable the following data per sector are gathered:

- Transport – Collected activity data on number of vehicles from MOI database and data on fuel consumption from energy balance, possible activity data on re-suspension from universities

- Industry – Activity Data on consumption/production and fuel use from State statistical office publications, Ministry of environment data base, Report from the conducted survey for air emsiions from households heating in the Southeast region, Survey for energy consumption in households 2014, IPPC A and B installations reports (fuel consumption, industrial products and raw materials as well as emission measurements data)

All gathered data will be used for preparation of the air emission inventory for the Southeast region.

2. Legislation framework

2.1. National legislation on air quality [i]

The principles of air quality management are set in the Law on Environment (Official Gazette No.53/05, 81/05, 24/07, 159/08, 83/09, 48/10, 124/10, 51/11, 123/12, 93/13, 187/13, 42/14 and 44/15). The Law on Ambient Air Quality (Official Gazette No. 67/04, 92/07, 35/10, 47/11, 59/12, 163/13, 10/15) recognizes the principles of the Law on Environment and introduces further principles of relevance for air protection. Most of the principles and obligations are in accordance with the obligations set in the EU directives for air quality and air emissions. The Ministry of Environment and Physical Planning (MoEPP) is the main competent body for implementation of the air quality legislation at national level. The municipalities are responsible for establishment of local air monitoring networks, preparation of local air quality management plans, conducting activities for improvement of air quality and provision of the finance necessary for full implementation of such activities. The general competence for

environmental issues is laid down in Article 22 paragraph (1) point 2 of the Law on Local self-government (Official Gazette No. 5/02).

In addition to the primary legislation set out above, a number of bylaws, plans and programs regarding air quality management are in force.

2.2. Law on environment

Within the Law on environment several articles place obligations on municipalities in relation to air quality management. The public must be informed in cases when emission limit values are exceeded and when a special act to undertake measures is adopted (article 26). The recommendation for establishing a local monitoring network for all media and environmental areas is regulated in articles 34 and 35. The manner of gathering and reporting emission measurement data is set in articles 41 and 42. Local environmental action plans and the manner of submission of data from public authorities and legal and physical persons responsible for implementation of the plan and the content of LEAP are defined in articles 60, 62 and 64 respectively. Articles 122-127 define municipalities as competent bodies for installations that are subjected to B-IPPC licensing, the manner of issuing such licenses, the content of the license and supervision of the implementation of the requirements set in the license.

2.3. Law on ambient air quality

In connection with article 34 of the LoE, article 39 in the LAAQ regulates conditions under which municipalities may establish a local monitoring network for ambient air quality. The obligations for preparation of local planning documents are set in article 26 and article 27-a respectively. Article 26 sets an obligation for preparation of plans for air quality protection in those zones and agglomeration where air quality limit values are exceeded. Article 27 sets the obligation for preparation of short term action plans in those zones and agglomerations where alarm thresholds values are exceeded. These plans are to be prepared by the Municipality, City of Skopje and municipalities in Skopje in cooperation with MoEPP. Both Air Quality Plans and Action Plans should be prepared at the level of zone/agglomeration. When preparing planning documents laid down in article 23, all other documents and regulations with integrated approach to the environmental protection and health protection should be examined (article31). The municipalities should inform the public regarding implementation of measures stipulated in local planning documents (article33) and report the status of implementation of the planning documents to the MoEPP (article34). Article51 (3) obliges municipalities to publish the planning documents and to inform the public on regular basis with regard to measures of management of ambient air quality. The municipalities should ensure financial support from their budget or other sources. LSGUs are required to implement measures in the local planning documents (article 64).

Currently there are 16 sub laws under the LAAQ regulating air quality management. The list of these rulebooks is given in ANNEX 1 of this Report. For the preparation of air quality plans, the municipality should be familiar, in particular, with the Rulebook on the detailed content and manner of preparation of the Plan for ambient air quality improvement and the Rulebook on the methodology for inventory and establishment of the emissions levels of polluting substances to the atmosphere in tons per year. This concerns all types of activities, as well as

other data to be submitted to the European Monitoring and Evaluation Program (EMEP This methodology should be used by the LSGUs for the preparation of the local emission inventories.)

2.4. Strategies and Planning Documents

National program for the gradual reduction of the quantities of emissions of the certain pollutants at the level of the Republic of Macedonia for the period 2012 to 2020

In this program, measures at national level to reduce emission of the air pollutants, sulphur dioxide, nitrogen oxides (expressed as nitrogen dioxide), ammonia, volatile organic compounds (VOCs), TSP and carbon monoxide to air, are identified. Additionally, the program sets national emission projections for the period 2015 to 2020 for these pollutants.

National plan for protection of the ambient air quality in the Republic of Macedonia for the period 2013-2018

The National plan for protection of the ambient air quality in the Republic of Macedonia presents the situation concerning air quality, defines the measures at national level for protection and improvement of the quality of ambient air of Republic of Macedonia per sector (energy, industry, traffic, agriculture, waste), and defines all relevant institutions responsible for their implementation for the next 5 years (2013-2018).

Air quality assessment reports

There are two air quality assessment reports:

—Preliminary assessment report on Sulphur dioxide, nitrogen dioxide, nitrogen oxides, carbon monoxide, particulate matter, ozone in the Republic of North Macedonia, in which zones and agglomerations are established and

—Air quality assessment on Sulphur dioxide, nitrogen dioxide, nitrogen oxides, carbon monoxide, particulate matter, ozone, lead, arsenic, nickel and cadmium concentrations in Republic of Macedonia

Assessment of air quality with regard to assessment thresholds is responsibility of MoEPP, nevertheless municipalities in cooperation with MoEPP, need to prepare plans for air quality improvement and short-term action plans for those zones and agglomerations where limit values/alarm threshold values are exceeded.

Convention on Long-Range Transboundary Air Pollution (CLRTAP)[ii]

The 1979 Convention on Long-Range Transboundary Air Pollution (CLRTAP) entered into force in 1983. The Republic of North Macedonia accessed as a member country and ratified and signed the Convention on November 17th 1991.The Convention now totals 51 countries-signatories which resolve the main environmental issues in the UNECE region through scientific cooperation and negotiations.

The purpose of the convention is to improve air quality at local, national and regional level through mutual cooperation and definition of specific measures that should be undertaken by

the countries in aim to reduce emissions of certain pollutants from various sectors (industry, agriculture, transport, etc.) due to the convention during the past eight defined protocols:

- The 1984 Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)
- The 1985 Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent
- The 1988 Protocol concerning the Control of Nitrogen Oxides or their Transboundary Fluxes
- The 1991 Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes
- The 1994 Protocol on Further Reduction of Sulphur Emissions
- The 1998 Protocol on Persistent Organic Pollutants (POPs) and its 2009 amended version
- The 1998 Protocol on Heavy Metals and its 2012 amended version
- The 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone and its 2012 amended version

The first five protocols Republic of North Macedonia has ratified in February 2010 (Fig. Gazette of RM no. 24/10), and the last three in October 2010 (Fig. Gazette of RM no. 135/10). However, due to the long duration of negotiations for accepting the national limit values and emissions in base years and their inclusion in Annex II, Republic of North Macedonia became a member of the Gothenburg Protocol in September 2014.

In 2009 were adopted amendments to the POPs Protocol, and in 2012 the Protocol on Heavy Metals and the Protocol on reducing acidification eutrophication and ground-level ozone. So far, only a few European countries have adopted these amendments.

As a member-state of the CLRTAP Convention and their Protocols, Republic of North Macedonia meets the protocol requirements through development, adoption and implementation of bylaws and strategies for coping with the release of pollutants in the air, by implementation and control of monitoring of pollutants, information exchange, consultations, research and monitoring of the documents deriving from the Convention.

3. Methodology for preparing the document and conducting identification of emission sourcess

The identification of emission sources for the Southeast region has been conducted in accordance to the Guidelines for Reporting Emissions and Projections Data[iii] under the United Nations Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution (LRTAP). The Guideline provides tiers representing different level of methodological complexity. Usually three tiers are provided; Tier 1 is the simple (most basic) method; Tier 2, the intermediate; and Tier 3, the most demanding in terms of complexity and

data requirements. Tier 1 methods apply a simple linear relation between activity data and emission factors. The activity data is derived from readily available statistical information (energy statistics, production statistics, traffic counts, population sizes, etc.). The default Tier 1 emission factors are chosen in way that they represent 'typical' or 'averaged' process conditions — they tend to be technology independent.

For preparation of this report the Tier 2 methods has been applied.

The data were collected with particularly designed questionnaire aiming to collect all necessary data from each municipality, such as: number of administrative and commercial buildings, their size, type of fuel, consumption, number of IPPC B installations, emission from B installations, number of elaborates on environment, and has also identified all IPPC – A installation in the Southeast region.

It is important to note that all municipalities were very cooperative and provided the requested data in the due time, but unfortunately huge amount of data are still missing mainly due to fact that municipalities are not collecting these data regularly. Also it is very important to mention that data provided are for the year 2017 or for data collected or measured up to this year.

The identified emission sources are necessary for conducting the calculations of air emission and preparation of the air emission inventory for Southeast region.

4. General considerations for Southeast region

4.1. Characteristics of the Southeast region

The Southeast Planning Region stretches across the southeastern part of the Republic of Macedonia and covers the area of Strumuca-Radovish and Gevgelija-Valandovo Valley, that is to say, the river basin of Strumica River and the lower flow of Vardar River on the move south of Demir Kapija. The geographical coordinates of the region are situated between 22°59' 6" and 22° 26' 6" geographical width and 41°07' and 41°40' geographical length. Above sea level altitude as the third geographical coordinate dimension varies between 64 m and 2,157 m above sea level. To the south, the Southeast Planning Region borders the Republic of Greece, to the east the Republic of Bulgaria, whereas to the north and to the west the East Planning Region and Vardar Planning Region, Republic of North Macedonia. The region covers in full the already mentioned valleys and the mountain massif Belasica in the south, Ograzhden in the east, Plachkovica in the north, Srta in the central part and Kozhuf Mountain on the eastern side.

Figure 1. Map of Southeast region

According to the data of 2017, 8,4% of the total population in the Republic of North Macedonia lives in the region. The region covers 10,9% of the total area of the country, with population density of 63,3 inhabitants per km2 , which makes this region the fifth in the country as per population density. The table below shows the number of populations that lives in the Southeast region in comparison to the Census in 2002 and total population of the whole country.

Table 1. Population in the Southeast region

Republic of Macedonia, 2017	Southeast region, 2002 (data from the last Census)	Southeast region, 2017
2.074.502	171.416	173.476

Source: State Statistical office

A total of 10 municipalities comprise the Southeast Planning Region: Municipality of Bogdanci, Municipality of Bosilovo, Municipality of Valandovo, Municipality of Vasilevo, Municipality of Gevgelija, Municipality of Dojran, Municipality of Konche, Municipality of Novo Selo, Municipality of Radovish and Municipality of Strumica.

Table 2. Population, area and populated are per municipality in Southeast region

Municipality	Population (Census 2002)	Population (2015)[1]	Area[2]	Populated areas[3]
Municipality of Bogdanci	8.707	8 243	114,24	4
Municipality of Bosilovo	14.260	14 080	161,99	16
Municipality of Valandovo	11.890	11 810	328,00	29
Municipality of Vasilevo	12.122	12 868	230,42	18
Municipality of Gevgelija	22.988	22 764	479,93	17
Municipality of Dojran	3.426	3 331	129,16	13
Municipality of Konche	3.536	3 592	223,06	14
Municipality of Novo Selo	11.567	10 872	237,79	16
Municipality of Radovish	28.244	29 039	497,50	36
Municipality of Strumica	54.676	56 961	321,53	25
Total	171.416	173 560	2.733,62	188

Source: Sources are listed as references below the page

Of the 10 municipalities, four are characterised by urban areas, as follows: Strumica, Gevgelija, Radovish and Valandovo.[4]

[1] State Statistical Office – Estimations on 30.06.2015 and 31.12.2015
[2] Agency for Real Estate Cadastre of the Republic of Macedonia
[3] State Statistical Office
[4] Law on Territorial Organisation of the Local Self-Government in the Republic of Macedonia, Official Gazette 55/2004 of 17.08.2004

Table 3. Households and dwellings in the Southeast region

Municipality	Households (Census 2002)	Dw ellings (all types of living quarters)
Municipality of Bogdanci	2.597	3.006
Municipality of Bosilovo	3.661	4.036
Municipality of Valandovo	3.545	4.050
Municipality of Vasilevo	3.306	3.360
Municipality of Gevgelija	7.221	9.292
Municipality of Dojran	1.021	2.116
Municipality of Konche	1.057	1.175
Municipality of Novo Selo	3.131	4.158
Municipality of Radovish	8.270	9.833
Municipality of Strumica	15.896	18.473
Total	49.705	59.499

Source: State Statistical office

4.2. Topography and climate conditions

The specific geographical and topographical location of the Southeast region provides long hot summers with high mid-day temperatures and reduced quantity of rainfall, as well as lower winter temperatures and emergence of winds from all directions. Winds characteristic for this region are the following: north-westerly wind, south-westerly wind, as well as the north wind and the south warm wind.

