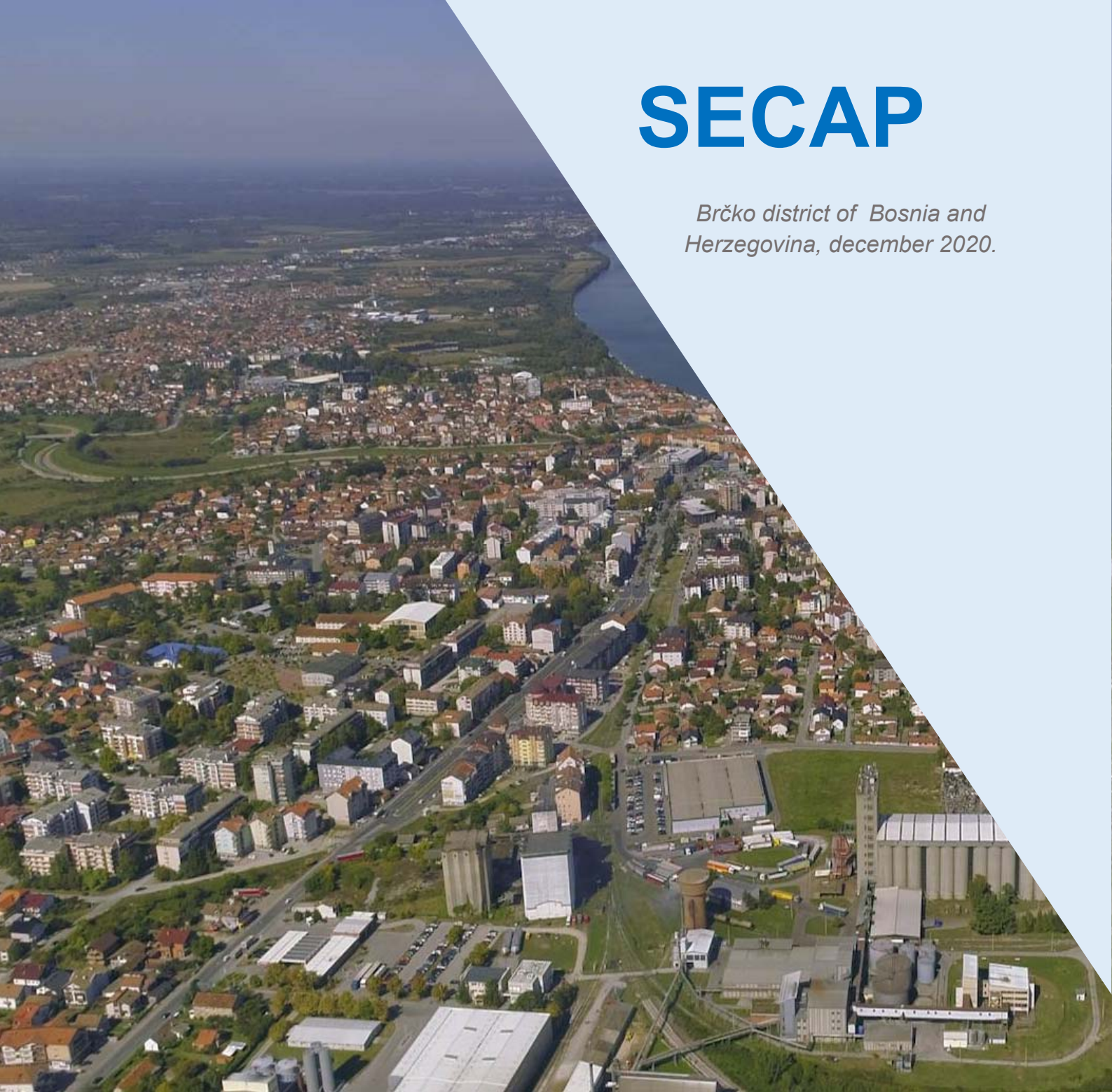


SECAP

Brčko district of Bosnia and Herzegovina, december 2020.



ACTION PLAN FOR SUSTAINABLE ENERGY MANAGEMENT AND CLIMATE CHANGE ADAPTATION (SECAP) OF THE BRČKO DISTRICT OF BOSNIA AND HERZEGOVINA FOR THE PERIOD UNTIL 2030.



The Action Plan for Sustainable Energy Management and Adaptation to Climate Change (SECAP) of the Brčko District of BiH for the period until 2030 was prepared within the project implemented by the United Nations Development Program (UNDP) in Bosnia and Herzegovina: “Increasing investment in low carbon emission public facilities” funded by the Green Climate Fund (GCF) and “Launching Environmental Financing for Low Carbon Urban Development ”(URBAN LED), funded by the Global Environment Facility (GEF). The projects are being implemented in cooperation with the Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina, the Ministry of Physical Planning, Construction and Ecology of Republika Srpska, the Federal Ministry of Physical Planning, the Environmental Protection Fund of the Federation of BiH and the Environmental Protection and Energy Efficiency Fund of Republika Srpska.

The contents of this document do not necessarily reflect the views of GCF, GEF, UNDP and partners.



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1 SUMMARY

Climate changes have been present on planet Earth for many years and have a tendency that their impact will increase on the human population. Average temperatures in the world are rising and precipitation patterns are changing. Large ice sheets are melting, floods, droughts and other natural disasters occur every year around the world. The consequences of climate change are diverse and are already being felt significantly. People living in developing countries are often heavily dependent on the natural environment, so changes in climate patterns have a significant impact on their lives. In addition to these are the countries that have the least resources to combat these negative trends. In some countries, the number of deaths that are directly related to high temperatures has increased, and changes in the prevalence of certain diseases and the way they are transmitted are already visible. The impact of climate change on the economy and infrastructure is enormous. It is estimated that the material damage caused by weather disasters around the world in the last 20 years will be about 3200 billion euros. Due to these changes, certain economic sectors that depend on temperature or rainfall, such as agriculture, tourism and energy are particularly affected.

The biggest cause of warming and other global climate changes are increased concentrations of greenhouse gases and are directly related to human activities. Natural warming of the atmosphere, so-called the greenhouse effect is the process responsible for maintaining a favorable temperature on Earth. However, the increased concentration of greenhouse gases such as CO₂ (carbon dioxide), CH₄ (methane) and others, retains solar radiation that bounces off the Earth's surface. Because of this, it causes further warming of the surface and lower atmosphere. The most important natural greenhouse gas is water vapor, while human activities release large amounts of other greenhouse gases. Their impact is crucial for climate changes. The main sources of greenhouse gases, those that are a direct product of human influence are:

- Combustion of fossil fuels (coal, oil and gas) released in the production of electricity, road, ship and air transport, in industry and households -CO₂;
- Agricultural activities -CH₄, and deforestation and burning -CO₂;
- Fossil fuel processing and disposal of various types of waste -CH₄;
- Use of fluorinated gases for various purposes.

Climate change is one of the greatest challenges of today, and will remain a global problem for decades to come. There are two ways in which society can react and they are mitigation and adaptation.

Mitigation present a measure used to mitigate climate change by reducing greenhouse gas emissions, e.g. switching to renewable energy sources, replacing fossil fuels with more environmentally friendly energy sources, subsidizing the use of electric cars, afforestation, etc.

Adaptation is the process of adapting to climate change and is key to changes that have already occurred. With adaptation, this global problem descends to the local level. Due to the lack or delay of international and national responses to certain climate changes, cities and municipalities are becoming leaders in solving their own problems such as: protection of the coast from rising sea and



oceans. They make the energy and management of agricultural and forest due to its lack of prolonged droughts, etc.

From all of this comes that cities are becoming leaders in the fight against climate change. Cities occupy only 2% of the Earth's surface. However, they are also home to 50% of the world's population, consume 60% of energy, and produce 70% of the world's waste. Cities are growing faster today than ever before and that creates new problems and requires fast and innovative solutions. The European Union (EU) has taken the role of a leader in the fight against climate change and has strongly committed significantly to reduce CO₂ emissions in its area. European Union countries have committed to reduce CO₂ emissions by at least 20% by 2020 compared to the 1990 reference year. According to the European Statistical Office (EUROSTAT), urban areas are directly responsible for 80% of energy consumption and CO₂ emissions.

On January 29, 2008, the European Commission launched an initiative with a clear goal for reducing greenhouse gas emissions. They have connected the mayors of energy-conscious European cities into a network with the aim of implementing energy efficiency measures and exchanging experiences that should support sustainable urban development. The result of the initiative is the signing of the Covenant of Mayors (CoM). According to these cities, municipalities or regions are obliged to reduce CO₂ emissions in their area by 20% by 2020 compared to the reference year. In the summer of 2015, the European Commission and the Covenant of Mayors Office, with the support of the European Committee, launched a consultation process in which stakeholders' views on the future of the Agreement were gathered. The answer was almost unanimous: 97% of signatories supported the new goal by 2020, and 80% to extend the process with a longer-term goal. In October 2015, the European Commission created a new integrated Covenant of Mayors for Climate and Energy, which has more optimistic targets than the one for 2020. Namely, all new signatories of the Agreement are committed to reducing CO₂ emissions by at least 40% by 2030 compared to the base year (2012). In addition, cities are committed to increasing resilience to climate change, reducing the risks they carry, sharing experiences, knowledge and results with other signatories, and developing an Action Plan for Sustainable Energy and Climate Change –SECAP.

SECAP is a document that includes an assessment of the geographical, demographic and energy local context of BEI - Baseline Emission Inventory and RVA - Risk and Vulnerability Assessment. It has a clear identification of emission reduction for planned activities in a certain periods. Through SECAP document, all are involved to take responsibilities in the process. The impacts of envisaged measures and costs of it have to be assessed. The dynamics of implementation, interest groups and key groups as well as potential energy savings and reduction of CO₂ for all proposed measures emissions were defined.

2 INTRODUCTION

2.1 Covenant of Mayors

The Covenant of Mayors presents the biggest world voluntary movement that involves the active participation of local authorities. The main goal is to achieve sustainable energy and climate policy. More than 10,000 cities, municipalities and regions from 60 countries signed the agreement, with a population of over 315 million.



Figure 1: Mayor's agreement on climate and energy - logo

Following the adoption of the European Union's Climate and Energy Package in 2008, the European Commission launched the Covenant of Mayors, to endorse and support the efforts deployed by local authorities in the implementation of sustainable energy policies. The agreement grew into a leading movement of local authorities that decided to take the lead in the fight against climate change. By signing the Agreement, municipalities, cities and regions have voluntarily committed to reduce CO₂ emissions in their area by at least 20% in the period up to 2020 through the Sustainable Energy Action Plan (SEAP). What makes this Agreement different is the implementation of bottom-up activities, in such a way that everyone, from citizens to mayors and political leaders are involved in the implementation and proposal of measures.

By the decision of the Assembly of the Brčko District of BiH from June 17, 2020, the consent was given to the mayor on signing the Covenant of Mayors for Climate and Energy and the development of an action plan for sustainable energy and the fight against climate change.



Figure 2: Formal signing of new Covenant of Mayors for Climate and Energy in the European Parliament in Brussels (Belgium)



The signatories of the new Covenant commit to reduce at least 40% of CO₂ emissions on their territory and to increase resistance to climate changes before 2030. Local authorities joining the Covenant of Mayors for Climate and Energy initiative commit to submit a Sustainable Energy and Climate Action Plan (SECAP) within two years following the formal signing, including the mainstreaming of adaptation considerations into relevant policies, strategies and plans. The signatories of this Action Plan as well as cities, municipalities and regions are:

- Dedicated to set ambitious climate change mitigation and adaptation to climate change
- Dedicated to the amount of final energy consumption and associated CO₂ emissions by energy carrier and by sector in the monitoring year
- Dedicated to assess climate risks and vulnerabilities in their territories;
- Dedicated to define a comprehensive set of actions that local authorities plan to take to mitigate and adapt to climate change;
- Dedicated to adopt and disseminate the Action Plan to public ;
- Dedicated to report regularly to the European Commission of the Action Plan ;
- Dedicated to the vision, the adaptation goals, the attribution of staff and financial capacities and the involvement of all present and potential signatories with local and regional level within EU and wider.

The commitments are related to the entire city territory and include the public and private sectors. However, from the local authorities is expected to be an example and to take over the most of measures that relate to their own facilities, appliances, street light, transport etc. Through SECAP various activities are planned. The focus and special emphasis is on field of construction, transport, public lighting as on sectors in which local government has the biggest influence and where it can contribute to reduce CO₂ emissions. SECAP can also include measures that are related with increasing the production of renewable sources' energy (solar power plants, wind farms, cogeneration etc.). It can also include the production of heating/cooling energy and some other sectors such as agriculture, forestry or fisheries. The primer goal of this Covenant is not industry but if there is a will to implement certain measures in this area, local authorities can choose to do it in this part of industry as well.

The signatories to the Covenant of Mayors for Climate and Energy are expected to act through some or all of the following models:

- **Energy consumption model:** The local authorities are responsible for their own energy consumption. At the same time, they are main role model and can significantly influence citizens and private sectors to use energy more efficiently.
- **Plans, programs and regulation:** The local authorities have a big influence and responsibility regarding to the policy' infrastructure as well on transport and land use. They have power to optimize energy performance of new facilities, to integrate sustainable transport measures and strategies to adapt local planning.
- **Manufacturer and supplier:** Local authorities can act as a local service operator and service provider. They can emphasize energy production and the use of renewable energy sources (for example: combined heat and power (cogeneration), district heating system, etc.)

- **Consultation and motivation:** It is very important to raise collective awareness of the whole community. Local authorities may gain the leadership in projects like this through that important activity. Cities can become advisors and educators for other citizens and stakeholders.

The period of the Covenant of Mayors for Climate and Energy is 2030. Therefore, SECAP should contain a clear overview of the activities, measures and obligations that the local government intends to undertake and fulfill by 2030. For local authorities that joined the Agreement before 1 November 2015, the 2020 target remains valid and represents an important step towards taking on new commitments for the period up to 2030.

The Assembly of the Brčko District at its 64th regular session held on June 17, 2020. It has adopted a Decision on accession to the Covenant of Mayors for Climate and Energy. They have agreed to develop the Action Plan for Sustainable Energy and Combating Climate Change (SECAP).

2.2 Brčko District of BiH

2.2.1 Geographical location

The territory of the Brčko District of BiH is located in northeastern Bosnia between 44 ° 50'24" and 44 ° 52'0" north latitude and between 18 ° 46'53" and 18 ° 49'40" east longitude. The elevation of the Brčko District of BiH ranges between 96 and 200 m / n, with 80% of the territory at an elevation below 200 m / n. Brčko District is located on the right bank of the river Sava and covers an area of the 493,3 km². That is less than 1% of the total Bosnia and Herzegovina area. The area of the central city is about 183 km² and 16% of the area belongs to the urban area of Brčko.

Brčko District was established on the entire territory of the former Municipality of Brčko. According to Bosnia and Herzegovina's internal administrative borders, the Brčko District borders several municipalities in the Republika Srpska and two of the ten cantons of the Federation of Bosnia and Herzegovina. Tuzla Canton is in the southwest and Posavina County is in the northwest.



Figure 3: Position of the Brčko District of BiH



The Brčko District is located on the almost same distance from the three major industrial, economic, political and consumer centers: Belgrade (200 km), Zagreb (270 km) and Sarajevo (210 km). It is connected with by road, rail and river.

2.2.2 Climatic characteristics

Brčko District has a moderate continental climate with hot summers and cold winters. The average temperature is above 10°C. The coldest month is January with average temperature around -1°C. The warmest is July with average temperature around 21°C. Precipitation is disproportionate and ranging between 700-800 mm, with maximum in warmer part of the year and minimum at the end of the cold period.

2.2.3 Natural potentials and resources

Brčko District of BiH is very rich with agricultural land. It is about 35.282 ha which is 71, 52% of total area. Of the total agricultural area, 53% (18,635 ha) or 37.8% of the total area is high quality land that is suitable for intensive production. It is located mostly along the banks of the Sava River and in the southwestern part of the Brčko District of BiH.

The limiting factor in agricultural production is the fragmentation of plots. They are around 2-4 ha, about 48% of 2 ha and less. About 27% of the total number of agricultural plots have acres smaller than 1 ha.

The Brčko District of BiH has great opportunities to direct primary agricultural production towards processing capacities, especially in the case of industrial crops of sunflower, soybean and oilseed rape.

The total area of forests and forest land on the territory of the Brčko District of BiH is 11,247 ha, which is 32.6% of the total land area. Nevertheless, forests are a poor natural potential in the area of the Brčko District of BiH. Of the total forest area, privately owned forests cover 8,275 ha (73.6%), while state forests cover 2,972 ha (26.4%). The forest cover in the whole area is very low. Forests are of medium and poor quality and poor surface structure. Areas under forests include different types, of which oak forests (in the plains and river valleys), beech forests (in the lower mountain belt) and fir and spruce forests (on the tops of the Majeveca Mountain) should be singled out.

2.2.4 Population

According to the 1991 census, the Brčko District of BiH had a population of 87,627, and according to the preliminary results of the 2013 census, that number was 93,028. According to the data of the Agency for Statistics of BiH (Branch Office of the Brčko District of BiH), the number of inhabitants in 2017 was 83,243. That is 10.5% less than in 2013. Changes in the total population are the consequences of natural increase and migrations.

In terms of age structure, 15.75% of the population in the Brčko District is under 15. 69.20% of the working age population is between 15 and 64, and 15.05% belongs to the older population (65+). Based on the above, it can be concluded that the number of younger population and elderly people is approximately equal, while the number of inhabitants who fall into the category of working age population is about 70%.

3 ENERGY AND CLIMATE POLICY

3.1 Vision

The main vision of the Covenant of Mayors for Climate and Energy is to bring together local and regional authorities voluntarily committing to implementing the European Union's climate and energy objectives on their territory. It is an imperative in the 21st century. Signatory local authorities share a vision for making cities decarbonized and resilient, where citizens have access to secure, sustainable and affordable energy. It offers citizens high quality of life due to improved air quality, reduction of traffic congestion etc. Cities together provide concrete and long-term measures that contribute to a stable ecological, social and economic environment for present and future generations. The collective responsibility of aware local communities is to build more resilient, attractive and energy efficient areas.

Climate change is already happening widely and therefore urgent action and cooperation between local, regional and national authorities around the world is crucial. In this way, local authorities share responsibility for climate action and create a willingness to act. It brings independence of the obligations from the other competent levels. The whole process in addition to combating climate change provides a better quality of life, stimulating investment and innovation, strengthening the local economy and creating new jobs.

The Covenant of Mayors for Climate and Energy defines new obligations and creates mutual long-term vision. The aim is to deal together with challenges such as; climate change mitigation and adaptation, access to safe, sustainable and affordable energy for all. The vision is based on three main goals;

- The acceleration of decarbonization-The signatories with this contribute to maintain an average global warming below 2°C compared to pre-industrial period in accordance with the international climate agreement signed in Paris in 2015.
- Strengthening the capacity for adapting the inevitable impacts of climate change, making their areas more resilient
- Increasing energy efficiency and use of renewable energy sources, which all ensure universal access to safe and sustainable energy services;
- The vision of each city is an inspiring long-term determinant of development. The city should focus on the specific goals in the future. The cities that are signatories to the Covenant of Mayors were committed to the vision a vision of an energy-sustainable and prosperous future.

3.2 Mitigation and adaptation objectives

The Covenant of Mayors for Climate and Energy at the global and regional levels is based on two climate activities:

- Mitigation: reducing of greenhouse gas emissions to the minimum and which are directly caused by natural processes or humans



- Adaptation: preparation and adaptation to overcome the effects of climate change

Mitigation is the reduction of greenhouse gas emissions through energy efficiency measures, the use of renewable energy sources or some other measure. SECAP is aimed at defining mitigation actions that allow cutting down at least 40% of CO₂ emissions by 2030. Mitigation of climate change as an area of activity and the scope of action is well defined and established. Greenhouse gas emissions are measurable and the progress towards its 'reduction is easy to follow. It is recommended that cities adopt mitigation measures, which are specific to each territory, in order to:

- Contribute efficiently to higher goals by achieving lower greenhouse gas emissions;
- coordinate existing policy frameworks on energy and climate change with higher political levels;
- Provide new financing mechanisms and programs to support the implementation of measures;
- use the best available technology and existing investment instruments

European Union legislation in 2018 has defined additional voluntary targets: improving energy efficiency by 32.5% and increasing the share of renewable energy sources in total energy production to 32% by 2030. In addition, the strategy of the EU member states to achieve carbon neutrality by 2050. It gives additional impetus to all signatories to the Covenant of Mayors to adopt measures that are even more ambitious.

One of the crucial SECAP characteristics are plans for adaptation to inevitable climate change. Unlike mitigation, the adaptation does not contain unique goals, neither quantitative target values. That is the reason why adaptation has a higher degree of uncertainty because it deals with projections and avoidance of negative consequences. However, similar to mitigation measures, the focus of action is to establish benchmarks through risk and vulnerability assessment. Through this assessment, the signatory cities need to identify the risks of climate change as well as the level of risk, and the expected changes in terms of intensity and frequency. Unlike mitigation measures, where the period for activities is 2030, the period for adaptation activities is not precisely defined and needs to be defined in accordance with local circumstances and characteristics and in the context of each measure.

It is assumed that responsibility for activities in the field of mitigation and adaptation belong to different departments in the city structure and the working group. Therefore, it is very important that there are no isolated activities, and that everyone works on mitigation and adaptation with a high degree of joint planning and cooperation. This increases the probability for higher efficiency of the final integrated climate plan, and achieving multiple benefits for the local community.

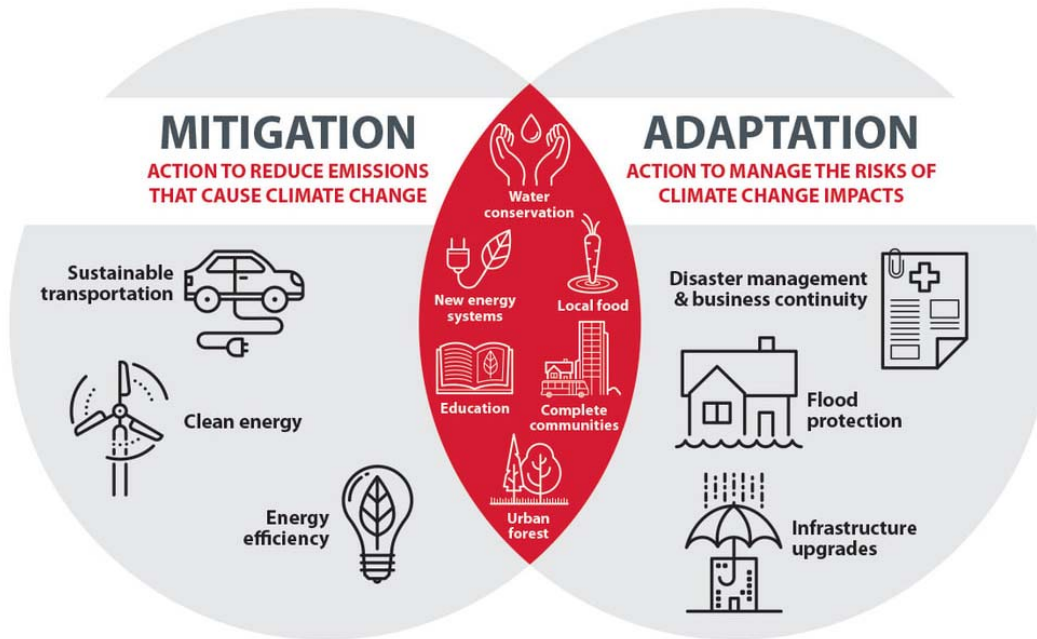


Figure 4: Building resilience to climate change - mitigation and adaptation

3.3 Coordination and organizational structure

It is very important to set a deadline for the drafting and assign individual tasks and activities in order of successfully implement the process of the Action Plan. The European Commission has given certain guidelines that determine the course of the process. However, this is a special challenge for each city. The actions required to develop, implement and monitor the SECAP are divided into several steps. The whole process includes the following:

- Preparations launching SECAP (political will, active support of the Mayor and the Municipal Assembly, professional bodies and other interested parties and groups)
- The creation and appointment of the Working Team (representatives of municipal services, public and private companies and potentially other stakeholders), according to the priority directions of action
- Establishment and appointment of an advisory group from among experts at the local stage
- Development of the Action Plan for Sustainable Energy Development and Climate Change (SECAP);
- Adoption of SECAP as an official document by the Assembly of the Brčko District of BiH
- Implementation of identified measures and activities proposed by the plan
- Monitoring and controlling of the implementation of identified measures;
- Preparation of reports on implemented projects in time intervals of 2 years;

After the preparation, the first step in building the organizational structure is to appoint a program coordinator. The coordinator is the key person for the implementation of the process. He makes all-important decisions and he establishes other bodies for the implementation of SECAP.

The team coordinator for the development of the Action Plan for the Brčko District is Ishak Abdurahmanović (BSc in Science and Technology). The working team for drafting the Action Plan consists of three members, appointed by the Mayor of Brčko District (Decision on appointing the team for drafting the action plan for sustainable energy and the fight against climate change, number: 01-02-920 / 20 from 17.06.2020.).

Members of the team are:

1. Ishak Abdurahmanović, team coordinator
2. Denim Beširović, team member;
3. Savo Radić, team member;

The tasks of the team are as follows:

- To analyze the current (initial situation), collect the necessary data, make initial inventory of CO₂ emissions and to assess climate risks and vulnerabilities and ensure that main persons are adequately involved.
- To establish a long-term vision and goals that support the vision.
- To ensure that they are shared with others main persons and approved by the political structures of government.
- To participate in the development of the plan as follows: to define policies and measures in accordance with the vision and goals, to determine the budget and sources, mechanisms of financing, deadlines, indicators, responsibilities.
- To inform political structures and to involve all key actors.
- To establish partnerships with key actors.
- To submit the plan to the Covenant of Mayors website.
- To present the plan to the public.

The Advisory Group has also been appointed ,in addition with working team for development of SECAP. It is supervisory and advisory body, which consists of representatives of main stakeholders from the local self-government unit. The Advisory Group consists of three members and is appointed by the Mayor (Decision on the appointment of the Advisory Group for the Development of the Action Plan for Energy Sustainable Development and Climate Change, number: 01-02-920 / 20 of 17.06.2020).

The Advisory Group members:

1. Stanko Stančić, team member;
2. Biljana Gavrić, team member;
3. Savo Radić, team member;

The tasks of the Advisory Group on Sustainable Energy and Climate Change are as follows:

- To gather all relevant information and data and to share knowledge with the team for the development of the Action Plan for Sustainable Energy Development and Climate Change.



- To participate in defining the vision and plan, including their views on the future of the municipality.
- To participate in the development of the plan.

The bodies of the Government of the Brčko District of BiH, which are in charge of participating in the development of the Action Plan, are expected to be present and involved in the process from the very beginning.

The tasks of the Government of the Brčko District of BiH in the implementation of the Action Plan are as follows :

- To provide professional staff for the implementation of identified energy efficiency and renewable energy measures and measures to adapt to the effects of climate change and assign specific roles and tasks;
- Successfully integrate the goals and measures of the Action Plan into the development strategy and other relevant strategic documents;
- Provide support to the continuous implementation of measures throughout the implementation period of the Action Plan until 2030;
- To continuously inform citizens about the implementation of the plan;
- To join the network of cities and municipalities signatories to the Covenant of Mayors in order to continuously exchange positive experiences and joint synergies in the making of energy sustainable urban areas in Europe.

In the preparatory phase of drafting the Action Plan, the participation of as many stakeholders as possible is provided. It is an initial step in the process of changing energy attitudes and behavior of citizens and changing awareness of the effects of climate change.

Participants in the development and implementation of the Action Plan are those :

- whose interests are in any way related to the Action Plan;
- whose activities affect the Action Plan in any way;
- whose ownership, access to information, sources, expertise, etc. are necessary for the successful development and implementation of the Action Plan.

Stakeholder consultations were held during the development of the SECAP for the Brčko District because the consultation process is extremely important in the preparation phase. The goal is to prepare ambitious but feasible and quantified measures.

4 METHODOLOGY

4.1 Introduction

Each signatory of the Covenant of Mayors has undertaken certain obligations. For their implementation is necessary to develop an Action Plan for Sustainable Energy Development and Climate Change (SECAP) in accordance with the defined guidelines. The methodology for drafting, planning, implementing and monitoring the Action Plan can be divided into 6 steps:

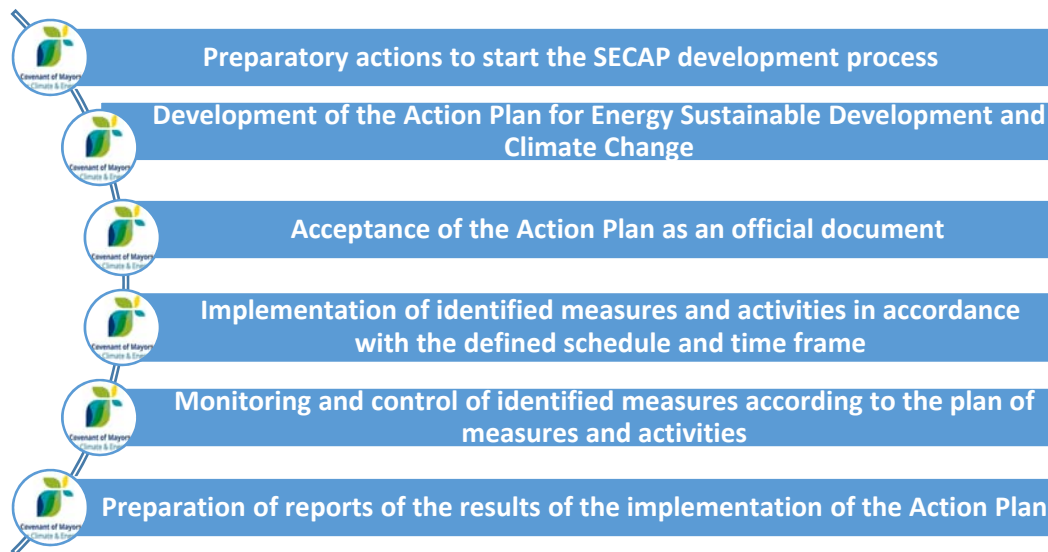


Figure 5: Methodology for making the Action Plan for Sustainable Energy Development and Climate Change (SECAP)

Preparatory actions to start the SECAP development process

There has to be certain level of political will for example support of the Mayor and the Assembly of the Brčko District of BiH in order to approach the process of SECAP. After the decision on signing the Covenant of Mayors for Climate and Energy is adopted the document will be signed by the Assembly of the Brčko District of BiH. By signing the Agreement, the city shows its commitment and orientation towards sustainable development. Successful implementation of the process requires the involvement of all city authorities from the start. Also, since this is a project that concerns all citizens and other relevant stakeholders, full transparency is necessary. The starting point for the successful development of SECAP is to establish clear organizational roles and responsibilities of all involved in the process. Brčko district of BiH should be focused on providing professional staff who will be involved in implementation and monitoring of The Action Plan. It should provide financial resources, support and quality monitoring of the process. One of the first steps is to identify stakeholders, form working bodies, and assign roles. Stakeholders are all those whose interests, ownership, activities and information are in any way related to the development of the Action Plan. They can be involved in the SECAP development process through various workshops. It will give value to the project, with expert support and comments when creating measures in individual sectors.

