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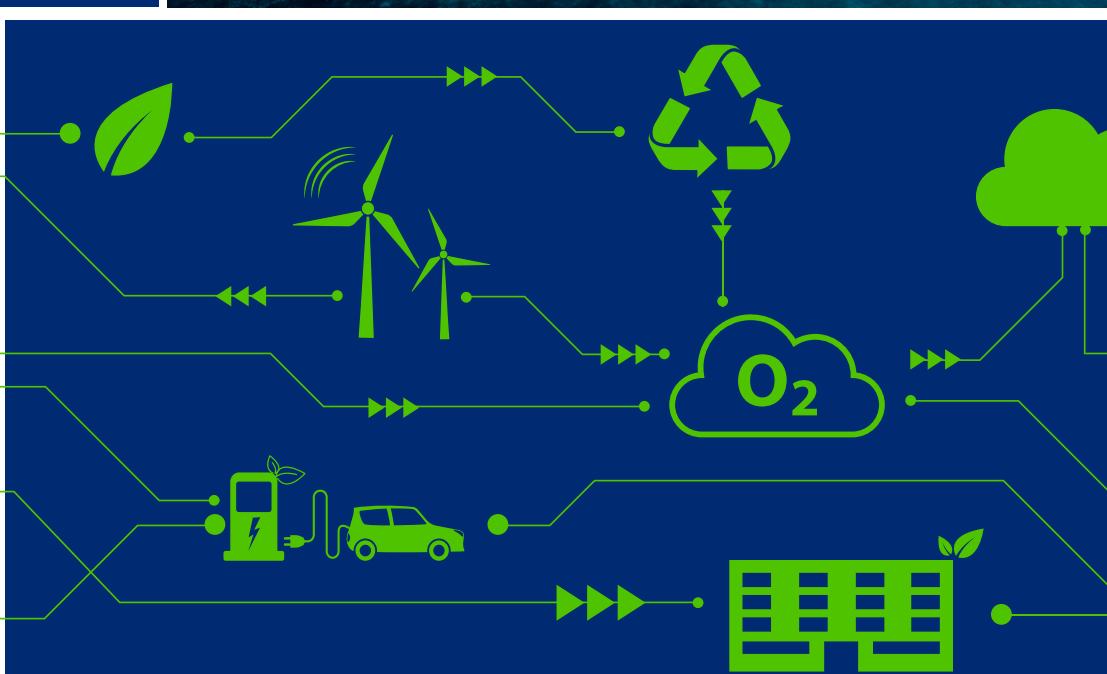
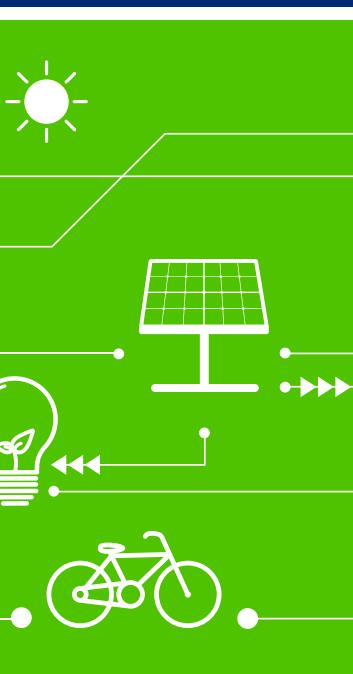
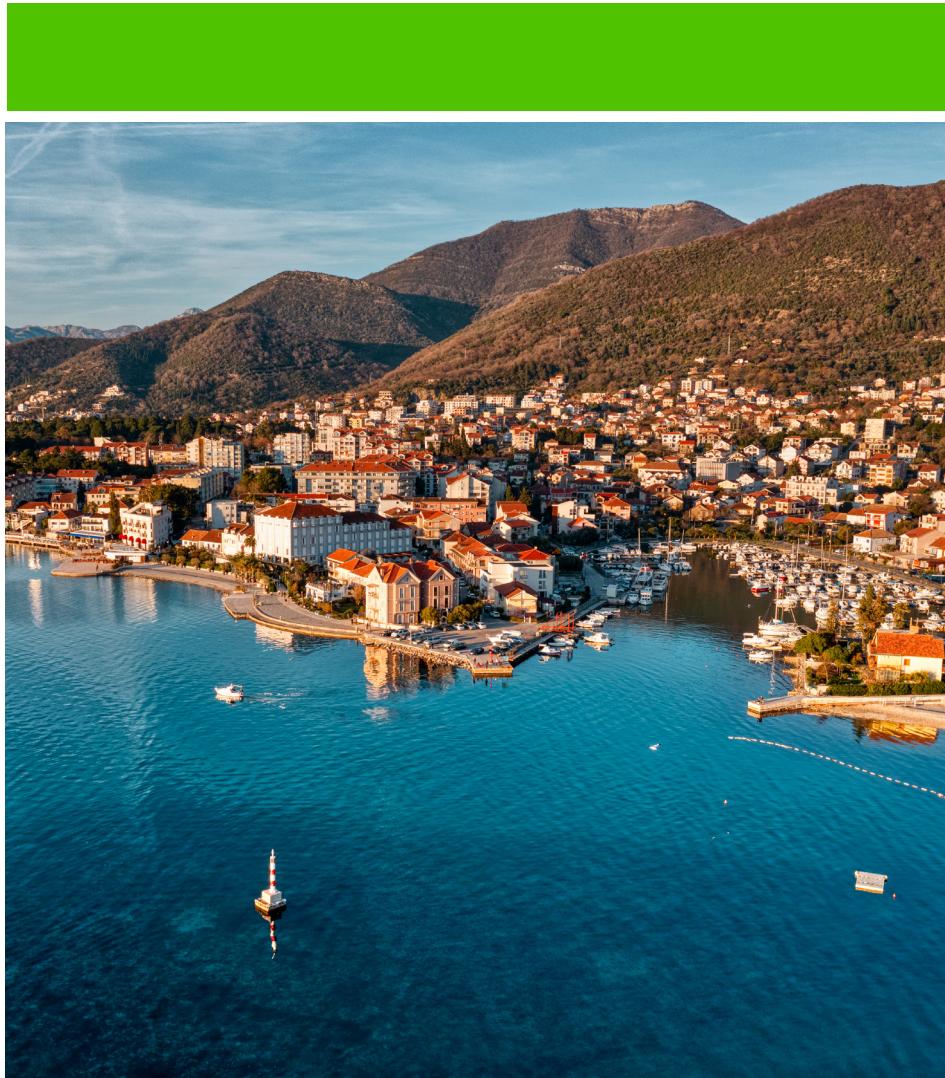
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DEUTSCHE ZUSAMMENARBEIT



# SECAP

Action Plan for Sustainable  
Energy and Climate

MUNICIPALITY OF TIVAT



Implemented by

**giz** Deutsche Gesellschaft  
für Internationale  
Zusammenarbeit (GIZ) GmbH



Covenant of Mayors  
for Climate & Energy





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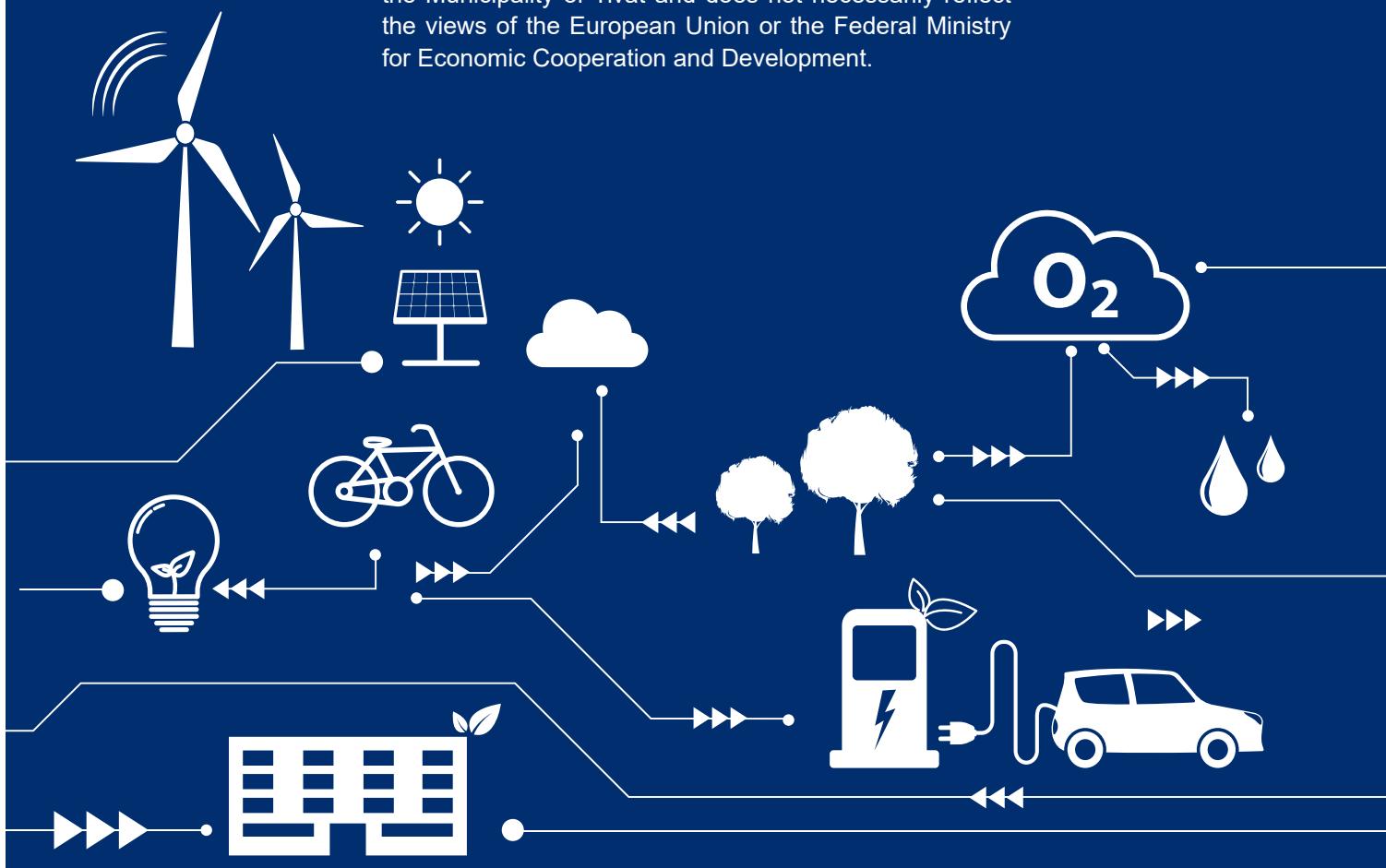
## ABBREVIATIONS AND ACRONYMS