The region features a long period of days of sunshine and high light intensity having a strong influence on fructification. Having a total of 230 sunny days annually or calculated by hours, 2,377 hours of sunshine on annual level, the Southeast region is one of the sunniest regions in the Republic of Macedonia. Fog is rare in the region and on average it amounts to 20 days throughout the whole year. The whole region may be divided into three micro regions, as follows: Strumica-Valandovo, Gevgelija and the micro region Radovish-Konche.

The sub-Mediterranean influence coming from the Aegean Sea and the influence of the continental climate reduce the quantity of rainfall on annual level, as well as the temperatures in the winter season. The situation in the micro region Radovish-Konche mildly differs from these climate characteristics, having a more expressed continental climate (warm continental climate) as a result of the average above sea level altitude of 400-707 metres.

The average annual temperatures in the plain part of the region range between 12,5°C and 13°C, whereas in the highest parts of mountain massifs up to 7,5°C. When it comes to this

average, the area of Dojran and Valandovo is distinguished by an annual temperature of up to 25°C. July and August are the warmest months, with an average temperature of up to 23°C, and January is the coldest month with 1,2°C. Rivers in the Republic of Macedonia belong to three drainage basins - Aegean (rivers Vardar and Strumica), Adriatic (Crn Drim) and Black Sea (Binachka Morava), with a total area of 25.713 km^2 . The Southeast region belongs to the Aegean Sea drainage basin with a total area of 1.784 km^2 . The drainage basin area of Strumica River (Vodocha, Turija, Radovishka, Podareshka and Cironska River) covers 1.535 km^2 and the drainage basin area of Dojran Lake (Luda Mara River) 120 km^2, or a total area of 1.649 km^2. The average annual rainfall in the region amounts to 563 mm, with considerable differences between mountainous and plain areas, and is below the average annual rainfall in the Republic of Macedonia amounting to 680 mm.

Municipality	**Bogdanci**[5]	**Bosilovo**[6]	**Valandovo**[7]	**Vasilevo**[8]	**Gevgelija**[9]	**Dojran**[10]	**Konche**	**Novo Selo**[11]	**Radovish**[12]	**Strumica**[13]
Mean daily maximum temperature, July	**32°C**	**32°C**	**32°C**	**31°C**	**34°C**	**32°C**	**29°C**	**32°C**	**30°C**	**31°C**
Precipitation, highest	Dec 71 mm	Dec. 71 mm	Dec 71 mm	Dec 71 mm	Dec 67 mm	Dec 71 mm	Dec 71 mm	Dec 85 mm	Dec 62 mm	Dec 71 mm
Precipitation lowest	Aug 22 mm	Aug 22 mm	Aug 22 mm	Aug 22 mm	Jul 10 mm	Aug 22 mm	Aug 22 mm	Aug 25 mm	Aug 20 mm	Aug 22 mm

[5] https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/bogdanci_north-macedonia_792523
[6] https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/bosilovo_north-macedonia_792419
[7] https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/valandovo_north-macedonia_784733
[8] https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/vasilevo_north-macedonia_784700
[9] https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/gevgelija_north-macedonia_790744
[10] https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/star-dojran_north-macedonia_785537
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[12] https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/radovis_north-macedonia_786565
[13] https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/strumica_north-macedonia_785380

Windrose in each municipality from Southeast region

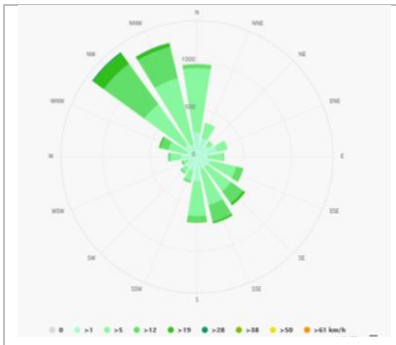

Figure 2. Wind rose, Bosilovo

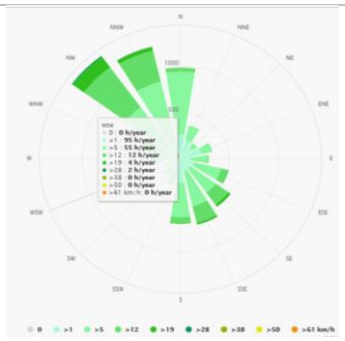

Figure 3, Wind rose for Bogdanci

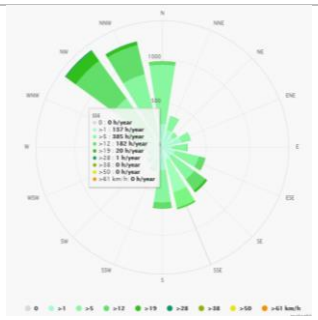

Figure 4. Wind rose Valandovo

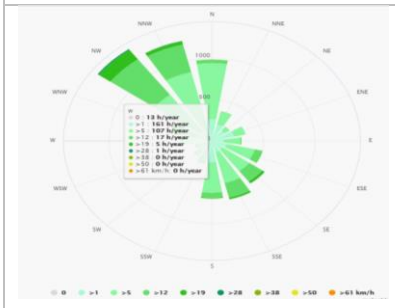

Figure 5. Wind rose Vasilevo

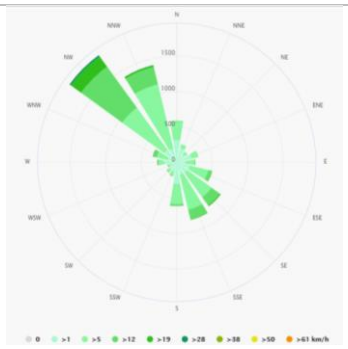

Figure 6. Wind rose Gevgelija

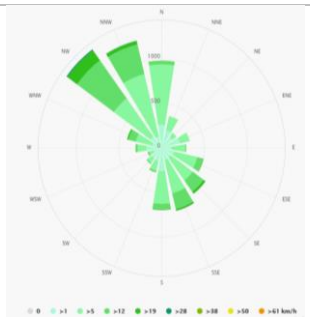

Figure 7. Wind rose Dojran

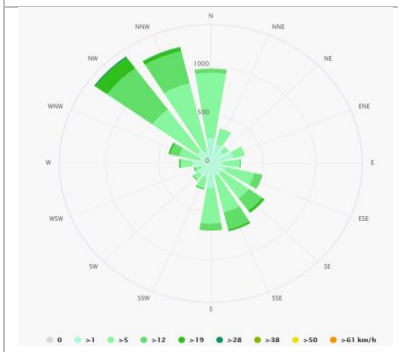

Figure 8. Wind rose Konche

Figure 9. Wind rose Novo selo

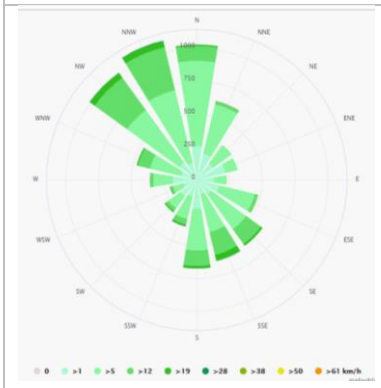

Figure 10. Wind rose Radovish

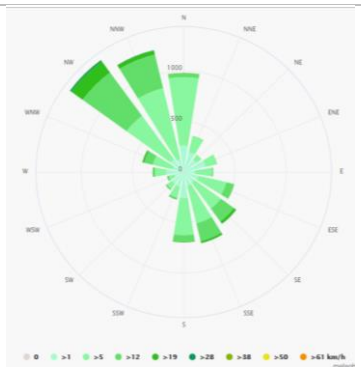

Figure 11. Wind rose Strumica

4.3. Industry and type of industry

Table 4. Number of new enterprises in Republic of North Macedonia 2016

Republic of North Macedonia	Vardar Region	East Region	Southwest Region	Southeast Region	Pelagonia Region	Polog Region	Northeast Region	Skopje Region
7132	463	482	885	543	696	1158	341	2564

According to the data of the State Statistical Office, there were 7 132 new enterprise in the Republic of North Macedonia in 2016, the data on the structure of new enterprise births by statistical regions show that the highest share of 36.0% belongs to the Skopje Region, while the Sotheast Region has share of 8%.

This region is mainly agricultural and there is no heavy and energy intensive industry. There are many food processing companies, companies for dairy products, wood and furtniture processing, greenhouses, textile industries but also companies that provide trade services. The only intensive installation in this region is the Bucim Mine located near Radovis. The list and elaboration of the biggest installations and potential pollutants is given under chapter 7 of this document.

4.4. Traffic infrastructure

Road transport and infrastructure play a key role in terms of economic development, in increasing the number of tourists in the region, as well as in improving the standard of living of the population as a whole. Institutions in charge of road infrastructure in the region are: Ministry of Transport and Communications, Public Enterprise for State Roads and the municipalities. Public roads, according to their state, economic, commercial and traffic significance and their level of construction are divided into state and municipal. According to the state, economic, commercial and traffic significance, as well as their level of construction, some of the state roads are categorised as highways, express roads and motorways (A-motorways) and serve to connect the Republic of Macedonia with the European road system and to maintain continuity of the international road network (international corridors – E roads), and to connect the road network with international road border crossings and to achieve traffic connection with the roads of neighbouring countries. All state roads are divided into: A-Motorways (highways, express roads, motorways), R1 – Regional roads of first category and R2 – Regional roads of second category. Out of a total of 14.395 km of road network in the Republic of Macedonia, 1.557,0 km or 10,82% cross the territory of the Southeast region, by which it may be concluded that the region is connected on a satisfactory level. However, some of the regional roads have not been constructed yet or their construction is not yet finished, whereas some are in a poor condition (road route A4, section Shtip – Radovish). An exception is the road route A4 Radovish – Strumica, which largely meets the standards and is in a good condition. The condition of the road route section Strumica – border with R. Bulgaria (BC Novo Selo) is bad, both as a result of the state of the road itself, and as a result of the horizontal and vertical signalisation. Thereby, it should be taken into consideration that this road passes through several populated settlements and leads to the border crossing with the Republic of Bulgaria.

4.4.1. Average Annual Daily traffic in Southeast region

The intensity of traffic on the state road network is measured by counting traffic, which is performed every year. The process of counting is done by help of automatic counting devices and manually by employees of the PE "Macedonia Road". Counting traffic on motorways and regional roads in the Republic of Macedonia is done in accordance with the 2010 methodological guidelines (State Statistical Office – Counting traffic on roads, 2010). The aim of counting traffic on roads is to collect data which will serve as a means of monitoring road conditions, planning road construction and maintenance. On the other hand, this should ensure safe traffic. The process of counting is carried out every year continuously on all categories of roads for several categories of vehicles. The counting results in 2011 and 2012 on the motorway and regional road network in the Southeast region are presented in the tables below. The average annual daily traffic in the Southeast Planning Region is given in Table 5 below.

Table 5 Average annual daily traffic in the Southeast region

Average annual daily traffic in the Southeast region	2011	2012
National road	19.944	19.877
Regional road	No data	13.688
TOTAL	19.944	33.565

Source: stat.gov.mk

The largest number of motor vehicles (Figure 12) are in the urban municipalities (Strumica, Gevgelija and Radovish) compare to the rural municipalities.