Development of the Action Plan for Energy Sustainable Development and Climate Change

The Action Plan for Sustainable Energy Development and Climate Change (SECAP) should start after the signing of the Covenant of Mayors for Climate and Energy. First of all, it is necessary to determine the reference year, primarily on the basis of the availability of data on energy and energy consumption. The action plan should set realistic goals for reducing CO₂ emissions in the city area by individual sectors in the time interval until 2030. It is necessary to form an expert working group, and to classify the sectors that consume energy and to which potential measures could be applied. The realistic goals are needed.

According to the recommendations of the European Commission, the energy consumption sectors are divided into:

- **Buildings** (residential or public buildings owned by the city, commercial and service buildings and residential buildings);
- **Transport**(vehicle fleet owned by the city, public transport in the city, personal and commercial vehicles);
- **Public lighting** (in the city);
- **Digital heating** (central heating system,if possible)

However,there is no exact form of how the Action Plan should look like.It should be reconciled with the reporting form of the Covenant of Mayors for Climate and Energy. The form includes the following:

- **Baseline Emission Inventory** – quantifies the amount of CO₂ emitted into the atmosphere, due to energy consumption in the city in the reference year. The emission reference inventory is the starting point for the development of the SECAP, on the basis of which it is possible to set relevant targets. Through the inventory final energy consumption for all key sectors and subsectors is reported. Emissions from the industrial, land use, and agriculture, forestry, and fisheries sectors are not necessary for analysis, but can be very useful and purposeful.
- **The proposal of measures to reduce emissions CO₂ for the analyzed sectors** – It is possible to identify specific measures according to CO₂ emissions data in time frames until 2030. Ultimately, the measures should contribute to the reduction of emissions CO₂ in line with the objectives of the Agreement, and to the increase of energy efficiency and adaptation to climate change in the city area. It is very important that the proposed measures and activities are in line with the legislative framework and legislation of the area for which they are defined.
- **The estimation of emission reduction of CO₂ until 2030.**– energy saving potentials and emission reduction potentials are determined by all identified measures and activities
- **The assessment of risk and vulnerability**– includes information concerning the climatic vulnerability of the city, ie. dangers of weather and climate change.All expected climate impacts in the coming period,property,processes are analyzed.



The acceptance of the Action Plan as an official document

Once the working group has adopted the Action Plan, it should to be presented to the City Council in order to be declared as the official document. This is a crucial point for CO₂ emissions reduction by 2030. It is very important to involve leading political leaders in the process of signing, drafting and monitoring the implementation of the Action Plan from the very beginning.

The implementation of identified measures and activities in accordance with the defined schedule and time frame

Although the approach to the Covenant of Mayors and everything that follows after the signing is on a voluntary basis, the implementation requires extremely high quality organization and commitment of all participants. The implementation of identified measures and activities in accordance with the defined schedule and time frame is the most complex step. Primarily it is because of the duration, then the need for strong will, focus and engagement of all actors, and the necessary financial resources. Activities and measures should be aligned with the Emission Reference Inventory (BEI), Risk Assessment and Vulnerability of the City (RVA) and should cover all sectors identified as potentials to reduce greenhouse gas emissions. Also, the proposed activities and measures must include components of climate change mitigation and adaptation.

By using the results of risk and vulnerability prioritization of planned activities the can be defined. With this assessment it is possible to achieve high quality data and by which hotspots of potential risks can be located. Beside this, many other factors influence the selection of priority activities. It is important to consider locally applicable criteria. It should be as simple, effective and measurable as possible. It is better to give advantage to activities that have wider spectrum of action and more positive effects for the environment. The working body of SECAP, all participants and stakeholders are very important for the implementation of all plans. Only through transparent action and by focusing on the implementation of the process it is possible to achieve the set goals.

Monitoring and control of identified measures according to the plan of measures and activities

Monitoring and controlling the identified measures may seem like an additional burden. However, it is a fundamental component of any successful plan to ensure its lasting and successful implementation. The monitoring and control phase of the Action Plan should be continuously provided at several levels:

- Monitoring the dynamics of implementation of energy efficiency measures according to the plan of measures and activities;
- Monitoring the success of project implementation;
- Monitoring and control of defined energy savings goals for each individual measure within the plan;
- Monitoring and control of CO₂ emission reductions separately for each measure and activity;

According to the recommendations of the European Commission, the best results making, implementation and monitoring of the Action Plan will be obtained if the Register of CO₂ is made

every two years. Thus it is important that the methodology of its preparation is identical to the methodology that was used for the preparation of a register in the reference year.

Monitoring the achieved results is very useful, because it enables:

- Comparing the effects from the planning phase with the achieved results in terms of energy savings, energy production from renewable sources, reduction of CO₂ emissions, and other realized benefits such as higher air quality, water, risk reduction, environmental protection, better economic opportunities;
- Identifying the need and determining the corrective measures that must be implemented, in case that certain activities have not achieved the expected results;
- Identifying failures in the implementation of certain measures, and identifying obstacles that prevent their implementation;
- Identifying new opportunities or introducing innovative measures;
- Documenting success stories that have emerged from planned measures and activities, and that can be shared with the local community and other cities;

Preparation of reports on the results of the implementation of the Action Plan

When approaching to the Covenant of Mayors for Climate and Energy, the cities committed themselves to drafting an Action Plan within two years from the date of signing, and to continuously report on implementation. For this purpose, the form has been developed in which the main parameters of the Action Plan are entered (responsible persons, energy consumption, CO₂ emissions, identified measures and activities and goals). The report about this process should be done every two years. It takes a lot of time for this so the Covenant of Mayors Association left to the signatories the choice of two options:

- To make the report every two years;
- To make the report about activity status (this application form does not include the preparation of emission inventory) and total report every four years which contains the status of activities and at least one control inventory of emissions MEI (Monitoring Emission Inventory);

In order to provide a quality and relevant report, it is necessary to form a team that will meet continuously and coordinate the monitoring and reporting process. It is important to identify data sources, and ensure an appropriate frequency of monitoring, ensure reliability and support. The collected data should be measurable and comparable during the process.

4.2 Process of development, implementation and monitoring of the Action Plan for Sustainable Energy Development and Climate Change of the Brčko District of BiH

Since the Assembly of the Brčko District of BiH on 17.06.2020. gave its consent to launch the initiative of the Covenant of Mayors, many activities for the Action Plan like the preparation, accession and development were carried out. The implementation phase and regular monitoring and reporting are initiated after the adoption of the Action Plan. All phases of the activity are listed above.

4.2.1 Preparatory actions to start the SECAP development process

The application form was signed by the Mayor of the Brčko District of BiH (Covenant of Mayors for Climate and Energy) after the Decision on Accession to the Agreement and adopted by the Assembly of the Brčko District of BiH.

The next step after the signing of the Covenant of Mayors for Climate and Energy is to appoint the working team and team coordinator as well as the advisory group. Their tasks have been explained previously in detail. It is necessary to determine who, how and when will do certain tasks.

The final step is to identify all stakeholders and participants for this task. This is very important for the strategy development. They should be involved from the start in order to make quality development. After that the implementation of measures of the Action Plan should be identified.

Stakeholders in the Brčko District are:

- Brčko district of BiH;
- Local communities in the Brčko District of BiH
- Educational Institutions ;
- Non-governmental organizations;
- Legal entities ;
- Public enterprises;
- Other interested legal entities and citizens;

4.2.2 Development of the Action Plan for Sustainable Energy Development and Climate Change of the Brčko District of BiH

The main element of the Action Plan is setting goals for reducing CO₂ emissions in the Brčko District of BiH by 2030. In order to set realistic goals for energy saving and CO₂ reduction by 2030, it is important to collect quality data on the energy situation and energy consumption for the reference year. The first step will be to classify the energy consumption sector in the Brčko District of BiH.

In accordance with the recommendations of the European Commission, the energy consumption sectors of the Brčko District of BiH are divided into three basic sectors:

- Buildings;
- Transport;
- Public lighting;

Building sector is divided into the following three subsectors:

- Buildings owned and under the jurisdiction of the Brčko District of BiH;
- Residential buildings (collective housing and houses);
- Commercial and service buildings;

Transport sector consists of three sectors;

- Vehicles owned and used by the Brčko District of BiH;
- Public transport of by the Brčko District of BiH;
- Private and commercial vehicles;

The **public lighting sector** consists of the electric network of public lighting in the area of the Brčko District of BiH.

The Action Plan for Energy Sustainable Development and Climate Change of the Brčko District of BiH has been developed through the chapters of climate change mitigation and adaptation. The Baseline Emission Inventory (BEI) was prepared for 2012 as a reference year, while the Monitoring Emission Inventory (MEI) was prepared for 2019.

Both inventories were prepared according to the instructions and methodology of the IPCC protocol. That is the protocol of the Intergovernmental Panel on Climate Change (IPCC). It is the executive body of the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO) for the implementation (United Nations Framework Convention on Climate Change (UNFCCC)).

CO₂ emissions include emissions from electricity and heat consumption and emissions from fuel combustion. Emisije CO₂ obuhvaćaju emisije iz potrošnje električne i toplotne energije te emisije iz sagorijevanja goriva. Fuel combustion emissions are calculated through standard emission factors (first level of the IPCC methodology calculation). Specific national emission factors were used for the calculation of emissions from electricity and heat consumption (Table 1). For the calculation were used emission factors for CO_{2eq} and the non-energy sectors whose emissions are expressed through CO_{2eq}. It is important to note that 1 tCO₂ = 1 t CO_{2eq}.

Table 1: Used emission factors for determining CO₂ emissions in the Brčko District of BiH

Energy source	Emission factors	
	Unit	CO ₂
Electricity	tCO ₂ /MWh _{el}	0,638
Heat energy	tCO ₂ /MWh	0,282
Natural gas	tCO ₂ /MWh	0,205
Heating oil	tCO ₂ /MWh	0,259
LPG (liquefied petroleum gas)	tCO ₂ /MWh	0,230
Mazut	tCO ₂ /MWh	0,282
Brown coal	tCO ₂ /MWh	0,346
Lignite	tCO ₂ /MWh	0,364
Motor gasoline	tCO ₂ /MWh	0,252
Diesel fuel	tCO ₂ /MWh	0,266
Firewood	tCO ₂ /MWh	0,000

The measures and activities of energy efficiency and renewable energy sources and adaptation measures to climate change have been identified according to data of CO₂ emissions. The analysis of the energy situation in energy balances for the last few years and energy consumption forecast until 2030. has also been made.

Identifying mitigation measures on the effects of climate change

1. Detailed analysis of energy consumption for the sectors of construction, transport, public lighting in the Brčko District of BiH
2. Preparation of Reference and Control Inventory of CO₂ emissions - BEI and MEI

- **Public buildings** - The calculations of CO₂ emissions and factors were performed and taken according to the IPCC methodology (for BiH). All is based on the data on the total annual energy consumption. **BEI** - Based on the collected data on the year of construction and purpose of the public (sector) building, the type of building was determined, according to the Typology of Public Buildings in BiH from 2017, which defines the specific energy required to heat a building per unit area $q_{hnd,spec, spec}$ (kWh / m²) which is multiplied by the actual heated area of the building A_k (m²) and thus the actual energy required for heating $Q_{hnd,stvar,real}$ (kWh) is obtained. Then the actual and reference degree days through which the final (delivered) energy was obtained are included. **MEI** - The energy consumption of public buildings for the control year 2019 was calculated on the basis of data on implemented energy efficiency measures on public buildings built before the base year and data on new buildings built in the period from the base year to 2019. For savings calculations, the methodology from the Methodology for Measurement and Verification of Energy Savings by the Bottom-Up Method (MVP) from 2017 was used, and data from the Typology of Public Buildings in BiH and the Rulebook on Minimum Requirements for Energy Performance of Buildings from 2015 were used.
- **Residential buildings** - The calculations of CO₂ emissions and factors were performed and taken according to the IPCC methodology (for BiH). **BEI** – According to data from the 2012 Census of population, households and residences in BiH and Typology of residential buildings and with the 2015 Brčko District Energy Sustainable Development Action Plan (SEAP) all data on energy consumption are calculated. Data on the specific energy required for heating and the heated area of residential buildings by type and period of construction were used from the Typology of residential buildings. **MEI** - The analysis of energy consumption of residential buildings was performed on the basis of collected data on energy consumption in households. The methodology from the Ministry of Foreign Affairs was used for the savings calculations, and the data from the Typology of Residential Buildings of BiH, the Rulebook on Minimum Requirements for Energy Performance of Buildings from 2015 were used.
- **Traffic – BEI** - COPERT software tool intended for vehicle emission calculation was used to process data related to CO₂ emissions from traffic. The software uses the structure and number of vehicles, the annual distance traveled, the average speed on different sections of the road, as well as data on the outside temperature and humidity and in order to calculate emissions according to European standards. Required data: number and structure of vehicles, average age (vehicle category, eco standard to which it belongs - EURO1, EURO2 ..). Data source: database of the Agency for Identification Documents, Records and Data Exchange (IDEEAA) related to registered vehicles in BiH; average annual distance traveled, amount of fuel consumed: national statistics, national plans - total values reduced to municipal levels based on the number of registered vehicles and climate data. **MEI** - With the help of COPERT, emissions were calculated for 2019 as well.
- **Public lighting – BEI i MEI** – calculations were made on the basis of data obtained from the Administrative Service of the Brčko District of BiH - Department for Housing and Communal Affairs, as follows:
 - General data on public lighting
 - The structure of the public lighting electrical network

- Average daily working hours (summer / winter)
- Total number of lamps in the system
- Annual electricity consumption of the system

3. Proposed measures to reduce CO₂ emissions for the analyzed sectors and their time and financial frameworks– after the insight in the current situation, concrete proposals for measures to reduce CO₂ emissions have been proposed with specific time and financial frameworks. Realistic possibilities for implementing such measures in the predicted period were given.

4. Estimation of CO₂ emission reductions by 2030– the estimation was made taking into account the number and extent of selected measures from the previous chapter;

5. Financing mechanisms, monitoring and control of the implementation of the Action Plan– the possibilities of full or partial financing by all levels of government or various funds have been identified with regard to the types of measures envisaged to reduce CO₂ emissions. For the implementation monitoring and control segment, it is very important that as many proposed emission reduction measures as possible are implemented within the set deadline.

4.2.2.1 *Determining climate change adaptation measures (RVA)*

1. Climate analysis in Bosnia and Herzegovina (Brčko District of BiH) with special reference to air temperature and precipitation and the possibility of floods;
2. Analysis of the vulnerability of BiH to climate change observed through the sectors of agriculture, water, tourism and health;
3. Analysis of the risk of natural disasters in the Brčko District of BiH;
4. Expected effects of climate change on various sectors in the Brčko District of BiH;
5. Proposition of measures for adaptation to climate change;

4.2.3 *Phase of monitoring and control of the implementation of the Action Plan*

The process of monitoring and controlling the implementation of the Action Plan for Energy Sustainable Development and Climate Change of the Brčko District of BiH should be implemented in parallel in several phases:

- Monitoring the dynamics of implementation of specific energy efficiency measures according to the Plan of priority measures and activities;
- Monitoring the success of project implementation;
- Monitoring and control of set energy savings goals for each individual measure with the Action Plan;
- Monitoring and control of achieved CO₂ emission reductions for each measure according to the Action Plan.

After the development of the Action Plan, it is necessary to evaluate it and propose it to the Assembly of the Brčko District of BiH. They should declare it as an official document for the purpose of its successful implementation. Acceptance of the Action Plan as an official document of the implementation of the Brčko District, is a key element for its implementation and the achievement of the objective of reduced CO₂ emissions by 2030.

The only way to successfully monitor the achieved savings in various sectors and their subsectors as well as to meet the set targets for reducing CO₂ emissions for each measure and for the implementation of the Plan as a whole is to develop a new Register of CO₂ emissions for Brčko District of BiH. According to the recommendations of the European Commission, the best results of the entire Process of drafting, implementing and monitoring the Action Plan would be achieved by drafting a new Emission Register every two years. It is important that the methodology of its development is identical to the methodology according to which the Reference Register of CO₂ emissions for 2008 was prepared. Only a unified methodology for creating the register enables its comparison and, ultimately, the answer to the question of whether the set targets for reducing CO₂ emissions have been met. According to the above instructions, as part of the development of SECAP, in 2019 the Control Inventory of CO₂ Emissions (MEI) was prepared.

When monitoring the implementation process, it is important to monitor and minimize risks. Covenant of Mayors in the document "Reporting template" lists the risks identified in the largest number of examples, and when implementing the Action Plan, it is recommended to monitor them in order to reduce their risk. For the purposes of risk planning and management, the table shows a qualitative assessment of the presented risks.

Table 2: Identified risks for the implementation of the Action Plan for Energy Sustainable Development and Climate Change according to the Form for reporting on the Covenant of Mayors and qualitative assessment of identified risks

Risk	Grade - high / medium / low
Limited financial resources	medium
Lack or weak regulatory frameworks	low
Lack of technical expertise	low
Lack of support from key participants	high
Lack of political support at other administrative levels	medium
Changes in local policy priorities	medium
Incompatibility with national political orientations	low
High costs or immaturity of available technology	high

The Covenant of Mayors Association recognized that the reporting process within every two years requires the allocation of significant financial and human resources and therefore leaves two options to choose from:

- Reporting every two years;
- Preparation of the Activity Status Report every two years (application form that does not include emission inventory) and the Total Report every four years including the activity status and at least one Emission Control Inventory (MEI form)

The Brčko District of BiH has decided for the option of preparing a Activity Status Report every two years (application form that does not include emission inventory) and a Total report every four years including activity status and at least one Emission Control Inventory (MEI application form).

5 BASELINE EMISSION INVENTORY (BEI)

The reference inventory of CO₂ emissions gives a numerical representation of the amount of CO₂ emitted in the reference year as a result of energy consumption in the area of the local self-government unit that is a signatory to the Covenant of Mayors. Based on the reference inventory, the sources of human contribution to CO₂ emissions are concluded and the priorities of reduction measures are set. The reference inventory is a key instrument in determining the success of planned activities to achieve energy efficiency and impact on CO₂ emissions.

5.1 Base year

The first version of the Action Plan for Sustainable Energy Development of the Brčko District of BiH (SEAP) was developed in May 2015, with the selected reference year for the savings budget being **2012**. An identical base year was accepted by the Sustainable Energy and Climate Change Action Plan (SECAP) team. The main criterion when choosing the reference year was the availability of data needed for the calculation of CO₂ emissions.

5.2 Analysis of energy consumption and reference inventory of CO₂ emissions from the building sector of the Brčko District of BiH

5.2.1 Analysis of energy consumption in the building sector in the base year

For the needs of energy consumption analysis, the building sector of the Brčko District of BiH is divided into the following subsectors:

- buildings owned and under the jurisdiction of the Brčko District of BiH,
- residential buildings,
- buildings of commercial and service activities.

Data on buildings in the building sector and their energy consumption were taken from the Action Plan for Sustainable Energy Development of the Brčko District of BiH (SEAP), and the calculation was performed according to the methodology previously described in Chapter 4.

5.2.2 Analysis of energy consumption of the sub-sector of public buildings of the Brčko District of BiH in the base year

The buildings of the Brčko District of BiH are classified into seven categories:

- buildings and offices of the Brčko District of BiH - Administrative buildings, local communities,
- buildings and offices of the Brčko District of BiH - Buildings of public companies of the Brčko District of BiH,
- buildings and offices of the Brčko District of BiH - Buildings of institutions in education,
- health care buildings,
- buildings for cultural activities,
- buildings for sports activities

- buildings for police and law institutions.

The total heated area of the analyzed buildings of the Brčko District of BiH is 142,408.40 m². Table 3 shows the consumption of individual energy sources for the buildings of the Brčko District of BiH for 2012.

Table 3: Energy consumption of buildings in the Brčko District of BiH in the base year

Category	Energy consumption (MWh / year)						
	Electricity	Electricity (for heating)	Mazut	Heating oil	Coal (brown)	Pellets	Wood
Government building and the Assembly of Brcko District	1.876	603	-	1.486	339	-	-
Rooms of local communities	210	1.732	-	-	-	-	144
Public companies	882	675	-	48	-	-	-
Institution buildings in education	1.265	535	-	8.147	285	-	-
Health care buildings	2.443	427	-	2.574	-	-	-
Buildings for cultural activities	149	39	-	683	-	-	-
Buildings for sports activities	122	-	-	635	-	-	-
Buildings of police and law institutions	752	59	-	1.283	-	-	-
TOTAL	7.699	4.070	0	14.856	624	0	144

The quota of energy consumption for buildings in the Brčko District of BiH is shown in Table 6, which shows that the health category is the largest consumer of electricity while the category of education is the largest consumer of thermal energy in the building sector owned and operated by the Brčko District of BiH.

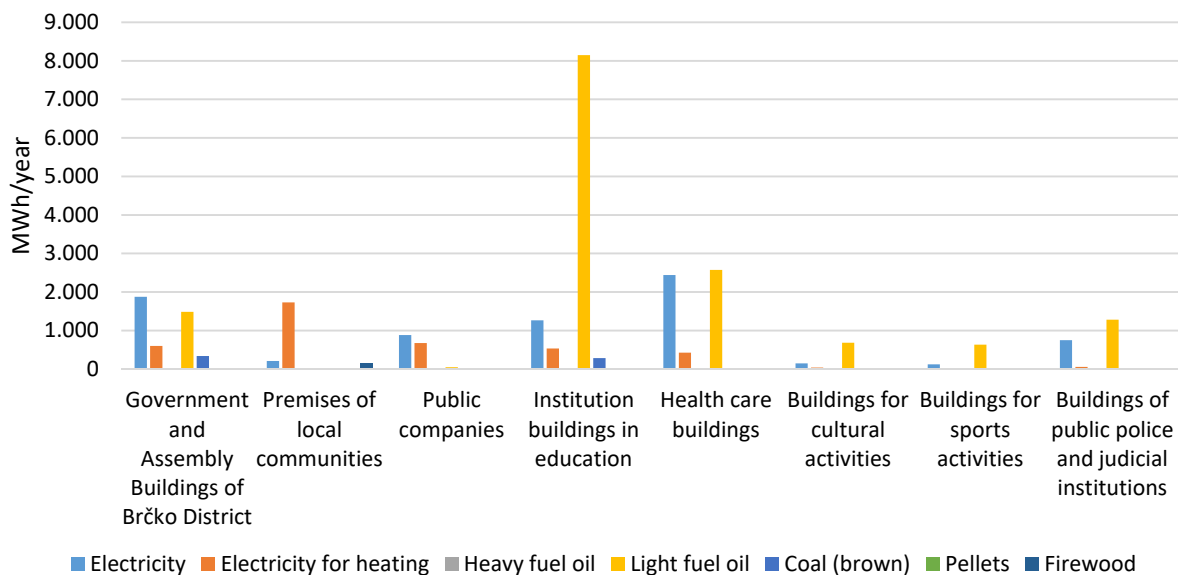


Figure 6: Energy consumption for buildings of the Brčko District of BiH by type of energy source

The most important energy source in the sub-sector of the building of the Brčko District of BiH is heating oil (light fuel oil) with the largest share in consumption in the amount of 75%, followed by electricity (for heating) 21%, heat from coal 3% and wood 0.73% (Figure 7).

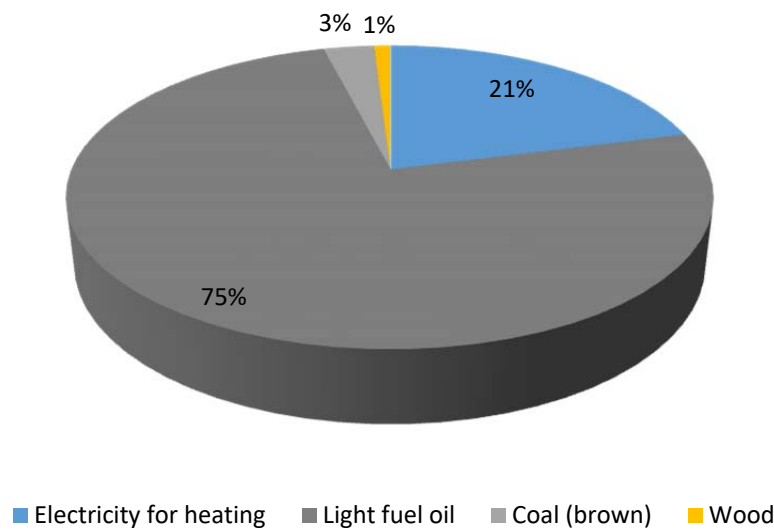


Figure 7: Share of individual energy source in the total energy consumption of the buildings of the Brčko District of BiH for 2012

5.2.3 Analysis of energy consumption in the housing sub-sector, for individual and collective housing in the base year

The Brčko District of BiH is territorially divided into 78 local communities. Buildings for family individual housing dominate in rural local communities as well as in the city of Brčko. For the analysis of energy consumption in the housing sector, all residential buildings are divided into two groups: apartments and private houses.

According to the data of the Tax Administration of the Brčko District of BiH, in the housing subsector of the Brčko District of BiH in 2012 there were a total of 34,871 housing units with a total area of 2,871,746 m², of which 28,263 houses with a total area of 2,506,764.48 m². The number of housing units in collective housing buildings is 6,608 with a total area of 364,981.61 m². In the residential sector of the Brčko District of BiH in 2012, 130,766 MWh of electricity was consumed, which gives a specific electricity consumption of 46 kWh / m², while the total heat consumption for the residential sector is 522,006 MWh, which gives a specific thermal energy of 192 kWh / m² (Table 4).

Table 4: Basic data for the housing sector of the Brčko District of BiH

Energy product	Energy consumption (MWh / year)
Electricity for heating	149.044
Electricity	130.766
Heating oil	10.281
Brown coal	163.230
Lignite	62.547
Wood	151.484
Pellets	15.421
Total	682.773

The biggest quota in energy consumption by type of energy used for heating has coal in the amount of 30%, followed by electricity and wood in the amount of 27% (Figure 8).

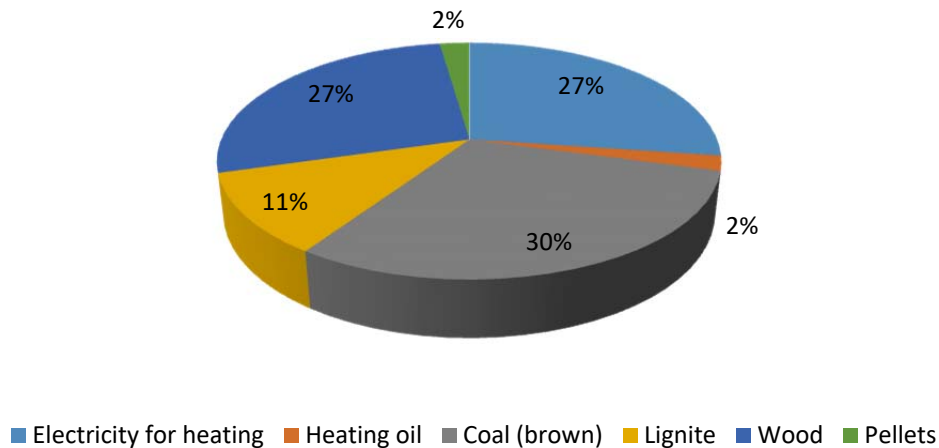


Figure 8: Share of energy consumption by type of heating energy source

When looking at the total energy consumption in residential buildings, the most common energy source is still coal with a slightly smaller quota of 24%, and the second most represented energy source is wood and electricity for heating with a quota of 27%. Figure 9 shows the total energy consumption in the residential building sector.