Abbreviations	Term
<b>BEI</b>	Baseline Emission Inventory
<b>BMZ</b>	Federal Ministry for Economic Cooperation and Development of Germany
<b>CG</b>	Crna Gora / Montenegro
<b>CoM</b>	Covenant of Mayors for Climate and Energy
<b>COP</b>	The Conference of Parties
<b>EU</b>	European Union
<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
<b>IPCC</b>	Intergovernmental Panel for Climate Change
<b>JP</b>	Javno preduzeće / Public company
<b>JRC</b>	Joint Research Centre
<b>RVA</b>	Risk and Vulnerability Assessment
<b>MEI</b>	Monitoring Emission Inventory
<b>SECAP</b>	Sustainable Energy and Climate Action Plan
<b>SI.</b>	Službeni / Official
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>GDP</b>	Gross Domestic Product
<b>C</b>	Celzijus / Celsius
<b>DUP</b>	Detailed Urban Plan
<b>DZ</b>	Dom zdravlja / Health Centre
<b>ED</b>	Electricity Distribution
<b>EU</b>	European Union
<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
<b>HW</b>	Heatwave
<b>IJZCG</b>	Institute for Public Health of Montenegro
<b>KI</b>	Kritična infrastruktura / Critical Infrastructure
<b>MICE</b>	Meetings, Incentives, Conferences i Events
<b>OVN</b>	Olujne vremenske nepogode / Storm Weather Events
<b>PM</b>	Particulate Matter
<b>PP</b>	Park prirode / Nature park
<b>PUP</b>	Prostorno-Urbanistički Plan / Spatial-Urban Plan
<b>TO</b>	Tourist organisation
<b>TS</b>	Transformer Station
<b>UNDP</b>	United Nations Development Program
<b>UNEPFI</b>	United Nations Environmental Program – financial initiative
<b>ViK</b>	Vodovod i kanalizacija / Water Supply and Sewage
<b>ZZZCG</b>	Zavod za zdravstvenu zaštitu Crne Gore / Institute for Health Protection of Montenegro
<b>ViK</b>	Vodovod i kanalizacija / Water Supply and Sewage
<b>ZZZCG</b>	Zavod za zdravstvenu zaštitu Crne Gore / Institute for Health Protection of Montenegro



The Sustainable Energy and Climate Action Plan (SECAP) of the Municipality of Tivat until 2030 has been prepared within the framework of the project "EU4Energy Transition – Covenant of Mayors in the Western Balkans and Türkiye," co-financed by the European Union and the Federal Ministry for Economic Cooperation and Development of the Federal Republic of Germany (BMZ), and implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in the Western Balkans.

The SECAP was developed with the technical assistance of CETEOR, CEDES, and IBF International Consulting. The content of this document is the sole responsibility of the Municipality of Tivat and does not necessarily reflect the views of the European Union or the Federal Ministry for Economic Cooperation and Development.





Dear Fellow Citizens,

It is my great honor to present our municipality's Sustainable Energy and Climate Action Plan (SECAP). As a signatory of the Covenant of Mayors, we are committed to taking ambitious steps to lead the transition to low-carbon development, tackle climate change challenges, and secure a sustainable and resilient future.

The SECAP is our strategic roadmap for a greener, more energy-efficient future. It outlines key actions to reduce greenhouse gas emissions, boost energy efficiency, and protect the environment. This plan was developed with support from the EU4 Energy Transition: Covenant of Mayors in the Western Balkans and Türkiye project, implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in the Western Balkans. Through this project, we collaborated with other cities and municipalities across the region, sharing ideas and best practices while defining crucial energy and climate actions. We also engaged citizens and local stakeholders through public consultations to shape the final plan.

The Action Plan provides clear goals and practical steps to guide our municipality's energy transition, improve climate adaptation, and support sustainable development. It will help us access funding, shape investments, and align with EU energy and climate goals, while addressing our local needs and priorities.

As your Mayor, I am committed to accountability and working together with citizens, businesses, and partners to make this transformation a reality. Your participation is key to our success. Together, we can create lasting change that benefits our community and environment.



Yours sincerely,  
Mayor of Tivat Municipality  
Željko Komnenović



## SUMMARY

The Sustainable Energy and Climate Action Plan represents the fundamental initiative aimed at harmonizing ecological goals with economic development and social inclusion. This plan emphasizes the importance of integrating different sectors and stakeholders in the decision-making process, promoting transparency and accountability. By advancing renewable energy sources, energy efficiency, and innovative technologies, the SECAP aims to lay the foundation for a low-carbon economy. Considering local specificities and needs, the plan focuses on adapting infrastructure and communities to reduce risks associated with climate change while ensuring that all segments of society benefit from these changes. This approach not only contributes to global efforts to combat climate change but also fosters sustainable development, strengthens local economies, and improves the quality of life for citizens.

### Strategic Objectives:

The main measurable goal of the SECAP is to achieve a CO<sub>2</sub> emission reduction of at least 40% by 2030 compared to the base year of 2019. This aligns with the broader vision of contributing to limiting the global temperature increase to below 2°C, in accordance with the international climate agreement reached at the UN Conference of Parties on Climate Change (COP21) in Paris, December 2015.

### Key Focus Areas:

- **Mitigation:** Implementation of measures to reduce both direct and indirect CO<sub>2</sub> emissions across sectors, including building infrastructure, public lighting, and transportation. The plan proposes a comprehensive set of mitigation measures designed to achieve the overall emission reduction target.
- **Adaptation:** Addressing vulnerabilities and risks associated with the impacts of climate change through targeted adaptation measures across various sectors such as infrastructure, water management, tourism, agriculture, forestry, natural resources, and health.
- **Energy Poverty:** Combating energy poverty through a multidimensional approach that includes measures aimed at improving energy efficiency in buildings, promoting the use of renewable energy sources, and providing targeted support to vulnerable and energy-poor households.

### Implementation and Evaluation:

The document provides a detailed description of the organisational structure and methodologies for the

implementation and monitoring of the action plan, including stakeholder engagement, financial aspects, and the implementation timeline.

### Key Figures:

- **Mitigation Measures:** The document outlines a total of 16 mitigation measures across sectors such as buildings, public lighting, and transportation, aiming to achieve a 41.31% reduction in CO<sub>2</sub> emissions by 2030 compared to the base year of 2019, with a total estimated value of EUR 66,306,050.00.
- **Adaptation Measures:** A comprehensive set of 20 adaptation measures is presented across sectors such as infrastructure, water management, tourism, agriculture, forestry, and health, with a total estimated value of EUR 37,205,000.00.
- **Measures for Energy Poverty:** Specific actions to combat energy poverty are discussed, focusing on improving energy efficiency, promoting renewable energy, and supporting energy-poor households, with a total estimated value of EUR 290,000.00.



# 1

## STRATEGY



The international initiative “Covenant of Mayors for Climate and Energy” (CoM) aims to strengthen and enhance climate and energy activities at the municipal level. The initiative is based on three pillars: reducing CO<sub>2</sub> emissions, enhancing resilience to climate change, and knowledge and experience exchange. It addresses both adaptation and mitigation of climate change to ensure sustainability and resilience at the local level while reducing greenhouse gas (GHG) emissions.

Local self-government units (LSUs) are key drivers of the energy transition and the fight against climate change at the administration level closest to the citizens. LSUs share the responsibility for combating climate change with institutions at the regional and national levels and are ready to act regardless of whether other participants meet their obligations.

Tivat's accession to this international initiative and the project “EU4Energy Transition – Covenant of Mayors in the Western Balkans and Turkey” represents the local government's political and strategic desire to continuously improve the economic, ecological, and social conditions of its citizens. This is achieved through the implementation of a vision for improving energy efficiency and decarbonisation within the municipality, alongside appropriate mitigation and adaptation measures to climate change, ensuring sustainable development and a stable, greener economic development of the municipality.