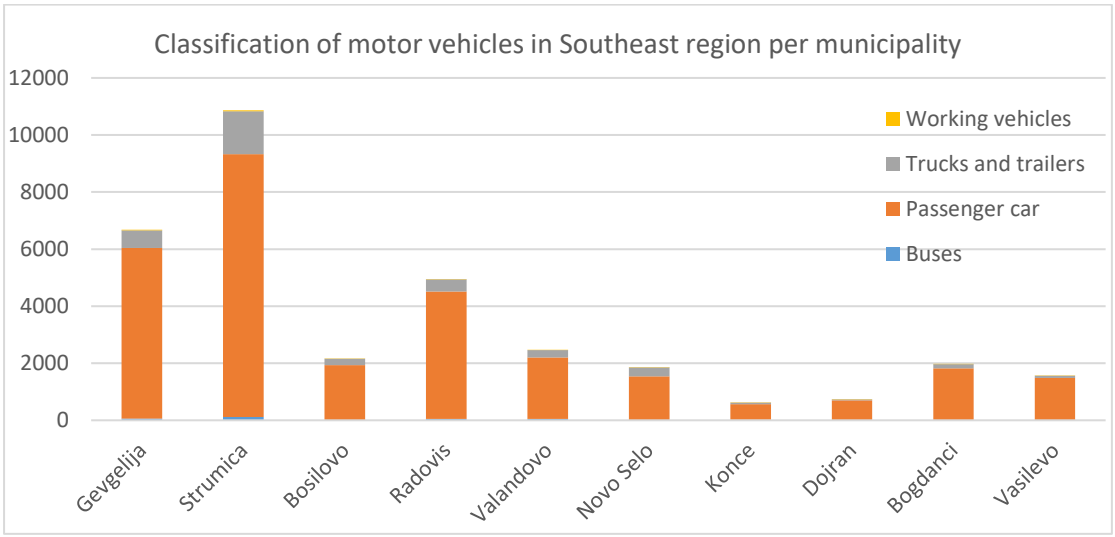

Figure 12 Classification of motor vehicles in Southeast region per municipality

More then 90% of the vehicles that runs on a gasoline (Figure 13) and diesel (Figure 14) in the Southeast region arebelow the EURO 4 standard, which means that are more than 15 years old.

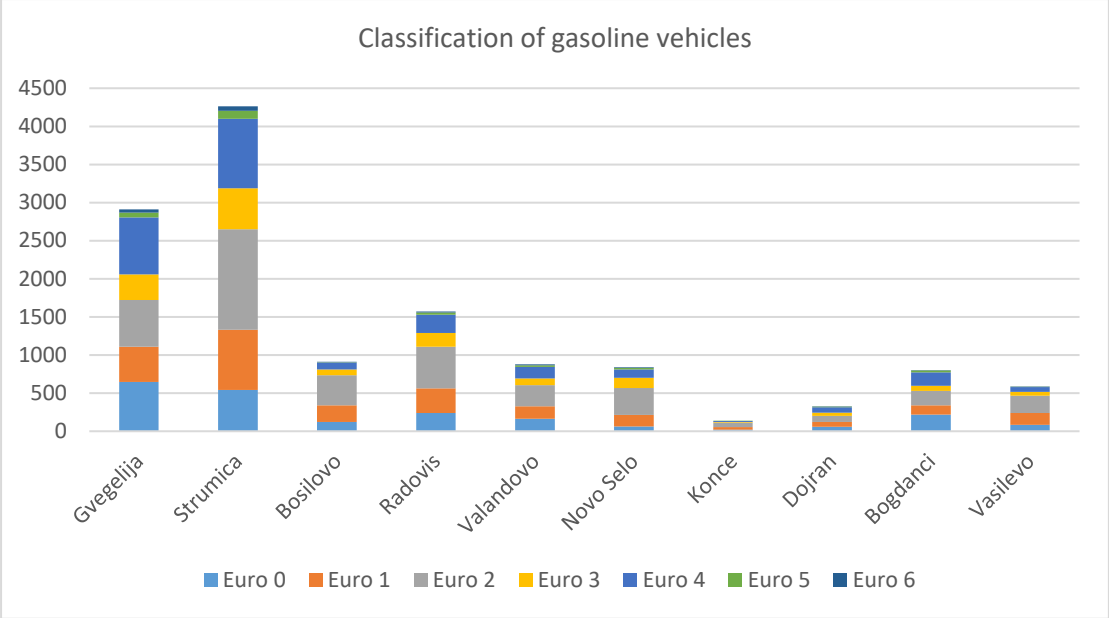

Figure 13 Classification of gasoline vehicles

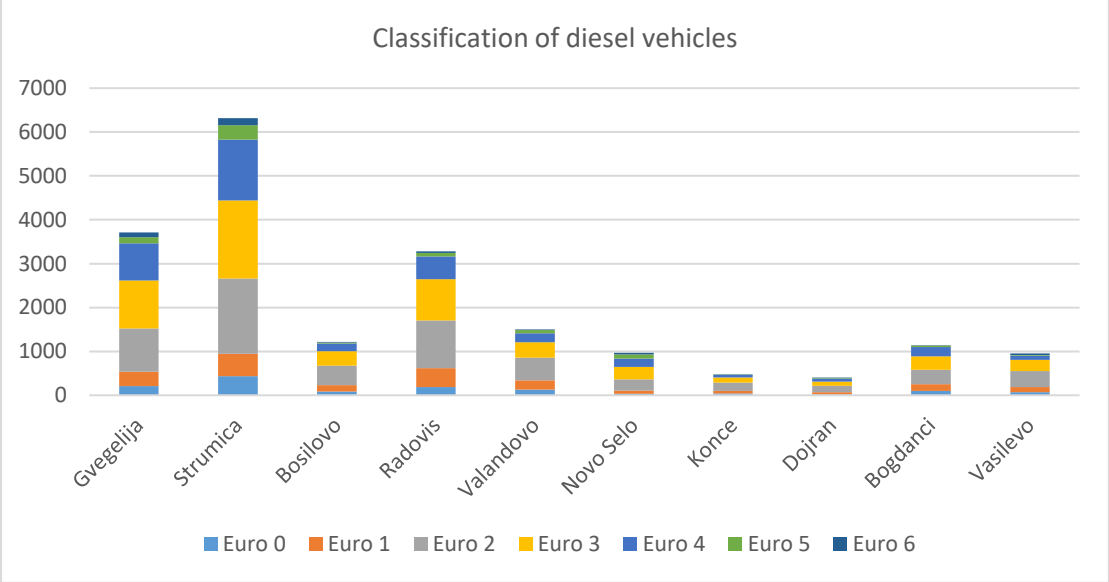

Figure 14 Classification of diesel vehicles

4.4.2. Railway infrastructure

The Southeast region is not covered by railway infrastructure, apart from the Municipality of Gevgelija. The total length of the rail track in the region is 24 km, whereas the average density is 8,46 km/km2 . Rail transport in the Southeast region, just as rail transport on national level, has shown a continuous fall. This trend applies to both passenger and goods transportation.

4.5. Energy infrastructure

The region has no big energy capacities. There are many hydropower plants and solar photovoltaic systems. The quantity of consumed energy in the Southeast region in 2015

amounted to 165 GWh, whereas in 2017 it amounted to 169 GWh, which is a increase of 4,32%. In terms of the energy potential, it should be emphasised that the region is not rich in hydro energy potential and is fully dependent on electricity. The installed electricity production capacity is 42 MW.

Table 6 Installed electricity production capacity

	Republic of Macedonia in MW	Southeast region in MW
2015	2029	42
2016	2033	42
2017	2043	42

Source: Regions of Macedonia, 2017

In the Southeast region in 2014 was completed the construction of the wind park "Bogdanci", the first such facility in the Republic of Northern Macedonia, which uses wind as a power plant for electricity production. The installed capacity of the wind park is 36,8 MW. Besides the wind park in the Southeast region according to the registry of privileged producers from Energy Regulatory Commission, there is one hydroelectric power plant with installed capacity of 160 kW and nine Photovoltaic power plant with total installed capacity of 405,23 kW.

5. Pollutants

Pollutants are the contaminants that get introduced into the natural environment, beyond permitted limits, and cause deleterious effects to the inhabitants in a visible or non-visible way. Air pollution can be defined as the presence of toxic chemicals or compounds (including those of biological origin) in the air, at levels that pose a health risk. In an even broader sense, air pollution means the presence of chemicals or compounds in the air which are usually not present and which lower the quality of the air or cause detrimental changes to the quality of life (such as the damaging of the ozone layer or causing global warming).

Air pollution is probably one of the most serious environmental problems confronting our civilization today. Most often, it is caused by human activities such as mining, construction, transportation, industrial work, agriculture, smelting, etc. However, natural processes such as volcanic eruptions and wildfires may also pollute the air, but their occurrence is rare and they usually have a local effect, unlike human activities that are ubiquitous causes of air pollution and contribute to the global pollution of the air every single day.

A large number of contaminants may pollute the air in a large variety of forms. Almost any toxic chemical could make its way into the atmosphere to pollute the air that we breathe. Aerosol particles (clouds of liquid and solid particles in a gas) that are found in the air may also contain pollutants.

The chemical compounds that lower the air quality are usually referred to as air pollutants. These compounds may be found in the air in two major forms:

- in a gaseous form (as gases),
- in a solid form (as particulate matter suspended in the air).

According EEA reports on environment for calculation of the quantities of the pollutants it is used the categorization by sector and NFR categories. The categorization by sectors is given in the table below.

Table 7. Categorization by sectors and NFR categorization

NFR category	NFR subcategory	Sector
1	**1.A.1**	**Production of electricity and heat**
	1.A.2	**Fuel combustion at industrial installations**
	1.A.3	**Transport**
	1.A.4	**Households and administrative capacities**
	1.A.5	**Other**
	1.B	**Fugitive emissions**
2		**Industry**
3		**Agriculture**
5		**Waste**

Source: Annual Report on Environmental Quality, 2018[iv]

In addition is given short description of all pollutants that might be emitted to the air from any of the abovementioned sectors.

6. Types of emission sources

6.1. General

Emissions to the air are defined as releases of pollutants into the air. Generally, it can be said that air quality depends entirely on the existing sources of emissions in the region included in the study. Different types of pollutants emitted to the air have different impacts on the environment, at both micro and macro scale levels.

The global impact of greenhouse gases occurs everywhere but with differing impacts on climate and weather conditions. Similarly, substances that destroy the ozone layer are a global issue. Thus GHG and ODS must be observed and analysed throughout the world, but in practice it is essential to start from the local level, because of their potentially severe impact, especially in densely populated urban areas.

Acidification and eutrophication represent a regional problem with cross-border effects. Acidification and eutrophication have a negative impact on human health, and degrade the biosphere and the local environment.

Due to these effects, on-going measurement of pollutants and their quantities is necessary, as well as determination and implementation of measures to protect and improve the ambient air quality.

6.2. Types of emission sources

Emissions is the term used to describe the gases and particles which are emited into the air by various sources. Different types of pollutants released into the air have different environmental effects, both on micro and macro levels. The global impact of greenhouse gases occurs everywhere but with differing impacts on climate and weather conditions. Similarly, substances that destroy the ozone layer are a global issue.

A number of different types of emission sources exist. These are defined in the LAAQ and are given below:

- Stationary sources or point sources emit pollutants to the air from specifically identified outlets from determined static position (technological processes, technological unit, industrial plants, defined activity, etc.) (A and B-IPPC installations in this report)
  Diffuse or surface sources (collective sources) are sources as: heating in residential buildings, combustion of fossil fuels in commercial-institutional facilities, mining activities, quarrying of minerals, materials handling, and distribution of fuel, petrol stations and oil terminals, agricultural processing, and municipal waste disposal as well disposal and incineration of other types of waste. Most individual emissions from these sources have low-intensity, but concentrated within a relatively small area; their joint share in air pollution can be quite substantial. Domestic heating as well as the heating of institution facilities (administrative, educational and health institutions etc.) is one essential factor for air pollution in Southeast region, especially in the winter period.
- Mobile sources are road and off- road vehicles involving the combustion of fossil fuels. Mobile sources also contribute to air pollution bearing in mind areas of high population density and as well as important business centers in the city and busy crossroads. In recent years, the number of registered vehicles has shown an upwards trend. Due to expected contributions of mobile sources in emissions of the basic pollutants in the air, mobile sources will be discussed separately.
- Natural sources

With regards to natural sources, emissions from forest fires are calculated on national level, but due to the fact that there are no available data at municipality level, no estimations were made for these sources.

The report does not cover all possible emission sources. For example, emissions from construction and machinery, small and medium-sized enterprises, agriculture and waste management are not fully covered. However, it is assumed that these sectors do not have a major impact on total emissions and air quality.

The emissions from the various sectors for the Southeast Planning Region will be calculated and estimated within the TRAP project as part of the deliverable 3.2. Developing air emission inventory.

6.3. Emissions from stationery sources

6.3.1 Emissions from A and B IPPC installations and smaller installations

According Law on Environment, the industry companies are divided on A and B IPPC[14] installation and installation where environmental elaborated are required. In addition, there are many smaller businesses such as bakeries, shops, fast food, etc. which are not under any of the abovementioned requirement but still have some air emissions. However, these small entities individually do not have large impacts although maybe sometimes their emissions do affect the air quality in Southeast region especially at a local scale.

Production and processing of metals

In the Southeast region, Dojran Steel is the only company which produces: rebar, wire mesh, lattice girders, copper coated welding wire, galvanized mesh and double twisted hexagonal mesh and has an IPCC A permit.