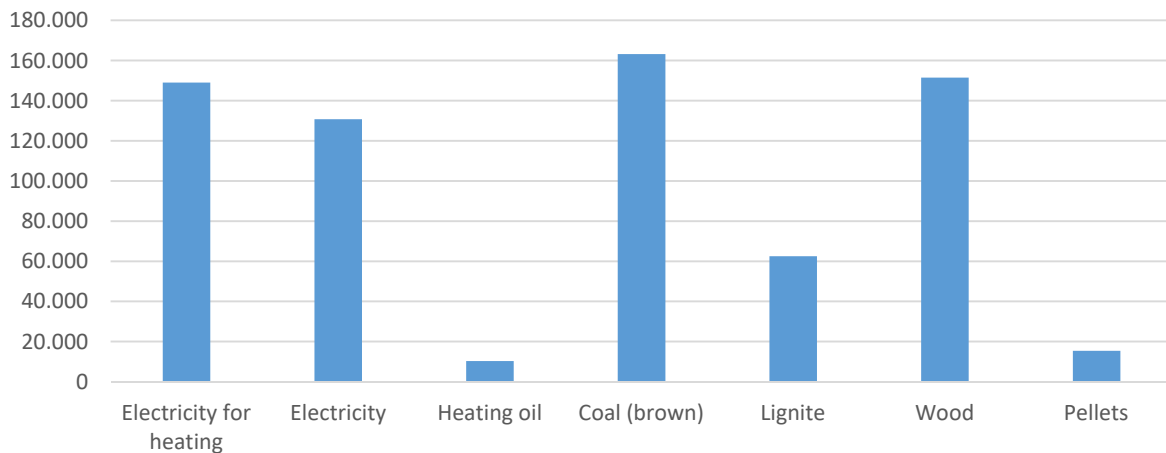


Figure 9: Total energy consumption in residential buildings by type of energy source

5.2.4 Analysis of energy consumption in the subsector of commercial and service activities of the Brčko District of BiH in the base year

The subsector of commercial and service activities includes about 5,037 facilities with a total area of 385,381 m². In 2012, a total of 37,512 MWh of electricity was consumed in the Brčko District of BiH in the subsector of commercial and service activities, which gives a specific consumption of 97 kWh / m². The total consumption of thermal energy in the commercial and service subsector of the Brčko District of BiH in the base year 2012 amounted to 56,553 MWh, which gives a specific consumption of thermal energy of 147 kWh / m². Table 5 shows the parameters of energy consumption in the subsector of commercial and service activities of the Brčko District of BiH.

Table 5: Energy consumption in the subsector of commercial and service activities of the Brčko District of BiH in the base year

Category	MWh/year
Electricity for heating	35.400
Electricity	37.512
Heating oil	14.311
Brown coal	2.466
Lignite	331
Wood	3.757
Pellets	286
TOTAL	56.590

In the subsector of commercial and service activities of the Brčko District of BiH, the largest share of energy consumption by type of energy source has electricity for heating in the amount of 63%, followed by heating oil with 25% (Image 10).

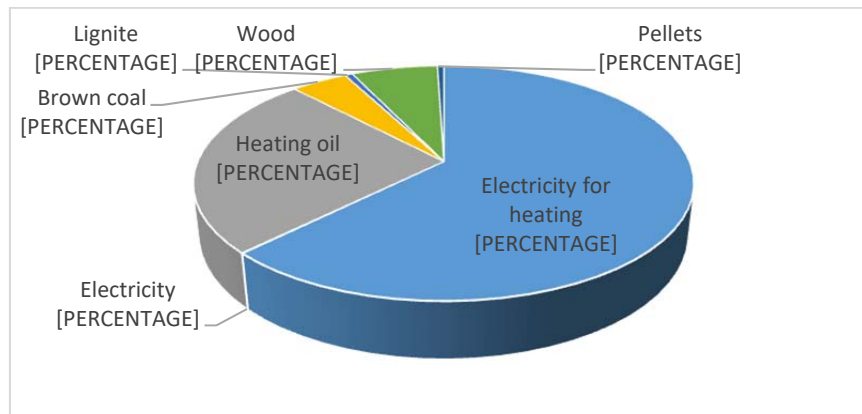


Figure 10: Share of individual energy in total consumption in the subsector of commercial and service activities of the Brčko District of BiH for 2012

5.2.5 Total energy consumption in the building sector of the Brčko District of BiH in the base year

The building sector of the Brčko District of BiH, which amounts to 766,755 MWh, the largest consumption is in buildings intended for housing in the amount of 682,773 MWh. It has the total of energy consumption. Detailed overview of energy consumption in the building sector of the Brčko District of BiH is on Table 6.

Table 6:: Energy consumption in the building sector in the base year

Buildings	Area(m ²)	Energy consumption (MWh / year)							
		Electricity	Electricity for heating	Mazut	Heating oil	Coal (brown)	Lignite	Pellets	Wood
Buildings owned and under the jurisdiction of the Brčko District of BiH	142.408	7.699	4.070	0	14.856	624	0	0	144
Building sector	2.871.744	130.766	149.044	-	10.281	163.230	62.547	15.421	151.484
Commercial and service buildings	385.378	38	35.400	-	14.311	2.466	331	286	3.757
Total	3.399.530	138.503	188.514		39.448	166.320	62.878	15.707	155.385

Of the total energy consumption in the building sector, the largest share is represented by residential buildings in the amount of about 89% (Figure 11).

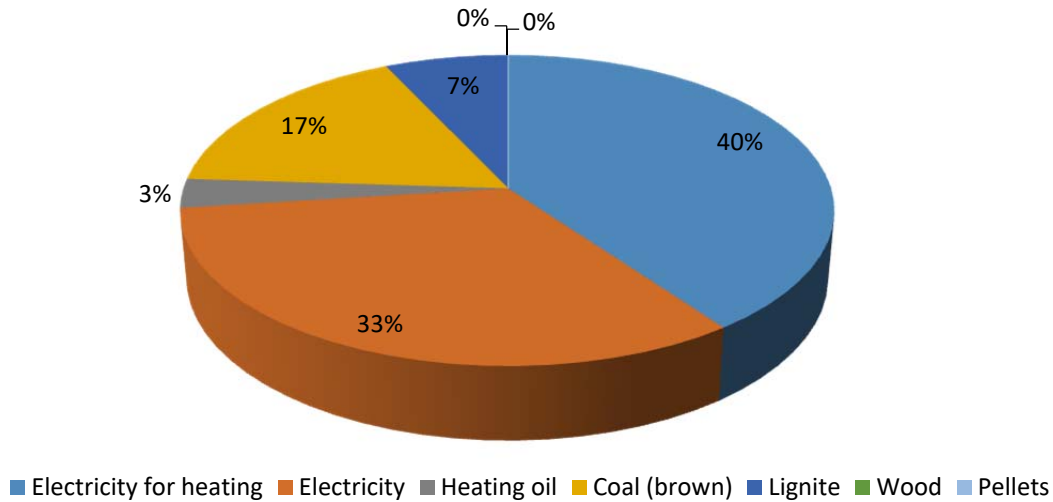


Figure 11: Distribution of energy consumption in the building sector by subsectors

5.2.6 Reference inventory of CO₂ emissions from the building sector

The reference inventory of CO₂ emissions of the Brčko District of BiH was prepared according to the protocol of the Intergovernmental Panel on Climate Change (IPCC) as the executive body of the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO) in implementing the United Nations Framework Convention on Climate Change. climate change (United Nation Framework Convention on Climate Change - UNFCCC). By ratifying the Kyoto Protocol in 2007, BiH committed itself to monitoring and reporting emissions of pollutants into the atmosphere according to the IPCC protocol, so it was used as a nationally recognized protocol for the development of the Reference Inventory of CO₂ emissions for the Brčko District of BiH.

CO₂ emissions from the building sector of the Brčko District of BiH include emissions from electricity and heat consumption and emissions from fuel combustion for buildings of the Brčko District of BiH, residential buildings and buildings of service and commercial activities of the Brčko District of BiH. Emission factors according to the type of energy source shown in Table 7 were used to calculate CO₂ emissions from the building sector of the Brčko District of BiH include emissions from electricity and heat consumption and emissions from fuel combustion for buildings of the Brčko District of BiH, residential buildings and buildings of service and commercial activities of the Brčko District of BiH. Emission factors according to the type of energy source shown in Table 7 were used to calculate CO₂ emissions.

Table 7: Emission factors by type of energy source

Energy product	Emission factors	
	Unit	CO ₂
Electricity	tCO ₂ /MWh _{el}	0,638
Firewood heat	tCO ₂ /MWh	0,282
Natural gas	tCO ₂ /MWh	0,205
Heating oil	tCO ₂ /MWh	0,259
Liquefied petroleum gas	tCO ₂ /MWh	0,230
Mazut	tCO ₂ /MWh	0,282
Brown coal	tCO ₂ /MWh	0,346
Lignite	tCO ₂ /MWh	0,364
Motor gasoline	tCO ₂ /MWh	0,252
Diesel fuel	tCO ₂ /MWh	0,266
Firewood	tCO ₂ /MWh	0,000

Table 8: CO₂ emissions from the building sector in the base year

Buildings	Energy consumption (tCO ₂ /year)							Wood
	Electricity	Electricity for heating	Mazut	Fuel oil	Brown coal	Lignite	Pellets	
Buildings owned and under the jurisdiction of the Brčko District of BiH	4.912	2.597	0	3.842	216	0	0	0
Housing sector buildings	83.428	95.090	0	2.658	56.453	22.787	0	0
Commercial and service buildings	23.933	35.400	0	3.701	853	121	0	0
Total	112.273	133.087	0	10.201	57.522	22.908	0	0

In the total CO₂ emissions from buildings, the largest share belongs to residential buildings in the amount of 78%, and the largest emissions in this subsector come from electricity and coal. In the subsector of buildings that are not under the jurisdiction of the Brčko District of BiH, the largest emissions come from coal and electricity.

Image 12, Image 13 and Image 14 show the shares of individual buildings in CO₂ emissions, in the complete building sector of the Brčko District of BiH in the base year 2012.13 and Figure 14 show the shares of individual buildings in CO₂ emissions, in the complete building sector of the Brčko District of BiH in the base year 2012.

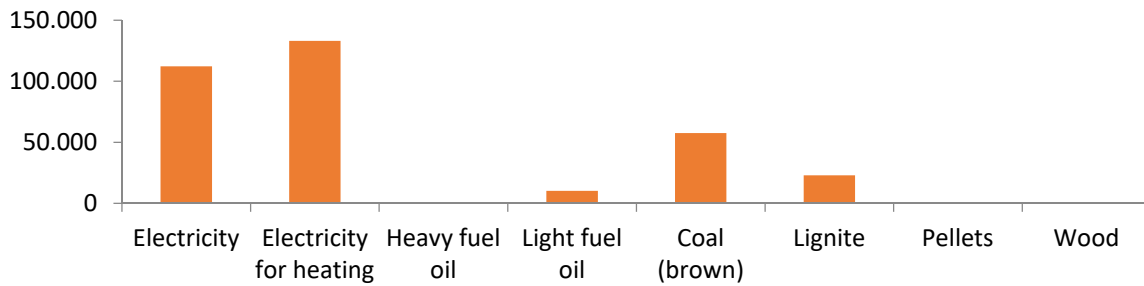


Figure 12: Reference inventory of CO₂ emissions from the building sector of the Brčko District of BiH by subsectors and energy for 2012

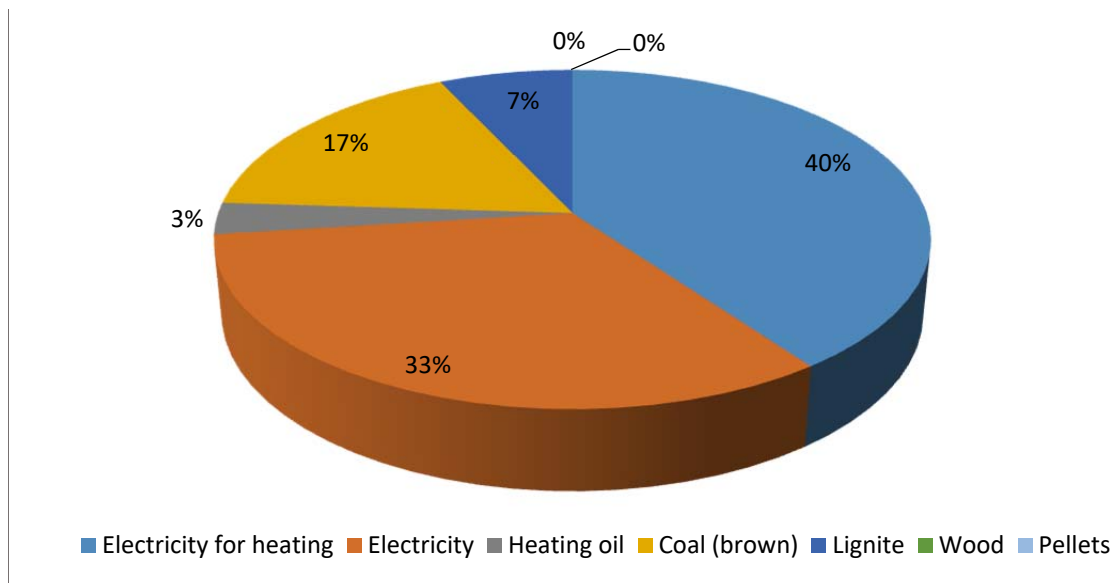


Figure 13: Share of individual energy sources in the total inventory of CO₂ emissions of the building sector for the year 2012

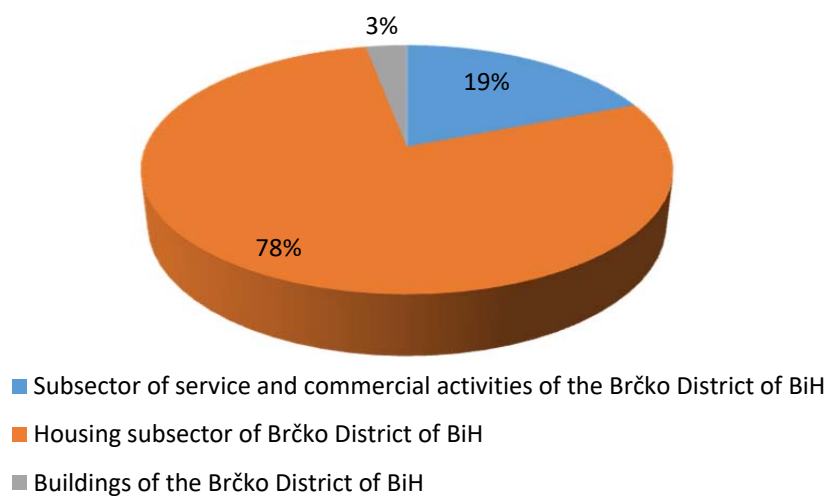


Figure 14: Share of each subsector in the total inventory of CO₂ emissions of the building sector for 2012

The largest emissions in the building sector of the Brčko District of BiH occur in the housing sector, about 78%, primarily due to the use of electricity for heating (40%) and electricity for other appliances (33%) throughout the year. Emissions from the use of energy for heating (coal) are 24%. Thus, the total CO₂ emissions for the Brčko District of BiH for the building sector in 2012 amounted to **312.082 tCO₂**.

5.3 Analysis of energy consumption and reference inventory of CO₂ emissions from the transport sector of the Brčko District of BiH

In urban areas, the transport sector is a significant source of air pollution, which greatly contributes to the creation of greenhouse gases, primarily CO₂, CH₄ i N₂O. CO₂ emissions from motor vehicles depend on various parameters, of which the main ones are fuel quality, construction of the vehicle engine, external meteorological conditions, engine maintenance and its age, etc.

In the area of the Brčko District of BiH in 2012, a total of 25,505 vehicles were registered, of which 24,780 were self-propelled vehicles, and the rest were trailers. The largest part belongs to the category of passenger vehicles 21,807, while in the category of trucks 2,329, buses 77, motorcycles 792.

The reference inventory of CO₂ emissions from the transport sector of the Brčko District of BiH is divided into three main subsectors:

- Vehicles owned and used by the Brčko District of BiH;
- Public transport in the Brčko District of BiH;
- Private and commercial vehicles.

5.3.1 Energy consumption and CO₂ emissions of vehicles owned and used by the Brčko District of BiH in the base year

The vehicle fleet owned by the Brčko District of BiH includes passenger cars, trucks and work vehicles, motorcycles, trailers and a bus. The total number of vehicles is 335, of which 264 are passenger vehicles, 34 trucks, 2 work machines, 28 motorcycles, 6 trailers and 1 bus. Of these categories of vehicles, commercial and cargo vehicles are primarily intended for the performance of communal activities.

Table 9: Energy consumption and vehicle emissions owned and used by the Brčko District of BiH by type of fuel in the base year

Table 9: Energy consumption and vehicle emissions owned and used by the Brčko District of BiH by type of fuel in the base year

Fuel type	Energy consumption (MWh)	Emission of CO ₂ [t CO ₂]
Diesel	2.703	719
Gasoline	872	220

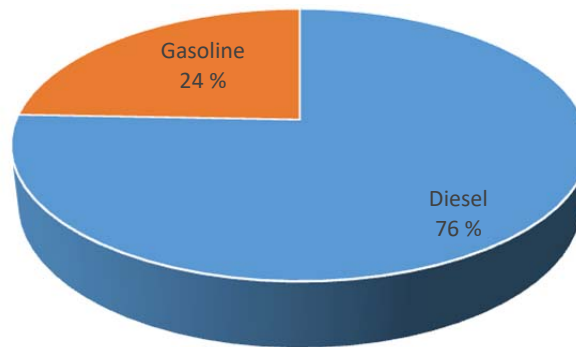


Figure 15: Energy share of vehicle fuel consumption owned and used by the Brčko District of BiH

5.3.2 Energy consumption and CO₂ emissions of public transport in the base year

Public transport in the area of the Brčko District of BiH is organized by bus and taxi vehicles. Public bus transport is organized in the Brčko District of BiH in 35 regular lines. The bus network covers the urban area of the city of Brčko and the suburbs of the District. The older buses are MAN and Mercedes types 303, 305 and 405 with Euro II and Euro III engines and so that their exhaust gases do not meet the new European standards for CO₂, HC and NO_x gases.

Within the Brčko District of BiH, a taxi service also operates within the public transport subsector. 110 licensed taxi carriers were registered in 2012. Most taxi companies provide their services in the narrower part of the city area. The vehicles are mostly with diesel or gasoline or LPG fuel. Table 10 shows energy consumption and CO₂ emissions in the public transport sector in the Brčko District of BiH.

Table 10: Energy consumption and CO₂ emissions of public transport vehicles of the Brčko District of BiH in the base year

Public transport vehicles	Energy consumption (MWh)		Emission of CO ₂ [t CO ₂]	
	Diesel	Gasoline	Diesel	Gasoline
Buses	11.044	0	2.939	0
Taxi vehicles	3.319	794	883	200
TOTAL	14.363	794	3.822	200

5.3.3 Energy consumption and emissions of private and commercial vehicles in the base year

In 2012, a total of 25,005 vehicles were registered in the Brčko District of BiH, of which 24,531 were private and commercial vehicles, excluding the number of vehicles owned by the Brčko District of BiH, taxis and public transport buses.

Of the total number of registered vehicles in the Brčko District of BiH, the largest share falls on passenger vehicles 21,433 (87%), followed by trucks 1,993 (8%), other vehicle categories 300 - tractors, working machines, etc. (1%) and mopeds and motorcycles 764 (3%) and buses 41 (0.2%).

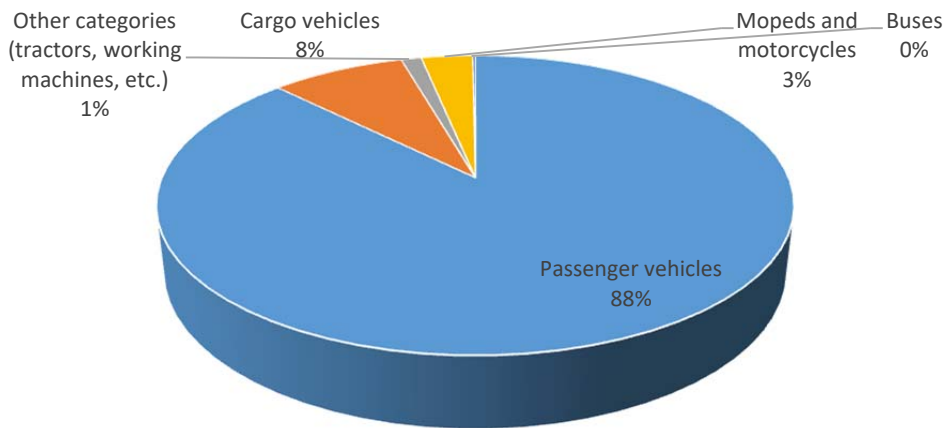


Figure 16: Representation of private and commercial vehicles in the Brčko District of BiH

Data on the structure and total fuel consumption were not available, and for the purposes of SECAP, an estimate of fuel consumption was made for these categories of vehicles.

The calculation is based on the experience of previous application of the COPERT IV model, developed by the European Environment Agency within the activities of the European Topic Center on Air and Climate Change. Estimates of fuel consumption for private and commercial are shown in Table 11.

Table 11: Fuel consumption of the subsector private and commercial vehicles in 2012 in the Brčko District of BiH

Fuel Consumption (t/year)	Gasoline(l)	Diesel(l)	Electricity (kWh)	Consumption (TJ)		Emission CO ₂ (t/year)	
				Gasoline	Diesel	Gasoline	Diesel
Private passenger vehicles	12.142.512	15.976.128	5.280	419,94	619,38	28.049,20	42.816,02
Light duty vehicles	132.342	3.631.504		4,58	140,79	305,71	9.732,43
Heavy duty vehicles	-	4.185.960			162,29	-	11.218,37
Buses (other)	-	2.383.699			92,41	-	6.388,31
Two-wheelers	79.059	-		2,73		182,63	
TOTAL	12.350.913	26.177.291	5.280	427,25	1.014,87	28.537,54	70.155,13

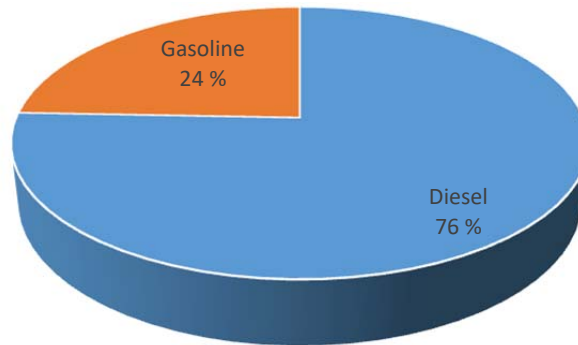


Figure 17: Share of consumption of certain types of fuel in the subsector private and commercial vehicles

5.3.4 Total energy consumption and CO₂ emissions from the transport sector of the Brčko District of BiH in the base year

Energy consumption and associated CO₂ emissions in the transport sector in the Brčko District of BiH is the highest in the subsector of passenger and commercial vehicles and amounts to 98,693 tCO₂. An overview of total energy consumption in the transport sector of the Brčko District of BiH is shown in Table 12, and Table 13 shows an overview of total emissions from the transport sector.

Table 12: Total energy consumption from the transport sector in the Brčko District of BiH

Subsector	Energy consumption (MWh)		
	Diesel	Gasoline	Total
Vehicles owned and used by the Brčko District of BiH	2.703	872	3.575
Public transport vehicles	14.364	794	15.158
Private and commercial vehicles	281.908	118.681	400.589

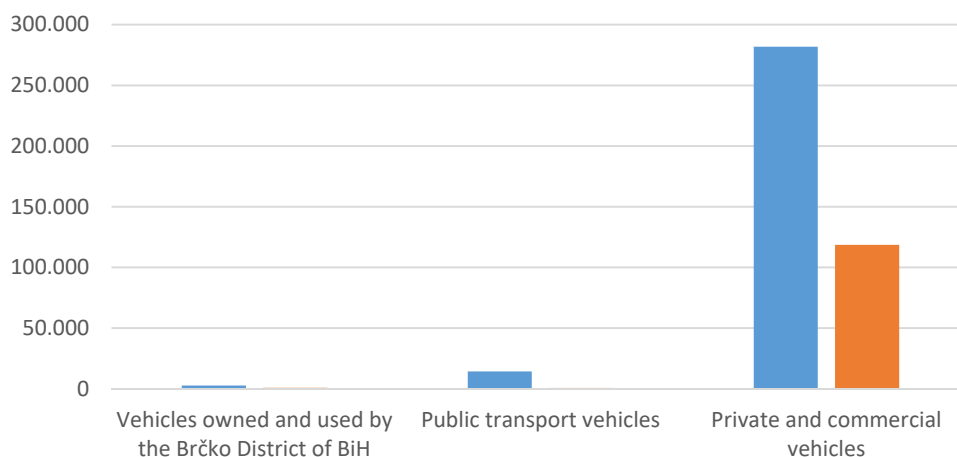


Figure 18: Total energy consumption from the transport sector expressed in MWh

Table 13: Total CO₂ emissions from the transport sector in the Brčko District of BiH

Subsector	Emission of CO ₂ [t CO ₂]		
	Diesel	Gasoline	Total
Vehicles owned and used by the Brčko District of BiH	719	220	939
Public transport vehicles	3.822	200	4.022
Private and commercial vehicles	70.155	28.538	98.693

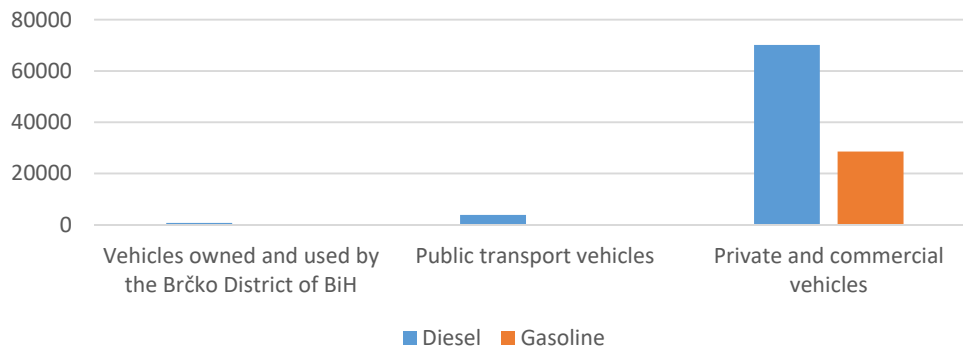


Figure 19: Total CO₂ emissions from the transport sector of the Brčko District of BiH expressed in tons in the base year

5.4 Analysis of energy consumption and reference inventory of CO₂ emissions from the public lighting sector of the Brčko District of BiH

5.4.1 Introduction

The public lighting network is owned by the Brčko District of BiH, and is therefore responsible for its maintenance, reconstruction and construction. This situation significantly simplifies and speeds up the process of collecting the necessary data, and also significantly contributes to a better analysis of the situation in the public lighting network and the identification of measures to improve energy efficiency. This approach is in line with the concept of SECAP, ie it allows local action to reduce emissions that have global consequences.

The necessary data for the analysis of energy consumption in the sector of public lighting in Brčko District were taken from the following sources:

- JP „Komunalno Brčko“ d.o.o.
- Department for Communal Affairs of the Government of the Brčko District of BiH

5.4.2 General data on public lighting in the Brčko District of BiH

The total number of lamps, which made up the public lighting of the Brčko District of BiH, in 2012 was 14,490. Of the total number, lamps with mercury bulbs were 8,235 or 56.83%, then 5,717 or 39.45% sodium bulbs, while 528 or 3.65% are other types of bulbs (metal-halogen, etc.), while bulbs made in LED technology not at all.

In 2012, 8,959,238 kWh of electricity was used to supply public lighting in the Brčko District of BiH.

5.4.3 Structure of the existing public lighting network of the Brčko District of BiH

The public lighting network of the Brčko District of BiH consists of:

- power supply - measuring points for public lighting,
- devices for programming the time of switching on and off public lighting,
- comb switches,
- power cables,
- lighting distributors,
- pillars,
- wall brackets,
- cables,
- lamps and bulbs.

Metering points are supplied from the network, belonging to the transformer area, on the basis of the electric power consent obtained from the competent public company. Measurement of the taken electricity for the needs of public lighting is done in the substations themselves, using special meters, which register only the consumption of public lighting. Management of public lighting (switching it on and off) is done through switching clocks and appropriate contactors or through the so-called. photo-relays and contactors. Public lighting works about 4,000 hours a year.

5.4.4 Structure of public lighting according to the type of light source in the area of Brčko District of BiH

In the network of public lighting of the Brčko District of BiH, the most represented are lamps with mercury lamps, which are represented in the amount of 87%, followed by sodium lamps, which are represented by 39%. Figure 20 shows the structure of public lighting in the Brčko District of BiH according to the type of light source.

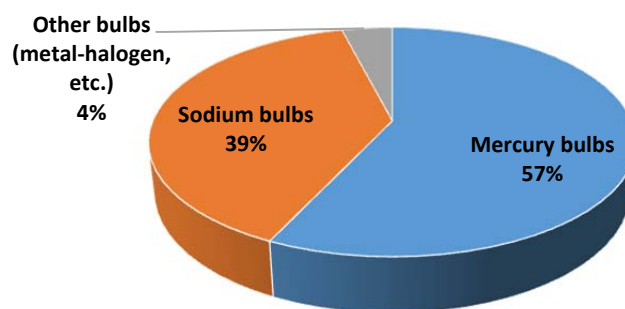


Figure 20: Structure of the public lighting network according to the type of light source

5.4.5 Electricity consumption in the public lighting network of the Brčko District of BiH in the base year

In 2012, 8,959 MWh of electricity was used to supply public lighting. The trend of expanding public lighting shows a moderate increase in the number of lamps. In the period from 2008 to 2012, the number of lamps increased by 727 pieces.

5.4.6 Reference inventory of emissions CO₂ for public lighting in the Brčko District of BiH for the base year

CO₂ emissions from the public lighting sector are indirect emissions because they are generated by electricity consumption. The total CO₂ emissions from the total electricity consumption for public lighting in the Brčko District of BiH for 2012 are shown in Table 14.