# 2

## THE COVENANT OF MAYORS FOR CLIMATE AND ENERGY



On January 29, 2008, the European Commission launched a major initiative to connect mayors of energy-conscious European cities into a permanent network aimed at exchanging experiences in implementing effective measures to improve energy efficiency in urban areas (Figure 1).

The initiative titled “Covenant of Mayors - CoM (hereinafter referred to as the Covenant)<sup>1</sup> , represents the world’s largest initiative focused on local energy and climate activities. Its primary goal is to strengthen and enhance climate and energy-related actions at the municipal level. The initiative is built upon three pillars: (1) reducing CO2 emissions, (2) strengthening resilience to climate change, and (3) knowledge sharing and exchange of best practices. It addresses both adaptation to and mitigation of climate change impacts to ensure sustainability and resilience at the local level while reducing greenhouse gas (GHG) emissions.

One of the key instruments for promoting strategic and continuous planning of climate change adaptation and mitigation measures at the local level is the development of the Sustainable Energy and Climate Action Plan (SECAP)<sup>2</sup> for municipalities/local governments, with specific guidelines<sup>3</sup> and instructions<sup>4</sup> for the methodology of

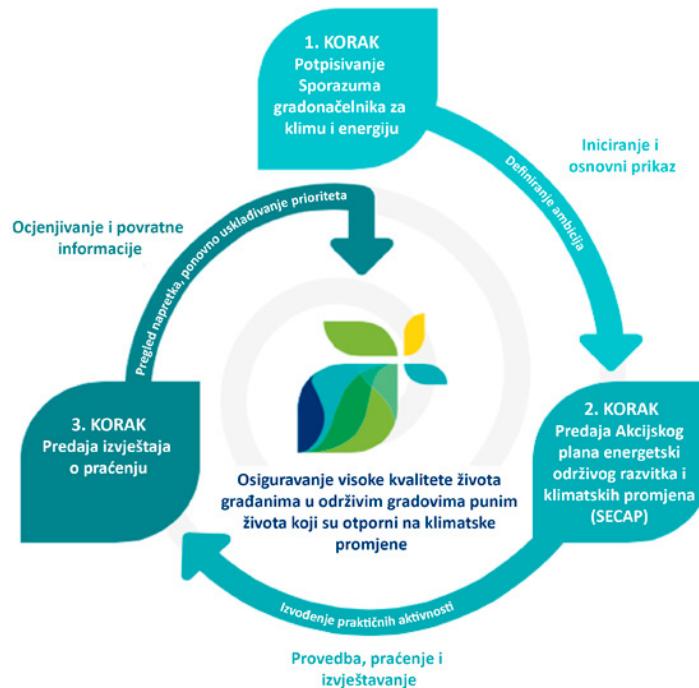
developing the Action Plan, standardised data collection, and reporting<sup>5</sup>, in order to achieve the set goals and obligations by 2030.

Thus, local authorities – signatories of the Covenant – share a common vision to ensure the decarbonisation and resilience of cities where their citizens will have access to safe, sustainable, and universally accessible energy.

Climate change adaptation involves predicting the harmful effects of climate change and taking appropriate measures to prevent or reduce the damage these effects may cause, while also taking advantage of opportunities that may arise in the process.

The Covenant of Mayors is the response of advanced European cities to the challenges of global climate change, and it is the first and most ambitious initiative of the European Commission to directly target local authorities and citizens through their voluntary active involvement in the fight against global warming. The initiative introduces a new approach to implementing energy and climate policy by applying the so-called “bottom-up” approach for the first time, a multi-sectoral collaboration model, and an activity framework driven by the local context in carrying out activities at the local level. The logo of the initiative is shown in Figure 2.

**Figure 1** The Covenant of Mayors for Climate and Energy – “step by step”



1 THE COVENANT OF MAYORS FOR CLIMATE AND ENERGY  
Agreement: [https://www.covenantofmayors.eu/IMG/pdf/CoM\\_CommitmentDocument\\_en.pdf](https://www.covenantofmayors.eu/IMG/pdf/CoM_CommitmentDocument_en.pdf)

2 CoM SECAP: [https://mycovenant.eumayors.eu/docs/seap/19514\\_1459614153.pdf](https://mycovenant.eumayors.eu/docs/seap/19514_1459614153.pdf)

3 <https://op.europa.eu/en/publication-detail/-/publication/a2ac8a5e-f134-11e8-9982-01aa75ed71a1/language-en>

4 <https://www.covenantofmayors.eu/support/reporting.html>

5 Recommendations for reporting under the Covenant of Mayors for Climate and Energy; software tools for planning climate adaptation measures available on website Urban-Adaptation Support Tool (Urban-AST).



Figure 2 Covenant of Mayors for Climate and Energy – Initiative Logo



To translate their political commitment into practical measures and projects, signatories of the Covenant commit to adopting an action plan within two years from the date of the municipal assembly's decision to join the Covenant of Mayors. The plan should outline the key activities they intend to undertake. It must include a Baseline Emission Inventory for monitoring mitigation efforts and a Climate Risk and Vulnerability Assessment for the impacts of climate change on individual sectors. As a result of consultations on the future of the Covenant of Mayors and the establishment of a new version of the Covenant as the Covenant of Mayors for Climate and Energy in October 2015, the Sustainable Energy Action Plan (SEAP) was upgraded to a new version called the Sustainable Energy and Climate Action Plan (SECAP).

**The main binding and measurable goal of the SECAP is for the proposed measures to result in a reduction of CO<sub>2</sub> emissions in the local government area by at least 40% by 2030, compared to the reference year of 2019.**

Joining the Covenant of Mayors marks the beginning of a long-term process and participation in an active community of local environments committed to reporting on the implementation of plans and improving the daily lives of citizens through the application of new activities, contributing to a sustainable future.

**A common plan for a shared vision** – in order to achieve their mitigation and adaptation goals, the signatories of the

Covenant of Mayors commit to taking a series of steps outlined in Table 1.

The Covenant of Mayors has established a framework for action that supports local authorities in achieving their mitigation and adaptation ambitions, while also taking into account the diversity on the ground.

**The signatories of the Covenant confirm a shared vision for the year 2050:**

- **implementing the decarbonisation of the local area**, thus contributing to limiting the average global temperature increase to below 2°C in line with the international climate agreement reached at COP21 in Paris in December 2015;
- **increasing the resilience of the local area**, thereby strengthening the capacity to adapt to the inevitable impacts of climate change;
- **enabling universal access to safe, sustainable, and affordable energy for all citizens**, contributing to the improvement of quality of life and enhancing energy security.

**The signatories of the Covenant commit to:**

- **reducing CO<sub>2</sub> emissions** (and possibly other greenhouse gases) in the local area by at least 40% by 2030 compared to the baseline year, through improved energy efficiency and increased use of renewable energy sources;
- **increasing resilience to climate change** through the application of climate change adaptation principles;
- **exchange of experiences, visions, results, and practices** with local and regional authorities in the region and the EU, through direct cooperation and knowledge exchange, within the context of the “Global Covenant of Mayors”;

**Requirements** that must be met for SECAP to be accepted within the framework of the Covenant initiative:

Table 1 Steps for Implementing the Covenant of Mayors

Steps	Mitigation	Adaptation
Initiation and review of the baseline	Baseline emissions inventory	Preparation of climate change risk and vulnerability assessment
Establishing strategic goals and planning	Submission of the Sustainable Energy and Climate Action Plan (SECAP) and inclusion of mitigation and adaptation considerations in relevant policies, strategies, and plans within two years after the municipal assembly decision	
Implementation, monitoring, and reporting	Progress report every two years after submitting SECAP on the initiative platform, following and updating the Monitoring Emission inventory (MEI) and the Risk and Vulnerability Assessment (RVA) every 4 years.	



- The Action Plan must be approved by the municipal assembly – it should be adopted by the municipal or city assembly;
- The Action Plan must clearly include the reduction target specified in the Covenant (e.g., at least 40% CO<sub>2</sub> reduction by 2030);
- The Action Plan must be based on the results of a comprehensive Baseline Emission Inventory (BEI) and Risk and Vulnerability Assessment (RVA);
- The Action Plan must cover key activity sectors, including at least public lighting, buildings, and transportation;
- The baseline emissions inventory must include public lighting, buildings, and transportation.

The development of the Sustainable Energy and Climate Action Plan (SECAP) includes the establishment of a visionary framework that aligns with the unique characteristics, challenges, and aspirations of each region. The overall SECAP vision for the Municipality of Tivat is based on several key components:

- Integration of renewable energy
- Carbon neutrality and emission reduction
- Resilience and adaptation
- Community engagement and education
- Economic growth and social equality
- Innovation and technology
- Partnership and collaboration

The main condition for the successful implementation of the SECAP development process is the establishment of an organisational structure that will ensure clarity from the outset regarding the tasks and activities to be completed, and the timeframes in which they should be completed. The actions required for the development, implementation, and monitoring of the SECAP are divided into several key steps, and the process includes the following phases:

- Preparatory actions for initiating the SECAP development process (political will; active support from leaders and the Municipal Assembly, professional resources, and other stakeholders).
- Formation and appointment of the working team (representatives from city services, public and private enterprises), according to priority action areas.
- Formation and appointment of an Advisory Group of local experts.
- Development of the SECAP.
- Adoption of the SECAP by the Municipal Assembly as an official, binding document.
- Implementation of the identified measures and activities proposed in the plan.
- Monitoring and control of the implementation of the identified measures.
- Preparation of progress reports on completed projects at intervals of two years.