The company is located on the outskirts of the village. Nikolic which is located near the coast of Lake Dojran. Main energy source for the production is electricity (which covers 95% of the needs) and mazut (which covers 5% of the needs).

The mazut is used only for the needs of the furnace for heating steel beams and uses a fan with a power of 11kW. The operating mode of the oven is 5,400 hours / year, ie 225 days (because it works 24 hours / day).

The height of the chimney is 14.5 meters, with a diameter of 1.2 meters. The oven has 4 burners, which achieve a working temperature of about 1.150^{o}C.

Mineral industry

[14] Integrated Pollution Prevention and Control

In the Southeast region in the category of mineral industry, the IPPC B installations are located in the municipalities Strumica and Gevgelija. The installations activities are production of concrete in a stationary concrete base, excavation, crushing and sowing of mineral resources.

Elenica Strumica is a factory for production of bricks and is located along the road Strumica - Valandovo and it has IPCC A license. During the production, the main emissions in the air are from the tunnel furnace that works on mazut and from the dryers.

Zikol Strumica is a company that has an installations for asphalt and concrete base and has an IPCC A permit. The company is located southeast of the city of Valandovo. The capacity of the asphalt base is 95 t / h, while the capacity of the concrete base is 50 m^3 of concrete.

Nematali Ograzden is a company that produces ground feldspar in furnace with a production capacity of more than 50 t / day. The company has an IPCC A license and is located on the south side of the city of Strumica. During production, the main emissions in the air are from the boiler room that serves to heat the building, discharge from the dryer, the system for pollination of the mill and the system for pollination of sieves, elevators and scales.

Chemical industry

In the chemical industry category there are two installations with IPPC permit. The Detonit explosives factory is located in Radovis. In the production of explosives, two boilers are used to heat the building with a capacity of 600 kW and both boilers run on oil.

Igor Agromarket is a company for production and packaging of liquid, granulated and crystal fertilizers. The installation is located in the village Vladievci, municipality of Vasilevo. The only emissions in the air during the production of fertilizers are from the ventilation outlet.

Mining industry

Rudnik Bucim, the only copper mine in the Republic of North Macedonia is located in the Southeast region and has an A IPPC permit. The mine is open and produces copper concentrate containing copper and gold. It processes over 4.5 million tonnes of ore annually. The copper mine is located near the village of Buchim and lies on the southern borders of the mountain Plachkovica. The mine for production of steam uses a 2.33 MW oil boiler with a steam output of 200 kg / h. Steam production is 5840 hours per year.

When processing ore, the main emission into the air is dust emitted from the following sources:

- Cyclone of primary crushing with a flow of 672,000 Nm^3 / day

- Open cycle cyclone with a flow rate of 1,100,000 Nm^3 / day

- Rotoclon 3 of secondary-tertiary crushing with flow of 500,000 Nm^3 / day

- Rotoclon 5 of secondary-tertiary crushing

- Rotoclon 7 of secondary-tertiary crushing with a flow of 700,000 Nm^3 / day

Cyclone of primary crushing, rotoclons for secondary-tertiary crushing 3, 5 and 7 work 8760 hours per year (24 hours, 365 days), while cyclone of open storage works after 16 hours, 365 days per year, ie 5840 hours / year.

Other Activities

In this category, the companies with A and B IPPC permits are in the food industry. There are three poultry farms and one pig farm in the Southeast region.

Agripro farm has an installation for breeding 88.000 chickens, while the company Veterinar has an installation for breeding 315,000 poultry.

The pig farm Veterinar is with a capacity of 7.750 pigs. The farm is located in the Gevgelija valley and has B IPPC B permit. For the needs of the farm, steam boiler on wood and steam boiler on oil are used. The steam boiler on oil has a power of 140 kW while the steam boiler on wood is with power of 40 kW.

In addition to farms, in the Southeast region there are installations for the production of milk and dairy products, a slaughterhouse, a plant for the production of bakery products and an installation for the production of alcoholic and non-alcoholic beverages.

In Southeast region were identified 26 Installations that are subject to A and B IPPC Permit. The list of A and B IPPC installations is given bellow.

Table 8 List of IPPC A and B installation in Southeast planning region

Name of the company	Type of installation	Municipality	Activity	Type of category
Boni - Intergradba DOO	IPPC B	Strumica	Plant for production of concrete and separation of sand	Mineral industry
Ograzden - Mikromiks DPTU	IPPC B	Strumica	Crushing, sowing and grinding calcium carbonate	Mineral industry
Almaks DOO	IPPC B	Strumica	Installation for the production of refined edible oil	Other activities
AD Klanica so ladilnik	IPPC B	Strumica	Installation for slaughter and processing of meat	Other activities
In - Mak Beton	IPPC B	Strumica	Installation for grinding, crushing and sowing gravel, sand and clay	Mineral industry
Agroproizvod Kamenolom Skrka	IPPC B	Strumica	Installation for excavation, crushing and sowing of mineral resources	Mineral industry
Beton - Pm DOO	IPPC B	Strumica	Plant for production of concrete and separation of sand	Mineral industry

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Ading Gradba DOO	IPPC B	Strumica	Installation for production of concrete and production of concrete elements	Mineral industry
Zito Strumica AD	IPPC B	Strumica	Installation for storage of grain and mill products, grinding of cereals and mill crops and production of bakery products	Other activities
Grozd AD	IPPC B	Strumica	Installation for production and trade of alcoholic and non-alcoholic beverages	Other activities
Klanica DOOEL	IPPC B	Novo Selo	Installation for production of Sausages & Other Prepared Meats	Other activities
Mlekara Zdravje DOO	IPPC B	Bosilovo	Dairy production	Other activities
Ekonomija DOO	IPPC B	Bosilovo	Hens breading capacity-40 000 places for live poultry	Other activities
Inter - Beton DOO	IPPC B	Gevgelija	Sand and gravel separation with concrete base	Mineral industry
Ansa - Goran DOOEL	IPPC B	Gevgelija	Sand and gravel separation	Mineral industry
Dojran Steel DOO	IPPC A	Dojran	Production and processing of metals	Production and processing of metals
Nemetali - Ograzden AD	IPPC A	Strumica	Plant for production of grinded and separated calcite and production of grinded and separated feldspar	Mineral industry

Detonit DOOEL	IPPC A	Radovis	Plant for prduciton of explosives	Chemical industry
Farma Agripro DOO	IPPC A	Valandovo	Intensive installations poultry or pig farming	Other activities
Elenica AD	IPPC A	Strumica	Production of clay bricks	Mineral industry
Zikol DOOEL	IPPC A	Strumica	Stationary asphalt bases and concrete bases	Mineral industry
Agromarket Igor DOOEL	IPPC A	Vasilevo	Production and packaging of liquid, granulated and crystal fertilizers	Chemical industry
Bucim DOO - mine Bucim	IPPC A	Radovis	Cooper mine	Waste management Mineral industry
Bucim DOO - production of cathode copper	IPPC A	Radovis	Copper mining complex for obtaining cathode copper	Production and processing of metals
Veterinar DOO	IPPC A	Gevgelija	Intensive installations poultry or pig farming	Other activities
Oranzerii - Hamzali	IPPC A	Bosilovo	Production of early horticultural crops	Other activities

The Table 8 is providing clear overview of the activities of the installations[15] with A and B IPPC permits. In Southeast region there are 2 installations (A IPPC) which are in the category Production and processing of metals, 11 installations (8 - B IPPC B and 3 – A IPPC) in the category Mineral industry, 2 installations (A IPPC) in the category Chemical industry, 1 installation (A IPPC) in the Waste management category and 10 installations (7 – B IPPC and 3 –A IPPC) in the categories such as poultry, greenhouses, slaughteries and food processing

The emission sources from A IPPC Installations is given below. The data for air emissions are undertaken from their Applications for A or B IPPC Permit.

		SPM Average			**CO Average**			**SO_2 Average**			**NO_x Average**			**Period of emission**
Company	Emission source	[mg/Nm^3]	[kg/h]	[kg/y]	[mg/Nm^3]	[kg/h]	[kg/y]	[mg/Nm^3]	[kg/h]	[kg/y]	[mg/Nm^3]	[kg/h]	[kg/y]	[h/y]
Nemetali Ograzden	AA1 - boiler outlet	15	0,02	24	133	0,105	126	129	0,102	122,4	80	0,063	75,6	1200
	AA2 - Drought discharge	16,07	0,023	132,48	37	0,054	311,04	14	0,02	115,2	114	0,165	950,4	5760
	AA3 - Discharge from a dusting system	7,43	0,043	247,68										5760
	AA4 - Discharge from a dusting system	18,28	0,049	282,24										5760

[15] http://www.moepp.gov.mk/wp-content/uploads/2014/09/Uredba%20za%20opredeluvanje%20na%20aktivnostite%20na%20instalaciite%20za%20koi%20se%20izdava%20integrirana%20ekoloska%20dozvola.pdf

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Oranzerii	Discharge from boiler A1				21,85	0,11	39,675	5029,6	24,34	9128,59	793,44	3,84	1440,07	375
	Discharge from boiler A2				14,42	0,07	26,17	5349,05	25,89	9708,28	820,34	3,97	1488,88	375
	Discharge from boiler A3				7,17	0,08	31,36	4813,77	56,16	21066	1038,98	12,12	4545,59	375
	Discharge from boiler A4				3,61	0,05	18,21	4839,59	65,12	24421,7	1064,96	14,33	5374,03	375
	Discharge from boiler A5				46,98	0,08	16,7	5279,71	9,39	1877,18	834,32	1,48	296,64	200
	Discharge from boiler A6				19,26	0,03	4,86	5251,19	8,83	1325,16	927,62	1,56	234,08	150
	Discharge from boiler A7				9,77	0,02	2,43	5289,95	8,78	1316,25	1020,55	1,69	253,94	150
Detonit	A1- Discharge from boiler CERTUSS tip Junior 600, 218-436 kW				33,7	0,01	11,2	80,95	0,03	33,6	349,79	0,11	123,2	1120
	A1- Discharge from the fan -				136,48	0,08	6,4	127,53	0,07	5,6	346,79	0,2	16	80

	Zagreb, Vaporax, 460 kW													
Bucim Mine	AA1 Boiler				25	0,125	730	20	0,1	584	350	1,75	10220	5840
	AA2 Cyclone of primary crushing	240,46	5,96	52209,6										8760
	AA3 Cyclone of open warehouse	25	0,1	876										8760
	AA6 Rotoclon – discharge no. 3	20	1	8800										8760
	AA8 Rotoclon 5 in secondary and tertiary crushing													5840
	AA9 Rotoclon 6 in secondary and tertiary crushing													5840
	AA10 Rotoclon 7 in secondary and tertiary crushing	20	1	8800										8760
Dojran Steel	AV-1 Furnace for heating steel beams				8,16	0,533	2987	96,4	6,534	35,294	41,3	2,8	15,12	5400

Elenica	OP1 Waste Discharge from tunnel furnace				322,5	5,6		31,46	0,54		88	1,5		

6.3.2. Environmental elaborates

According to the gatherer data from the municipalities that respond to the questionnaires', bellow is given the number of elaborates issued until 2017

Municipality	Number of elaborates
Vasilevo	4
Bosilovo	46
Dojran	25
Novo Selo	0
Strumica	347

6.4. Heating sources – residential and commercial facilities

Domestic heating along with industry and transport is one of the larger consumers of energy. Thus, emissions from sources of domestic heating form an important part of this report.

In the Southeast region 49,69% [16]are detached single-family building (where one family resides), the rest 50,31% are collective residential building. Southeast region does not have a district heating system or any larger centralized heating system, so all consumers have their own local or individual heating system.

6.4.1 Collective residential facilities

Most of the collective residential facilities in Southeast region use electricity as the energy source for household heating. Hence, they do not contribute in the regional air pollution, but rather at the place of the production of the electricity.

As the system in collective residential facilities, traditionally households use thermo-accumulative heating, but in the last few years there is a trend of installing heat pumps (mostly air to air split systems).

6.4.2. Commercial and other facilities

Commercial facilities primarily use electricity, diesel, light oil or LPG as an energy source. Systems vary from large boiler facilities (mostly old) with a Coefficient of Productivity COP of 0.8 up to modern energy efficient heat pumps with underground water cooling with COP up to 5.

[16] http://www.stat.gov.mk/Publikacii/6.4.15.03.pdf

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The commercial and other facilities such as educational institutions, administrative institutions and commercial service-institutions mainly use solid, liquid fuel or LPG for heating in the winter period. Emissions from these sources make a significant contribution to air pollution in the region.

6.4.3. Educational institutions

In Southeast region there are 15 kindergartens, 99 primary schools, 7 high schools and 1 university.