Table 14: Electricity consumption and indirect CO₂ emissions of public lighting electricity network

Public lighting	Electricity consumption (kWh)	Emission factor tCO ₂ /MWh	Emission tCO ₂
	8.959.238	0,638	5.716

Total emissions in the public lighting sector for the reference year 2012 amounted to 5,716 tons of CO₂.

5.5 Total energy consumption and reference inventory of CO₂ emissions of the Brčko District of BiH

5.5.1 Energy consumption of Brčko District of BiH - Reference inventory (BEI)

The analysis of energy consumption of the Brčko District of BiH for 2012 includes consumption from the building, transport and public lighting sectors.

Table 15: Division of energy consumption of individual sectors by energy sources in the base year

Energy product	Energy consumption MWh/year				%
	Buildings	Traffic	Public lighting	Total by energy sources	Share by energy sources
Diesel	0	298.975		298.975	25
Heating oil	39.448			39.448	3
Motor gasoline	0	120.347		120.347	10
Electricity for heating	188.514			188.514	16
Electricity	138.503		8959,238	147.462	12
Coal (brown)	166.320			166.320	14
Lignite	62.878			62.878	5
Pellets	15.707			15.707	1
Wood	155.385			155.385	13
TOTAL	766.755	419.322	8.959	1.195.036	100
Sector share (%)	64%	35%	1%		

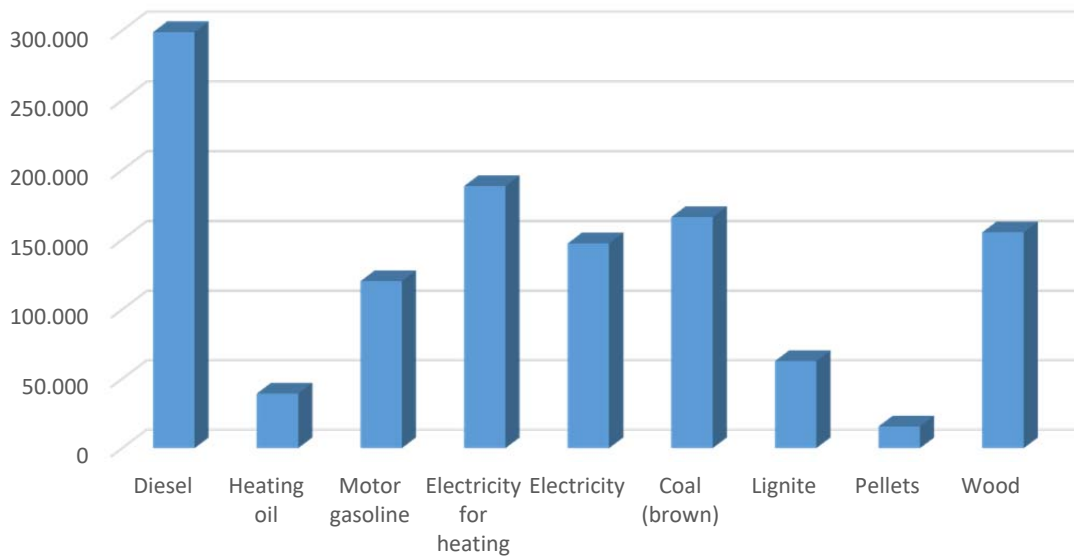


Figure 21: Energy consumption by energy sources in 2012 (MWh/year)

Based on the analysis of total energy consumption by energy sources, it follows that diesel is the energy source with the largest share in total energy consumption. Diesel consumption in 2012 amounted to about 298,975 MWh, which is 25% of total energy consumption in the Brčko District of BiH. The dominant energy sources, in addition to motor gasoline, are electricity for heating, brown coal and wood.

The total energy consumption of the analyzed energy sectors of the Brčko District of BiH is 1,195,036 MWh, of which 766,755 MWh is consumed in buildings, and the remaining part in the transport and public lighting sector.

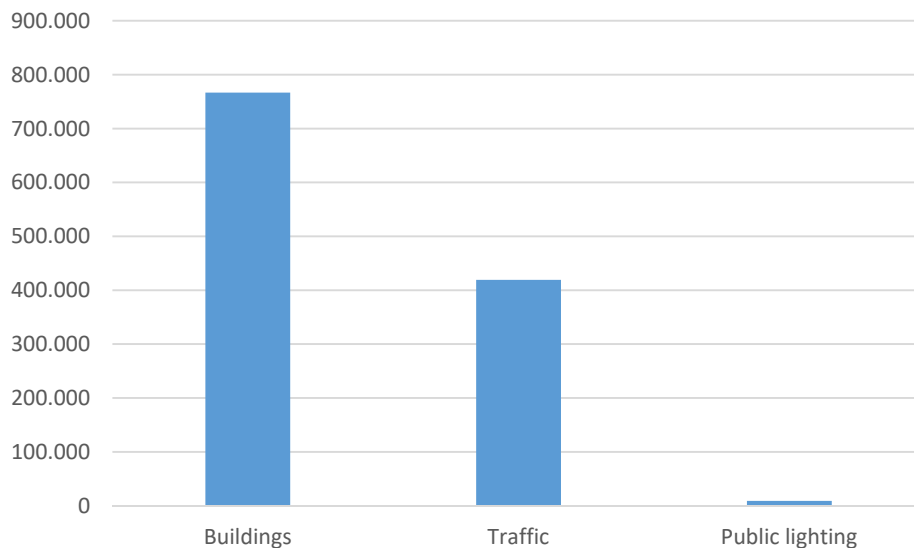


Figure 22: Total energy consumption by sectors in 2012 (MWh/year)

Figure 23 shows the total energy consumption by sectors and energy sources in 2012 in the Brčko District of BiH.

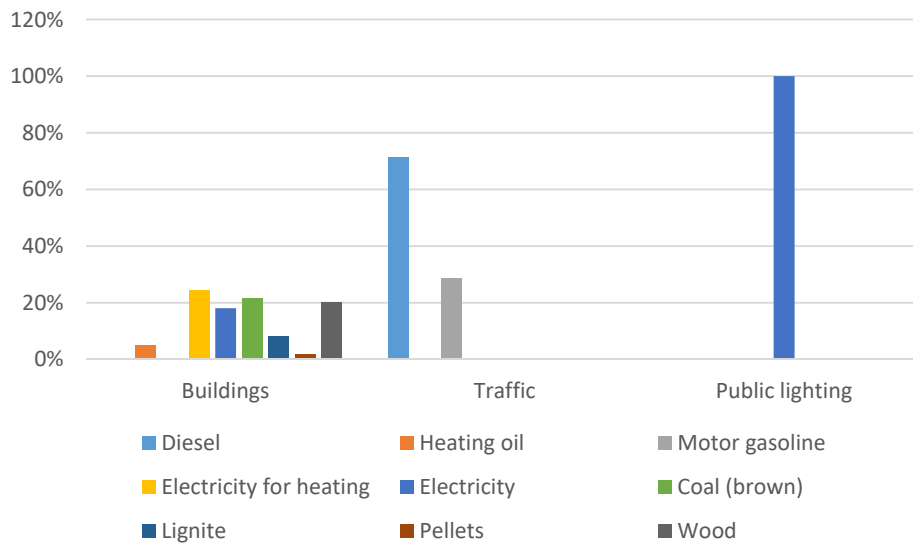


Figure 23: Total energy consumption by sectors and energy sources in 2012

Electricity for heating (25%) and brown coal (22%) are the most represented energy sources in the building sector, while diesel and motor gasoline are the most consumed in the transport sector.

5.5.2 Total CO₂ emissions of the Brčko District of BiH - Reference Inventory (BEI)

The reference inventory of emissions of the Brčko District of BiH for 2012 includes direct (combustion of all types of fuel except biomass) and indirect (electricity consumption) CO₂ emissions from three sectors of direct energy consumption, as follows:

- Buildings,
- transport and
- public lighting.

Table 16: CO_{2eq} emissions by sectors and energy sources in 2012

Energy product	Emission tCO _{2eq} /year			Total by energy sources	% Share by energy sources
	Buildings	Traffic	Public lighting		
Diesel	0	74.696		74.696	18
Heating oil	10.201			10.201	2
Motor gasoline	0	28.958		28.958	7
Electricity for heating	133.087			133.087	32
Electricity	88.364		5.716	94.080	22
Coal (brown)	57.522			57.522	14
Lignite	22.908			22.908	5
Pellets	0			0	0
Wood	0			0	0
TOTAL	312.082	103.654	5.716	421.452	100
Sector share (%)	74%	25%	1%		

The construction sector has the largest share of 74% in total CO_{2eq} emissions, followed by the transport sector with a share of 25%.

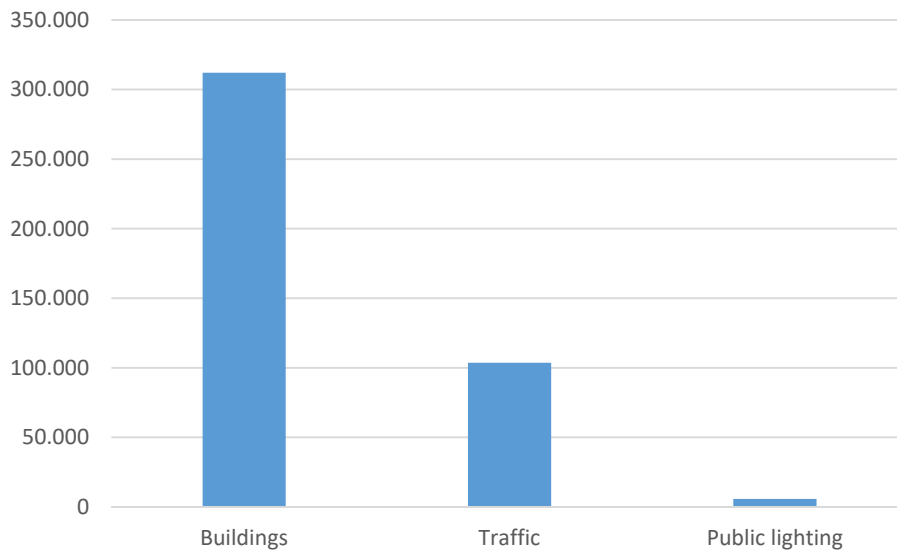


Figure 24: Total CO₂ emissions by sector for 2012

Total CO_{2eq} emissions of the reference inventory of the Brčko District of BiH amount to 421.452 tCO_{2eq}. The largest source of emissions, as well as energy consumption, is the building sector with total emissions of 312.082 tCO_{2eq}, followed by the transport sector with total emissions of 103.654 tCO_{2eq}.

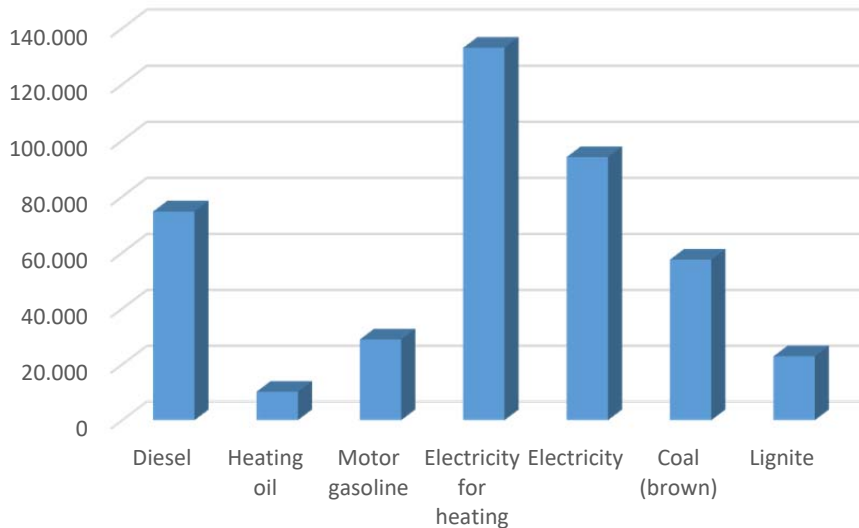


Figure 25: Total CO₂ emissions shown by energy sources in 2012

Emissions from the consumption of electricity for heating (133,087 tCO₂) and electricity for other uses (94,080 tCO₂) and diesel (74,696 tCO₂) are the most represented in the total reference inventory of emissions of the Brčko District of BiH for 2012.

6 Monitoring Emission Inventory (MEI)

6.1 Control inventory of CO₂ emissions from the building sector for 2019

6.1.1 CO₂ emissions from buildings owned and under the jurisdiction of the Brčko District of BiH

Table 17 shows CO₂ emissions from buildings owned and managed by the Brčko District of BiH for 2019.

Table 17: CO₂ emissions of public buildings of the Brčko District of BiH in the control year 2019

Category	Energy consumption tCO ₂ /year						
	Electricity	Electricity for heating	Mazut	Heating oil	Coal (brown)	Pellets	Wood
Government and Assembly Buildings of Brčko District	693	536	0	675	134	0	0
Premises of local communities	466	1.702	0	0	0	0	0
Public companies	161	554	0	28	0	0	0
Institution buildings in education	2.458	690	0	3.319	228	0	0
Health care buildings	652	303	0	862	0	0	0
Buildings for cultural activities	205	40	0	224	139	0	0
Buildings for sports activities	146	19	0	213	0	0	0
Buildings of public police and judicial institutions	665	37	0	764	0	0	0
TOTAL	5.446	3.881	0	6.084	501	0	0

Observing the buildings owned and under the jurisdiction of the Brčko District of BiH, the largest share in the total emissions for the control year are emissions from buildings intended for education in the amount of 64%, followed by buildings from local communities in the amount of 21%.

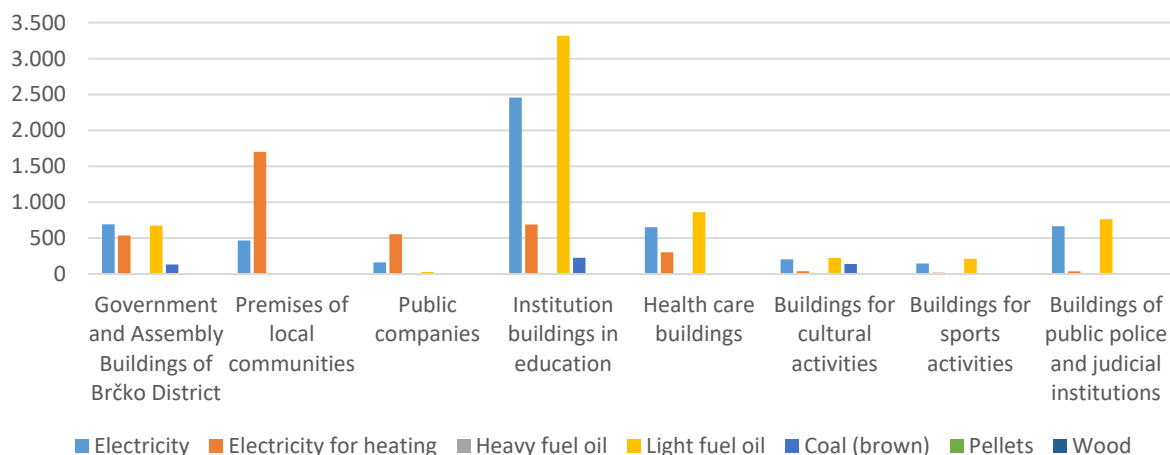


Figure 26: CO₂ emissions from buildings owned and under the jurisdiction of the Brčko District of BiH in the control year 2019

The largest share in the total CO₂ emission is the emission caused by the consumption of heating oil of 58%, followed by the use of electricity for heating with a share of 37%.

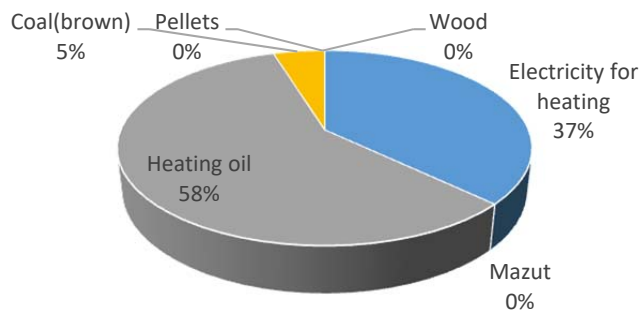


Figure 27: Share of individual energy source in the total CO₂ emissions from buildings owned and under the jurisdiction of the Brčko District of BiH for the control year 2019

6.1.2 CO₂ emissions in the housing sub-sector, for individual and collective housing in the control year

Table 18: CO₂ emissions of the housing sector of the Brčko District of BiH in the control year 2019
Table 18 shows CO₂ emissions from the housing sector of the Brčko District of BiH for 2019.

Table 18: CO₂ emissions of the housing sector of the Brčko District of BiH in the control year 2019

Energy product	Energy consumption tCO ₂ /year
Electricity for heating	96.516
Electricity	84.680
Heating oil	2.698
Brown coal	49.226
Lignite	23.129
Wood	0
Pellets	0
Total	256.249

The largest share in the total CO₂ emissions in the housing sector of the Brčko District of BiH is the emission due to the use of electricity for heating with a share of 38% and electricity for other uses of 33%, followed by emissions from coal with a share of 19%

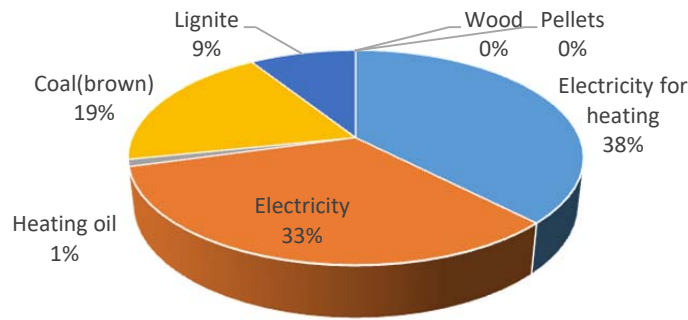


Figure 28: Share of individual energy source in the total CO₂ emissions from the housing sector of the Brčko District of BiH for the control year 2019

6.1.3 CO₂ emissions in the subsector of commercial and service activities of the Brčko District of BiH in the control year

Table 19 shows CO₂ emissions from the subsector of commercial and service activities of the Brčko District of BiH for 2019.

Table 19: CO₂ emissions in the subsector of commercial and service activities of the Brčko District of BiH in the control year 2019

Category	Energy consumption tCO ₂ /year
Electricity for heating	23.037
Electricity	23.933
Heting oil	2.720
Brown coal	870
Lignite	123
Wood	0
Pellets	0
TOTAL	50.683

Most of the CO₂ emissions are generated by the use of electricity for heating and their share is 46% and electricity for other uses with a share of 47%.

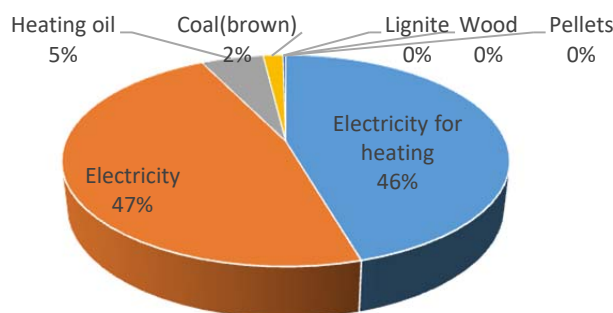


Figure 29: Share of individual energy source in total CO₂ emissions from the subsector of commercial and service activities of the Brčko District of BiH for the control year 2019

6.1.4 Total CO₂ emissions of the building sector in the control year

Table 20 shows the CO₂ emissions of the building sector of the Brčko District of BiH for 2019.

Table 20: Control inventory of CO₂ emissions of the building sector for the control year 2019

Buildings	Energy consumption (tCO ₂ /year)							
	Electricity	Electricity for heating	Mazut	Heating oil	Brown coal	Lignite	Pellets	Wood
Buildings owned and under the jurisdiction of the Brčko District of BiH	5.446	3.881	0	6.084	501	0	0	0
Housing sector buildings	84.680	96.516	0	2.698	49.226	23.129	0	0
Commercial and service buildings	23.933	23.037	0	2.720	870	123	0	0
Total	114.058	123.434	0	11.502	50.597	23.252	0	0

The largest share in the total CO₂ emissions is made up of emissions from electricity for heating and other uses with a share of 38% and 35% respectively, while the emissions caused by the remaining energy sources do not exceed 16% in total.

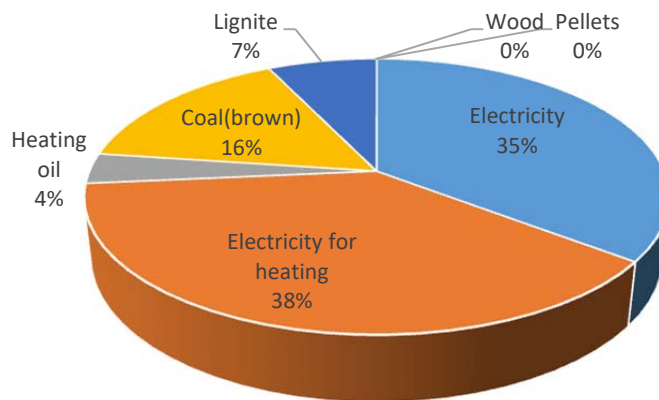


Figure 30: Share of individual energy source in the total inventory of CO₂ emissions of the building sector for the control year 2019

Looking at the building sector, the largest share in total emissions has residential buildings with 79%, followed by the subsector of services and commercial activities 16%, while buildings owned and managed by the Brčko District of BiH contribute with 5% of total CO₂ emissions.

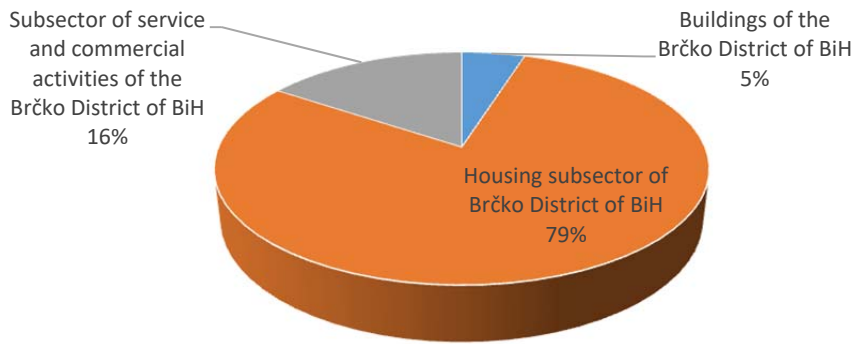


Figure 31: Control inventory of CO₂ emissions from the building sector of the Brčko District of BiH by subsectors and energy sources for 2019

6.2 Control inventory of CO₂ emissions from the transport sector for 2019

6.2.1 Control inventory of CO₂ emissions of vehicles owned and used by the Brčko District of BiH

In 2019, the vehicle fleet of the Brčko District of BiH has 329 vehicles, of which 258 are passenger vehicles, 47 trucks, 3 work machines, 19 motorcycles and 2 buses. Compared to the base year, there was a decrease in the number of vehicles in this subsector by about 2%.

Table 21 shows the energy consumption of vehicles owned and used by the Brčko District of BiH in the amount of 2,220 MWh and CO₂ emissions of vehicles owned and used by the Brčko District of BiH expressed in tCO₂ for the control year.

Table 21: Energy consumption and vehicle emissions owned and used by the Brčko District of BiH by type of fuel in the control year

Fuel type	Energy consumption (MWh)	Emission of CO ₂ [t CO ₂]
Diesel	1.729	460
Gasoline	401	124

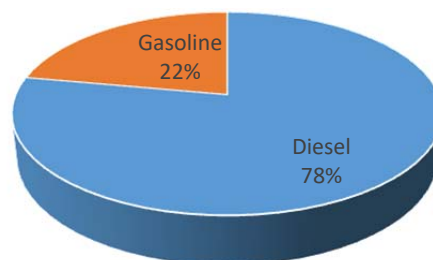


Figure 32: Energy share of vehicle fuel consumption owned and used by the Brčko District of BiH in the control year

In 2019, compared to the base year 2012, in the area of the Brčko District of BiH, the public transport service was modernized. The fleet of carriers in the control year consists of 71 buses. All vehicles use diesel as fuel.

In the area of the Brčko District of BiH, within the subsector of public transport, there is also a taxi service, as previously mentioned, which has 29 vehicles with a diesel engine and three vehicles with gasoline / LPG. Table 22 shows energy consumption and CO₂ emissions in the public transport sector in the Brčko District of BiH.

Table 22: Energy consumption and CO₂ emissions of public transport vehicles of the Brčko District of BiH in the control year

Fuel type	Energy consumption (MWh)	Emission of CO ₂ [t CO ₂]
Diesel	17.316	4.607
Gasoline	0	0
LPG	451	104

6.2.2 Control inventory of CO₂ emissions of private and commercial vehicles

In the area of the Brčko District of BiH, in 2019, 28,641 private vehicles (passenger cars), 942 mopeds and motorcycles, 1,139 trucks, 1,006 attached and working machines and 207 tractors were registered. Compared to the base year, there was an increase in the number of vehicles by approximately 18% compared to the base year. The structure of registered private and commercial vehicles is shown in Figure 33.

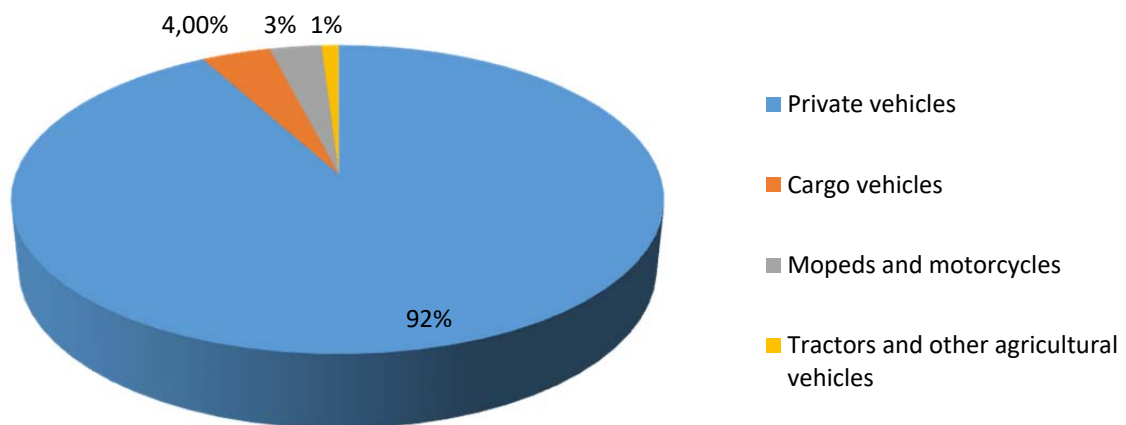


Figure 33: Representation of private and commercial vehicles in the Brčko District of BiH

Diesel vehicles are the largest consumer in this subsector and they consume as much as 73% of energy, followed by vehicles that use gasoline as fuel with 23%. Fuel consumption for private and commercial is shown in Table 23.

Table 23: Energy consumption in the private and commercial vehicle subsector

Categories	Fuel type	Fuel consumption (ton)	Consumption (MWh)	Share (%)
Private vehicles	D	34.557	414.686	87,65
	B	1.463	17.690	3,74
	LPG	1.979	24.411	5,16
Cargo vehicles	D	1.285	15.420	3,26
	B	14	173	0,04
Mopeds and motorcycles	B	36	436	0,09
Tractors and other agricultural vehicles	D	24	287	0,06
Total		39.358	473.103	100

Table 24: **CO₂** emissions of private and commercial vehicles in the control year 2019 Table 24 shows the vehicle emissions depending on the propellant of that vehicle type.

Table 24: CO₂ emissions of private and commercial vehicles in the control year 2019

Categories	Fuel type	Consumption (MWh)	Emission of CO ₂ [t CO ₂]
Private vehicles	D	414.686	110.721
	B	17.690	4.405
	LPG	24.411	5.541
Cargo vehicles	D	15.420	4.117
	B	173	43
Mopeds and motorcycles	B	436	109
Tractors and other agricultural vehicles	D	287	77
Total		473.103	125.013

6.2.3 Control inventory of total CO₂ emissions of the transport sector

The total CO₂ emission expressed in tons in this subsector is 130,308, which is an increase of approximately 20% compared to the base year. An overview of total energy consumption in the transport sector in the Brčko District of BiH is shown in Table 25, and Table 26 for an overview of total emissions from the transport sector.