## 2.2 Objectives of SECAP Development

The following chapters present an overview of the SECAP objectives concerning: greenhouse gas emission mitigation goals, adaptation to climate change, and measures to mitigate energy poverty.

## 2.1 Vision for the Municipality of Tivat

The Municipality of Tivat, led by the Mayor and the Municipal Assembly, shares a common vision of a sustainable future with other cities and municipalities in Europe and around the world.

### VISION

**Tivat is a modern coastal city, an attractive tourist destination that combines elite and rural tourism. Through sustainable development, it has preserved its natural and cultural values, utilises renewable energy sources, reduced CO<sub>2</sub> emissions and greenhouse gas effects, turned risks into opportunities, and as such, represents the best small European city to live in.**

Mitigation and adaptation to climate change can have multiple positive effects on the environment, society, and the economy. When these issues are addressed collectively, they create new opportunities for improving sustainable local development. This includes the construction of participatory communities that are resilient to climate change, in which energy is used efficiently, the quality of life is improved, investment and innovation are encouraged, local economic growth is promoted, new jobs are created, and stakeholder participation and cooperation are strengthened.

Local solutions to energy and climate change problems ensure that citizens have access to secure, sustainable, and competitively priced energy, contributing to the reduction of energy dependence while protecting vulnerable consumers.



## 2.2.1 Mitigation Objectives for Greenhouse Gas Emissions

The SECAP of the Municipality of Tivat introduces a total of 16 climate change mitigation measures aimed at reducing direct and indirect CO<sub>2</sub> emissions from the building, public lighting, and transportation sectors, which will be implemented from 2024 to 2030. The mitigation measures implemented by 2030 will result in a total CO<sub>2</sub> emission reduction of 41% by 2030 compared to the reference year of 2019, thus meeting the 40% target set by the Covenant of Mayors.

## 2.2.2 Adaptation Objectives for Climate Change

Adaptation measures are implemented by local government bodies and other legal entities with public authority, responsible for environmental issues, disaster risk reduction/management, agriculture, fisheries, forestry, water management, energy, industry, transportation, infrastructure, meteorology, health, spatial planning, nature conservation, marine and coastal areas, and tourism.

The strategic goals of the climate change adaptation plan within the SECAP of the Municipality of Tivat are:

- Assessing the current and future vulnerability to climate change and related risks in selected sectors;
- Reducing the vulnerability of natural systems and society to the negative impacts of climate change;
- Reducing the negative impacts that exacerbate climate change;
- Ensuring the sustainable development of Tivat through adaptation of sectors such as infrastructure, water management, tourism, agriculture, forestry, natural resources, and health by implementing measures and projects across the municipality of Tivat;
- Increasing the recovery capacity after the effects of climate change;
- Mitigating the effects of energy poverty;
- Harnessing potential positive effects that may also arise from climate change.

## 2.2.3 Objectives for Energy Poverty Measures

In the context of SECAP for the Municipality of Tivat, addressing energy poverty is crucial for improving social equity, raising living standards, and achieving sustainability goals. The strategic goals of the energy poverty reduction plan in Tivat under SECAP may include:

### Improving Energy Efficiency in Residential Buildings:

- Implementing initiatives aimed at improving the energy efficiency of residential structures.

- This includes applying measures to reduce energy consumption and alleviate the financial burden on households, especially those with limited economic capabilities.

### Encouraging the Development of Renewable Energy:

- Promoting the use of renewable energy technologies, such as solar panels and biomass heating systems, to reduce dependence on expensive and environmentally harmful fossil fuels.
- Diversification of the energy portfolio, enhanced energy security, and reduced energy costs for residents are expected benefits.

### Promoting Fair Access to Energy:

- Promoting affordable and reliable energy services for all residents, including those living in marginalized communities or facing financial difficulties.
- These activities include facilitating access to energy-efficient appliances, advocating energy-saving practices, and providing financial assistance or subsidies for energy costs.

### Implementing Social Support Initiatives:

- Implementation of social assistance programs to help low-income households and vulnerable groups mitigate energy poverty.
- These efforts may include targeted financial assistance, promotion of discounts or subsidies on energy bills, and support for improving energy efficiency in social housing and public infrastructure.

### Developing Community Engagement and Capacity Building:

- Encouraging community participation and empowerment through awareness campaigns, educational activities, and capacity-building initiatives.
- Equipping residents with knowledge and skills related to energy efficiency and renewable energy sources.

To ensure sustainable development and improve the quality of life, it is essential for local communities, including Podgorica, to continuously work on reducing energy poverty and supporting citizens in achieving a decent standard of living.

Additionally, SECAP emphasizes the importance of targeted support and social policies that specifically address the needs of those most at risk of energy poverty. This may include financial assistance programs for energy-efficient home improvements, subsidies for renewable energy installations, and educational campaigns to raise



awareness about energy-saving practices. By integrating these measures, the aim is not only to reduce greenhouse gas emissions and mitigate climate change but also to ensure that the transition to a low-carbon economy is equitable and inclusive.

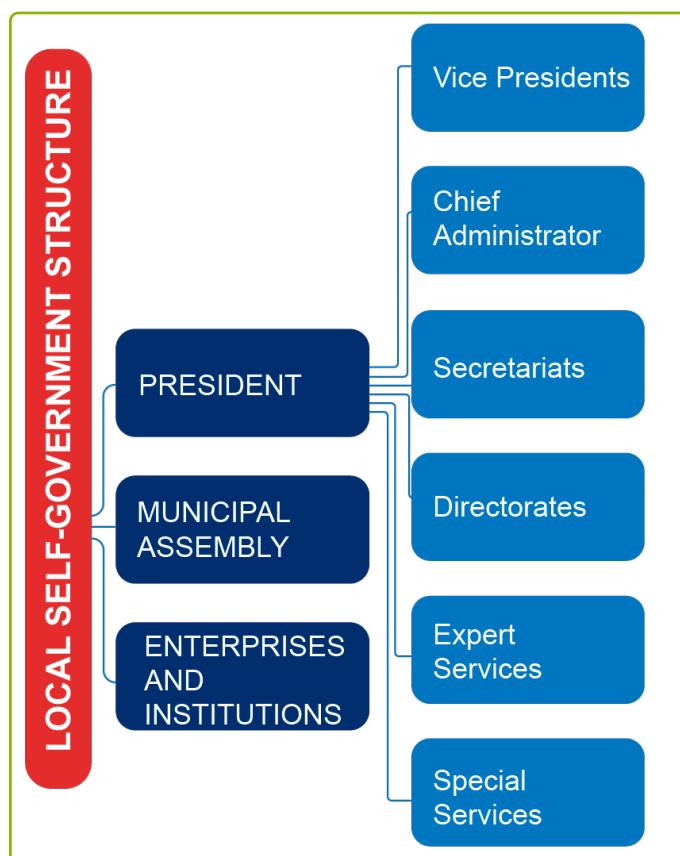
One of the key challenges in implementing measures to prevent energy poverty lies in developing legally defined, clearer criteria and methodologies for identifying and monitoring energy-vulnerable or at-risk groups.

Local governments must play a role in building capacity to combat energy poverty by providing technical and administrative support to energy-poor households. The goal is to empower these households to utilise various measures aimed at improving the energy efficiency of the buildings they reside in and the appliances they use.

## 2.3 Organisation of the Municipality of Tivat

The organisational structure of the Municipality of Tivat is examined from two perspectives: the organisational structure of the local government unit and the structure established for the implementation of the SECAP, as outlined in the following two subsections.

Figure 3 Organigram of Tivat Municipality



### 2.3.1 Organisational Structure of the Municipality of Tivat

*The coordination, organisational structures, and capacities of the Municipality of Tivat are detailed below:*

### 2.3.2 Organisational Structure of the Municipality of Tivat for SECAP Implementation

Figure 4 illustrates the organigram of Tivat Municipality, focusing specifically on the structure designed for the implementation of the Sustainable Energy and Climate Action Plan (SECAP).

## 2.4 Methodology for SECAP Developing

The following sections provide an explanation of the general approach, as well as the specific methodology tailored to Tivat Municipality, for the development of the SECAP.

### 2.4.1 General Principles of SECAP

In alignment with the guidebook "How to develop a Sustainable Energy and Climate Action Plan (SECAP)" (hereinafter referred to as the Guidebook) developed by the Covenant of Mayors Secretariat and the Joint Research Centre (JRC) of the European Commission, signatories of the Covenant commit to submitting a Sustainable Energy and Climate Action Plan (SECAP) within two years of the decision by the local parliament to adopt the Covenant, with the key activities they plan to undertake outlined in the plan. The plan includes a Baseline Emission Inventory (BEI) for tracking adaptation activities and the Risk and Vulnerability assessment (RVA) to climate change. Furthermore, signatories are required to report on the progress of their plans every two years. Depending on the approach, signatories undertake activities related to reporting and implementation monitoring.