Table 9 List of educational institutions

Municipality	Name of educational institution	Address
Dojran	OOU „Koco Racin“	ul. Mosha Pijade br. 14, Dojran
Dojran	POU „Koco Racin“	Star Dojran
Dojran	POU „Koco Racin“	s. Crnicani
Dojran	POU „Koco Racin“	s. Furka
Dojran	POU „Koco Racin“	s. Gopceli
Dojran	POU „Koco Racin“	s. Kurtamzali
Dojran	POU „Koco Racin“	s. Nikolik
Bogdanci	SOU„Bogdanci“	"ul. Marshal Tito br.87,Bogdanci"
Bogdanci	OOU „Petar Musev“- Bogdanci	ul. Krushevska br.64, Bogdanci
Bogdanci	OOU „Petar Musev“- podracno uciliste	br.124 s. Gavato
Bogdanci	OOU „Kiril i Metodij“- s.Stojakovo	"ul. Marshal Tito br.60, s.Stojakovo"
Bogdanci	OOU „Kiril i Metodij“ - podracno uciliste s. Selemli	"ul. JNA br.10, s.Selemli"
Bogdanci	JOUDG „Kosta Pop Ristov – Delcev	"ul. Izvorski br. 53, Bogdanci"
Konce	OOU „Goce Delcev“	bb Konce
Konce	JPKD „Lakavica“	bb Konce
Vasilevo	JOUDG „Prva Radost“	s. Vasilevo br. 373
Vasilevo	OOU „Atanas Nivicanski“	s. Nova Maala
Vasilevo	OOU „Goce Delcev“	s. Vasilevo
Vasilevo	PU „Goce Delcev“ Angelci	s. Angelci
Vasilevo	PU „Goce Delcev“ Vladevci	s. Vladevci
Vasilevo	PU „Goce Delcev“ Susevo	s. Susevo
Vasilevo	PU „Goce Delcev“ Radicevo	s. Radicevo
Vasilevo	PU „Goce Delcev“ Dukatino	s. Dukatino
Vasilevo	PU „Goce Delcev“ Edrenikovo	s. Edrenikovo
Vasilevo	PU „Goce Delcev“ Sedlarci	s. Sedalrci
Vasilevo	JPKD Turija	s. Vasilevo
Strumica	POU „Marsal Tito“ - s. Murtino	s. Murtino

Strumica	POU „Marsal Tito“ - s. Sacevo	s. Sacevo
Strumica	OOU „Dame Gruev“	s. Kuklish
Strumica	OOU „Sv. Kiril i Metodij“	s. Dabilje
Strumica	OOU „Geras Cunev“	s. Prosenikovo
Strumica	OU Bansko	s. Bansko
Strumica	OU Gabrovo	s. Gabrovo
Strumica	OU Dobrejci	s. Dobrejci
Strumica	OU Banica	s. Banica
Strumica	OU Veljusa	s. Vequsha
Strumica	OU Vodoca	s. Vodoca
Strumica	OU Kosturino	s. Kosturino
Strumica	OU Popcevo	s. Popcevo
Strumica	OU Ric	s. Ric
Strumica	JOUDG „Detska Radost“ K-1	Koco Racin br.7
Strumica	JOUDG „Detska Radost“ K-2	ul. Guro Salaj br.2
Strumica	JOUDG „Detska Radost“ K-3	ul Mladinska br.1
Strumica	JOUDG „Detska Radost“ K-4	Braka Miladinovo bb
Strumica	JOUDG „Detska Radost“ K-5	s. Novo Selo
Strumica	JOUDG „Detska Radost“ K-6	Mladinska br.122
Strumica	Univerzitet „Goce Delcev“	bul. Goce Delcev bb
Strumica	Muzicko uciliste „Boro Xoni“	ul. Gorgi Trajkov bb
Strumica	Gimnazija „Jane Sandanski“	Ploshtad Goce Delcev bb
Strumica	Sredno tehnicko „Nikola Karev“	ul. Marshal Tito bb
Strumica	Sredno zemjodelsko „Dimitar Vlahov“	ul. Mito Haxivasilev Jasmin bb
Strumica	OOU „Vidoe Podgorec“	ul. Prvi Maj bb
Strumica	OOU „Nikola Vapcarov“	ul. Mladinska bb
Strumica	OOU „Sando Masev“	ul. Mosha Pijade br. 2
Strumica	OOU „Marsal Tito“	ul. Sv. Kiril i Metodij bb
Gevgelija	OU „Krste Misirkov“ – Gevgelija	ul. Petar Musev br. 22
Gevgelija	PU „Krste Misirkov“ – s. Moin	s.Moin
Gevgelija	OU „Vlado Kantarxiev“ – Gevgelija	ul. Ljubljanska br. 4
Gevgelija	PU „Vlado Kantarxiev“ – s. Bogorodica	s.Bogorodica
Gevgelija	PU „Vlado Kantarxiev“ – s. Mrzenci	s.Mrzenci
Gevgelija	PU „Risto suklev“ – s. Negorci	Marshal Tito bb, Negorci
Gevgelija	PU „Risto suklev“-s.Prdejci	s.Prdejci
Gevgelija	OU „Kliment Ohridski“ -s.Miravci	s.Miravci
Gevgelija	PU „Kliment Ohridski“ -s.Miletkovo	s.Miletkovo
Gevgelija	PU „Kliment Ohridski“ -s.Smokvica	s.Smokvica
Gevgelija	PU „Kliment Ohridski“ -s.Davidovo	s.Davidovo
Gevgelija	SOU „Josif Josifovski“ Gevgelija	ul. Makedonija br.1
Gevgelija	JOUDG „Detska Radost“ – Centralna gradinka	ul. Goce Delcev br. 16
Gevgelija	JOUDG „Detska Radost –Soncogledi“	ul. Risto Janev br. 12

Gevgelija	JOUDG „Detska Radost –Cvetovi“	ul. Ilindenska br. 16
Radovis	SOU „Kosta Susinov“	Kej “8-mi Septemvri”bb
Radovis	OU „Nikola Karev“	Kej “8-mi Septemvri”bb
Radovis	PU „Nikola Karev“ – Raklis	s. Raklish
Radovis	PU „Nikola Karev“ – Topolnica	s. Topolnica
Radovis	PU „Nikola Karev“ – Bucim	s. Bucim
Radovis	PU „Nikola Karev“ – Parnalija	s. Parnalija
Radovis	OU „Krste Petkov Misirkov“	Bul. „Aleksandar Makedonski “ bb
Radovis	OU „Kiril i Metodij“	s. Oraovica
Radovis	OU „Kosta Racin“	s. Podaresh
Radovis	OU „Orce Nikolov“	s. Injevo
Radovis	JOUD „ACO KARAMANOV“ -Upravna zgrada	ul. ,,Aco Karamanov,, br. 54
Radovis	JOUD „ACO KARAMANOV“ – Cvetovi	ul. ,,Ilija Aleksov,, bb
Radovis	JOUD „ACO KARAMANOV“ - Detsko izvorce	Ploshtad „Sloboda“ br. 10
Bosilovo	OU „Goce Delcev“	s. Bosilovo
Bosilovo	PU „Goce Delcev“ – Ednokukevo	s. Ednokukevo
Bosilovo	PU „Goce Delcev“ – Robovo	s. Robovo
Bosilovo	PU „Goce Delcev“ – Petralinci	s. Petralinci
Bosilovo	PU „Goce Delcev“ - Staro Baldovci	s. Staro Baldovci
Bosilovo	PU „Goce Delcev“ – Drvos	s. Drvosh
Bosilovo	PU „Goce Delcev“ – Saraj	s. Saraj
Bosilovo	PU „Goce Delcev“ – Gecerlija	s. Gecerlija
Bosilovo	OU „Sv. Kiril i Metodij“	s. Ilovica
Bosilovo	PU „Sv. Kiril i Metodij“ – Turnovo	s. Turnovo
Bosilovo	PU „Sv. Kiril i Metodij“ – Sekrinik	s. Sekirnik
Bosilovo	PU „Sv. Kiril i Metodij“ – Radovo	s. Radovo
Bosilovo	OU „Boris Trajkovski“	s. Monospitovo
Bosilovo	PU „Boris Trajkovski“ –Borievo	s. Borievo
Novo Selo	OU „Vidoe Podgorec“	s. Koleshino
Novo Selo	PU „Vidoe Podgorec“ – Mokrino	s. Mokrino
Novo Selo	PU „Vidoe Podgorec“ – Mokrievo	s. Mokrievo
Novo Selo	OU „Manus Turnovski“	s. Novo Selo
Novo Selo	PU „Manus Turnovski“ – Susica	s. Sushica
Novo Selo	PU „Manus Turnovski“ – Zubovo	s. Zubovo
Novo Selo	PU „Manus Turnovski“ – Samoilovo	s. Samoilovo
Novo Selo	PU „Manus Turnovski“ - Novo Kowarevo	s. Novo Kowarevo
Novo Selo	PU „Manus Turnovski“ - Staro Kowarevo	s. Staro Kowarevo
Novo Selo	PU „Manus Turnovski“ - Dra`evo	s. Drazevo
Novo Selo	PU „Manus Turnovski“ – Smolari	s. Smolari
Novo Selo	Posebno Osnovno Uciliste „Sveti Kliment Ohridski“	s. Novo Selo
Valandovo	OOU „Straso Pinxur“	s. Josifovo

Valandovo	PU „29-ti Noemvri“ – Kalkovo	s. Kalkovo
Valandovo	PU „Jane Sandanski “ – Grciste	s. Grcishte
Valandovo	PU „Mito Simeonov“ – Marvinci	s. Marvinci
Valandovo	PU„Straso Pindjur“ – Udovo	s. Udovo
Valandovo	SOU„Goce Delcev“	Valandovo
Valandovo	OOU „Josip Broz Tito “	Valandovo
Valandovo	PU „Goce Delcev“ – Pirava	s. Pirava
Valandovo	PU „Dame Gruev“ – Brajkovci	s. Brajkovci
Valandovo	PU „Nam’k Kemal“ – Calakli	s. Calakli
Valandovo	PU „Jeni Gun“ – Basibos	s. Bashibos
Valandovo	PU „Mosa Pijade“ – Dedeli	s. Dedeli
Valandovo	PU „Cvetan Dimov“ – Kazandol	s. Kazandol

6.4.4. Administrative institutions

Is Southeast region there are 41 administrative buildings (municipality buildings, theaters, houses of culture, museums etc.) The list of administrative institution is given bellow:

Table 10 List of administrative institutions

Municipality	Name of administrative institution	Address
Dojran	Opstinska zgrada	Kej 5-ti Noemvru bb
Bogdanci	Opstinska zgrada	ul. Marshal Tito br. 62
Konce	Opstina Konce	bb Konce
Konce	Maticno oddelenie	bb Konce
Vasilevo	Opstina Vasilevo	s. Vasilevo bb
Strumica	Opsta Bolnica Strumica	ul. Mladinska br. 2
Strumica	JZU „Zdravstven Dom i del od stara bolnica - Usno, Ocno, Stomatologija	ul. Dimitar Vlahov br. 36
Strumica	Centar za mentalno zdravje i del od Opsta Bolnica Neuro – Psihijatrija	ul. Spiro Zahiv bb
Strumica	Ministerstvo za vnatresni raboti SVR Strumica	ul. Nikola Tesla bb
Strumica	NUCK Dom na kultura „Anton Panov“	Ploshtad Goce Delcev bb
Strumica	Zavod za vrabotuvanje Strumica	ul. Prvi Maj br. 36
Strumica	Osnoven Sud Strumica	bul. Leninova br. 6
Strumica	JPKD „Komunalec“ Strumica	ul. 24 Oktomvri br. 2
Strumica	Muzej na Opstina Strumica	ul. 27mi Mart br. 2
Strumica	Zgrada na Opstina Strumica	ul. Sando Masev br.1
Strumica	Dom na ARM	ul. Blagoja Muceto bb
Strumica	Biblioteka	ul. Blagoja Muceto bb
Gevgelija	Opstina Gevgelija	ul. Dimitar Vlahov br. 4
Gevgelija	TPPE-Gevgelija	ul. 7-mi Noemvri bb

Gevgelija	Naroden teatar Gevgelija	
Radovis	Opstina Radovis	Bul. „Aleksandar Makedonski“ br. 7
Radovis	JP „Plavaja“	Ul. „Sv.Spaso Radovishki“ Br.32
Radovis	JP „Makedonski sumi“ podru`nica Plackovica	
Radovis	Osnoven sud-Radovis	22-ri Oktomvri b.b.
Radovis	Oddelenie za katastar na nedviznosti Radovis	22-ri Oktomvri b.b.
Radovis	OVR Radovis	Kej “8-mi Septemvri”bb
Radovis	Danocno oddelenie Radovis	ul. „22-ri Oktomvri“ bb
Radovis	Zdravstven dom-Radovis	Bla`e Koneski 1
Radovis	"Fond za PIOM-Radovis"	Ana Pockova 1
Radovis	Opstinska ustanova CK Aco Karamanov – Radovis	
Radovis	Opstinskata narodna biblioteka ,,Braka Miladinovci“ – Radovis	
Radovis	TPPE Radovis	ul. Ilindenska bb.
Bosilovo	Opstina Bosilovo	s. Bosilovo
Bosilovo	JPKD „Ogra`den“	s. Bosilovo
Novo Selo	JKPD „Komuna“	s. Novo Selo
Novo Selo	Policiskata stanica za granicna kontrola	s. Novo Selo
Novo Selo	Policiskata stanica	s. Novo Selo
Novo Selo	TPPE Novo Selo	s. Novo Selo
Novo Selo	Opstinska zgrada	s. Novo Selo
Valandovo	Opstina Valandovo	Valandovo
Valandovo	"Regionalen centar za sertifikacija"	Valandovo

6.4.5. Commercial-service institutions

The category commercial-service institutions include 20 major banks, 2 branch offices of the Macedonian post, 3 branches from mobile providers and 3 insurance companies branches. Furthermore, there are 37 hotels located in the Southeast region.