Table 25: Total energy consumption from the transport sector in the control year 2019

Subsector	Energy consumption (MWh)			
	Diesel	Gasoline	LPG	Total
Vehicles owned and used by the Brčko District of BiH	1.729	491		2.220
Public transport vehicles	17.316	0	451	17.767
Private and commercial vehicles	430.393	18.299	24.411	473.103

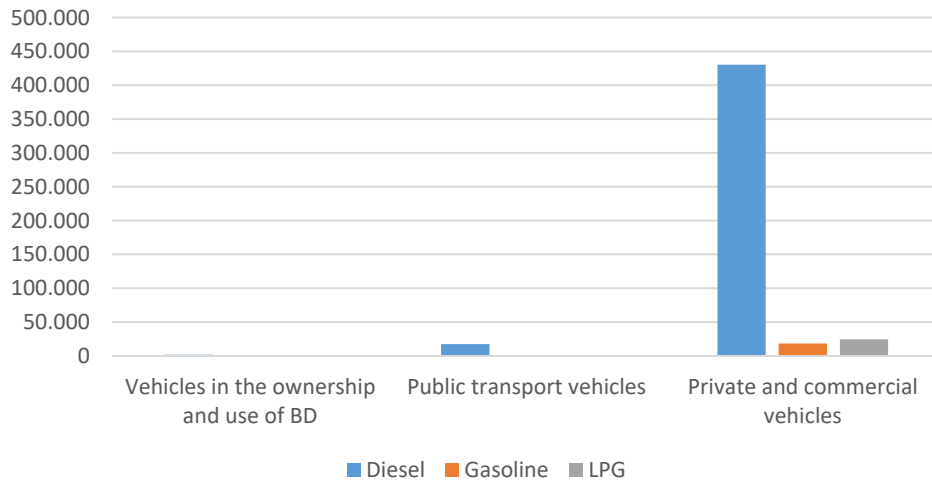


Figure 34: Total energy consumption from the transport sector expressed in MWh in the control year 2019

Table 26: Total CO₂ emissions from the transport sector in the control year 2019

Subsector	Emisija CO ₂ [t CO ₂]			
	Diesel	Petrol	LPG	Total
Vehicles owned and used by the Brčko District of BiH	460	124		584
Public transport vehicles	4.607	0	104	4.711
Private and commercial vehicles	114.915	4.556	5.541	125.013

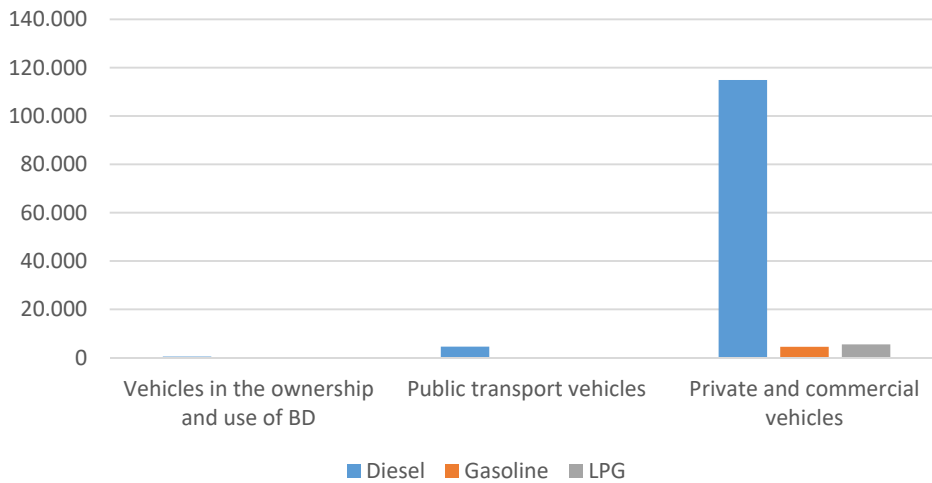


Figure 35: Total CO₂ emissions from the transport sector expressed in tons in the control year 2019

6.3 Analysis of energy consumption and control inventory of CO₂ emissions from the public lighting sector in 2019

In 2019, compared to the base year 2012, in the area of the Brčko District of BiH, there was an expansion of public lighting due to the expansion of the network. In 2019, 10,126 MWh of electricity was used to supply public lighting, which is 12% more than in the base year.

CO₂ emissions from the public lighting sector are indirect emissions because they are generated by electricity consumption. The total CO₂ emissions from the total electricity consumption for public lighting in the Brčko District of BiH for the control year 2019 are shown in Table 27.

Table 27: Electricity consumption and indirect CO₂ emissions of public lighting electricity network

Public lighting	Electricity consumption (kWh)	Emission factor tCO ₂ /MWh	Emission tCO ₂
	10.126	0,638	6.461

Total emissions in the public lighting sector for the control year 2019 amounted to 6,461 tons of CO₂.

6.4 Total Control Inventory of CO₂ Emissions for 2019

6.4.1 Total CO₂ emissions of the Brčko District of BiH - Control Inventory (MEI)

The control inventory of CO₂ emissions of the Brčko District of BiH includes direct CO₂ emissions from fuel combustion and indirect CO₂ emissions from the consumption of electricity and heat for the buildings, transport and public lighting sectors.

Table 28: CO₂eq emissions by sectors and energy in the control year 2019

Energy product	Emission of tCO ₂ eq/year				%
	Buildings	Traffic	Public lighting	Total by energy sources	Share by energy sources
Diesel	0	119.982		119.982	26
Heating oil	11.502			11.502	3
Motor gasoline	0	4.680		4.680	1
LPG		5.645		5.645	1
Electricity for heating	123.434			123.434	27
Electricity	114.058		6.461	120.519	26
Brown coal	50.597			50.597	11
Lignite	23.252			23.252	5
Pellets	0			0	0
Wood	0			0	0
TOTAL	322.844	130.308	6.461	459.612	100
Sector share (%)	70%	28%	1%		

The largest share of 70% in total CO_{2eq} emissions has the building sector, followed by the transport sector with a share of 28%. The public lighting sector participates in total emissions in the amount of only 1%.

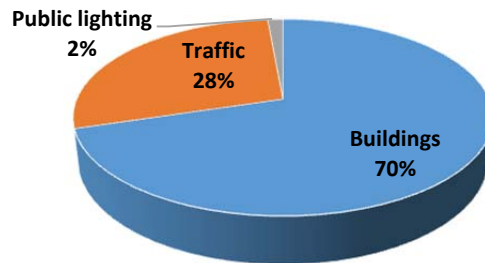


Figure 36: Percentage share of the sector in total CO₂ emissions in the control year 2019

Total CO_{2eq} emissions from the control inventory of the Brčko District of BiH amount to 459,612 tCO_{2eq}. Emissions from electricity consumption for heating and other uses (123,434 tCO₂ and 120,519 tCO₂) and diesel fuel (119,982 tCO₂) are the most represented in the total control inventory of emissions of the Brčko District of BiH for 2019.

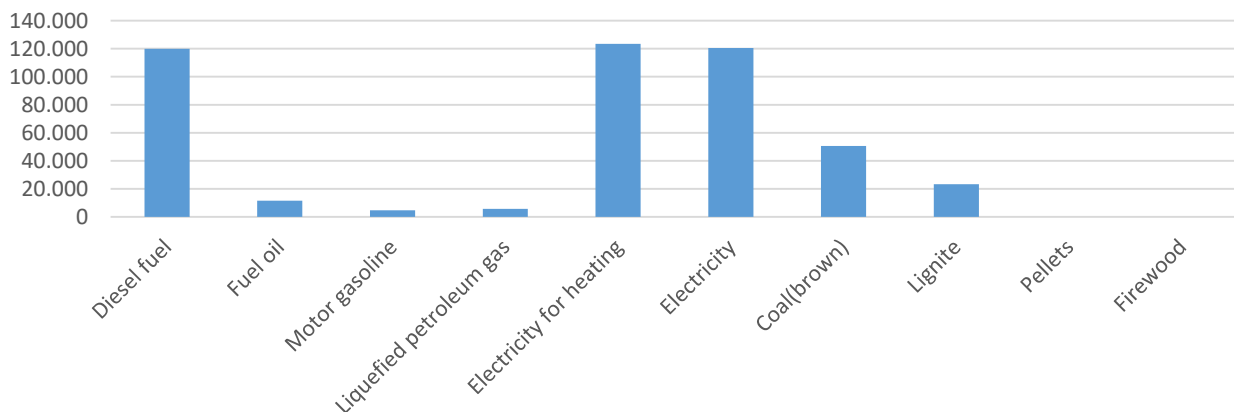


Figure 37: Total CO₂ emissions shown by energy sources in the control year 2019 (tCO₂)

7 Comparison of Reference and Control Inventory of Brčko District of BiH

The total Control Inventory of CO₂ Emissions in 2019 amounted to 459,612 tCO_{2eq} and is about 8% higher than the Reference Inventory of CO₂ Emissions, which amounted to 421,452 tCO_{2eq} in 2012. The largest increase in CO₂ emissions in 2019 compared to the base year 2012 was achieved from diesel fuel emissions (Figure 38).

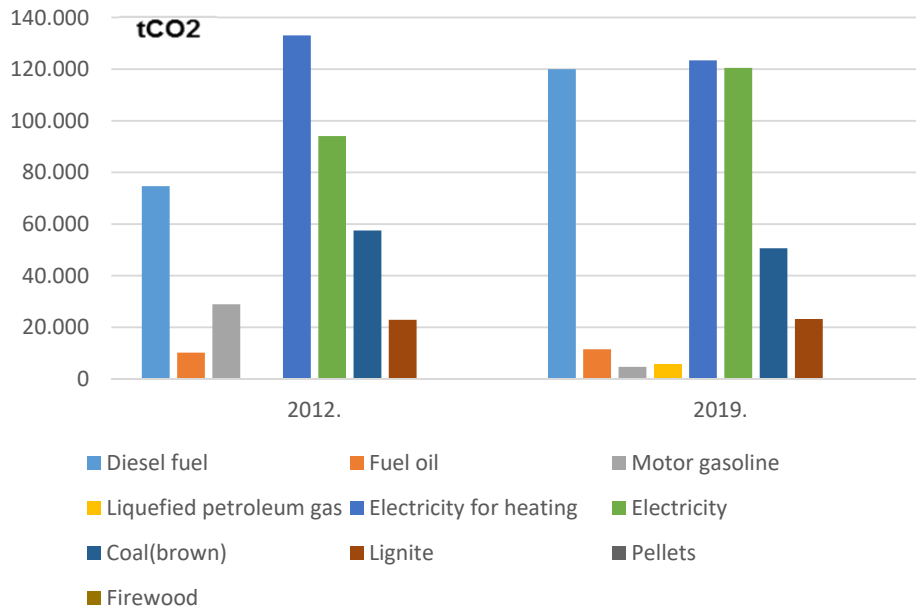


Figure 38: Comparison of Reference and Control Inventory by energy sources

Analyzing the share of the sector in the total emissions of the Brčko District of BiH in 2019 compared to 2012, the structure of their share in the total CO₂ eq emissions changed, ie the share of the transport sector increased by 18% (Figure 39).

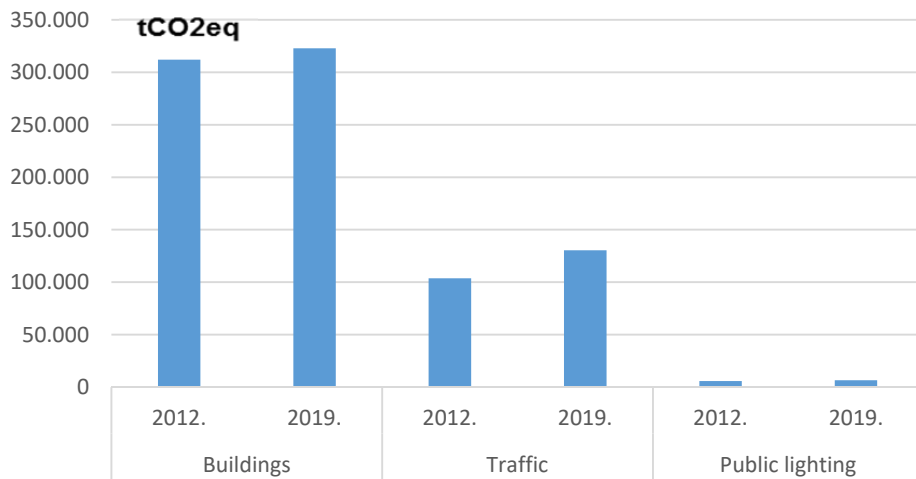


Figure 39: Comparison of Reference and Control Inventory by sectors

8 MITIGATION OF CLIMATE CHANGE EFFECTS - Plan of priority climate change mitigation measures

8.1 Measure for reduction of CO₂ emissions from buildings sector in Brčko district BiH

8.1.1 Public buildings owned by and under the competence of Brčko district BiH

Measure number	Z – 1
Name of measure/activity	Introduction of energy management – establishment of information system for monitoring of energy consumption in public buildings owned by and under the competence of Brčko district BiH
Competent authorities	<ul style="list-style-type: none"> – Office for public assets management of Brčko district BiH; – Public utility company “Komunalno Brčko” d.o.o.; – Human Resources sub-department; – Department for professional and administrative affairs.
Beginning/end of implementation (year)	2020-2025
Needed investment (KM)	200.000
Estimated energy saving (MWh)	1.370
Estimated decrease of emission (tCO₂)	578
Funding sources for implementation of measure	<ul style="list-style-type: none"> - Budget of Brčko district BiH; - Potential donors: GIZ, UNDP, USAID.
Description	<p>For all buildings under the competence of / owned by Brčko district BiH the establishment of information system for monitoring of energy consumption – energy accounting is proposed.</p> <p>Information system for energy management is used for supervision and analysis of energy and water consumption in public sector buildings, and is unavoidable tool for system energy management. Main functions of the system are:</p> <ul style="list-style-type: none"> • Collection and entry of main data about buildings as well as control of energy and water consumption; • Simple access to information about total quantity of consumed energy and water; • Calculations and analyses aimed at determining undesirable, excessive and irrational consumption, and identifying opportunities for energy and financial savings; • Verification of generated savings; • Automatic alarming about critical situations and irregularities in work. <p>The proposed measure is not financially intensive, it generates savings and is implemented with establishment of the body comprising employees that would be energy management, whose function would be to monitor and manage the energy consumption.</p> <p>Establishment of management at institution level would, based on genesis of events and costs, monitor the consumption of all energy fuels. All irregularities or increases in consumption would be diagnosed shortly and corrective actions could be taken in order to prevent undesired consequence;</p>

Measure number	Z – 1
Name of measure/activity	Introduction of energy management – establishment of information system for monitoring of energy consumption in public buildings owned by and under the competence of Brčko district BiH
	<p>afterwards, the actions would be taken that would decrease the probability of repeating the same or similar undesired consequence in future. The selected management should take control over consumption and should act preventively in order to downsize the energy consumption to optimal measure. This type of energy management would result with significant decrease of thermal energy consumption.</p> <p>In addition to establishment of information system for monitoring of energy consumption, the measure includes several educational activities that are implemented continuously:</p> <ul style="list-style-type: none"> • Making and distribution of educational material (leaflets, brochures, stickers, etc.); • Organisation of educational workshops and forums – way to raise the awareness on energy saving opportunities.

Measure number	Z – 2
Name of measure/activity	Establishment of legal framework for efficient energy management and introduction of criteria for green public procurements of electrical appliances for buildings owned by and under the competence of Brčko district BiH
Competent authorities	<ul style="list-style-type: none"> - Department for professional and administrative affairs including the Public Procurements Sub-Department; - Responsible departments of Brčko district BiH government and assembly
Beginning/end of implementation (year)	2020-2024
Needed investment (KM)	50.000
Estimated energy saving (MWh)	539
Estimated decrease of emission (tCO₂)	344
Funding sources for implementation of measure	<ul style="list-style-type: none"> - Budget of Brčko district BiH; - Potential donors: GIZ, UNDP, USAID.
Description	Subsidies for procurement of energy efficient electrical appliances for all buildings owned by and under the competence of Brčko district BiH through introduction of green public procurements. Criteria for procurement of appliances should be defined in advance and standardized by special Guidelines, and all new appliances should meet the defined criteria. The measure includes drafting the Energy Efficiency Law and Guidelines related to energy management primarily in building sector, and later in other segments as well.

Measure number	Z -3
Name of measure/activity	Improvement of energy efficiency in buildings owned by and under the competence of Brčko district BiH
Competent authorities	Office for public assets management of Brčko district BiH
Beginning/end of implementation (year)	2020-2030
Needed investment (KM)	4.000.000
Estimated energy saving (MWh)	2.954
Estimated decrease of emission (tCO₂)	998
Funding sources for implementation of measure	<ul style="list-style-type: none"> - Budget of Brčko district BiH; - International donors: GIZ, UNDP, USAID; - EU Funds.
Description	<p>For about 1/3 of buildings owned by and under the competence of Brčko district BiH provide primarily implementation of detailed energy audits. Audit results shall indicate the specific activities to be taken for each building to achieve maximum savings with economic benefits.</p> <p>The following is planned for detached buildings owned by and under the competence of Brčko district BiH, which have not been recently the subject of energy/thermal reconstruction:</p> <ul style="list-style-type: none"> • Thermal insulation of outside walls – warming up the existing buildings with installation of contemporary facade systems of improved thermal insulation (recommendation: mineral wool and similar) as well as thermal insulation of building towards non-heated attic or basement premises and thermal insulation of roofs /ceilings. • Replacement of existing joinery of poor quality and high infiltration degree with new construction joinery of lower heat transfer coefficient with integrated overheat protection (at south and west oriented sides of buildings).

Measure number	Z -4
Name of measure/activity	Modernization of boilers in buildings owned by and under the competence of Brčko district BiH – installation of boilers utilizing biomass as a fuel
Competent authorities	<ul style="list-style-type: none"> – Office for public assets management of Brčko district BiH; – Department for education.
Beginning/end of implementation (year)	2020-2028
Needed investment (KM)	12.000.000
Estimated energy saving (MWh)	-
Estimated decrease of emission (tCO₂)	4.057
Funding sources for implementation of measure	<ul style="list-style-type: none"> - Budget of Brčko district BiH; - International donors: GIZ, UNDP, USAID and - EU Funds.
Description	<p>The measure includes installation or replacement of the existing boiler facilities in buildings owned by and under the competence of Brčko district BiH, which use oil and brown coal for heating with highly efficient pyrolytic boilers utilizing wooden biomass as a fuel.</p> <p>New generation of boilers utilizing biomass as a fuel, primarily pellet, is automatically steered, and efficacy coefficient increases to 95%. The power of those boilers is to 1.000 kW, and they can burn different types of</p>

Measure number	Z -4
Name of measure/activity	Modernization of boilers in buildings owned by and under the competence of Brčko district BiH – installation of boilers utilizing biomass as a fuel
	wooden waste, such as woodchips, wood remains, sawdust, wood shavings. In addition to zero CO ₂ emission, the price of this type of heating is twice cheaper than heating with oil as a fuel that is currently used. The source of wooden chips are bushes and vegetated watercourses within Brčko district with enormous quantities of biomass. Quantity of heat used by these buildings is 8.432 MWh a year, and CO ₂ emission savings are 2.205 tons.

Measure number	Z -5
Name of measure/activity	Modernization of lights in buildings owned by and under the competence of Brčko district BiH
Competent authorities	<ul style="list-style-type: none"> - Department for education; - Office for public assets management of Brčko district BiH.
Beginning/end of implementation (year)	2020-2022
Needed investment (KM)	65.000
Estimated energy saving (MWh)	1.540
Estimated decrease of emission (tCO₂)	982
Funding sources for implementation of measure	<ul style="list-style-type: none"> - Budget of Brčko district BiH; - EU Funds.
Description	<p>Purchase and replacement of the existing light units with saving lights of better technical features is proposed for buildings owned by and under the competence of Brčko district BiH, which use outdated lightbulbs.</p> <p>Lights in public buildings are not a dominant type of energy consumption, but cumulatively, on annual level, it can represent a significant share in electricity bills. Light units, except for electricity consumption purposes, are very important for general comfort in the premises. Development of light units during the previous decades resulted with occurrence of halogen, fluo-compact (saving) lights, as well as fluorescent tubes of better features than classical incandescent bulbs. The latest technology, which achieves the best results and is energy most-efficient solution, is LED light. In addition to consuming to 80% less electricity than incandescent bulbs, LED lights have the longest age as well.</p>

Measure number	Z -6
Name of measure/activity	Installation of thermometers in all buildings owned by and under the competence of Brčko district BiH
Competent authorities	Office for public assets management of Brčko district BiH
Beginning/end of implementation (year)	2020-2022
Needed investment (KM)	8.000
Estimated energy saving (MWh)	100
Estimated decrease of emission (tCO₂)	32
Funding sources for implementation of measure	<ul style="list-style-type: none"> - Budget of Brčko district BiH

Measure number	Z -6
Name of measure/activity	Installation of thermometers in all buildings owned by and under the competence of Brčko district BiH
Description	<p>Installation of thermometers at the wall in each premise (offices, schools, kindergartens, etc.) enables control of temperature and temperature management with proper airing of premises and regulation of heating/cooling in premises. In addition to installation of thermometer at the wall in each premise, the measure includes the initial educational activity:</p> <ul style="list-style-type: none"> • The following shall be written on thermometer 1°C saves to 6% ENERGY; • When installing the thermometer to premises, the purpose of this measure and ways to successfully implement it shall be explained to the users of the premises; • Design and distribution of leaflets, etc.

Measure number	Z -7
Name of measure/activity	Installation of thermostatic sets in all buildings owned by and under the competence of Brčko district BiH
Competent authorities	Office for public assets management of Brčko district BiH
Beginning/end of implementation (year)	2020-2025
Needed investment (KM)	200.000
Estimated energy saving (MWh)	197
Estimated decrease of emission (tCO₂)	67
Funding sources for implementation of measure	- Budget of Brčko district BiH;
Description	Installation of thermostatic sets to all buildings owned by and under the competence of Brčko district BiH to 2025 is proposed. The measure includes installation of radiator valves with thermo-regulation heads.

8.1.2 Residential buildings

Measure number	Z -1
Name of measure/activity	Education and promotion of energy efficiency for citizens
Competent authorities	Department for utility affairs
Beginning/end of implementation (year)	2020 – 2030
Needed investment (KM)	100.000
Estimated energy saving (MWh)	23.002
Estimated decrease of emission (tCO₂)	10.080
Funding sources for implementation of measure	- Budget of Brčko district BiH - NGO
Description/comment:	Introducing the owners of residential buildings with energy consumption opportunities, with possible long-term significant financial savings, as well as adequate training for owners/users of buildings about the ways to reduce energy and fuel consumption thus contributing to decrease of their consumption as well as consumption of water, affecting that way the decrease of CO ₂ emission as well. The measure includes several

Measure number	Z -1
Name of measure/activity	Education and promotion of energy efficiency for citizens
	<p>educational activities to be implemented continuously:</p> <ul style="list-style-type: none"> • Informing the citizens about ways of energy saving and about actual energy topics; • Making and distributing educational and promotional material about energy efficiency and use of renewable energy sources; • Establishment of info energy efficiency galleries/corners <p>The emphasis of education in this sector should be on promotion of construction of low energy and passive houses and buildings.</p>

Measure number	Z – 2
Name of measure/activity	Purchase of efficient household appliances
Competent authorities	Sub-department for support to local communities and non-governmental organisations
Beginning/end of implementation (year)	2020 – 2030
Needed investment (KM)	2.000.000
Estimated energy saving (MWh)	39.230
Estimated decrease of emission (tCO₂)	25.028
Funding sources for implementation of measure	<ul style="list-style-type: none"> – Funds of citizens and trade companies; – International donors: GIZ, UNDP, USAID.
Description/comment:	<p>Energy efficient appliances shall decrease the quantity of energy and resources used, and shall result with lower costs. Energy efficient household appliances save money, decrease the emission of hazardous gasses as well as exploitation of natural resources. This measure could be implemented with subsidies. The mentioned measure pertains to household appliances with significant electricity consumption, such as refrigerators, freezers, laundry machines, dishwashers, etc.</p> <p>Most of the household appliances in the households of Brčko district BiH are replaced in average with new models every 10 years. The suggestion is to promote in Brčko district BiH the use of saving appliances in cooperation with trade companies importing and advertising the household appliances.</p>

Measure number	Z -3
Name of measure/activity	Improvement of energy efficiency in residential buildings
Competent authorities	<ul style="list-style-type: none"> – Government of Brčko district BiH with relevant departments. – Assembly of Brčko district BiH
Beginning/end of implementation (year)	2020-2030
Needed investment (KM)	40.000.000
Estimated energy saving (MWh)	138.002
Estimated decrease of emission (tCO₂)	44.247
Funding sources for implementation of measure	<ul style="list-style-type: none"> – Budget of Brčko district BiH; – Funds of citizens; – EU Funds.
Description:	<p>For all residential buildings ensure primarily implementation of detailed energy audits. Audit results shall indicate specific activities for each building to achieve maximum savings with economic benefits. For residential buildings that were not recently the subject of energy/thermal reconstruction, the following is foreseen:</p> <ul style="list-style-type: none"> • Thermal insulation of outside walls - warming up the existing

Measure number	Z -3
Name of measure/activity	Improvement of energy efficiency in residential buildings
	<p>buildings with installation of contemporary facade systems of improved thermal insulation (recommendation: mineral wool and similar) as well as thermal insulation of building towards non-heated attic or basement premises and thermal insulation of roofs /ceilings.</p> <ul style="list-style-type: none"> • Replacement of existing joinery of poor quality and high infiltration degree with new construction joinery of lower heat transfer coefficient with integrated overheat protection (at south and west oriented sides of buildings). <p>The suggestion is to select residential buildings of unfavourable thermal protection and generally of poor construction features.</p>

8.1.3 Buildings in commercial and service sector

Measure number	Z – 1
Name of measure/activity	Introduction of energy management in the buildings of commercial and service sectors
Competent authorities	<ul style="list-style-type: none"> – Public and private enterprises; – Department for economic development, sport and culture.
Beginning/end of implementation (year)	2020-2023
Needed investment (KM)	50.000
Estimated energy saving (MWh)	16.977
Estimated decrease of emission (tCO₂)	12.030
Funding sources for implementation of measure	<ul style="list-style-type: none"> - Funds of companies; - EU Funds.

Measure number	Z – 1
Name of measure/activity	Introduction of energy management in the buildings of commercial and service sectors
Description:	<p>The measure is not financially intensive, but generates savings is establishment of the body comprising employees that would be energy management, whose main function would be to monitor and manage the energy consumption.</p> <p>Significant measure for improvement of the system for energy consumption management which could finally be used in planning of budget and possible current and future investments is establishment of management at institution level which would, based on genesis of events and costs, monitor the consumption of all energy fuels. All irregularities or increases in consumption would be diagnosed shortly and corrective actions could be taken in order to prevent undesired consequence; afterwards, the actions would be taken that would decrease the probability of repeating the same or similar undesired consequence in future. The selected management should take control over consumption and should act preventively in order to downsize the energy consumption to optimal measure. This type of energy management would result with significant decrease of thermal energy consumption.</p> <p>The measure includes several educational activities implemented continuously:</p> <ul style="list-style-type: none"> • Making and distributing educational material (leaflets, brochures, stickers, etc.); • Organisation of educational workshops and forums – way to raise the awareness on energy saving opportunities; • Establishment of information system for monitoring of energy consumption.

Measure number	Z -2
Name of measure/activity	Improvement of energy efficiency in buildings of commercial and service sectors
Competent authorities	<ul style="list-style-type: none"> – Department for economic development, sport and culture; – Assembly of Brčko district BiH.
Beginning/end of implementation (year)	2020-2030
Needed investment (KM)	5.000.000
Estimated energy saving (MWh)	8.483
Estimated decrease of emission (tCO₂)	6.011
Funding sources for implementation of measure	<ul style="list-style-type: none"> - Funds of companies; - EU Funds.
Description:	<p>For all buildings not owned by and not under the competence of Brčko district BiH ensure primarily implementation of detailed energy audits. Audit results shall indicate specific activities to be taken for each building in order to achieve maximum savings with economic benefits.</p> <p>For detached buildings not owned by and not under the competence of Brčko district BiH, which have not been lately the subject of energy / thermal reconstruction, the following is foreseen:</p>

Measure number	Z -2
Name of measure/activity	Improvement of energy efficiency in buildings of commercial and service sectors
	<ul style="list-style-type: none"> • Thermal insulation of outside walls - warming up the existing buildings with installation of contemporary facade systems of improved thermal insulation (recommendation: mineral wool and similar) as well as thermal insulation of building towards non-heated attic or basement premises and thermal insulation of roofs /ceilings. • Replacement of existing joinery of poor quality and high infiltration degree with new construction joinery of lower heat transfer coefficient with integrated overheat protection (at south and west oriented sides of buildings).

Measure number	Z -3
Name of measure/activity	Subsidies for purchase of energy efficient electrical appliances for commercial and service sub-sector
Competent authorities	<ul style="list-style-type: none"> – Department for economic development, sport and culture; – Public and private enterprises.
Beginning/end of implementation (year)	2020-2025
Needed investment (KM)	150.000
Estimated energy saving (MWh)	7,6
Estimated decrease of emission (tCO₂)	5
Funding sources for implementation of measure	<ul style="list-style-type: none"> - Funds of companies; - EU Funds.
Description:	Subsidies for purchase of energy efficient electrical appliances is proposed for existing buildings in commercial and service sub-sector. According to the experiences so far, the estimated electricity saving is 20% of total electricity consumption in this sub-sector. Before implementation of the measure, it is necessary to conduct a comprehensive analysis to determine the status, possibilities and terms of implementation.

8.2 Measures for decrease of CO₂ emissions in public lights system of Brčko district BiH

Measure number	JR – 1
Name of measure/activity	Modernization of public lights within Brčko district BiH – installation of LED lights and lights management
Competent authorities	<ul style="list-style-type: none"> - Department for utility affairs ; - Public utility enterprise „Komunalno Brčko“ d.o.o. Brčko district BiH.
Beginning/end of implementation (year)	2020-2027
Needed investment (KM)	2.000.000
Estimated energy saving (MWh)	2.688
Estimated decrease of emission (tCO₂)	1.715
Funding sources for implementation of measure	<ul style="list-style-type: none"> – Budget of Brčko district BiH; – EU Funds.
Description/comment:	Modernization includes replacement of mercury bulbs with sodium or

Measure number	JR – 1
Name of measure/activity	Modernization of public lights within Brčko district BiH – installation of LED lights and lights management
	<p>LED lights, which have electronic muffler. Proposed lights are of the following features: more energy efficient (for the same illumination level, much longer age, decreased maintenance costs). Public lights modernization measure comprises the following activities:</p> <ul style="list-style-type: none"> • Disassembly of existing lights with lyra; • Reconstruction of reinforced – concrete and pipe poles; • Purchase and installation of LED lights; • Construction works on preparing of the route; • Electrical material, test protocols and commissioning; • Installation of the lights control system; • Dislocation of public lights measuring boxes from transformer stations; • Main project design and project management.