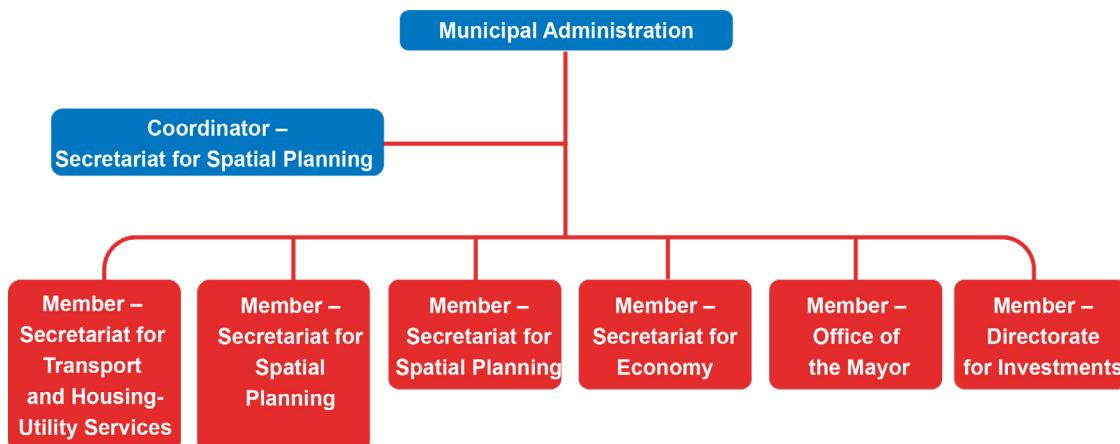
The guidelines for drafting a Sustainable Energy and Climate Action Plan for municipalities<sup>6</sup> consist of three parts:

- Part I: The SECAP Process – A Step-by-Step guide toward low-carbon and climate-resilient cities by 2030

<sup>6</sup> Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)', Science for Policy report by the Joint Research Centre (JRC), 2018. <https://eu-mayors.ec.europa.eu/en/resources/reporting>



Figure 4 Organisational Structure of the Municipality of Tivat for SECAP Implementation (Organigram)



- Part II: Baseline Emissions Inventory and Risk and Vulnerability Assessment (RVA)
- Part III: Policies, key measures, best practices for mitigation and adaptation, and SECAP financing measures

#### 2.4.2 Methodological Approach for the Municipality of Tivat

The creation of Tivat Municipality's SECAP follows the general approach described above but has been tailored to reflect the specific environmental, social, economic, and other relevant characteristics of the area. The methodology is also aligned with the Covenant of Mayors' Guidelines for Climate and Energy Reporting. A summary of key elements for drafting the document is as follows:

- Project scope: SECAP for the Municipality of Tivat covers the administrative territory of the municipality.
- Baseline year: The reference year for energy consumption analysis and baseline emissions inventory is set to 2019.
- Timeframe: The plan encompasses the period up to 2030.
- Emissions calculation: Calculations adhere to standard emission factors aligned with the principles of the Intergovernmental Panel for Climate Change (IPCC) and those utilised by Montenegro in preparing UNFCCC reports.
- Categories of measures considered – divided into three main categories:
  - Mitigation measures to address the consequences of climate change
  - Adaptation measures to enhance resilience to climate change
  - Measures to mitigate energy poverty
- Main types of greenhouse gas emissions – included

in the baseline and monitoring inventory of emissions:

- Direct emissions, which result from energy consumption physically occurring in the project area.
- Indirect emissions, which refer to the consumption of grid energy, where the production plants for this energy may be located outside the project area, but its consumption takes place within this territory.
- Emissions related to non-energy consumption, specifically in the water supply sector.
- Types of greenhouse gases considered – exclusively CO<sub>2</sub>
- Adopted approach for CO<sub>2</sub> emissions inventory creation – The methodological approach chosen for the creation of the SECAP for the Municipality of Tivat is activity-based. This approach includes all direct and indirect CO<sub>2</sub> emissions resulting from activities that involve energy consumption in the project area
- Energy consumption sectors considered – as outlined below:
  - Building sector, including city administration buildings, municipal institutions and enterprises, commercial and service sector buildings, and residential buildings.
  - Public lighting sector
  - Transport sector, which includes urban road traffic. This relates to energy consumption of vehicles owned by the city administration and municipal enterprises and institutions, vehicles in public road transport (city bus services and taxi services), as well as vehicles of individuals and legal entities registered within the observed area.



## 2.5 Strategic and Legal Framework Relevant to SECAP

Below is an overview of the relevant legal framework concerning SECAP at the EU, national, and local levels.

### 2.5.1 EU Framework

The European Green Deal is a package of initiatives with the primary goal of the green transformation of the EU, with the ultimate objective being climate neutrality by 2050. The accompanying legislative framework, within which the legal goals are defined, is encompassed by the EU Climate Law. By adopting this law, the EU and its member states have committed to reducing net greenhouse gas emissions in the EU by at least 55% by 2030 compared to 1990 levels. At the beginning of 2024, the European Commission recommends new, more ambitious targets on the path to achieving climate neutrality, which include reducing net gas emissions by 90% by 2040 compared to 1990 levels.

### 2.5.2 National and Local Framework

The Law on Protection from the Negative Impacts of Climate Change was adopted on December 25, 2019, and its main goal is to protect against the negative impacts of climate change, reduce greenhouse gas emissions, protect the ozone layer, and address other issues related to climate change protection. This document foresees the adoption of:

- 1) 1) Strategy for low-carbon development; and
- 2) Climate Change Adaptation Plan.

At the national level, Montenegro has not yet adopted the Integrated National Energy and Climate Plan (NECP), a medium-term plan through which countries outline the actions to achieve net-zero greenhouse gas (GHG) emissions by 2050.

The implementation of Montenegro's NECP goals will contribute to the decarbonisation of the entire economy, thereby enhancing the competitiveness of Montenegro's economic sectors. The NECP outlines actions across five dimensions: decarbonisation, energy efficiency, energy security, internal energy market, and research, innovation, and competitiveness.

The adopted concept of sustainable development in Tivat obligates the development of models for more responsible energy use as a resource. By adopting the Local Energy Plan as an official document, initiatives and activities for

sustainable energy management and "green" development in the municipality are being initiated.

Planning documents recognise the potential for utilising renewable energy sources (hydro-power, wood fuels, solar energy, and wind energy).

The Local Plan also includes an analysis of energy consumption by energy source, primarily electricity, wood biomass, and liquid fuels. In addition to this analysis, the use of energy sources by sector was considered. In this context, the building sector, including its subsectors (administrative buildings of the municipal administration and public companies, households, services, public lighting, etc.), and the transportation sector with its subsectors (municipality-owned vehicles, public transport, etc.) were examined.

Furthermore, implementing identified energy efficiency measures that will enable CO<sub>2</sub> emissions reduction remains a priority area for municipal action. This will be achieved through support for systematic energy design and management in buildings, sustainable transportation, the use of alternative energy sources, and improvements in the public lighting system.

The Municipality of Tivat adopted the Local Energy Plan of Tivat Municipality 2017–2026 and the Strategic Development Plan of Tivat Municipality 2024–2029. The goal of these plans is to improve accessibility and quality of life for all citizens through the establishment of sustainable transport and the balanced development of all modes of transportation.

Through the adoption of such a plan, the Municipality of Tivat aims to:

- Ensure better accessibility and mobility for all residents
- Increase traffic safety
- Improve living spaces
- Reduce pollution and harmful gas emissions
- Mitigate the negative effects of traffic on human health
- Enhance energy efficiency
- Support tourism development in the municipality
- Encourage the green economy
- Ensure greater equity among all modes of transportation



## 2.6 Stakeholder and Citizen Involvement

Activities aimed at mitigating and adapting to climate change involve assessing the harmful effects of climate change and implementing appropriate measures to prevent or reduce the damages these effects may cause. This process can also yield positive opportunities that contribute to more effective measures and actions in combating climate change.

Mitigation includes key activities in addressing climate change by intervening to reduce greenhouse gas (GHG) emissions. However, experience has shown that mitigation alone is insufficient, making it essential to establish systems that create the conditions for identifying climate adaptation measures for the most vulnerable receptors and implementing activities to enhance their resilience. Climate change adaptation is a continuous, long-term process without a definitive start or end date, requiring a thorough analysis of all relevant factors. The feasibility of implementing proposed policies and measures must consider existing barriers and potential conflicts.

Defining mitigation and adaptation measures at the local level requires, in addition to the key role of local governments, the involvement of other key stakeholders, such as relevant municipal departments, municipal enterprises, and other interested parties—including citizens and the civil sector. Setting priorities for measures at the local level, to advance the creation of the SECAP, should primarily include the input of experts, while also accounting for public opinion to a reasonable extent. This approach helps prioritise both mitigation and adaptation measures already defined in local planning documents, those derived from BEI and RVA analyses, as well as those identified during consultation processes.

Based on a detailed analysis of adopted local planning documents, environmental status reports, action plans, and intersectoral consultations, a comprehensive list of mitigation and adaptation measures for the Municipality of Tivat was created. This list includes measures relevant to the municipality's territory, regardless of whether they pertain to valid documents or expired ones (provided that no new or updated documents have been adopted in the interim).

The measures were categorised according to the sectors they address, and duplicate measures with the same or similar proposed activities were redefined to avoid repetition, while ensuring the feasibility of implementation and the preservation of the measure's primary objective.