Table 11. Table of Commercial-services institutions

Hotels		
Municipality	Name of hotel	Address
Strumica	Bela voda	Kliment Ohridski 4
Strumica	Car Samoil	s.Bansko b.b
Strumica	Central	Marsal Tito 2
Strumica	Emi	Goce Delcev 49
Strumica	Esperanto	Josif Josifovski Svestarot 2
Strumica	Hotel Gligorov	Sv.Kliment Ohridski b.b

Strumica	Ilinden	Goce Delcev b.b
Strumica	Saint George	Kliment Ohridski 105
Strumica	Sirius	Marsal Tito 195
Strumica	Studio-in	Gjorgji Vasilev 97
Strumica	Tiveriopol	Bratstvo Edinstvo 20
Strumica	Vila Park	Blagoj Jankov-Muceto 5
Vasilevo	Miss Stone	s. Vasilevo
Gevgelija	Apollonia Hotel & Casino	Gevgeliski Partizanski Odredi 1
Gevgelija	Ramada plaza Hotel & Princess Casino	Granicen premin Bogorodica
Gevgelija	Hotel sky	Granicen premin Bogorodica 8-b
Gevgelija	Flamingo Hotel Casino	Granicen premin Bogorodica
Gevgelija	Asikot	Gevgeliski Partizanski Odredi 2
Gevgelija	NAR	Mrzenski pat 17
Gevgelija	Kala	s. Negorci
Gevgelija	Jasen	s. Negorci
Gevgelija	Bozur	s. Negorci
Gevgelija	Paint it Black	Deko Kovacev 3
Gevgelija	Silhouette	Hotel Princess, prizemje
Radovis	Bel kamen	Pljackovica b.b.
Radovis	Diamond exclusive	Spaso Radoviski 1
Valandovo	RC Izvor	Lazar Kolisevski 57
Dojran	Hotel Makedonija	Marshal Tito 46
Dojran	Prestige	Marsal Tito b.b
Dojran	Hit International	Karac 1
Dojran	Rojal	Marsal Tito 17
Dojran	Polin	Marsal Tito 11
Dojran	Romantik	Marsal Tito 19
Dojran	Makoil	Marsal Tito b.b
Dojran	Beton	Marsal Tito 1
Dojran	Izgrev-vila Marija	Kuzman Josifovski Pitu 1
Dojran	Istatov	Marsal Tito b.b.
Post offices		
Strumica	Strumica	ul. Marsal Tito br. 22
Gevgelija	Gevgelija	ul. Marsal Tito br. 24
Banks		
Bogdanci	STB - Bogdanci	ul. Marsal Tito br. 24
Valandovo	STB - Valndovo	ul. 6-ti Noemvri
Gevgelija	STB - Gevgelija	Plostad Sloboda bb
Radovis	STB - Radovis	22 Oktomvri 42a
Novo Selo	STB - Novo Selo	ul. Marsal Tito br. 49

Strumica	STB - Strumica	ul. Leninova 19
Radovis	Komercijalna Banka - Radovis	ul. 22 Oktovmri br. 19/2
Bogdanci	Komercijalna Banka - Bogdanci	ul. Marsal Tito br. 107
Gevgelija	Komercijalna Banka - Gevgelija	Gevgeliski Partizanski Odredi 4/2-1
Strumica	Komercijalna Banka - Strumica	ul. Marsal Tito br. 16
Strumica	Sparkasse banka - Strumica	ul. Marsal Tito bb
Gevgelija	Sparkasse banka - Gevgelija	ul. Dimitar Vlahov br. 7/3
Strumica	Ohridska Banka - Strumica	Leninova 17
Gevgelija	Ohridska Banka - Gevgelija	ul. Marsal Tito br. 126
Gevgelija	Silkroad banka - Gevgelija	ul. Marsal Tito br. 110
Strumica	Silkroad banka - Strumica	ul. Leninova 100
Radovis	NLB Tutunksa - Radovis	22 Oktomvri bb
Strumica	NLB Tutunksa - Strumica	ul. Blagoj Muceto bb
Valandovo	NLB Tutunksa - Valandovo	ul. Mosa Pijade br. 2
Gevgelija	NLB Tutunksa - Gevgelija	ul. Dimitar Vlahov br. 7
Mobile providers		
Strumica	A1 - Strumica	ul. Marsal Tito br. 5/5-1
Strumica	A1 - Radovish	ul. Marsal Tito br. 1
Gevgelija	A1 - Gevgelija	ul. Dimitar Vlahov bb
Radovis	Telekom - Radovis	22 Oktomvri br. 78
Strumica	Telekom - Strumica	ul. Marsal Tito bb
Gevgelija	Telekom - Gevgelija	ul. Marsal Tito bb
Insurance companies		
Radovis	Triglav - Radovis	
Strumica	Triglav - Strumica	
Gevgelija	Triglav - Gevgelija	

6.4.6. Individual residential facilities

Individual residential facilities consist of one to three households, often with each having an individual heating system. Most of them are using traditional biomass heating – with wood as a primary energy source for heating although in the last few years there is a trend of new buildings using heat pumps.

Most of the furnaces and boilers used for heating in the Southeast region belong to one of the following groups:

- Traditional stoves. These have a poorly organized combustion process resulting in low efficiency (40 % to 50 %) and significant emissions of pollutants mainly originating from incomplete combustion (TSP, CO, NMVOC and PAH). Their autonomy (i.e. the ability to operate without user intervention) is low, lasting from three to eight hours. Those, which are equipped with hot-plate zones, are used also

for cooking. Some are also used to provide hot water. Many households use such systems.

- Energy efficient conventional stoves. Essentially, traditional stoves with improved utilization of secondary air in the combustion chamber. Their efficiency is between 55 % and 75 % and emissions of pollutants are lower and their autonomy of use ranges from 6 to 12 hours.
- Advanced combustion stoves. These stoves are characterized by multiple air inlets and pre-heating of secondary combustion air by heat exchange with hot flue gases. This design results in increased efficiency (close to 70 % at full load) and reduced CO, NMVOC and TSP emissions in comparison with the conventional stoves. Most ecolabelled stoves burning woodlogs are advanced combustion stoves. Very few households use these systems.
- Modern pellet stoves. Use of modern pellet stoves is a developing trend in the country because of the convenience of the automation of the process. This is a type of advanced stove, using pelletized fuels such as wood pellets, which are distributed to the combustion chamber by a fuel feeder fed from a small fuel storage. Modern pellets stoves are often equipped with an active control system for supply of the combustion air. They reach high combustion efficiencies by providing the proper air/fuel mixture ratio in the combustion chamber at all times (CITEPA, 2003). For this reason they are characterized by high efficiency (between 80 % and 90 %) and low emissions of CO, NMVOC, TSP and PAH.
- Small wood fired central heating systems. Some individual buildings use small boilers fired by wood logs for central heating. These can be divided into two broad categories regarding the organisation of combustion process: overfeed and underfeed boilers. They can be further differentiated as conventional and advanced combustion boilers.

Additional survey within the TRAP project will be conducted in order examining the number and capacity of the abovementioned types of heating appliances in the households. The results from this survey will be published in a separated document.

According to the survey “Energy consumption in households 2014” that has been conducted in 2015 by the *State Statistical Office* and published in 2016, the total number of households in the Southeast region is 48.956.

Most households (Figure 15) use solid or liquid fuel stoves (79.53%) as their main heating source, with storage heaters (thermal heaters) are heating (11.46%), while a smaller number of households use Central heating with a boiler installation in the apartment and air conditioners and inverters.

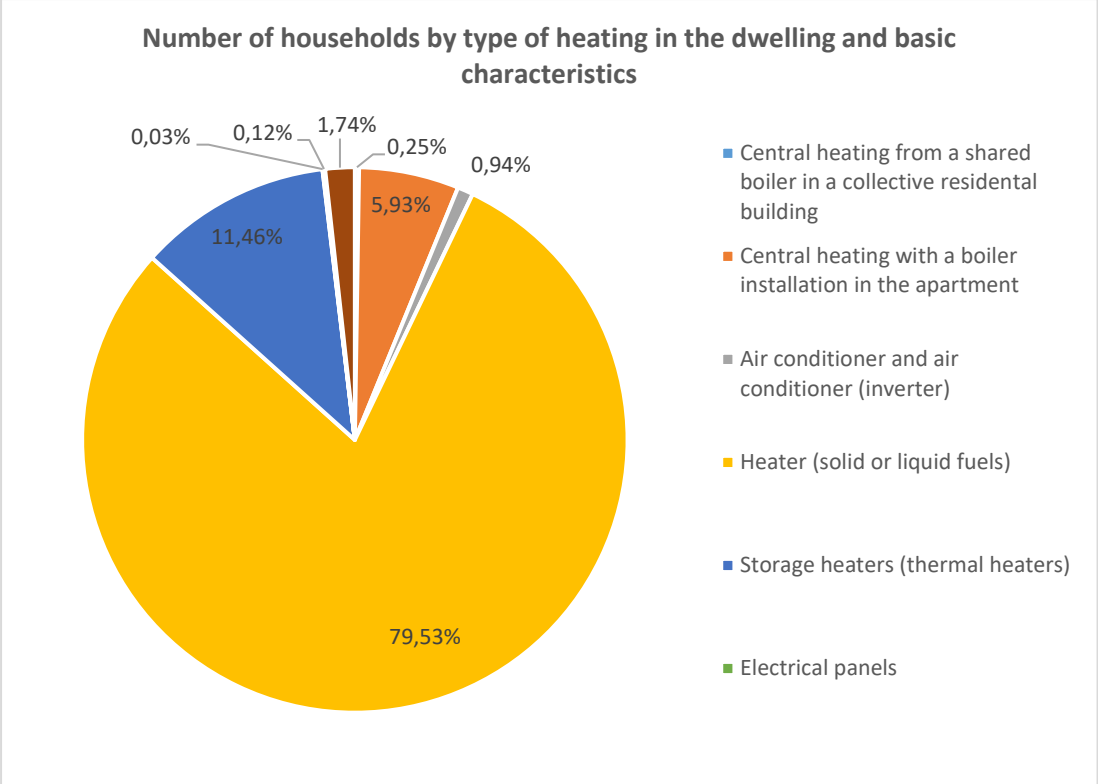

Figure 15 Number of households by type of heating in the dwelling and basic characteristics

The most commonly used primary heating energy is fuelwood (about 85%), followed by electricity (12%), wood waste, wood briquettes and pellets (2%) and LPG gas (1%).