Measure number	JR – 2
Name of measure/activity	Management of public lights intensity
Competent authorities	<ul style="list-style-type: none"> - Department for utility affairs ; - Public utility enterprise „Komunalno Brčko“ d.o.o. Brčko district BiH.
Beginning/end of implementation (year)	2020-2027
Needed investment (KM)	50.000
Estimated energy saving (MWh)	1.792
Estimated decrease of emission (tCO₂)	1.143
Funding sources for implementation of measure	<ul style="list-style-type: none"> - Budget of Brčko district BiH; - EU Funds.
Description/comment:	<p>The mentioned measure requires investment at already installed sodium lights, while implementation of the measure 1. shall automatically enable implementation of the measure 2. to all newly installed lights. The measure is implemented with decrease of light intensity at late night hours, when the level of activities decreases, so the earlier level of light is not necessary. This way the significant savings are generated as demonstrated by numerous examples of this measure implemented in the cities of BiH.</p>

8.3 Measures for decrease of CO₂ emissions in traffic sector of Brčko district BiH

Measure number	S – 1
Name of measure/activity	Renewal of vehicle fleet owned and used by Brčko district BiH
Competent authorities	<ul style="list-style-type: none"> - Government of Brčko district BiH with relevant departments.
Beginning/end of implementation (year)	2020-2025
Needed investment (KM)	500.000
Estimated energy saving (MWh)	894
Estimated decrease of emission (tCO₂)	235
Funding sources for implementation of measure	<ul style="list-style-type: none"> - Budget of Brčko district BiH; - Potential donors.

Description/comment:	The first step in implementation of this measure is making the Decision regulating purchase of new vehicles owned and used by Brčko district BiH. All new vehicles to be purchased by Brčko district BiH must have a small emission of CO ₂ , and it must be accompanied by adequate decision regulating terms of those procurements. The estimate is that replacement of all existing vehicles owned by Brčko district BiH with new vehicles of small CO ₂ emission by 2025 would decrease CO ₂ emissions for 20% compared to the year 2012.
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Measure number	S – 2
Name of measure/activity	Training for citizens in traffic sector
Competent authorities	<ul style="list-style-type: none"> – Sub-department for support to local communities and NGOs; – Department for education; – Police of Brčko district BiH; – Driving schools.
Beginning/end of implementation (year)	2020-2030
Needed investment (KM)	80.000
Estimated energy saving (MWh)	20.966
Estimated decrease of emission (tCO₂)	5.183
Funding sources for implementation of measure	<ul style="list-style-type: none"> – Budget of Brčko district BiH; – EU Funds; – Potential donors.
Description/comment:	<p>Based on the experiences of European cities, it has been determined that with continuous education and sharing of information to the citizens, significant savings of 5% may be achieved in energy consumption in traffic sector. It includes minor changes in driving habits to be presented through promotional, information and educational workshops, as well as distribution of adequate promotional material. Promotional, information and educational measures and activities include:</p> <ul style="list-style-type: none"> • Promotion and education about environmental driving; • Promotion of alternative fuels' use; • Promotion of bicycles' use; • Campaign: one day without vehicle; • Continuous organisation of the European mobility week; • Organisation of different forums, workshops and round tables, conducting questionnaires, assessment and preparing, printing and distributing information material.

Measure number	S – 3
Name of measure/activity	Promoting bicycle riding and improvement of bicycle transport
Competent authorities	<ul style="list-style-type: none"> – Department for economic development, sport and culture; – Public enterprise "Putevi Brčko" d.o.o.; – Department for public affairs.
Beginning/end of implementation (year)	2020-2030
Needed investment (KM)	2.500.000
Estimated energy saving (MWh)	20.030
Estimated decrease of emission (tCO₂)	4.935
Funding sources for implementation of measure	<ul style="list-style-type: none"> – EU Funds; – Private companies and investors.
Description/comment:	The aim of this measure is to improve the status of cycling

	<p>infrastructure in a way to provide cycling lanes. Network of cycling lanes must be well-connected and safe for use. It is planned to install bicycle holders in front of all public institutions and schools. This measure also includes promotional campaign promoting wider use of bicycles as means of transport, particularly at shorter routes. The group of measures encouraging the use of bicycle as mean of transport includes the following activities:</p> <ul style="list-style-type: none"> • Construction of cycling lanes along all newly planned roads and streets, as possible; • Construction of parking place for bicycles; • Establishment of network for free bicycle rent with IT anti-theft security. <p>The mentioned measures would be implemented through continuous promotion of bicycles' use as means of transport, particularly at 5-10 km routes.</p>
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Measure number	S – 4
Name of measure/activity	Promoting the use of public transport as cheap and efficient way of transport
Competent authorities	<ul style="list-style-type: none"> – Department for public affairs; – Public enterprise "Putevi Brčko" d.o.o.; – Concessioner of public transport.
Beginning/end of implementation (year)	2020-2030
Needed investment (KM)	250.000
Estimated energy saving (MWh)	40.059
Estimated decrease of emission (tCO₂)	9.869
Funding sources for implementation of measure	<ul style="list-style-type: none"> – Budget of Brčko district BiH; – EU Funds.
Description/comment:	<p>Public transport measures would include all those measures that increase its use against own vehicles use, as well as the quality of transport, and measures preferring the public transport vehicles with smaller CO₂ emission as well as those utilizing alternative fuels.</p> <ul style="list-style-type: none"> • Encouraging the use of alternative fuels in public transport vehicles; • Subsidies for bus tickets for certain population categories; • Possession of bus produced recently, with EURO 4 and EURO 5 engines, as a condition for concession; • Educating the bus drivers about fuel savings generated by driving style and turning off the engine when the vehicle stops.

Measure number	S – 5
Name of measure/activity	Construction of round about instead of priority crossroads and those regulated by streetlights, and constructing them when making new roads and streets;
Competent authorities	<ul style="list-style-type: none"> - Department for public affairs; - Public enterprise "Putevi Brčko" d.o.o. Brčko district BiH.
Beginning/end of implementation (year)	2020-2030
Needed investment (KM)	4.000.000
Estimated energy saving (MWh)	2.097
Estimated decrease of emission (tCO₂)	518
Funding sources for implementation of measure	<ul style="list-style-type: none"> – Budget of Brčko district BiH; – EU Funds.

Description/comment:	With construction of round about instead of the existing priority crossroads and those regulated by street lights, as well as their construction when making new roads and streets would significantly increase the level of traffic services on those crossroads.
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8.4 Sector of renewable energy sources (RES)

Measure number	RES – 1
Name of measure/activity	Installation of solar systems
Competent authorities	Government of Brčko district BiH with relevant departments.
Beginning/end of implementation (year)	2020-2030
Needed investment (KM)	2.500.000
Estimated energy saving (MWh)	2.798
Estimated decrease of emission (tCO₂)	1.785
Funding sources for implementation of measure	<ul style="list-style-type: none"> – Funds of citizens; – Budget of Brčko district BiH; – EU Funds.
Description:	The measure includes installation of 300 solar collector systems in total for water heating for houses/apartment a year until 2030, which includes installation of 1.800 solar collector systems in total (12,5 m ² per building). To successfully implement this measure, it is necessary to make a subsidy model by which part of the costs shall be covered by Brčko district BiH, EU funds (IPA, IEE, NAMAs and others), and part by the citizens.

Measure number	RES – 2
Name of measure/activity	Installation of solar systems for heating in public institutions
Competent authorities	- Government of Brčko district BiH with relevant departments.
Beginning/end of implementation (year)	2020-2030
Needed investment (KM)	2.500.000
Estimated energy saving (MWh)	2.354
Estimated decrease of emission (tCO₂)	1.500
Funding sources for implementation of measure	<ul style="list-style-type: none"> – Budget of Brčko district BiH; – EU Funds.
Description:	<p>According to insolation data in Brčko district BiH region, it is possible to generate significant savings by using thermal energy of sun in transition and winter period.</p> <p>Thanks to technological development in the past several decades, solar heating systems are currently a reliable and efficient way of thermal energy production for heating of water and premises. One square meter of solar collectors can produce about 800 W of heat for heating of water or premises.</p> <p>Use of renewable energy sources such as solar energy is one of the main strategies for reduction of greenhouse gases emission in atmosphere. With installation of solar collectors for water heating and supplemental water heating in the heating system shall generate the savings in terms of needs for thermal energy obtained in conventional manner (from fossil</p>

	<p>fuels, electrical energy).</p> <p>One of the most efficient ways of PTV heating throughout the year is a combined solar system with additional thermal and electrical heater. In winter, in periods of insufficient insulation or increased consumption, heat exchanger is used as supplement source, through which the hot water flows from the existing heating boiler in the premises. During summer period, when central heating system does not work, electrical heater installed to hot water reservoir is used for water heating.</p> <p>In the audit phase, it is necessary to define the type of solar system and calculate approximately needed collector surface and reservoir volume for water heating, and determine their positions in the building. Detailed calculation of solar system (repeated calculation of collector surface and reservoir, as well as dimensioning of heat exchangers, expansion dish and piping system) is resolved in designing phase.</p>
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Measure number	RES – 3 ¹
Name of measure/activity	Gasification of Brčko city
Competent authorities	Public administration and relevant administration bodies of Brčko district BiH
Beginning/end of implementation (year)	2020-2030
Needed investment (KM)	Funds for whole investment shall be estimated only after the project design is made
Estimated energy saving (MWh)	55.200
Estimated decrease of emission (tCO₂)	13.303
Funding sources for implementation of measure	<ul style="list-style-type: none"> – Budget of Brčko district BiH; – EU Funds.
Description:	<p>Within Brčko district BiH there is no gas infrastructure, although several studies and elaborates have been made so far about justification of introduction of gas network in Brčko district BiH, primarily through gasification plans by the government of Republika Srpska. Gasification in Brčko district BiH can go in two directions:</p> <ul style="list-style-type: none"> • Main gas lines Šepak-Bijeljina-Banja Luka and • Gas line from Republic of Croatia. <p>Framework energy strategy of BiH until 2035 considers gasification of Brčko district BiH as one of possible strategic options of Brčko District BiH at medium focus level with indicative implementation period 2025 - 2035. The development itself shall depend, among other things, on market opportunities, in fact trend of gas prices. Considering relatively small area of Brčko, gasification possibilities of Brčko district BiH should be considered systematically according to the entity plans of gas network development, as well as bigger urban centres such as Tuzla. Therefore, due to its geographic position Brčko District BiH is a transit route for gas network towards the entities in future. Natural gas as heating fuel has enormous benefits compared to other fuels in terms of reduced pollution and emission of CO₂, and also more practical and comfortable uses.</p>

¹ Gas + RES

Measure number	RES – 4
Name of measure/activity	Construction of local heating facility – cogenerative facility
Competent authorities	Public administration and relevant administration bodies of Brčko district BiH
Beginning/end of implementation (year)	2020-2030
Needed investment (KM)	Funds of the total investment shall be estimated only after the project documentation is made.
Estimated energy saving (MWh)	153.908
Estimated decrease of emission (tCO₂)	31.720
Funding sources for implementation of measure	<ul style="list-style-type: none"> – Public-private partnership; – EU Funds.
Description:	<p>Brčko district BiH does not have local heating facility and did not resolve the issue of remote heating. According to the Sustainable Energy Action Plan adopted by the government of Brčko District BiH in 2015, construction of cogeneration facility and development of heating system are planned. Within the territory of Brčko district BiH, considering the existing infrastructure, there are several locations for construction of cogeneration facility that are favourable for transport of energy, access and environmental impact, and provide the source of cooling water. According to the current needs of Brčko district BiH and future development projection, it is considered that two units with capacity of 2x20 MWe and 2x40 MWt would ensure supply of 220 GWhe and 180 GWht energy, and would meet all the needs of Brčko district BiH. Facility utilizing biomass of the mentioned capacity would use annually about 20.000 t of poplar tree of biomass of equivalent value, and it is estimated that there are capacities for production of the mentioned quantity of biomass on unused land in Brčko district. In addition, it is possible to use the remains from wood industry and incineration of the local waste in energy purposes. Foreseen period for construction of the mentioned cogeneration facility is 4 years, and in that period it is necessary to develop heating system and biomass plantations to be used as energy source.</p>

9 ESTIMATED REDUCTION OF CO₂ EMISSIONS FOR IDENTIFIED MEASURES UNTIL 2030.

9.1 Introduction

For the needs of reduction of CO₂ emissions by 2030 for identified measures of climate changes mitigation in building and public lights sector of Brčko district BiH, the projections of energy consumption trends and emissions by 2030 have been made.

9.2 Projections of CO₂ emissions per sectors

9.2.1 Projections of CO₂ emissions from building sector

According to the proposed measures for related sub-sectors of building sector, for the buildings owned by and under the competence of Brčko district BiH, energy consumption in 2030 shall be 60,95% lower than in 2012, while in the buildings not owned by Brčko district BiH that percentage is 66,87%, and in residential buildings 57,43%. At the same time, due to implementation of previously mentioned measures, it is foreseen that CO₂ emissions in 2030 for buildings owned by and under the competence of Brčko district BiH shall be 90,46% lower than in 2012, for buildings not owned by Brčko district BiH 44,76%, and for residential buildings 47,75% ().

Table 29: Projections of CO₂ emissions from building sector

Building sector	Energy consumption [MWh]		Decrease compared to 2012. [%]	CO ₂ emission [t]		Decrease compared to 2012. [%]
	2012.	2030.		2012.	2030.	
Buildings owned by and under competence of Brčko district BiH	27.393	10.697	60,95%	11.567	1.104	90,46%
Residential buildings	682.773	290.647	57,43%	260.416	136.061	47,75%
Buildings in commercial and service sector	56.589	18.749,40	66,87%	40.099	22.150	44,76%

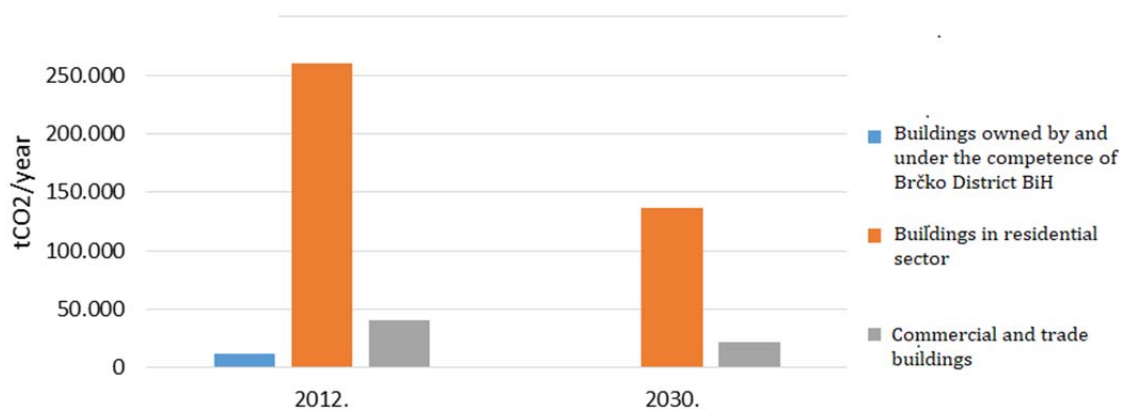


Figure 40: Comparison of CO₂ emissions in building sector

9.2.2 Projections of CO₂ emissions from public lights sector

According to the proposed measures for public lights sector in Brčko district BiH, energy consumption in 2030 shall be 1% lower than in 2012. At the same time, due to implementation of earlier mentioned measures for the mentioned sector, it is foreseen that CO₂ emission in 2030 shall be 50% lower than in 2012. (Table 30).

Table 30: Projections of CO₂ emissions from public lights sector

Lights	Energy consumption [MWh]		CO ₂ emission [t]		Decrease compared to 2012. [%]
	2012.	2030.	2012.	2030.	
Public lights	8.959	4.479	5.716	2.858	50,00%

9.2.3 Projections of CO₂ emissions from traffic sector

According to the proposed measures for traffic sector in Brčko district BiH, described in details in the previous chapter, energy consumption and CO₂ emission in 2030 for vehicles owned by Brčko district BiH shall be 30,56% lower than in 2012, and for private and commercial vehicles 20,50% (Table 31).

Table 31: Projections of CO₂ emissions from traffic sector

Traffic	Energy consumption [MWh]		Decrease compared to 2012. [%]	CO ₂ emission [t]		Decrease compared to 2012. [%]
	2012.	2030.		2012.	2030.	
Vehicles owned and used by Brčko district BiH	3.575	2.484	30,52%	939	652	30,56%
Public transport vehicles	15.158	14.324	5,50%	4.022	3.801	5,50%
Private and commercial vehicles	400.589	318.467	20,50%	98.693	78.460	20,50%

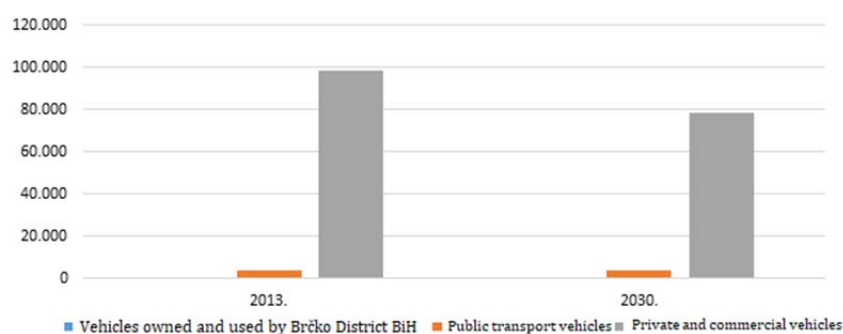


Figure 41: Comparison of CO₂ emission in traffic sector

9.3 Total projections of CO₂ emissions by 2030.

Table 32 gives an overview of total emission inventory per sectors after implementation of the measures described in the chapter 8 *MITIGATION OF CLIMATE CHANGES EFFECTS - Plan of priority measures for mitigation of climate changes effects*. The biggest share of decrease in total emission is in the public lights sector with 50%, followed by the building sector with 48,95%.

Total emissions are 245.087 tCO₂ which gives decrease of total emissions in Brčko district BiH compared to 2012 in the amount of **41,85%**.

Table 32: Projections of CO₂ emissions after implemented measures

Sector	Emission, t CO ₂		Decrease compared to 2012. [%]
	2012.	2030.	
Building	312.082,24	159.314,87	48,95%
Traffic	103.654,00	82.914,00	20,01%
Public lights	5.715,99	2.857,99	50,00%
TOTAL	421.452,24	245.086,86	41,85%

10 ADAPTATION TO CLIMATE CHANGES - Plan of priority measures for adaptation to climate changes

10.1 Introduction

Nowadays, climate changes are one of the most important environmental, economic, social and political challenges. Effects of climate changes are present in all parts of the world, including Bosnia and Herzegovina. Although those changes are happening today and already have a drastic impact to society and environment, the biggest consequences are expected in future. As the development of future changes is uncertain, it shall mainly be shaped by our actions.

According to the **III National report on climate changes**² within Bosnia and Herzegovina significant changes in climate factors may be expected in future, particularly for the scenarios that do not include implementation of the relevant mitigation measures. The most important elements and consequences of climate changes in Bosnia and Herzegovina are: increase of temperature, change of pluviometry regime, reduced quantity of precipitations during vegetation season, increased intensity and frequency of drought periods, and increased number of days with tropical temperatures. In May 2014 historical floods happened, which caused over 2 billion Euro damages and losses in Bosnia and Herzegovina (almost 15% of GDP). The state combats every year the fire, and occasionally long-term drought periods. The mentioned extreme events show how vulnerable is the contemporary society to climate shocks, which are more frequent. Nature is significantly burdened, and negative effects are manifested mostly through changes in water resources, eco systems, energy infrastructure, human health, as well as significant impact to agriculture as the most affected sector. The estimates are that 46% of total surface in Bosnia and Herzegovina is agricultural land. Air temperature is the main determinant of land productivity, and the assumption is that the impact of future climate changes shall be much bigger.

Within the territory of Bosnia and Herzegovina, significant changes of climate conditions may be expected in future, particularly climate scenarios which do not foresee the adequate measures for mitigation of climate change. By the end of this century, according to IPCC scenarios, possible change of medium annual temperature compared to the period 1961-1990 ranges from 2,4 to 4 °C, depending on selected scenario and part of the territory. Forecasts of climate conditions foresee increase of average annual temperatures in Bosnia and Herzegovina for 2 - 4°C by the end of 21st century. If those forecasts come true, it shall require comprehensive changes in the sectors of agriculture, forestry, as well as land and water management. Agriculture and forestry significantly participate in total GDP, employ significant number of employees, and have a decisive role in rural development of country. Changes in precipitation regime shall reflect on electricity production, and without the adequate adjustment there is a possibility that existing capacities shall not be able to respond to energy needs of the consumer. Bosnia and Herzegovina is particularly vulnerable to potential changes due to its geographic position, importance of affected branches, as well as limitations of the capacities for adaptation to new situation. Although the measures for mitigation of

² Third National Report and other two-year report of greenhouse gases emission in Bosnia and Herzegovina according to the United Nations Framework Convention of Climate Changes, 2016.

climate changes are specific and directly influence the management of further situation development, it is necessary to adequately adapt in order to reduce the risks and sensitivity of the society and economy, and to identify new development opportunities.

10.2 Climate in Bosnia and Herzegovina

Climate of Bosnia and Herzegovina is conditioned by several main climate factors such as geographic position, geology bases, relief, coverage of fields with plant communities, and vicinity of Mediterranean. In addition to main climate factors, different extreme factors influence the climate in Bosnia and Herzegovina as well. Those are the occurrences of sub-tropical belt currents, higher air pressure and sub-polar belts, low air pressure, which leads to change of polar and tropical air masses. Besides, occurrence of air masses of polar origin are possible, as well as currently from Atlantic, cyclone and anti-cyclone coming from Mediterranean and Adriatic sea and continental Asia. All climate factors in Bosnia and Herzegovina are significantly influenced by relief, so that two main geographic climate regions can be differentiated: North and South. North region mainly has continental climate with hot summers and cold winters, while the South has Mediterranean type of climate characterised by hot summers and humid winters. North and South region is divided by the area of high mountains, plateaus and valleys, where the mountain type of climate is dominant. Therefore, in Bosnia and Herzegovina, there are three main types of climate:

- Continental and moderately-continental;
- Mountain and mountain- valley climate;
- Mediterranean and modified – Mediterranean;

Continental climate occurs at North and in central parts of the country, Mediterranean climate at the South, and these two regions are separated by the part with mainly high mountains, plateaus and canyons where the mountain type of climate is dominant. Within the entire area, constant increase of temperature has been evident in the past several decades.



Figure 42: Types of climate in Bosnia and Herzegovina

Climate in Bosnia and Herzegovina has suffered significant changes in the past 50 years. Medium annual temperature is constantly increasing in all parts of the country, and the biggest temperature



increases are recorded in summer period (June – August). During the previous two decades, such trends have been even more emphasised, and the climate is characterised by warmer days and less cold days. Long-term precipitation changes are not expressed, although some data suggest decrease of rainy periods during spring and summer, and increase during the winter. On the other side, winters are characterised by smaller quantity of snow, which can significantly influence the availability of water during spring and summer period.

In future, significant changes of climate conditions can be expected, so according to certain scenarios the temperature would increase to 4°C by the end of the century compared to the period 1961 – 1990. Decrease of precipitation to 305 is expected depending on the selected scenario and part of the territory. If the existing global trends in greenhouse gasses emission are maintained and measures for climate change mitigation are not taken, the climate in Bosnia and Herzegovina could be much different in future compared to the second half of the 20th century. The climate shall, without adequate reaction, become much warmer with emphasized droughts and more frequent extremes.

10.2.1 Air temperature and precipitations

There are various climate models used for the assessment of future climate conditions, and two main models are General Circulation Model – GCM and Regional Climate Model – RCM. General Circulation Model analyses climate factors in future, depending on different scenarios of greenhouse gases concentration, while Regional Climate Model provides relevant information about future climate through regional and sub-regional context.

Analysis of meteorological data for the period 1961 – 2014 showed that medium annual temperature constantly increased, particularly in the past 30 years. Different factors influence temperature increase, and beside greenhouse gases emission, particularly emphasized in urban areas are Urban Heating Islands – UHI. With decrease of green areas, constant increase of number of vehicles, industrial development and increased needs for energy, higher temperatures are recorded in cities compared to suburban areas and surrounding natural environments. The assessed period is characterised by change in the number of hot and cold days, so therefore the number of cold days in almost all measuring points shows negative trend.

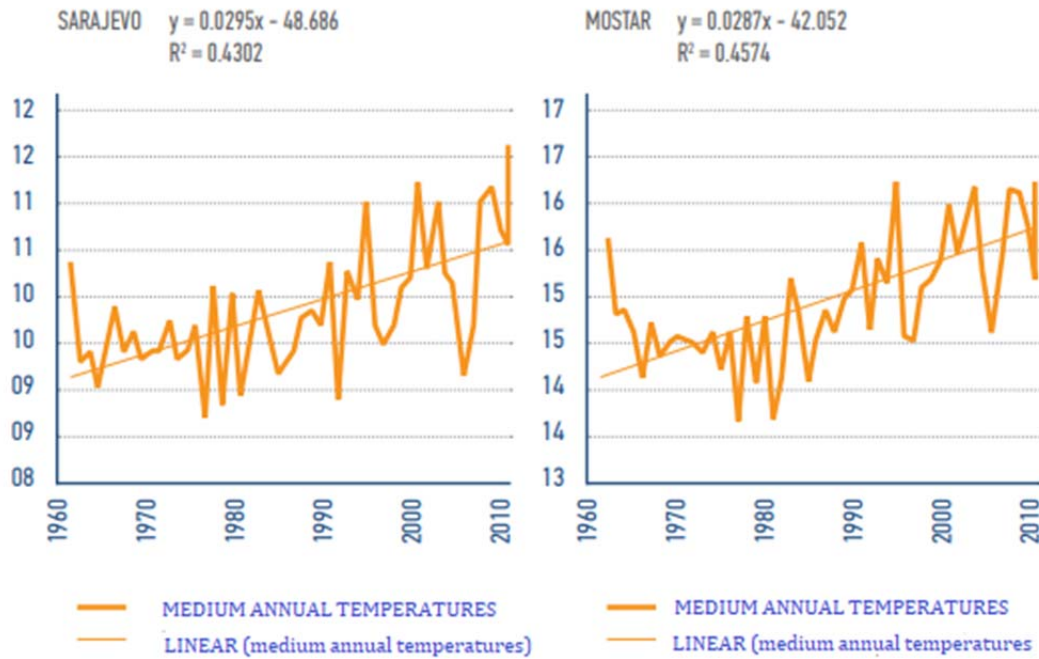


Figure 43: Trends of air temperature change in Bosnia and Herzegovina (Sarajevo and Mostar)²

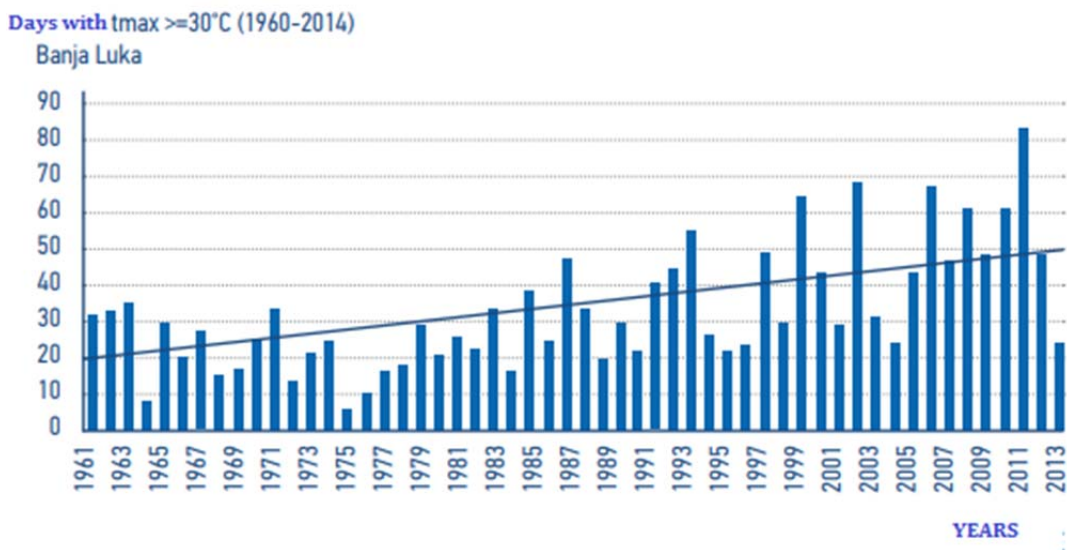


Figure 44: Changes in number of tropical days in Banja Luka²

For Bosnia and Herzegovina the projections have been made so far compared to the reference period 1971 – 2000 for three time periods: 2011 – 2040, 2041 – 2070, 2071 – 2100, through three scenarios: RCP8.5, A2 and A1B. All three scenarios more or less foresee continuous increase of temperature. According to the scenario RCP8.5 temperature increase in the first thirty-year interval ranges from 1,6 to 2°C, while for the period 2071 – 2100 temperature increase ranging from 5,4 to 5,6°C is expected. In other two scenarios, temperature increase is somewhat milder, so that the expected temperature increase for the scenario A2 is 1°C in the period 2011-2040, 2,4°C for the period 2041 –

2070 and to 4°C for thirty-year period 2071-2100. Scenario A1B foresees in the first part the temperature increase to 1,2°C, for period 2041 – 2070 increase from 2 to 2,2°C, while in the period 2071 – 2100 it foresees the increase ranging from 3,6 to 3,8°C.