Special attention was paid to the principles and required criteria for SECAP preparation, ensuring that the proposed measures can be incorporated into the future document.

The draft of priority measures was further analysed by representatives of the Municipality of Tivat and enterprises under the jurisdiction of the local government. Subsequently, these measures were presented to the wider public of Tivat during the next phase of evaluation.

## 2.7 Monitoring and Evaluation Process

The Sustainable Energy and Climate Action Plan (SECAP) for the local government is intended to be implemented by the year 2030, with some measures planned to continue beyond this timeline. It is, therefore, crucial to establish a dedicated organisational unit within the local administration (the SECAP Unit) that will be fully equipped to address the numerous challenges of this highly complex task. This is particularly important as the plan's implementation requires coordination among multiple independent entities, often decentralised and with varying degrees of interest and levels of engagement.

The success of implementing this plan depends on a series of activities that must be carried out, with their implementation objectively monitored, controlled, documented, and evaluated based on measurable performance indicators.

Applying best practices in project management is a reliable guarantee for the success of all these steps. In this context, it is recommended to adopt knowledge and skills aligned with the ISO 21500 standard, whose guidelines will assist both managers and operational staff in addressing the challenges of implementing the measures outlined in this plan systematically and professionally. Certification in ISO 9001 standards is highly beneficial and possibly necessary to ensure the administration is fully prepared to apply quality management principles based on international best practices.



## 2.7.1 Monitoring and Control of Action Plan Implementation

The SECAP Unit's primary task is to monitor progress and control the implementation of the Action Plan. This includes:

- Monitoring the timeline for implementing adaptation and mitigation measures.
- Tracking the success of implemented measures.
- Monitoring and controlling the achievement of specific goals for each measure within the SECAP.
- Monitoring and verifying CO<sub>2</sub> emission reductions achieved through climate change mitigation measures.

Effective monitoring of energy consumption savings, reductions in CO<sub>2</sub> emissions across various sectors and subsectors, and progress toward achieving the SECAP's goals will be facilitated by creating a new CO<sub>2</sub> emissions inventory. It is critical that the methodology used to develop this new inventory is identical to the one used for the Baseline Emission Inventory.

## 2.7.2 Progress Reporting on SECAP Implementation

By joining the Covenant of Mayors for Climate and Energy, the local government has committed to regularly reporting on the measures and activities implemented. This reporting may also occur more frequently, especially if disruptions to the planned schedule arise. The reporting guidelines, Covenant Reporting Guidelines, are publicly available<sup>7</sup>.

It is recommended to prepare a Status Report every two years and a comprehensive report every four years. Table 2 outlines the minimum reporting requirements when submitting the SECAP and associated monitoring templates.

All measures identified in the catalogue of this SECAP must be made visible on the corresponding web platform, where all required data should be entered in their respective sections<sup>8</sup>.

## 2.8 Financial Aspects of the Municipality of Tivat

At the municipal level, the financial dimension of the SECAP involves a comprehensive strategy aimed at mobilizing resources to support the implementation of climate and energy initiatives. This strategy includes sourcing funds from various channels such as national budgets, international grants and loans, public-private partnerships, and innovative financial instruments like green bonds or energy performance contracts. Additionally, local governments can leverage revenue streams generated from energy-related activities such as feed-in tariffs, energy efficiency savings, and carbon pricing mechanisms to fund SECAP projects. Ensuring financial sustainability and accessibility is crucial, requiring careful budget planning, cost-benefit analyses, and prioritisation of investments based on their potential to deliver significant climate and energy benefits while addressing the specific needs and priorities of the community. Collaboration with financial institutions, development agencies, and other stakeholders is pivotal in mobilizing the necessary

**Table 2** Minimum Reporting Conditions According to the Timeline

	Phase of Registration	SECAP		Activity Monitoring Report		Comprehensive Monitoring Report	
		Year 0	Year 2	Year 4	Year 6		
<b>My Strategy</b>	X	✓		✓		✓	
<b>Action Plan – Document Updates</b>	X	✓		X		X	
<b>Emission Inventory</b>	X	✓ (BEI*)		X		✓ (MEI*)	
<b>Risk and Vulnerability Assessment</b>	X	✓		✓		✓	
<b>Actions for Mitigating the Effects of Climate Change</b>	X	(Min. 3 key actions)		✓		✓	
<b>Actions for Adapting to Climate Change</b>	X	X		(Min. 3 key actions)		✓	
<b>Actions for Addressing Energy Poverty</b>	X	X		(Min. 1 key action)		✓	

<sup>7</sup> Covenant Reporting Guidelines <https://eu-mayors.ec.europa.eu/sites/default/files/2022-10/Covenant-reporting-guidelines-EN-final.pdf>

<sup>8</sup> <https://mycovenant.eumayors.eu/site/landing>



resources and unlocking financial opportunities to advance the city's climate and energy goals.

Tivat, known as a tourist hub in Montenegro, operates with a budget adopted annually by the Municipal Assembly. The budget reflects the municipality's economic conditions, needs, and planned projects. In 2023, Tivat's municipal budget amounted to EUR 24,055,700.00 marking a substantial increase compared to previous years. This rise enables greater investments in public facilities, infrastructure, culture, sports, social benefits, and the NGO sector.

Revenue sources include taxes, surcharges, fees, and charges. Property and income taxes, tourist fees, and other local levies make up a significant portion of the revenue.

Expenditures are divided into current and capital expenses, with significant allocations to infrastructure and tourism. Additional revenue streams encompass donations, asset transfers, and income from asset sales.

## 2.9 Overview of Key Parameters Specific to the Municipality of Tivat

The following is a detailed overview of key parameters specific to the Municipality of Tivat, including an assessment of adaptation opportunities, strategies for extreme climate events, and analyses from the perspective of energy poverty.

### 2.9.1 Evaluation of Adaptation Opportunities through Risk and Vulnerability Assessment for Identified Hazards and Sectors

The goal of adaptation measures is to minimize the consequences of risks resulting from current and future climate changes. These measures are aimed at people, property, and natural resources within the administrative area of the municipality that could be affected by these risks. The adaptation cycle begins with the development of a Risk and Vulnerability Assessment, as shown in Figure 5.

After the preparatory activities (1), which primarily involve securing political support, gathering initial information, as well as identifying human, technical, and financial resources, along with key stakeholders, were completed, the Risk and Vulnerability Assessment (2) was carried out. At this stage, the conditions were created to proceed to the next step, which involves the implementation of several activities until full readiness to respond to hazard occurrences is achieved. These activities include the following:

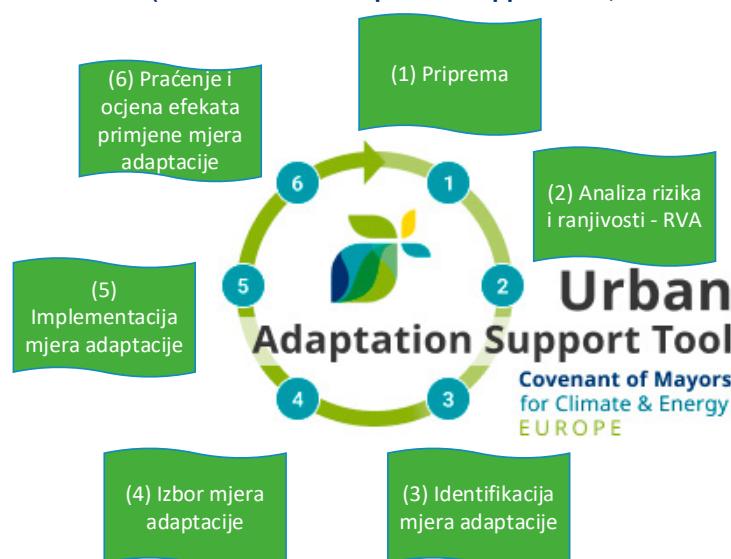
#### 1. Identification of Adaptation Opportunities

- 1.1 Creation of a catalogue of relevant adaptation options
- 1.2 Finding examples of good adaptation practices
- 1.3 Identification of adaptation opportunities: Self-check

#### 2. Assessment and Selection of Adaptation Opportunities

- 2.1 Selection of assessment framework for adaptation options
- 2.2 Conducting cost-benefit analysis of adaptation measures

Figure 5 Steps in the Adaptation Process (Source: Urban Adaptation Support Tool, CoMO/EEA)





- 2.3 Determining the priorities of adaptation options
- 2.4 Assessment and selection of adaptation opportunities: Self-check

### 3. Implementation of Adaptation Measures

- 3.1 Creation of an adaptation action plan (description of items, deadlines, resources, responsibilities)
- 3.2 Finding examples of adaptation action plans
- 3.3 Integrating adaptation into urban policies and plans
- 3.4 Combating climate change through adaptation and mitigation
- 3.5 Implementation of adaptation: Self-check

### 4. Monitoring and Evaluation of the Effects of Implemented Adaptation Measures

- 4.1 Development of monitoring and evaluation methodology
- 4.2 Defining monitoring indicators
- 4.3 Finding examples of adaptation monitoring indicators
- 4.4 Using monitoring results to improve the adaptation process
- 4.5 Monitoring and evaluation of adaptation: Self-check

#### The Importance of Monitoring and Evaluating the Effects of Applied Adaptation Measures

Monitoring and evaluating the effects of adaptation measures play a key role in addressing the impacts of climate change by identifying bottlenecks, providing information and insights that can help in making climate-sensitive decisions, and supporting effective climate action. The implementation of adaptation measures is an important tool for demonstrating efficiency and accountability. It is crucial in ensuring the long-term success of climate and adaptation initiatives, plans, and actions. Adaptation measures have an important role in the following three aspects of climate change adaptation:

- Monitoring the performance of activities undertaken during the development of the adaptation plan,
- Monitoring previously identified risk thresholds/trigger levels to identify when new adaptation actions should be taken;
- Determining whether the planned results and outcomes from adaptation actions have been achieved.