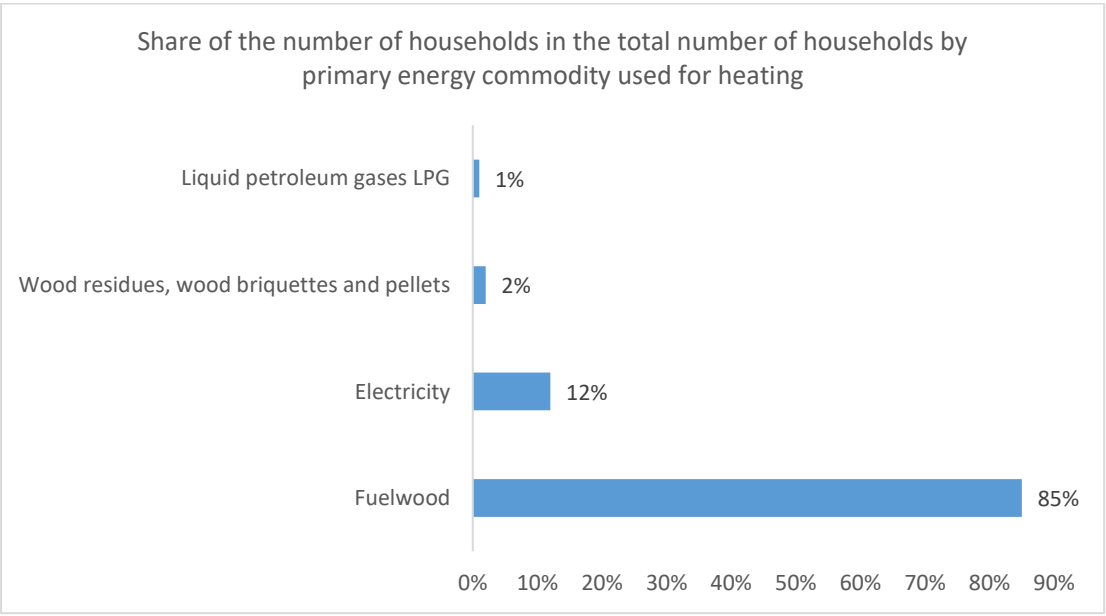

Figure 16 Share of the number of households in the total number of households by primary energy commodity used for heating

According to these data, the use of fuelwood in the Southeast region is primary solution and this may have a significant contribution to air pollution, especially PM10.

Heating degree days

The heating season starts as early as October and can last until April. The coldest period is late December, January and February. The Report from the conducted survey for air emissions from household heating for South-eastern region shows that primary fuel for heating in households in the Southeast region is the firewood. Table 12 shows the estimated energy consumption for the Southeast region.

Table 12 Energy consumption inthe Southeast region

TYPE OF FUEL	QUANTITY
Wood (m^3)	347.510,00
Pellets (t)	21.838,00
Briquettes (t)	322,00
Extra light (t)	378,00
TNG (kg)	464.480,00

6.5. Transport

According to the data from the Ministry of Environment and Physical Planning (Figure 178) shows the type of vehicles registered in the Southeast region, where it is noted that the largest share have passenger cars with 87.9%.

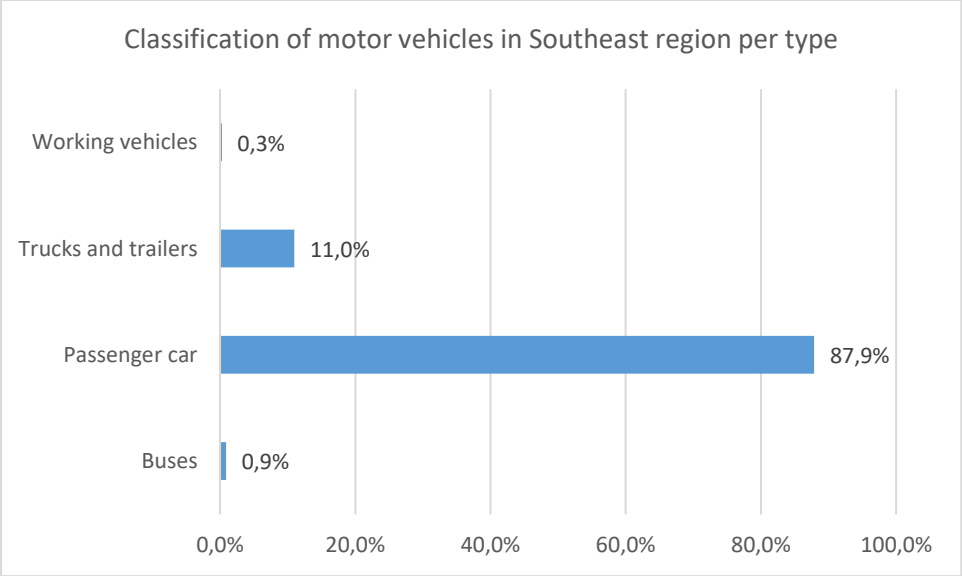

Figure 17 Classification of motor vehicles in Southeast region per type

Figure 189 shows the distribution of vehicles by fuel type, where it can be seen that in the Southeast planning region most vehicles use diesel as fuel (59%), while vehicles using gasoline are 39% and the remaining 2 % of vehicles use LPG.

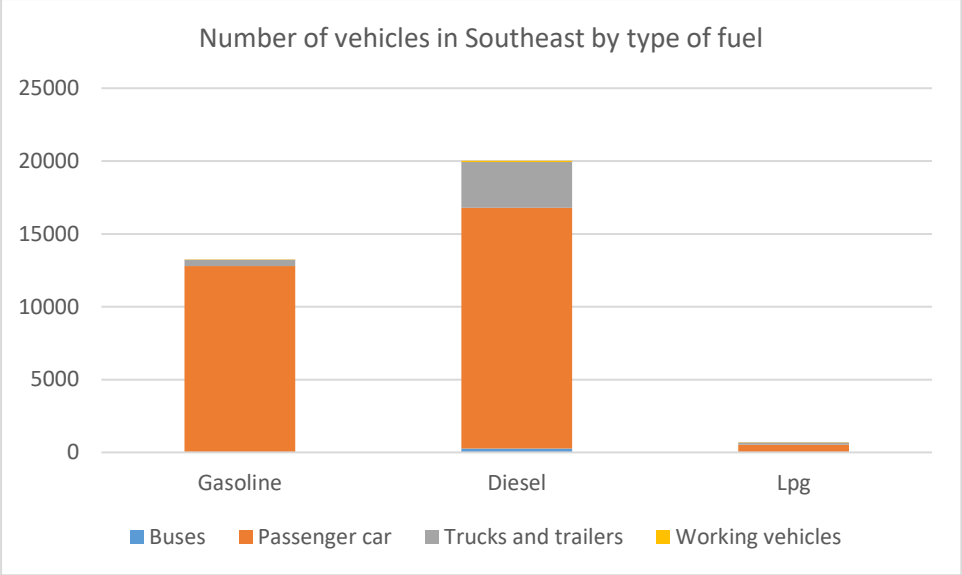

Figure 18 Number of vehicles in Southeast by type of fuel

Figure 19 shows that in the Southeast Planning Region, 55% of motor vehicles are classified in Euro 0 (pre-Euro), Euro 1 and Euro 2. This means that for the most part the fleet consists of vehicles with more than 15 years of activity. Statistics for the bus sector show that 15% of vehicles are classified as Euro 0 (more than 20 years of activity).

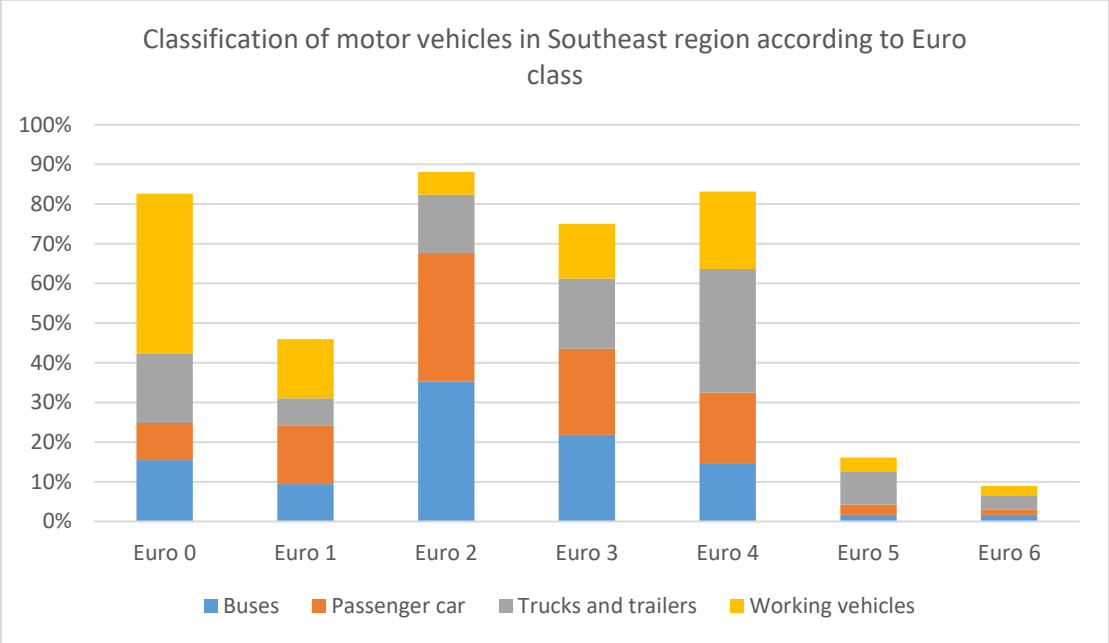

Figure 19 Classification of motor vehicles in Southeast region according to Euro class

Most of the vehicle (Figure 20) in the Southeast region has higher emission factors, only a very small proportion of vehicles (5%) meet Euro 5 and 6 standards.

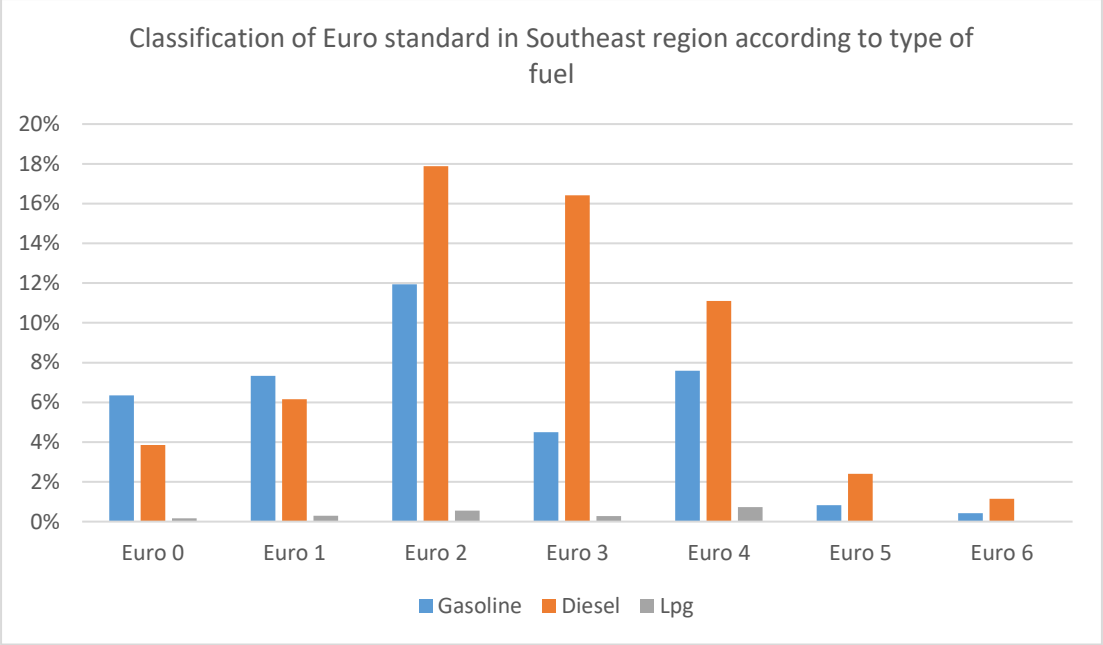

Figure 20 Classification of Euro standard in Southeast region according to type of fuel

6.6. Other sources (Agriculture, Waste, Constructions)

6.6.1. Agriculture

The Southeast region is the most well-known and most developed region in terms of production of early fruit and vegetables and their processing. The region has a total agricultural area of 37.852 hectares, which is 11,7% of the total agricultural area in the Republic of Macedonia. The total used land amounts to 32.078 hectares, which expressed in percentage equals 12,1% of the total used land in the Republic of Macedonia. From the perspective of use of agricultural land, agricultural area in the Southeast region has a share of 8.83% in the total area on national level. The region features a high degree of scattered land plots. Taking into account that they are predominantly privately owned, it may be concluded that they can be the subject of conversion of agricultural crops, thus changing the structure which contributes to the creation of greenhouse gases, but also directly endangering the environment by means of using agrochemical products. The involvement of agriculture in environmental protection is in direct correlation to the way how land is cultivated, types of agricultural crops and their treatment. In addition, conversion of forests into agricultural land has a large influence. In this segment, agriculture is also related to the energy system, taking into account that wood mass is the most used biomass for household heating. Furthermore, it is being used for heating agricultural plastic and glass greenhouses, but it should be emphasised that here is where coal and petroleum jelly are most used. The sector of agriculture is at the same time the second biggest producer of solid waste (animal and plant) after the mining sector. By applying good agricultural practice, the Southeast region may drastically change its image when it comes to pollution. This is as a result of the possibility to

use animal and plant tissues, which are by-products, in the process of creation and exploitation of renewable energy. Unfortunately, the region does not pay enough attention to creating facilities which would treat and deposit such waste.