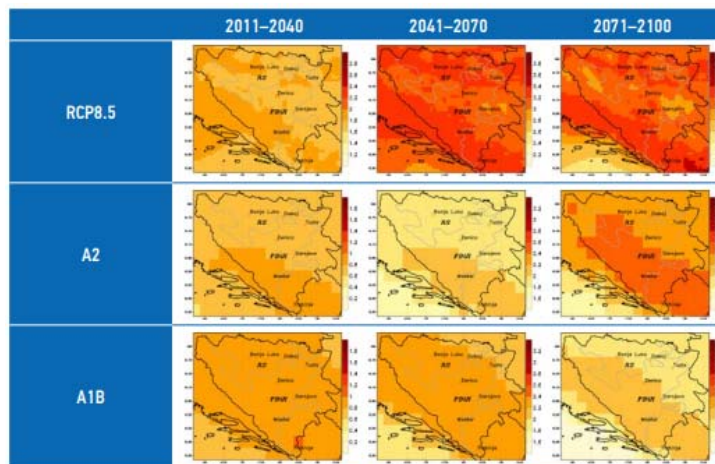


Figure 45: Change of annual temperatures through different scenarios for future periods 2011 – 2040, 2041 – 2070, 2071 – 2100 compared to the reference period 1971 – 2000.²

Based on the analysis of precipitation in the period 1961 – 2014, in the major part of Bosnia and Herzegovina there is stagnation or slight increase of precipitations quantity. Changes of precipitation are expressed more per seasons than annually. The biggest changes are recorded during spring and autumn, and due to the higher share of heavy rains, the risk of floods is higher, particularly in lowlands. In the assessed period, the increase of annual number of humid and extremely humid days is also recorded.

	Banja Luka	Bjelašnica	Bijeljina	Doboj	Zenica	Mostar	Sarajevo	Sokolac	Tuzla	Trebinje
max 2001-2014	1,561	1,996	1,090	1,494	1,201	2,491	1,187	1,274	1,353	2,734
min 2001-2014	589	972	466	496	519	873	692	622	566	1,054
med 2001-2014	1,054	1,397	781	1,009	848	1,527	984	946	963	1,776
max 1961-2014	1,561	1,996	1,090	1,494	1,201	2,491	1,249	1,274	1,353	2,741
min 1961-2014	589	693	466	497	519	841	625	562	566	1,054
med 1961-2014	1,042	1,204	760	922	810	1,499	945	850	906	1,731
max 1981-2010	1,396	1,996	1,090	1,427	1,051	2,491	1,249	1,274	1,325	2,741
min 1981-2010	702	952	481	627	543	841	625	562	569	1,101
med 1981-2010	1,039	1,314	792	934	811	1,401	937	859	911	1,678
max 1961-1990	1,281	1,518	892	1,154	1,010	1,987	1,170	1,048	1,233	2,398
min 1961-1990	685	693	492	657	543	841	625	562	600	1,311
med 1961-1990	1,029	1,114	738	871	782	1,522	932	802	894	1,751

Figure 46: Change of precipitation quantity in Bosnia and Herzegovina in period 1961 – 2014.²

Scenarios made for temperature change in period 2011 – 2100 are adequate for assessment of change in precipitation quantity, compared to the reference period 1971 – 2000. Scenario RCP8.5

only for the first period 2011 – 2040 foresees at certain locations the increase of precipitation to 5%, while for the period 2041 – 2070 and 2071 – 2100 negative anomaly in quantity is expected to -20%. According to the scenario A2 for period 2011 – 2040, most of Bosnia and Herzegovina territory has slightly positive anomaly to 5% or stagnation when it comes to the quantity of precipitation. In the remaining two periods, 2041 – 2070 and 2071 – 2100, this trend is negative and it ranges from -10 to -20%. Scenario A1B foresees already in the first assessment thirty-year period negative trend of annual precipitation to -10%. Similar to previous two scenarios, it foresees decrease of annual precipitation by 2100 to -20%.

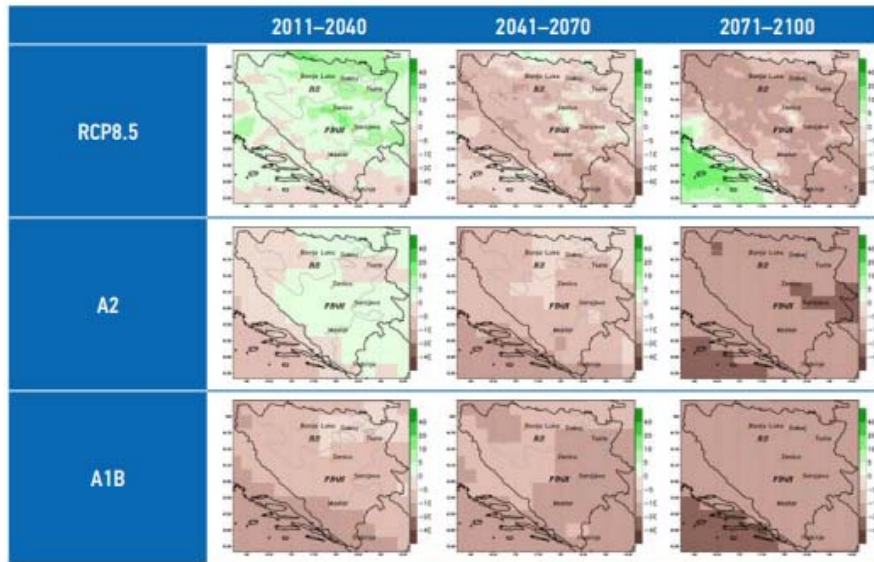


Figure 47: Change of annual quantity of precipitation through different scenarios for future periods 2011 – 2040, 2041 – 2070, 2071 – 2100 compared to the reference period 1971 – 2000.²

The estimate is that distribution of precipitation throughout the year shall be different in the following period. Total quantity of precipitation shall stagnate or decrease, but there is a risk of intensified extreme precipitation. The fact is that warmer air, as a result of temperature increase, can bring enormous quantity of water steam, which in certain atmosphere circumstances can result with profuse precipitations. Analysing the results of three climate scenarios for Bosnia and Herzegovina, it is evident that the climate shall change towards warming up, and that it shall depend, more or less, on the process of climate changes. How the unavoidable changes shall impact social, economic and health aspect depends on the taken adaptation measures.

10.3 Vulnerability to climate changes

Climate changes have an important impact to socio-economic factors in Bosnia and Herzegovina, and their effects shall be felt more in future in different segments of economy and society. Adaptation to climate changes is very important process, which ensures minimizing negative consequences for numerous vulnerable groups and business sectors. Some of the affected sectors are crucial for social development, so therefore the issue of adaptation to climate changes can reasonably be considered as the most important challenge. The most affected sector in Bosnia and Herzegovina is agriculture, which participates with 7,6% in GDP of the country, employs 20% of labour and is a key source of food safety for rural population. Limited productivity due to droughts and extremely heavy rains, poor quality of soil and decrease of usable land plots contribute significantly to vulnerability of this

sector to climate changes. Since 1990 several extreme weather disasters affected Bosnia and Herzegovina, causing the billions-worth damage and preventing business and social development.

10.4 Analysis of climate and climate changes in Brčko district BiH

Climate as meteorological term is a group of meteorological impacts and occurrences in certain area and for certain period of time makes the average status of atmosphere in some part of the Earth. The climate of Bosnia and Herzegovina is very complex and conditional on its geographic position. In Brčko District the climate is moderate continental, characterised by hot summers and cold winters. Medium annual temperature is about 11 degrees Celsius, and annual quantity of precipitation is 760 mm. So, continental type of climate with average annual air temperature over 10°C is dominant in Brčko District (average air temperature for January is - 3 °C, and the average temperature in the warmest month – July is over 20 °C). Annual quantity of precipitations ranges between 700 and 900 mm.

10.5 Risks related to climate changes for Brčko District

According to previous chapters addressing the climate in Bosnia and Herzegovina, and considering meteorological events in the previous years, the impact of climate changes in Brčko District BiH is evident. The risks of extremely high temperatures, drought and landslides are higher and higher.

10.5.1 Extremely high temperatures

Extremely high temperatures occur in June, July and August with several consequent hot (temperatures over 25°C) and tropical (temperatures above 30°C) days. According to the data from the closest meteorological station in Bijeljina, number of summer days ranged from 116 in 2016, to 119 in 2017. Number of tropical days ranged from 45 in 2016 was 45 and 64 in 2017.³ According to the report of the Federal hydro meteorological institute of Bosnia and Herzegovina, the discrepancy in medium annual temperature in Brčko District in 2019 compared to average temperature for period 1961-1990 was 2,5-3,0°C.⁴

10.5.2 Precipitations and floods

In Brčko District the quantity of precipitation during a year is a bit below the average in Bosnia and Herzegovina. Since 2018 in Brčko district BiH have been done measuring of air quality utilizing mobile automatic station. Mobile station is also equipped with meteorological sensors measuring meteorological parameters (air temperature, air humidity, global solar radiation, route and direction of wind), at the location in EŠ settlement near the 1st primary school in Brčko.

In Brčko District the average quantity of precipitation is about 785 mm. The least of rain is in March and average precipitation quantity is 47 mm. With the average of 94 mm, the most of precipitation is in June.⁵

³ Republic hydrometeorology institute of Republika Srpska, 2017.

⁴ Federal hydrometeorology institute of Bosnia and Herzegovina: Climate analysis 2019.

⁵ Based on meteorological data from the surveillance satellite available at <http://en.climate-data.org/location/26031/> (accessed on: 13.11.2020)

Brčko District as well as most of Bosnia and Herzegovina was affected in 2014 by the most abundant precipitation ever, which caused floods in some regions, particularly in the southern parts of the District and in areas where Sava river flooded. According to „Assessment of floods and landslides risks for residential sector in Bosnia and Herzegovina“ done by the Hydrotechnics Institute Sarajevo (HEIS), 373 residential buildings and 1156 citizens (about 1,3% of total population) in Brčko District are under exceptional risk of floods. It is evident from the above mentioned that natural disasters happen occasionally, caused by abundant precipitation, and particular risk is enormous potential of Sava river flooding. Number of days with snow is moderate.

10.5.3 Drought and water shortage

Droughts in Brčko district BiH have been more frequent problem in the past years, due to climate changes characterised by rarer and more abundant precipitation, with emphasised drought periods. In Brčko District the drought was recorded in 2017 when the agricultural crops were half of the earlier yield. Droughts affect decrease of yield and quality of products, and consequently the increase of price of agricultural and all other products related to agriculture activities. In Brčko District 3750 agricultural farms and 243 holders of agricultural households were recorded, whose primary sector of work was vegetable and livestock production, as well as fruit production. Due to the mentioned, the damages caused by droughts significantly influence the economic opportunities.

In the context of water supply, there are certain obstacles in some parts of Brčko district BiH during the year, since this segment is not resolved on a long-term run, as well as the problems caused by drought and lack of water in some parts of the year.

10.5.4 Landslides and soil displacements

Probability of landslides and soil displacement in Brčko district BiH is characterised mainly as low (around Sava river), while towards the south of the District, probability of landslides increases and enters the zone of medium to high. During the floods that happened in the past few years, certain soil displacements have been recorded. From the assessment of risks from floods and landslides for residential sector in BiH, flood risk index for Brčko District BiH is 12 of maximum 100, which groups it to the areas of smaller risk.⁶ Currently, 70 – 80 landslides are registered in Brčko district BiH.

⁶ Development Strategy of Brčko District 2021-2027

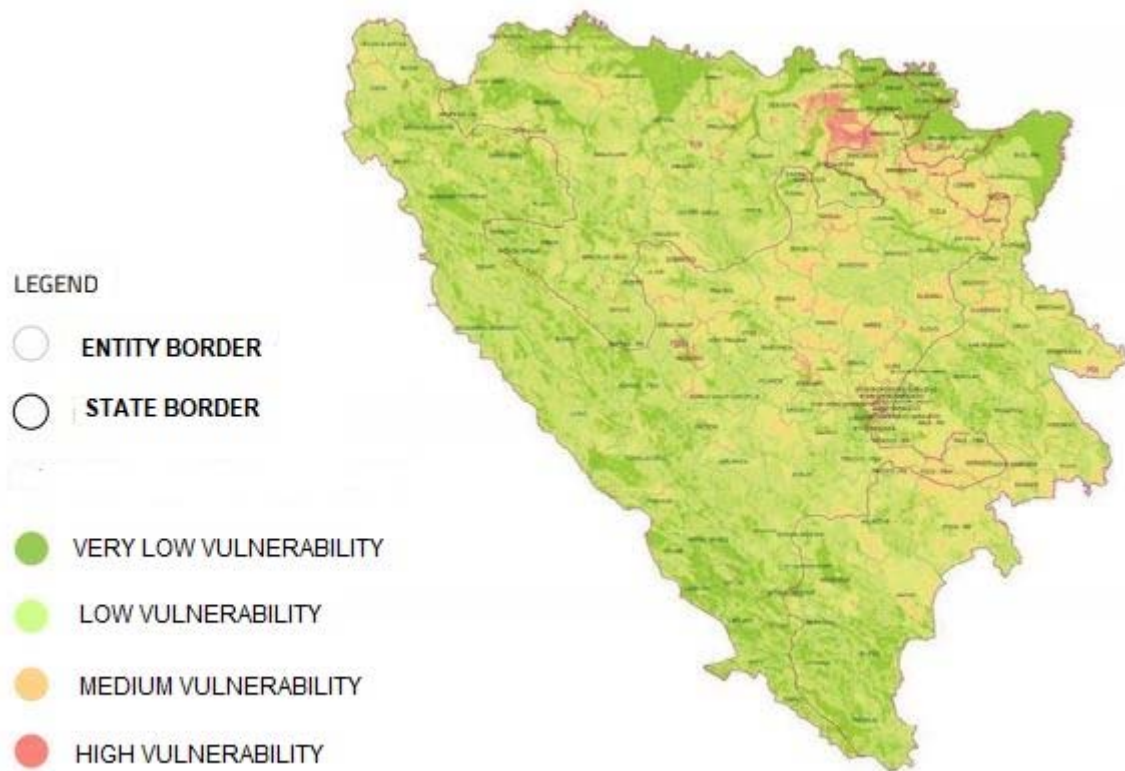


Figure 48: Distribution of zones vulnerable to landslides in Bosnia and Herzegovina⁷

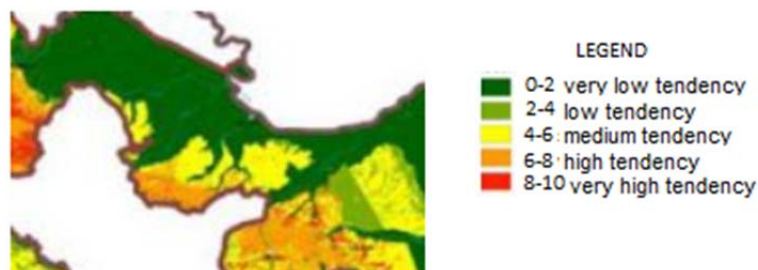


Figure 49: Map of land inclination to sliding in Republika Srpska (area of Brčko district BiH)⁸
Source: Made by author based on the data from the Geology Institute of RS/RAS – Map of land inclination to sliding in Republika Srpska

10.5.5 Forest fires

In Brčko District fire forests are not frequent, and it happens mainly sometimes during the summer months. Forest fires mainly happen in the south, hilly part of the district, without any material damages caused so far. According to information from the activity report of the Public Security

⁷ Landslide risk management study for Bosnia and Herzegovina – UNDP, 2016.

⁸ Geology Institute RS/RAS – Map of land vulnerability to landslides for Republika Srpska

Department of the Government of Brčko district 2014-2019, the number of forest fires and fire at open space in 2019 totalled 125.

Table 33: Features of identified dangers from climate change consequences in Brčko district BiH

Danger	Features of danger				
	Current features		Future features		
	Probability of danger	Danger impact	Expected change of intensity	Expected change of frequency	Time period
Extremely high temperatures	Moderate	High	Increase	Increase	Risk in long-term period
Precipitations and floods	High	High	Increase	Increase	Risk in short-term, mid-term and long-term period
Drought and water shortages	Moderate	High	Increase	Increase	Risk in short-term, mid-term and long-term period
Landslides and soil displacement	Moderate	High	Increase	Increase	Risk in short-term, mid-term and long-term period
Forest fire	Low	Moderate	Increase	Increase	Risk in short-term, mid-term and long-term period

10.6 Assessment of sector and groups vulnerability to identified hazards in Brčko district BiH

Almost all segments of human life are exposed to hazards from climate changes. The sectors addressed in this analysis include:

- **Buildings / building sector** – includes all (municipal/residential/tertiary, public/private) buildings or groups of buildings, permanently constructed or placed in their locations;
- **transport** – includes road, railway, air and water transport and necessary infrastructure (roads, bridges, junctions, tunnels, ports and airports) as well as wide range of public and private assets, vehicles (their parts and processes);
- **agriculture and forestry** – includes land aimed for use in agriculture and forestry, as well as associated organisations and industries. It includes animal husbandry, forestry, vegetable production, bees keeping, horticulture and other types of production and services in agriculture and forestry in certain area;
- **water resources** – includes water supply services and related infrastructure. It includes water consumption and water management systems (waste and rain water) such as sewerage and drainage systems as well as filtering facilities (in fact processes that bring the waste water into a condition that meets environmental standards and manage the excessive precipitation or rainfalls).
- **health** – includes geographic distribution of dominant pathogen conditions (allergy, cancer, respiratory diseases, cardiac disease, etc.), including information about impact to health (biomarkers, reduced fertility, epidemics) or welfare of people (fatigue, stress, post-traumatic stress disorder, death, etc.) which are directly (air pollution, heat waves, drought, huge floods, ozone above ground, noise, etc.) or indirectly (food/water quality, genetically

modified organisms, etc.) related to environment quality. It also included health care service and related infrastructure (e.g. hospitals);

- **civil defence and emergency services** – pertains to the work of civil defence and emergency services for or in behalf of the public authorities (e.g. civil defence organisations, police, firemen, ambulances and medical emergency service), and includes management and reduction of risks from local disasters (e.g. staff training, coordination, development of emergency plans, etc.).
- **environment and biodiversity** – Environment pertains to green landscapes, air quality, while biodiversity pertains to diversity of living things in specific area, measured by diversity within the species, among species and diversity of eco-system;
- **energy and infrastructure** – refers to energy supply services and related infrastructure (networks for production, transport and distribution of energy). It includes coal, liquid natural gas, raw material for refineries, additives, oil derivatives, gasses, renewable fuels and water, electricity, heating and cooling;
- **waste management** – includes activities related to collection, processing and treatment of waste, such as solid and no-solid industrial or household waste, and contaminated locations;
- **land use plans** – the process implemented by local authorities to identify, assess and decide on the land use options, including consideration of long-term economic, social and environmental objectives and impacts to different communities and interest groups, which made and adopted based on that the plans or regulations describing allowed or acceptable types of use;
- **tourism** – refers to a group of relations and occurrences arising from travels to and stay of the visitors in some place, providing that such staying does not include permanent residence and if such staying does not include any business activity. It includes recreation, travel and resting.
- **education** – refers to institutions, processes, contents and results of organised and/or accidental learning in function of development of various cognitive capabilities, as well as gaining different knowledges, skills, crafts and habits about physical, social and economic environment and
- **information-communication technologies** – refers to integration (association) of telecommunication, computers, software, memory, in order to provide to the users the access, storage, transfer and manipulation of information.
- **industry** – refers to the group of human activities focused on production of goods or services. It is divided to three sectors: primary – collection and direct use of natural resources (raw material, energy and certain food commodities), secondary – processing industry, tertiary – service activities.



Table: Affected socio – economic and natural sectors per identified hazards within Brčko district BiH

Sector	Climate factors	Risk	Risk level
Buildings and building sector	Precipitations and floods	Increased number of buildings endangered by floods	high
	Landslides and soil displacement	Increased number of damaged residential buildings	high
	Forest fires	Increased number of damaged and endangered residential buildings	low
Transport	Precipitations and floods	Flooding of traffic roads and stopping the traffic	high
		More traffic accidents	
	Landslides and soil displacement	More damaged traffic roads and destroyed residential buildings	high
Agriculture and forestry	Extremely high temperatures	Bigger quantity of land with damaged crops	high
		Bigger presence of agricultural pests	high
	Precipitations and floods	Soil freezing	moderate
		Loss of yield	high
	Drought and water shortage	Spreading of weeds, pathogen microorganisms and parasites that love higher temperature	moderate
		Higher prices of food	high
	Landslides and soil displacement	Land erosion	moderate
Forest fires	Destruction of forest and agricultural surfaces	low	
Water resources	Extremely high temperatures	Low water level and changed river flows, particularly during summer	moderate
	Drought and water shortage	Reduced reliability and quality of drinking water	high
	Precipitations and floods	Increased loss of water from evaporation and transpiration	moderate
		Negative impact to agriculture, energy and health	high
Health	Extremely high temperatures	More medical interventions	high
		Higher mortality caused by heat, due to brain and heart strokes, and deterioration of existing health problems	high
	Precipitations and floods	Consequences caused by floods such as higher mortality, exposure to chemical substances, infections, mental difficulties and damages of health infrastructure	moderate
		Bigger presence of mosquitos, ticks and other transmitters of diseases	moderate
Civil defence and	Extremely high temperatures	Increased number of interventions by relevant departments	high



Sector	Climate factors	Risk	Risk level
emergency services	Precipitations and floods	Increased number of interventions by relevant departments	high
	Landslides and soil displacement	Increased number of interventions by relevant departments	high
	Forest fires	Increased number of interventions by relevant departments	moderate
Environment and biodiversity	Extremely high temperatures	Change of habitat and extinction of species	high
		Spreading of invasive species	high
	Precipitations and floods	Stopped migration patterns of certain species	moderate
		Change of level and quality of water, affecting food diversity	moderate
		Higher risk of forest fires	moderate
		Higher vulnerability of forest areas to different pests and pathogen species	moderate
Energy and infrastructure	Extremely high temperatures	Energy facilities endangered by overheating	moderate
	Precipitations and floods	Damage of infrastructure caused by floods, including interruption of communication and energy supply	high
	Landslides and soil displacement	Damage of energy infrastructure, interruption of energy supply	moderate
	Forest fires	Damage of energy infrastructure, interruption of energy supply	low
Waste management	Precipitations and floods	Inability to collect waste	moderate
		Generating bigger quantities of waste, higher exposure to dangerous waste and infections	moderate
Land use plans	Precipitations and floods	Vulnerability of larger useful land surface	high
Tourism	Extremely high temperatures	Tourists not coming to certain areas due to bad climate conditions	moderate
	Precipitations and floods	Damage caused to infrastructure, eco-systems and natural attractions	moderate
	Landslides and soil displacement	Damage of road infrastructure	moderate



Sector	Climate factors	Risk	Risk level
	Forest fires	Damage caused to infrastructure, eco-systems and natural attractions	low
Education	Precipitations and floods	Increased number of days when it is possible to organise lessons	low
	Landslides and soil displacement	Increased number of days when it is possible to organise lessons	low
Information – communication technologies	Precipitations and floods	Interruptions or harder work of telephone / mobile network and internet	moderate
	Landslides and soil displacement	Interruptions or harder work of telephone / mobile network and internet	low
Industry	Extremely high temperatures	Harder performance of some activities due to the impact of higher temperatures	moderate
	Precipitations and floods	Flooding of production areas, damages of infrastructure, termination of production and performance of activities	high
	Drought and water shortage	Lack of resources, higher prices of final products	moderate
	Landslides and soil displacement	Damage of infrastructure, termination of production and performance of activities	low

It is assumed that the biggest impact of climate factors shall be in agriculture and industry sector, considering the frequency of extremely high temperatures, floods and other weather conditions in Brčko district BiH. High risks is assumed in transport and water resources sector as well. In addition to endangered sectors, the entire population is endangered by climate change consequences with different levels of impact to different population categories. Extremely high temperatures have particularly negative impact to: women and girls, children, persons suffering chronic diseases and persons living in buildings below standard (barracks, old dilapidated houses and similar), low income population. Abundant precipitation including abundant rains and snowfalls have particularly unfavourable impact to the elderly living in the buildings below standard (barracks, old dilapidated houses, etc.), migrants and displaced persons. Floods and landslides are the hazards affecting many people, all the population living in areas with risk of floods and landslides within the municipality. However, particularly negative impact is to children, elderly, low income population and persons living in buildings below standard.

10.7 Climate change adaptation measures of Brčko district BiH

10.7.1 Adaptation measures to drought and water shortage

Measure number	1
Name of measure/activity	Raising the public awareness on importance of water consumption in households and climate change impact to water as environment component
Competent authorities	Public utility enterprise „Komunalno“ Brčko d.o.o.
Implementing partners:	<ul style="list-style-type: none"> • Government of Brčko district BiH; • Department for agriculture, forestry and water management; • Non-governmental organisations; • Primary and high schools.
Beginning/end of implementation (years)	2020-2030
Estimated costs (KM)	15.000
Funding sources	<ul style="list-style-type: none"> • Own funds of the public utility enterprise „Komunalno“ Brčko d.o.o. • Budget of Brčko district BiH • Donor funds
Short description of measure/activity	Water as resource is one of the most sensitive resources to climate change effects, in terms of its availability and quality. Its availability has become a larger problem, so any activity aiming the awareness on rational use and climate change impact to water is desirable and necessary. It is desirable to use for this activity the available communication channels and infrastructure (web sites, jumbo posters, posters, leaflets, invoices, etc.), as well as to develop new ones.

Measure number	2
Name of measure/activity	Water supply for city and sub-urban settlements
Competent authorities	<ul style="list-style-type: none"> - Department for utility affairs; - Public utility enterprise „Komunalno“ Brčko d.o.o.
Implementing partners:	<ul style="list-style-type: none"> • Government of Brčko district BiH; • Department for agriculture, forestry and water management.
Beginning/end of implementation (years)	2020-2025
Estimated costs (KM)	1.000.000*
Funding sources	<ul style="list-style-type: none"> • Own funds of the public utility enterprise „Komunalno“ Brčko d.o.o. • Budget of Brčko district BiH • Donor funds
Short description of measure/activity	The aim of this measure is through overall reconstruction of water supply system to ensure increase of water supply system efficiency from the aspect of decrease in water losses and energy, and increase of supply safety. At the same time, that would ensure compliance with the relevant directives of the European Union (The Water Framework Directive (2000/60/EC) and Directive on the quality of water intended for human consumption (98/83/EC)). To ensure sufficient quantities of good-quality water for human consumption and increase the rate of connected households to public water supply systems, the specific activities to be implemented within this measure include development

Measure number	2
Name of measure/activity	Water supply for city and sub-urban settlements
	<p>of study and project documents and implementation of infrastructure works. Capital budget pertaining to water supply is characterised by numerous smaller lines (in financial terms), which foresee construction of facility for some streets and parts of settlements. A part of settlements in Brčko district BiH is supplied with water from artesian and sub-artesian wells. Department for utility affairs estimated that there are about 100 such wells, although the register is not available or any document regulating management and maintenance of wells and local water systems, or any agreement or decision on assignment of that to some entity.</p> <p>* Following the baseline analysis of water supply in Brčko District, the budget needed for implementation of this measure may be made.</p>

Measure number	3
Name of measure/activity	Rationalization of water consumption in buildings owned by the government of Brčko district BiH
Competent authorities	Department for utility affairs;
Implementing partners:	<ul style="list-style-type: none"> • Government of Brčko district BiH; • Department for agriculture, forestry and water management.
Beginning/end of implementation (years)	2022-2027
Estimated costs (KM)	10.000
Funding sources	<ul style="list-style-type: none"> • Own funds of the public utility enterprise „Komunalno“ Brčko d.o.o. • Budget of Brčko district BiH
Short description of measure/activity	<p>The Government of Brčko District must implement the measures for rationalization and decrease of water consumption in the buildings it owns or uses. In the first phase of this measure implementation, it is necessary to make the water consumption analysis per buildings taking into consideration the available data. Analysis should show the status of the existing infrastructure for water consumption, terms of use and places for improvement, both in terms of infrastructure and behaviour of users.</p> <p>The second phase includes implementation of specific activities which should include installation of smart meters for remote reading.</p>

Measure number	4
Name of measure/activity	Regulation of Brka river bank to the bridge in Klanac in length about 710,5 m
Competent authorities	Department for agriculture, forestry and water management.
Implementing partners:	<ul style="list-style-type: none"> • Government of Brčko district BiH; • Department for agriculture, forestry and water management.
Beginning/end of implementation (years)	2019-2021
Estimated costs (KM)	5.000.000
Funding sources	<ul style="list-style-type: none"> • Budget of Brčko district BiH • International funders and donors (EU, UNDP, USAID etc.)
Short description of measure/activity	<p>From the aspect of vulnerability to floods, the most critical part in Brčko district BiH is melioration area of Tinja-Brka, located in central-west part of Brčko District.</p> <p>Regulated Brka river bank has the role of faster elimination of abundant hill water within Brka river basin to the main recipient – Sava river. Within the regulated part of Brka river bed, in 2007 the damages on concrete plates were reconstructed and the entire deposited drift from the bottom and mowed material at the full profile of regulation along the entire length (13.579,00 m³ of deposited drift), while in 2011 carried away bank and bottom of Brka river were reconstructed at the mouth to Sava river, in length of about 75 m.</p> <p>The arrangement of Brka river bank to the bridge in Klanac, in length of about 710,5 m is ongoing. This project regulates river banks in the parts that are vulnerable to floods and destruction of agricultural crops and residential buildings</p>

Measure number	5
Name of measure/activity	Regulation of Tinja river bank to the bridge in Krepšić upstream, in length about 2.929 m
Competent authorities	Department for agriculture, forestry and water management.
Implementing partners:	<ul style="list-style-type: none"> • Government of Brčko district BiH; • Department for agriculture, forestry and water management.
Beginning/end of implementation (years)	2022-2030
Estimated costs (KM)	7.000.000
Funding sources	<ul style="list-style-type: none"> • Budget of Brčko district BiH • International funders and donors (EU, UNDP, USAID etc.)
Short description of measure/activity	<p>From the aspect of vulnerability to floods, the most critical part in Brčko district BiH is melioration area Tinja-Brka, located in central-west part of Brčko District. Regulation of Tinja river bank near the bridge on Tinja in Gorice to Sava river was done in 1979/1980 and its role is to evacuate as quickly as possible the hill waters in Tinja basin. The facility is maintained in terms of current maintenance - mowing from st. km 0+275 to st. km 1+767, where the route from st. km 0+000 to st. km 0+275 is not maintained as it is assumed that this route is quiet. At the rout from st.</p>

	km 0+275 to st. km 1+767 there were several damages. In 2008 the works were done on reconstruction of damages on regulated Tinja river bank at the route st. km 0+900,00 to st. km 1+756,00. This project regulates the river banks in the part vulnerable to floods and destruction of agricultural crops and residential buildings.
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10.7.2 Adaptation measures to risks from extremely high temperatures

Measure number	6
Name of measure/activity	Mapping the buildings to determine potentials for use of green technologies
Competent authorities	Institute for planning, construction and development of Brčko district BiH
Implementing partners:	<ul style="list-style-type: none"> • Department for physical planning and legal-property affairs • Building managers
Beginning/end of implementation (years)	2020-2025
Estimated costs (KM)	30.000
Funding sources	<ul style="list-style-type: none"> • Budget of Brčko district BiH • International funders and donors (EU, UNDP, USAID etc.)
Short description of measure/activity	The aim of the measure is to analyse and document potential for use of green technologies in public, residential and commercial buildings. Based on the earlier assessment of microclimate conditions of boiling and location, the mapping should show the areas and buildings where it is possible to apply green technology and green facades. The analysis should include the proposal for use of plants of the lowest allergen potential that are the most adequate for the climate of Brčko district BiH and that would be the most efficient in achievement of optimal effects, determine technical limitations and opportunities, and present the calculation of green facade effects to a building and summary for certain area.