When developing the adaptation measures catalogue in this document, all identified measures have been grouped into the following types: **Institutional measures, Education and awareness, Infrastructure measures, and Financial measures.**

### 2.9.2 Strategy for Extreme Climate Events

The analysis of strategies for extreme climate events was carried out in three steps:

- Extreme weather events in the past
- Summary of risks from weather hazards
- Vulnerability of local authorities or regions

#### **Extreme Weather Events in the Past<sup>9</sup>**

Extreme weather and climate events/hazards for the purposes of this document are those that caused damage and/or difficulties in the municipality of Tivat between 2003-2020, either directly or indirectly through climate-related events.

##### • **Heatwaves**

Heatwaves occurred multiple times during the period from 2003-2020, including in 2003, 2007-2011, 2012, 2013, 2015, 2017, and 2018-2020, with extremely high temperatures ranging from 39.7°C to 40.2°C. Some of the consequences included: inability to conduct outdoor work, increased electricity consumption for cooling, complete and partial drying of plants, and impacts on human health.

##### • **Droughts**

Due to frequent droughts from 2000 to 2020 (particularly in 2003, 2005, 2007, 2009, 2011, 2012, 2017), accompanied by high temperatures, forest fires often occurred.

##### • **Strong Rainfall Leading to Flooding**

Intense rainfall events in 2012, 2015, 2016, and 2022, accompanied by a series of intense cyclonic activities with heavy precipitation, led to the overflow of sewage channels which were unable to absorb the large volume of water. As a result, streets and parts of the main road were flooded. There was also a significant accumulation of deposited waste, street torrents, and flooding of basements and auxiliary buildings. The Tivat airport facilities were also flooded

<sup>9</sup> Source: Climate Change Adaptation Strategy for the Municipality, March 2016. [https://Tivat.me/db\\_files/Urbanizam/Dokumenta/8.predlog\\_strategije\\_adaptacije\\_na\\_klimatske\\_promjene\\_glavnog\\_grada.pdf](https://Tivat.me/db_files/Urbanizam/Dokumenta/8.predlog_strategije_adaptacije_na_klimatske_promjene_glavnog_grada.pdf)

**Table 3** Probability of Climate Hazards

Probability class	Description	Probability (p)
<b>High</b>	Extremely likely to occur.	p>0,05
<b>Moderate</b>	Likely to occur	0,005<p=<0,05
<b>Low</b>	Unlikely to occur	0,0005<p=<0,005
<b>Unknown</b>	Climate hazard not observed in the past or cannot be precisely calculated based on available data	

- Storm<sup>10</sup> and hail**

Storms, which are defined as strong winds potentially accompanied by heavy rain, snow, hail, thunderstorms, and lightning, occurred in November 2018, December 2019, and September 2020. These events caused a rise in sea levels, damage to fruit orchards, vegetable crops, and olive groves; damage to vehicles, windows, and facades of houses. A strong 'bora' wind (from the north) on June 9, 2018, and between February 23-24, 2019, caused damage to Tivat Airport, including to smaller aircraft parked at the airport, endangering human safety. Additionally, the electrical grid, city greenery, and residential rooftops were damaged.

- Summary of Weather Hazard Risks**

Based on the previously analysed extreme events (observed in the past and projected for the future based on climate projections) that occur in the Municipality of Tivat (table in Annex 1), Table 4 summarizes the existing and

future risks of their potential occurrence, trends, or physical consequences that could lead to fatalities, injuries, and other health issues, damage to property, infrastructure, etc.

The timeframe indicates when changes in the frequency of these hazards can be expected (short-term – 20 to 30 years from now, mid-term – after 2050, and long-term – during the 2100s). The probability levels of climate hazards are determined according to Table 3.

As seen in Table 4, the actual risk from a climate hazard is determined by two parameters – the probability of the climate hazard and its impact. Future risk due to climate hazards is assessed based on three parameters – expected changes in the frequency of occurrence of hazards, expected changes in hazard intensity, and the time frame.

It is estimated that extreme high temperatures, droughts,

**Table 4** Risks from Climate Hazards of Particular Importance to the Municipality of Tivat

Climate Hazard/ Climate-Related Hazard	Existing Risk of Hazard Occurrence		Future Hazards		
	Hazard Probability	Hazard Impact	Expected Changes in Hazard Intensity	Expected Changes in Hazard Frequency	Time Period
<b>Extreme heat</b>	High	High	Increase	Increase	Medium-term
<b>Extreme cold</b>	Low	Low	Decrease	Decrease	Medium-term
<b>Heatwaves</b>	High	High	Increase	Increase	Medium-term
<b>Heavy rainfall</b>	High	High	Increase	Increase	Medium-term
<b>Floods</b>	High	Moderate	Increase	Increase	Medium-term
<b>Snowfall</b>	Low	Moderate	Decrease	Decrease	Medium-term
<b>Droughts</b>	High	Moderate	Increase	No change	Medium-term
<b>Storms</b>	High	Moderate	Increase	Increase	Medium-term
<b>Forest fires</b>	High	High	Increase	Increase	Long-term

<sup>10</sup> Storms refer to strong winds that can be accompanied by heavy rain, snow, hail, thunder, and lightning.



heavy rains leading to floods, and storms as hazards have the highest level of risk in terms of frequency of occurrence and the damage/danger they cause. Climate projections indicate an increase in their intensity in the future. Thus, in the RCP8.5 scenario, throughout this century, a decrease in the number of episodes where five-day precipitation exceeds 60 mm can be expected across most of Montenegro, but an increase in accumulation during individual episodes is also projected. This means that, although the duration will be shorter, the accumulated precipitation will be higher on average. This change can

be particularly important when analysing the risk of flash floods and the triggering of landslides and rockfalls.

Considering that the frequency of extremely low temperatures has been low from 1951 to the present, and that they show a decreasing trend in the future, it is assessed that the risk of their occurrence is low (Table 4).

### Vulnerability of Local Authorities or Region

In Table 5, the socio-economic vulnerabilities, physical vulnerabilities, and environmental vulnerabilities to climate change are presented. Vulnerability indicators that point to the occurrence of specific risks are also shown.

**Table 5** Socio-Economic Vulnerability, Physical and Environmental Vulnerability for the Municipality of Tivat

Vulnerability Type	Vulnerability Description	Vulnerability Indicators
Socio-Economic	<p><i>Water Management</i></p> <ul style="list-style-type: none"> <li>Decreased yield from water sources and the lowering of water levels in wells is a limiting factor for the city's development and the number of tourists.</li> <li>Water shortages at local sources lead to the use of more expensive water from the regional water supply.</li> </ul>	<p><i>Water Management</i></p> <ul style="list-style-type: none"> <li>Decreased yield from water sources</li> <li>Increased water consumption</li> <li>Salt-water intrusion into water sources of Plavda and Topliš</li> <li>Water turbidity in Plavda (water quality and safety, number of turbidity days)</li> </ul>
	<p><i>Agriculture</i></p> <ul style="list-style-type: none"> <li>Ageing of the population engaged in agriculture and the unfavourable structure of households.</li> <li>The impact of climate change on beekeepers and their productivity.</li> <li>Low adaptive capacity causes high vulnerability in the sector.</li> </ul>	<p><i>Agriculture</i></p> <ul style="list-style-type: none"> <li>Decrease in the number of farmers</li> <li>Reduced productivity of beekeepers</li> <li>Reduced agricultural yields</li> <li>Continued fragmentation of agricultural land</li> <li>Increased irrigation costs due to longer dry periods</li> <li>Very small percentage of arable land has irrigation systems</li> </ul>
	<p><i>Forestry</i></p> <ul style="list-style-type: none"> <li>Fires degrade forest ecosystems.</li> <li>Fires have negative effects on the population, visitors, and the tourism economy in general.</li> <li>Fires have negative effects on air quality, and thus on human health.</li> </ul>	<p><i>Forestry</i></p> <ul style="list-style-type: none"> <li>Due to the increase in population and tourists in the municipality of Tivat, the risk of fires and the occurrence of climate extremes indirectly increase.</li> </ul>
	<p><i>Natural Resources</i></p> <ul style="list-style-type: none"> <li>Increase in sea temperature promotes the spread, proliferation, and impact of invasive species.</li> <li>The occurrence of overpopulation of species that are not normally invasive.</li> </ul>	<p><i>Natural Resources</i></p> <ul style="list-style-type: none"> <li>Decreased biodiversity of the marine ecosystem, changes in natural conditions, lead to a reduction in the potential for fishing, which is the primary or additional livelihood for some citizens.</li> </ul>