The Southeast region is the most significant agricultural region in the Republic of Macedonia. It has a total agricultural area of 37.852 hectares, which is 11,7% of the total agricultural area in the Republic of Macedonia. The total land used amounts to 32.078 hectares, which expressed in percentage equals 12,1% of the total used land in the Republic of Macedonia.

The area of used agricultural land, as well as its structure, is given in the following table:

Table 13. Agricultural land by category of use in hectares

	Agricultural area – total	**Cultivated land**	**Arable land and gardens**	**Orchards**	**Vineyards**	**Meadows**	**Pastures**
2015							
Republic of Macedonia	1 264 408	513 564	415 004	15 856	23 240	59 464	750 359
Southeast region	124 306	58 962	49 241	1 925	5 710	2 086	65 219
%							
2016							
Republic of Macedonia	1 267 134	516 644	417 456	16 138	23 613	59 437	749 772
Southeast region	124 096	58 805	48 815	2 129	5 766	2 095	65 171
%							
2017							
Republic of Macedonia	1 266 008	516 870	416 709	16 546	23 703	59 912	748 413
Southeast region	124 017	59 534	48 944	2 233	5 876	2 481	64 360
%							

The data on the number of livelihoods in the South-East region are obtained from the Makstat database by the Central Bureau of Statistics. Below is the total number of income, poultry and bee families for the South East region for 2017.

	Horses	Cattle	Pigs	Sheep	Goats	Poultry	Beehives
Southeast Region	**5 017**	**30 618**	**15 032**	**75 117**	**20 551**	**111 065**	**3 781**

6.6.2. Waste

Waste in the Southeast region

The average amount of municipal waste generated in the region totals 348 kg per capita per year, where the average for urban settlements is 449, and for rural 218 kilograms per capita per year. These figures are higher than the national average of 300 kg per inhabitant per year for urban and 200 kg per capita for rural settlements.

According to the regional waste management plan[17] for the southeast planning region, the amounts of waste generated by municipalities in the Southeast planning region are given in table below.

Municipality	Waste (t/y)	Percent
Gevgelija	10.333	19%
Valandovo	3.428	6%
Radovis	6.860	12%
Strumica	23.743	43%
Konce	955	2%
Novo Selo	2.314	4%
Bosilovo	2.405	4%
Vasilevo	2.425	4%
Dojran	969	2%
Bogdanci	1.678	3%
TOTAL	**55109,52821**	100%

Table 14 Waste generated in Southeast region[v]

From the Table 14 it can be noticed that 75% of the total amount of waste is generated by the urban municipalities of Strumica, Gevgelija and Radovish, where municipality of Strumica is creating almost half of the total amount of generated waste in the Southeast region.

Figure 21 shows a comparison between the generated and collected waste in the Southeast Planning Region.

[17] http://www.moepp.gov.mk/wp-content/uploads/2014/12/Regionalen-plan-za-jugoistocen-region.pdf

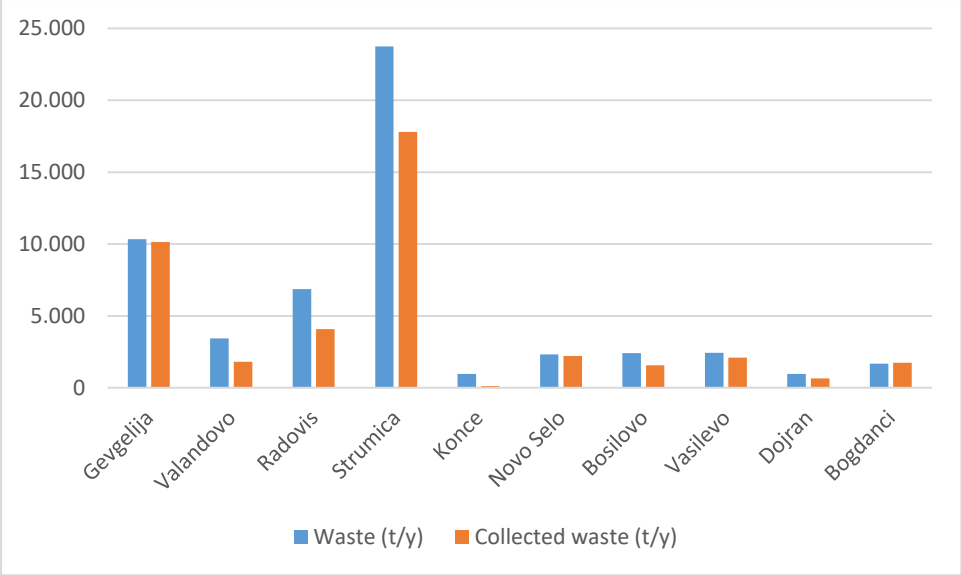

Figure 21 Comparison between the generated and collected waste in the Southeast Planning Region

In Table 156 are given the amounts of waste per municipality by fractions (in tonnes / year):

Table 15 Amounts of waste per municipality by fractions

Municipality	Biodegradable	Paper and Cardboard	Plastic	Glass	Textiles	Metal	Non-metal	Hygienic	Inert waste	Hazardous waste	Remains
Gevgelija	3799	2037	1365	131	607	62	367	318	583	337	728
Valandovo	1076	690	508	300	215	47	71	52	196	0	272
Radovis	2539	566	841	610	70	32	109	878	876	29	310
Strumica	10096	2410	2478	2555	168	100	544	2885	993	341	1174
Konce	371	96	123	34	0	0	93	50	139	0	49
Novo Selo	870	373	216	445	127	9	22	30	92	29	100
Bosilovo	789	533	385	190	6	35	56	123	133	53	102
Vasilevo	1181	64	46	23	1	4	7	15	16	6	12
Dojran	340	158	111	38	31	8	53	42	44	17	126
Bogdanci	772	77	278	46	174	23	43	45	115	8	100
Total	21834	7004	6349	4373	1398	320	1364	4438	3186	820	2974

Collection, transport and landfilling of waste in the Southeast region

Collection of waste

Most of the municipalities in the region use three types of waste containers: 1,100 liters (1.1 m^3), 120 liter metal or plastic bins, and 80 liter old metal bins. Also, some municipalities use large metal open containers with a volume of 5 to 7 m^3. The 1.1 m^3 containers are the most widely used in residential areas where multi-storey buildings dominate, while 120 liter cans and metal bins are used by private households. The 1.1 m^3 containers, together with the large metal open containers with a volume of 5 m^3, are used by large public institutions and industry.

The incidence of waste collection varies depending on the size of the city and the size of the waste collection container. In the central parts of the larger cities (Strumica, Gevgelija, Radovis, Valandovo), the frequency of waste collection is 6 times per week. In suburban areas,

urban waste is collected two times per week, while in smaller rural settlements, waste is usually collected once a week. It has been said that the present incidence of waste collection - in those cities and places where organized waste collection is satisfactory; however, the largest problem remains the large number of settlements are not part of the existing waste management service.

Transport of waste

As far as waste vehicles are concerned, most of the "small" municipalities use "traditional" trucks or tractors that transport non-compacted waste, while larger municipalities (urban cities) also use the vehicles as the “small” municiplaties, as abn addition they use modern day compactors with a volume of 5 up to 15 m^3. To a large extent, the driving park is quite outdated, with the majority of trucks aging at the age of 15 and at the end of their working lives, which creates exceptionally high costs for operation and maintenance. The collected waste is transported directly to the nearby landfill.

Table 16 Vehicles that are used to collect and transport waste in the South-East Region

Municipality	Waste collection vehicles			
	Truck, tractor, trailer	Compactor vehicles	Vehicles for big metal open containers	Total volume of equipment for transport (m^3)
Radovis	2	3		64
Konce	2			10,5
Valandovo	1	1		8,5
Gevgelija	2	5		48
Bogdanci	2			5
Dojran	2	2		20
Strumica	2	5	1	89
Vasilevo	1			2,5
Bosilovo	1			2,5
Novo Selo	2			5
TOTAL	**17**	**17**	**1**	**255**

Waste lanfilling

As in other parts of the country, each settlement, town and village in the region has its own landfill or dump, and most settlements have several. Apart from landfills used by larger cities and run by responsible public enterprises, often referred to as "municipal landfills", the locations / landfills used by the villages are not regulated, although some of them are permitted by municipal councill to function as official waste disposal sites. The list of official municipal landfills in the region is given in the Table 17. Existing landfill waste management practices throug the Southeastern region are extremely low. Even official municipal landfills cannot be categorized as sanitary landfill. Solid waste is usually dumped right to the line (edge)

where the location / illegal landfill begins. In some cases, although very rarely, a bulldozer is used to compact (dispose of) the disposed waste and cover part of the deposited waste. However, in all cases there does not seem to be an available amount of soil to create a waterproof cover on the waste, which leads to significant amounts of deposited solid waste always being in open contact with the atmosphere. Spontaneous fires at landfills are common. Apart from the municipal landfill in Gevgelija and the industrial landfill "Trkanja" near Strumica, all other locations are not fenced.

Table 17 Official municipal landfills in the Southeast region

Municipality	Name od the landfill	Year of establishment
Radovis	River Susica, Radovis	1963
Konce	Krst Cuka	2004
Valandovo	Suva Reka, Valandovo	1962
Gevgelija	Suva Reka, Gevgelija	1976
Gevgelija, construction waste	Suva Reka, Gevgelija	/
Bogdanci	Brdanov Kamen, Bogdanci	1985
Dojran	Dikiltas	1980
Dojran	Karac	/
Strumica	Sapkar, Dobrasinci	1992
Strumica, industrial waste	Trkanja, Strumica	1998
Vasilevo	Vasilevo	1996
Novo Selo	Solena Reka, Novo Selo	2004

6.6.3. Construction

Number of completed and uncompleted constructions, according to their type, built by business entities, 2015, 2016, 2017. In the Southeast region the number of constructed buildings in 2017 is for 200% incresed copmpare to year 2015.

Table 18 Number of completed and uncompleted constructions

Types of constructions	2015	2016	2017
Buildings			
Total	25	54	79
Completed	12	33	46
Civil engineering			
Total	24	81	73
Completed	19	48	48
Reconstruction, renovation, adaptation, major repairs of buildings			
Total	82	62	75

Completed	67	55	72
Construction works			
Total	91	70	41
Completed	75	64	39

On Table 19 are shown issued building permits, by number, type and investor, from the table it can be noticed that the number of permits is increasing, that leads to increased emission for construction activities.

Table 19 Issued building permits, by number, type and investor in Southeast region

Year	Issued building permits
2012	295
2013	216
2014	268
2015	319
2016	371
2017	385

7. Conclusions

Southeast region is specific with its geographical location and long hot summers, high average daily temperatures and reduced amount of precipitation. It has 230 sunny days and is one of the sunniest region in the whole country. The wind rose is also favourable which enables constant air flow from north to south and vice versa. The abundance of natural resources is precondition for many agricultural activities which makes this region for one of the most valuable for production of vegetable crops. Even though the region is rich with mineral resources besides the Buchim mine, there are no other similar activities such as excavation or ore processing.

The identification of emission sources shows that most of the industrial activities are in the industry of metal production and processing including mineral industry. There is also significant amount of installations for food processing such as poultry and pig farms, slaughterers, food processing, greenhouses, production of dairy products etc. However, most of them are not conducting regular monitoring so the air emissions data are not available.

In regards to administrative and commercial building their identification is complete, but there is lack of data for the square meters and type of fuel. Considering the fact that Southeast region is not connected to any district heating networks we can conclude that administrative and commercial building as well as educational institutions and households are using either electricity either heating appliances running on biomass or mazute for heating purposes.

The report on identification of emission sources should serve as basis for doing the calculations of air emissions from all identified sources and developing air emission inventory. The inventory will indicate where the air pollution comes from and will assist at developing short term and long term measures for reducing the air pollution in the Southeast region.

References

[i] Report, Review of Air Quality in Tetovo
[ii] http://air.moepp.gov.mk/?page_id=272&lang=en
[iii] EMEP/EEA air pollutant emission inventory guidebook 2016, EEA report, No 21/2016
[iv] Annual Report on Environmental Quality, Ministry of Environment and Physical Planning, Skopje 2018
[v] Регионален план за интегриран систем за управување со отпад во Југоисточен регион, март 2017