Measure number	7
Name of measure/activity	Use of green roofs technology and facade in buildings owned by Brčko district BiH
Competent authorities	Institute for planning, construction and development of Brčko district BiH
Implementing partners:	<ul style="list-style-type: none"> • Department for private development, sport and culture • Non-governmental organisations from Brčko district BiH and southeast Bosnia and Herzegovina region.
Beginning/end of implementation (years)	2025-2030
Estimated costs (KM)	To be determined based on the analysis foreseen in the measure Mapping the buildings to determine the potentials for use of green technologies.
Funding sources	<ul style="list-style-type: none"> • Budget of Brčko district BiH • International funders and donors (EU, UNDP, USAID etc.)

Short description of measure/activity	Based on the mapped opportunities for use of green technologies in Brčko district BiH, depending on possibilities, technology shall be implemented (used) in certain part of buildings it owns. While designing energy reconstruction of buildings owned by Brčko district BiH, the possibilities for use of green technologies should be analysed.
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Measure number	8
Name of measure/activity	Raising the awareness of population and prevention of heat waves impact to health
Competent authorities	Public security department (Protection and rescue sub-department)
Implementing partners:	<ul style="list-style-type: none"> • Health institutions • Civil defence headquarters • Local population
Beginning/end of implementation (years)	2020-2025
Estimated costs (KM)	15.000
Funding sources	<ul style="list-style-type: none"> • Budget of Brčko district BiH
Short description of measure/activity	<p>The aim of the project is to improve the information system for citizens about the risks caused by sudden heat waves during the summer period, as well as to develop the system for due informing of the citizens about possible heat waves. The project may be implemented in cooperation with health institutions, as well as civil defence headquarters.</p> <p>The aim is to decrease the effect of heat waves to population health, particularly to sensitive groups that are additionally exposed to risk, spreading the health awareness culture, decrease of social and health costs utilizing prevention instead of intervention policy.</p>

10.7.3 Other adaptation measures to climate change risks

Measure number	9
Name of measure/activity	Education and information about climate changes, energy efficiency and sustainability
Competent authorities	Government of Brčko district BiH
Implementing partners:	<ul style="list-style-type: none"> • Department for business development, sport and culture
Beginning/end of implementation (years)	2020-2030
Estimated costs (KM)	50.000
Funding sources	<ul style="list-style-type: none"> • Budget of Brčko district BiH • International funders and donors (EU, UNDP, USAID etc.)

Short description of measure/activity	<p>Design and dissemination of educational and information material through web site „www.vlada.bdcentral.net“ about climate changes, energy efficiency and sustainability, including the following topics:</p> <ul style="list-style-type: none"> • Status of climate parameters; • Occurrence of extreme climate conditions; • Alarming about: extreme climate conditions, forecasts of extreme conditions within seven day period, changes of air quality, changes of water quality, occurrence of high pollen concentrations, etc.; • Advices and suggestions about rational energy and water use; • Advising citizens about the issues on climate change adaptation, etc.
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Measure number	10
Name of measure/activity	Providing safe electricity production
Competent authorities	Government of Brčko district BiH
Implementing partners:	<ul style="list-style-type: none"> • Department for utility affairs
Beginning/end of implementation (years)	2020-2030
Estimated costs (KM)	35.000
Funding sources	<ul style="list-style-type: none"> • Budget of Brčko district BiH • International funders and donors (EU, UNDP, USAID etc.)
Short description of measure/activity	<p>Making the register of consumption and origin of produced energy in Brčko district BiH. Take the steps towards decrease of electricity consumption. Encouraging electricity production from renewable sources, in order to increase energy safety and independence. Delivering workshops for potential investors about energy production from renewable sources, as well as encouraging own capacities for implementation of those measures.</p>

Measure number	11
Name of measure/activity	Pilot project of solar supply for public lights system in remote local communities
Competent authorities	Department for utility affairs
Implementing partners:	<ul style="list-style-type: none"> • Department for utility affairs
Beginning/end of implementation (years)	2020-2023
Estimated costs (KM)	50.000
Funding sources	<ul style="list-style-type: none"> • Budget of Brčko district BiH • Users • International funders and donors (EU, UNDP, USAID etc.)
Short description of measure/activity	<p>Pilot project includes installation of public light system supplied by small solar panels integrated into the light poles. Implement the project in remote local communities as a kind of awareness on use of renewable energy sources and decrease of electricity consumption.</p>

Measure number	12
Name of measure/activity	Making the cadastre of agricultural land surfaces
Competent authorities	Department for agriculture, forestry and water management
Implementing partners:	<ul style="list-style-type: none"> • Land owners • Agricultural cooperatives and farms
Beginning/end of implementation (years)	2020-2030
Estimated costs (KM)	80.000
Funding sources	<ul style="list-style-type: none"> • Budget of Brčko district BiH • International funders and donors (EU, UNDP, USAID etc.)
Short description of measure/activity	Project shall include all necessary assessments, analyses and estimates of overall arable and non-arable land, to obtain adequate insight into the level of vulnerability and risks related to climate changes, particularly related to climate factors such as extremely high temperatures and drought. The project shall finally define measures for improvement of agricultural production, in cooperation with local producers.

Measure number	13
Name of measure/activity	Preventing the overgrowing of agricultural land
Competent authorities	Department for agriculture, forestry and water management
Implementing partners:	<ul style="list-style-type: none"> • Land owners • Agricultural cooperatives and farms
Beginning/end of implementation (years)	2020-2030
Estimated costs (KM)	200.000
Funding sources	<ul style="list-style-type: none"> • Budget of Brčko district BiH • Users of measure, land owners • International funders and donors (EU, UNDP, USAID etc.)
Short description of measure/activity	Within the measure for increase of agricultural production scope, decrease of dependence on import, reduction of transport costs with measures and subsidies for prevention of agricultural land overgrowing. Land overgrowing in addition to business loss is additional higher risk for big fires and harder fire extinguishing, because overgrowing closes fire-protection corridors, while invasive plants and weeds are favourable structure for spreading of big fires. These measures foresee stimulative cultivation of deserted agricultural land surfaces (mainly owned by refugees and displaced persons) with favourable fruit and other types resistant to drought and good for maintenance, as well as stimulation of cattle breeding adjusted to new conditions enabling maintenance of hill meadows and prevention of overgrowing. (goat keeping, sheep breeding)

Measure number	14
Name of measure/activity	Stimulation of finalization and availability of agricultural production in order to meet as many local needs as possible
Competent authorities	Department for agriculture, forestry and water management
Implementing partners:	<ul style="list-style-type: none"> • Agricultural producers • Agricultural cooperatives and farms
Beginning/end of implementation (years)	2020-2030
Estimated costs (KM)	150.000
Funding sources	<ul style="list-style-type: none"> • Budget of Brčko district BiH • Users of measure, • Relevant ministries • International funders and donors (EU, UNDP, USAID etc.)
Short description of measure/activity	<p>Within the measure for increase of agricultural production finalization, in order to meet as many local needs as possible and to decrease transport costs, loss of quality and prices, it is necessary to use local resources to the maximum. The measure is diverse and pertains to preference of domestic products in different ways such as increase of standardization and finalization of agricultural production. Increase of availability and quality of supply. Those measures, in addition to business benefits, save energy in transport of food products and raw material, and often the costs of packing, and improve overall living conditions particularly in situations of accident and enormous disasters.</p>

Measure number	15
Name of measure/activity	Training for entrepreneurs about terms of energy fuel saving
Competent authorities	Department for utility affairs
Implementing partners:	<ul style="list-style-type: none"> • Company owners in Brčko district BiH
Beginning/end of implementation (years)	2020-2025
Estimated costs (KM)	80.000
Funding sources	<ul style="list-style-type: none"> • Budget of Brčko district BiH • International funders and donors (EU, UNDP, USAID etc.)
Short description of measure/activity	<p>Delivery of trainings for entrepreneurs in Brčko district BiH about importance and possibilities of energy fuel saving through construction of energy efficient business facilities and modernization of production processes, as well as energy production from renewable energy sources for the own needs. Within the training, information leaflets and sheets shall be made. In cooperation with local, entity and state authorities, encourage energy reconstruction of business buildings, as encourage investing into modernization of processes and use of renewable energy sources.</p> <p>Design and dissemination of educational and promotional material shall be done through web site „www.vlada.bdcentral.net“</p>



Measure number	16
Name of measure/activity	Equipping and capacity building of Public security department
Competent authorities	Public security department
Implementing partners:	<ul style="list-style-type: none"> Budget of Brčko district BiH International funders and donors (EU, UNDP, USAID etc.)
Beginning/end of implementation (years)	2024-2026
Estimated costs (KM)	200.000
Funding sources	<ul style="list-style-type: none"> Budget of Brčko district BiH
Short description of measure/activity	<p>Planning fire protection, protection from accidents and other disasters, civil protection, protection and rescue from natural and other disasters, demining and removal and destructions of UFO and mines, surveillance and informing, and physical-technical insurance for buildings, as well as important segments of public security, are assigned to the Public Security Department. Implementation of this measure includes material and staff capacity buildings of the Public Security Department, linking with civil defence administrations in entities, organisation, material and staff development of the Surveillance and information unit and physical-technical insurance buildings in the government of Brčko district BiH.</p>

11 FUNDING MECHANISMS FOR IMPLEMENTATION OF SUSTAINABLE ENERGY AND CLIMATE ACTION PLAN

11.1 Overview of possible funding sources

To fund the measures proposed by this document it is possible to find different funding sources. Generally, energy efficiency sector is expanding and is more in the focus of numerous funders. Unfortunately, the overall economic situation in Bosnia and Herzegovina prevents significant allocation of funds, so it is necessary to focus on international funds. Necessary funds can be mobilized from one only source of funding or in combination with several different sources. Considering the current situation, decision makers should choose the optimal funding model that suits the local self-governance unit. The overview of currently available funding sources is given in the Table 34.

Table 34: Overview of available funding sources

	Funding sources	Type	Type of funding
Local sources	Budget funds	Own funds	Grants
	Environmental protection and energy efficiency fund of RS	Own funds	Grants
	Environmental Fund of the Federation of Bosnia and Herzegovina	Own funds	Grants
	Investment development institutions	Private funds	Credits under favourable terms
	Commercial finance institutions	Private funds	Credit
	Private investors	Private funds	Funding Co-funding
International sources	International organisations, EU and bilateral cooperation funds	International funds	Technical assistance Grants
	International finance institutions	International funds	Credits Credits under favourable terms

The overview of funding sources for priority measures recommended by this Action Plan is given below.

11.2 Local funding sources

1. Budget funds

Potential funding source that could provide funds for implementation of the measures from the Sustainable Energy Efficiency and Climate Change Action Plan includes budget sources as well. When it comes to the budget funds, the following sources may be identified:

- **Budget of Brčko district BiH** – is the main document of Brčko district BiH estimating profit and income and determining expenses and costs per year. Budget funds are used to finance businesses, functions and programmes of Brčko district BiH, in the amount necessary for their performance. Brčko district BiH through its regular operations is able to integrate into

its strategic documents the measures foreseen by this document, and to plan accordingly the necessary funds in its budget. Budget of Brčko district BiH for 2020 is 256.239.993 KM.

Significant negative effects to business trends, as well as budget income at all levels, from local self-governance to state budget, are visible already in the second quarter of 2020 and it is uncertain how long it will take to recover and regain usual trends from the period before the crisis.⁹

2. Environmental protection and energy efficiency fund of RS

Environmental protection and energy efficiency fund of Republika Srpska through its business operations provides financial assistance for the project aiming environmental protection and improvement of energy efficiency. The Fund is financed from the fees paid by the environment polluter, waste disposal fees, water fees, contributions, donations, funds from international projects, etc.

The Fund's activities include funds rising, as well as funding design, implementation and development of programmes, projects and similar activities in the segment of maintenance, sustainable use and development of environment, as well as energy efficiency and use of renewable energy sources as stipulated by the Law on Fund, particularly the following:

1. Expert and other activities related to provision, management and use of funds of the Fund,
2. Initiating, funding, mediation and control of projects implementation within the scope of the Fund's work,
3. Mediation in funding the environmental protection, energy efficiency and renewable energy sources, by the international organisations, finance institutions as well as international legal and natural entities,
4. Continuous monitoring of the programmes, projects and other activities through measureable environmental effects, quantity of saved energy and money, and reduction of emissions by polluters,
5. Keeping different databases about programmes, projects and similar activities in the segment of environmental protection, energy efficiency and renewable energy sources, as well as necessary and available funds for their implementation,
6. Encourage, establish and achieve cooperation with international and local finance institutions and other legal entities for funding of environment, energy efficiency and renewable energy sources according to interests of environmental protection of the Republic, strategic documents, action and reconstruction plans as well as other plans and programmes, and signed international agreements for those purposes as stipulated by this Law,
7. Other activities related to subsidizing and funding the environment, energy efficiency and renewable energy sources, as stipulated by the regulations applicable to this segment.

3. Environmental protection fund of the Federation of Bosnia and Herzegovina

At the level of the Federation BiH, the Environmental Fund of the Federation of Bosnia and Herzegovina is established and in function. The activities of the Environmental Fund of the

⁹ Development strategy of Brčko district BiH 2021-2027.



Federation BiH include funds raising and distribution for environmental protection within the Federation of Bosnia and Herzegovina.

The Fund's activities include funds raising, as well as funding the design, implementation and development of programmes, projects and similar activities in the segment of preservation, sustainable use, protection and improvement of environment, as well as in the segment of energy efficiency and use of renewable energy sources as stipulated by the Law on Fund, particularly the following:

1. Raising the funds, subsidizing and funding design, implementation and development of programmes, projects and similar activities in the segment of preservation, sustainable use, protection and improvement of environmental status and use of renewable energy sources, particularly expert and other activities related to provision, management and use of funds of the Fund,
2. Mediation in funding of the environment from the foreign state funds, international finance institutions and departments, as well as local and international legal and natural entities,
3. Provision of expert services related to funding of environmental protection; keeping the database on programmes, projects and similar activities in the sector of environmental protection, as well as necessary and available funds for their implementation,
4. Subsidizing, establishment and achievement of cooperation with international and local finance institutions and other legal and natural entities in order to fund environmental protection in accordance with: Federal environmental strategy, environmental protection plans made based on the Strategy, international agreements that Bosnia and Herzegovina is a member of, as well as other programmes and documents in the segment of environmental protection; performing other activities related to subsidizing and funding the environmental protection, as stipulated by the Statute of the Fund.

Funds, pursuant to the Law on the Environmental Fund of the FBiH, are provided from the fees paid by the environment polluters, particular environmental fees paid at every registration of motor vehicle. Income for funding of the activities is generated from the funds generated based on international bilateral and multilateral cooperation, as well as cooperation in country within the joint programmes, projects and similar activities in the sector of environmental protection. Funds from this Fund are used to fund environmental protection, as follows:

1. Protection, preservation and improvement of the quality of air, land, water and sea, and mitigation of climate changes and protection of ozone layer,
2. Rehabilitation, avoidance and decrease of waste accumulation,
3. Use of valuable features, and processing of waste,
4. Protection and preservation of biological and landscape diversity,
5. Implementation of energy programmes,
6. Implementation of de-mining programmes,
7. Improvement and construction of environmental infrastructure,
8. Improvement, monitoring and assessment of the environmental status, and introduction of the environmental management system,
9. Subsidizing sustainable use of natural resources,



10. Subsidizing sustainable business activities, in fact sustainable economic development,
11. Encouraging researches, development studies, programmes, projects and other activities, including demonstration activities.

4. Investment development institutions

Development bank of the Federation BiH is financial institution, which provides possibility to close finance construction for implementation of the measures from the Sustainable energy and climate adaption action plan. Within its specific portfolio, Development bank of the Federation BiH has a special credit line aimed for local self-governance units. This credit line enables withdrawal of funds for local self-governance units in the Federation BiH under favourable credit terms (repayment deadline to 12 years with 12 month grace period, minimum annual interest rate of 2,5% and credit processing fees to 0,30% of credit amount).

To help the municipalities and cities in Republika Srpska to adequately present their potentials and resources and provide them the opportunity to increase the inflow of foreign investments, the Investment-development bank of Republika Srpska designed the database of investment locations in Republika Srpska. Such comprehensive database with information about available places for investment, located in one place and accessible in any moment, significantly alleviates decision making by foreign investor to select the most favourable location for investment in Republika Srpska. The intention is, in cooperation with local communities, that this database is continuously updated and supplemented in order to include as many information and to be as attractive as possible for potential foreign investors.

At the same time, Investment development bank of Republika Srpska provides the opportunity for closing of the financial construction for implementation of the measures from the Sustainable energy and climate change action plan. Actually, Investment development bank of Republika Srpska has in its credit portfolio a special credit line designated for local self-governance units. The mentioned credit line enables withdrawal of funds for local self-governance units in RS under favourable credit terms, including: grace period, flexible repayment period, low interest rated and charges, and fees to 1% of credit value.

5. Commercial finance institutions

Within Brčko district BiH there are several commercial finance institutions active, primarily banks, which disburse the funds under market terms. Some banks have programmes for funding the projects of energy efficiency and renewable energy sources. Local self-governance units are able to take the loan or obtain the guarantee for repayment of due obligations of public enterprises. Taking the loan at commercial finance institutions is a tool which can ensure partial or total funding of the measures proposed by this document.

6. Private investors

Utilizing the public sector for funds raising for implementation of CO₂ reduction measures, private sector is also a potential source of funding. Private capital of the investors is significant source of



funds, which can be used for this purpose. The most frequently used models for engagement of private capital in public purposes are:

ESCO model (Energy Service Companies)

While lacking the significant funds, it is necessary to work on affirmation of the private capital for implementation of measures and projects of wider social importance. One of such possibilities reflects in implementation of ESCO projects. ESCO companies are the companies providing energy services and are particular form of market mediation. Therefore, those companies do not supply energy, but only provide energy services. Energy Service Company or abbreviated ESCO provides a combination of information, training, projects identification, financial and technical analysis, funding, contracting services and installation, monitoring and joint saving arrangements, in fact energy saving measures. ESCO achieves all this by using the contract arrangements between ESCO company and customer, so called service contract. Energy service contract includes funding of the projects on the account of energy saving and ESCO company guarantees that savings should be generated in certain period of time. Those activities are cost-efficient, and ESCO companies and customers find the interest in cooperation. Clear profit from saved energy is divided between the user and ESCO company according to the contractual provisions. There are two important elements, which differentiate ESCO company from any usual energy advising company, including: (i) providing integrated solutions and (ii) linking payments with effects of implemented project.

Additional benefit of ESCO model is the fact that during all project phases, service user cooperates with one company only, based on the „all in one spot“ principle, and not with several different entities, which significantly decreases the costs of energy efficiency project and risk of investing into it. At the same time, ESCO project includes all energy systems at some location, which enables optimal choice of measures with favourable ratio of investment and savings. Users of ESCO services may be private and public enterprises, institution and local self-governance units.

Currently in Bosnia and Herzegovina, as well as in Brčko district, not a single ESCO company has been established, which is not the case in the countries in the environment and wider, where ESCO companies successfully operate for years.

Public private partnership (PPP)

- **PPP** is a model of association of resources of public and private sector for the needs of production of public products or provision of public services. Local self-governance units have the opportunity to use this model of organisation of certain work in cases when they do not have necessary resources or when it is not able to independently perform public works. Primary reasons why public sector chooses PPP are: lack of capacities and resources, lack of expert staff, high costs, high business risk, etc. On the other side, PPP includes participation of private sector with its capacities, knowledge, skills and capital. In the mentioned ratio, public sector defines the need and scope of public product or service, ensure equality and prevents abuses, while private sector is trying to ensure profitability and meet all requested terms and conditions. PPP as a model is a long-term contractual cooperation between public and private partner, where distribution of business risk is mainly transferred to private partner. Project where PPP is most frequently used as model of cooperation includes: energy sector, health and education.

11.3 International funding sources

In addition to local funding sources, for implementation of the measures from the Sustainable Energy and Climate Action Plan, it is possible to use the funds from the international aid. International organisation, international finance institutions and agencies present in Bosnia and Herzegovina implement the activities aiming the environmental protection and improvement of living conditions for citizens. Brčko district BiH through several-year international cooperation with partners from other countries, established good-quality mechanisms for management of local development, and developed numerous examples of good practices in the context of local development. Successful cooperation has already been established with numerous international organisations such as UNDP, USAID, GIZ, as well as Ministries of Foreign Affairs of Norway, Republic of Germany, Italy, Czech Republic and other countries. Through this cooperation, numerous projects were implemented, which had important impact to development of local environment and development of numerous local development initiatives. In the projected period, continuation of this successful cooperation may be expected in the context of development and implementation of energy efficiency initiatives and projects as well.

1. International organisations, EU and bilateral cooperation funds (UNDP, GIZ, EU, USAID)

In Bosnia and Herzegovina there are numerous international organisation implementing programmes that offer technical as well as financial assistance. Using the international aid funds, it is possible to provide necessary funding of measures from the Sustainable energy and climate action plan. Programmes offering funds for mentioned projects are time-limited, but they are likely to repeat in the same or similar form. The most important international donors in the sector of energy efficiency, use of renewable energy sources and reduction of CO₂ emissions in BiH are:

- **European Union** – with instrument of pre-accession assistance (**IPA II**), countries which are candidates or potential candidates for membership in EU are eligible to funding. IPA II is the instrument preparing the mentioned countries for use of funds, once they are part of the EU system. The mentioned pre-accession assistance in BiH is used in the following spheres: democracy and management, rule of law and rights, competitiveness and innovation, education, employment and social changes, transport, climate change and energy, of agriculture and rural development. The most significant agencies through which the EU disburses its assistance are:
 - Directorate for European integrations
 - Department for bilateral assistance of the European Union to BiH
 - Department providing support to BiH for participation in the Community programmes.

Horizon 2020 is the European Union research and innovation programme encompassing the activities of the Seventh Framework Programme (FP7), innovation aspects of the Competitiveness and innovation programme (CIP) and EU contribution to the European institute of innovation and technology (EIT). Structure of Horizon 2020 is based on three main priorities: Excellent Science, Industrial Leadership and Societal Challenges.



Strategic programming of societal challenges with high potential for growth and innovativeness has identified twelve key areas where the funds and research activities will be concentrated to support key programme objectives:

1. Personalized health care
 2. Sustainable food safety
 3. Blue growth: realising the potential of oceans
 4. Smart cities and communities
 5. Competitive energy with low CO₂ emission
 6. Energy efficiency
 7. Mobility for growth
 8. Waste: source for recycling and reuse of raw material
 9. Innovations related to water resources: valuation of water resources for Europe
 10. Overcoming the crisis: new ideas, strategies and management structure for Europe
 11. Disaster resilience: safe societies, including adaptation to climate changes
 12. Digital safety
- **UNDP** – United Nations Development Programme (UNDP), with support of global UNDP network, has been providing assistance in Bosnia and Herzegovina since 1996 to attract and use international aid. **UNDP** closely works with government institutions in Bosnia and Herzegovina at all levels, through the relevant ministries, agencies and institutions. UNDP programme activities are implemented by partner institutions / organisations (as applicable) including partners from government institutions (government) and civil society organisations. UNDP in Bosnia and Herzegovina focuses four programme sectors led by the sector coordinators: Rural and regional development, Social inclusion and democratic management, Justice and Security, Energy and Environment. Local self-governance units may receive UNDP support after applying for the projects funded by UNDP independently or in partnership with other agencies. In addition to financial support, the programmes funded by UNDP provide also technical assistance in implementation of project activities.
 - **German organisation for technical cooperation (GIZ)** – is the organisation working intensively on institutional development in BiH and making pre-conditions for independent funds rising from the European funds. GIZ has been present in Southeast Europe region, and has established Open regional fund for Southeast Europe including the energy efficiency and renewable energy sources fund for Southeast Europe as well. It is possible to get the funds from the mentioned Fund through international cooperation with other countries entitled to co-funding and technical assistance.
 - **USAID** – organisation providing assistance in the segments relevant for sustainable energy development and climate changes, primarily affecting adoption of measures, attracting the investments and integration of BiH energy market with regional and EU market. Main project goal, Investing into energy sector, is to support the country in attracting investments and making new employments in energy sector. Within its project activities, USAID is trying to ensure compliance of the permit issuing process for construction of energy production facilities, in order to make them consistent, transparent and attractive for investors. The project shall develop and propose measures in legislative framework at all levels, in order to stimulate investments into new facilities – particularly those using renewable energy



sources. The projects shall help in establishment of market in a way that customers can select the supplier. In cooperation with local communities, this project is trying to maintain this sector as profitable in BiH economy, in a way to provide investors to enter the market easily.

2. International finance institutions (EIB, EBRD, EEEF)

Numerous international finance institutions are present at the financial market of BiH where through favourable credit arrangement they are trying to promote importance of environmental protection and reduction of CO₂ emissions. Financial institutions through commercial banks in BiH disburse the loans funding the energy efficiency and renewable energy sources projects. In many cases, the mentioned credit lines of international finance organisations provide also subsidies for investments, such as: grants, technical assistance, favourable funding sources, grace period, etc. Leading finance institutions disbursing the funds in BiH for the needs contributing to reduction of CO₂ emissions include: European Investment Bank (EIB), German Development Bank (KfW), European Bank for Reconstruction and Development (EBRD) and others.



12 CONCLUSIONS AND RECOMMENDATIONS

Sustainable energy action plan of Brčko district BiH (SEAP) made and adopted in 2013, was the first condition of the Mayors' agreement including guidelines for sustainable and environmentally friendly development. As SEAP was made to meet the objective of reduction of **CO₂ emissions for 20% by 2020** compared to baseline year 2012, it expired, and Brčko District BiH signed the Mayors' Agreement in 2020 thus announcing beginning of Sustainable energy and climate action plan development (SECAP) with obligation to reduce **CO₂ emission for 40% by 2030** compared to baseline year 2012.

Action plan SECAP focuses on long-term impact of climate changes to the area of local self-governance units, including energy efficiency, and it gives measurable results related to reduction of energy consumption and CO₂ emissions. According to the made Reference inventory of greenhouse gases emissions for 2012 of Brčko district which totalled 421.452 tCO₂ the indicative goal of 40% CO₂ emission until 2030 is determined.

Forecasts of indicative goal for Brčko district were made according to the baseline emissions inventory – BEI for 2012 based on the available data, while CO₂ monitoring emissions inventory – MEI for Brčko district was made for the year 2019. According to available data and analyses, measures for mitigation of climate change effects and adaptation to climate changes were proposed. Climate change adaptation measures are integrated for the first time into one document of this type for local self-governance unit, and some measures are of analytical – research type, which indicates that it is necessary to put additional efforts into development of the bases to be used in the following period in planning of specific activities in this segment.

To decrease CO₂ emissions by 2030, in the sector of buildings, traffic, public lights and renewable energy sources, the projection of energy consumption and emission trends by 2030 have been made. Building sector has the major share in total emissions for the baseline year 2012. Share of the building sector in total emissions is 74%, while in traffic sector it is 25%.

24 measures for reduction of CO₂ emissions by 2030 have been identified, including 13 measures in building sector, 5 measures in traffic sector, 2 measures in lights sector and 4 measures in renewable energy and gas sector. Total emissions after applying all the proposed measures in the relevant document by 2030 would total 245.087 tCO₂ thus achieving 41,85% reduction of total emissions in Brčko district compared to the year 2012. At the same time, measures of adaptation to climate changes in Brčko district BiH have been identified for the first time, including 16 measures in total. The Sustainable Energy and Climate Action Plan – SECAP for Brčko district BiH for the period to 2030, was made in a way that implementation of measures, as well as their effects, shall be followed up and reported, which is also its obligation pursuant to the Mayors' Agreement for Climate and Energy.