Vulnerability Type	Vulnerability Description	Vulnerability Indicators
Socio-Economic	<p>Health</p> <ul style="list-style-type: none"> <li>• Heatwaves</li> <li>• Fires (caused by heatwaves)</li> <li>• Heavy rains that lead to floods</li> <li>• Flooding</li> <li>• Storms and storm winds</li> </ul>	<p><i>Health</i></p> <ul style="list-style-type: none"> <li>• <i>Sensitivity to heatwaves and fires among the population</i></li> <li>• <i>Number of days with increased air pollution due to fires</i></li> <li>• <i>Number of days when water sources are salinized</i></li> <li>• <i>Number of days when drinking water was not usable due to floods</i></li> <li>• <i>Reduced quantities and availability of drinking water</i></li> <li>• <i>Number of interruptions in the water supply</i></li> <li>• <i>Occurrence of infectious diseases</i></li> </ul>
Real Estate/Buildings (Physical)	<p>Infrastructure</p> <ul style="list-style-type: none"> <li>• Residential and business buildings near the KI (Critical Infrastructure) corridors</li> </ul>	<p><i>Infrastructure</i></p> <ul style="list-style-type: none"> <li>• The number of residential and commercial buildings that were threatened or damaged as a result of fires near KI (Critical Infrastructure) facilities in the past.</li> <li>• The number and coverage of training for parts of the population whose buildings may potentially be at risk from fires.</li> </ul>
	<p>Tourism</p> <ul style="list-style-type: none"> <li>• Changes in sea level affect tourism infrastructure, namely, beaches and cities becoming too hot for comfortable tourism or recreational activities.</li> <li>• Due to strong storms, the attractiveness of coastal areas diminishes, especially for maritime activities like sailing, which can lead to the loss of economic assets, ultimately resulting in a decrease in municipal revenues.</li> </ul>	<p><i>Tourism</i></p> <ul style="list-style-type: none"> <li>• Decrease in the number of visitors to various tourist attractions or points of interest in the city.</li> </ul>
	<p>Water Management</p> <ul style="list-style-type: none"> <li>• Changes in sea levels affect water supply and sewerage infrastructure.</li> <li>• Increased water consumption requires additional water supply and sewerage infrastructure.</li> </ul>	<p><i>Water Management</i></p> <ul style="list-style-type: none"> <li>• Salinisation in the water supply network.</li> <li>• Increased water losses.</li> <li>• Increased water consumption.</li> </ul>
	<p>Agriculture</p> <ul style="list-style-type: none"> <li>• The trend of increasing water shortages in already dry areas.</li> <li>• Agriculture primarily takes place outdoors and is therefore exposed to weather impacts.</li> <li>• Reduced crop yields.</li> <li>• Limited infrastructure for animal husbandry and irrigation systems.</li> <li>• Low adaptive capacity of farmers.</li> </ul>	<p><i>Agriculture</i></p> <ul style="list-style-type: none"> <li>• Increased vulnerability of agricultural facilities caused by flooding.</li> <li>• Small farms with low investment capacities, small plots that are difficult to modernize, low economic power of farmers, ageing agricultural population, etc.</li> <li>• Reduced fish catches and income for coastal communities. Economic losses due to damage to fishing equipment.</li> </ul>



Vulnerability Type	Vulnerability Description	Vulnerability Indicators
Real Estate/ Buildings (Physical)	Forestry <ul style="list-style-type: none"> <li>A large amount of infrastructure has been built in the municipality, including numerous infrastructure facilities, tourist and private properties, and the airport.</li> <li>Notably, protected areas such as the Tivat Solila and the area being put under protection, Vrmac, should be highlighted.</li> </ul>	Forestry <ul style="list-style-type: none"> <li>Public buildings and administration</li> <li>Commercial buildings</li> <li>Airport</li> <li>Tourist facilities</li> <li>Residential buildings</li> <li>Protected area of Tivat Solila and the area being put under protection, Vrmac.</li> </ul>
	<i>Natural Resources</i> <ul style="list-style-type: none"> <li>High temperatures, accompanied by heatwaves and the absence of rainfall, significantly contribute to the occurrence and spread of forest fires.</li> <li>Heavy rains, followed by storms, cause rivers and streams to overflow, as well as atmospheric sewage systems, which carry pollutants that ultimately flow into natural recipients, the sea.</li> </ul>	<i>Natural Resources</i> <ul style="list-style-type: none"> <li>Loss of plant material, green spaces.</li> <li>Deterioration of air quality, impacting human health.</li> <li>Increased concentrations of pollutants in surface waters.</li> <li>Threats to the quality of water in water sources.</li> <li>Disruption of soil structure, leading to erosion and landslides.</li> <li>Damage or destruction of green spaces in urban areas.</li> </ul>
	<i>Health</i> <ul style="list-style-type: none"> <li>Fire (caused by heatwaves)</li> <li>Heavy rains leading to floods</li> <li>Flooding</li> <li>Storms and storm winds</li> </ul>	<i>Health</i> <ul style="list-style-type: none"> <li>Number of damaged residential buildings—loss of housing (fires, storms, floods).</li> <li>Water consumption (increased number of tourists)—pressure on the water supply system.</li> <li>Increased discharge of sewage (increased number of tourists)—pressure on the existing sewage system.</li> </ul>
Environment	<i>Infrastructure</i> <ul style="list-style-type: none"> <li>Extreme heat affecting biodiversity.</li> <li>Fires near KI corridors and environmental consequences.</li> <li>Impact on air, soil, and water.</li> </ul>	<i>Infrastructure</i> <ul style="list-style-type: none"> <li>Quality of fire response preparedness.</li> <li>Number of fires in KI corridors and the level of destruction of significant/protected plant species.</li> <li>Reducing the likelihood of fires through controlled cutting and clearing of KI corridors.</li> <li>Monitoring resource consumption under the authority of the local government (water, fuel, electricity consumption).</li> <li>Development of e-mobility and monitoring of indicators for success in projects aimed at reducing resource consumption.</li> <li>Environmental monitoring.</li> </ul>



Vulnerability Type	Vulnerability Description	Vulnerability Indicators
Environment	<p><i>Tourism</i></p> <ul style="list-style-type: none"> <li>Changes in sea level, as well as sea temperature, affect the structure and development of coastal ecosystems and habitats, which impacts the provision of ecological services to tourists. Changes in marine ecology and habitats may alter sports and food fishing.</li> </ul>	<p><i>Tourism</i></p> <ul style="list-style-type: none"> <li>Difficulties in preserving Mediterranean biodiversity; increased illegal fishing at sea..</li> </ul>
	<p><i>Water Management</i></p> <ul style="list-style-type: none"> <li>A decrease in groundwater levels due to intense droughts negatively impacts the living world, causing loss/reduction in biodiversity.</li> <li>Saltwater intrusion of underground waters due to prolonged droughts or rising sea levels leads to changes in biodiversity.</li> <li>Extreme hydrological conditions, such as large and sudden peaks in surface flow rates and changes in groundwater levels, negatively affect biodiversity, especially aquatic species.</li> </ul>	<p><i>Water Management</i></p> <ul style="list-style-type: none"> <li>Groundwater levels</li> <li>Surface water flow rates/drying up of surface flows</li> <li>Saltwater intrusion of groundwater</li> <li>Frequency of extreme hydrological events</li> </ul>
	<p><i>Agriculture</i></p> <ul style="list-style-type: none"> <li>Changes in marine ecosystem conditions.</li> <li>Increased occurrence of invasive marine species.</li> <li>Expected faster phenological cycles could cause disruptions in the pollination season and affect the beekeeping sector.</li> </ul>	<p><i>Agriculture</i></p> <ul style="list-style-type: none"> <li>Warming of the sea, changes in salinity, pH, and oxygen availability affect the population of commercial marine species.</li> <li>Increased occurrence of invasive marine species.</li> </ul>
	<p><i>Forestry</i></p> <ul style="list-style-type: none"> <li>Reduction in areas covered by forest vegetation.</li> <li>Air pollution and negative environmental impact on residents and visitors.</li> </ul>	<p><i>Forestry</i></p> <ul style="list-style-type: none"> <li>Air pollution</li> <li>Loss of recreational and leisure spaces</li> <li>Environmental and landscape experiences</li> <li>Habitat protection</li> </ul>
	<p><i>Natural resources</i></p> <ul style="list-style-type: none"> <li>High temperatures, accompanied by heatwaves and the absence of rainfall, significantly contribute to the occurrence and spread of forest fires, leading to loss/reduction in biodiversity, deterioration of air quality, erosion, and soil loss.</li> </ul>	<p><i>Natural resources</i></p> <ul style="list-style-type: none"> <li>Decreased number of plant and animal species, disrupted habitats.</li> <li>Increased concentrations of pollutants in the air, impacting human health.</li> <li>The emergence of barren lands, loss of the surface soil layer, changes in soil structure.</li> </ul>



Vulnerability Type	Vulnerability Description	Vulnerability Indicators
	<p><i>Health</i></p> <ul style="list-style-type: none"> <li>• Fire (caused by heatwaves)</li> <li>• Heavy rains leading to floods</li> <li>• Flooding</li> <li>• Storms and storm winds</li> </ul>	<p><i>Health</i></p> <ul style="list-style-type: none"> <li>• Number of days with increased air pollution due to fires (number of visits to healthcare facilities)</li> <li>• Unavailability of drinking water—number of days when water sources are salinated due to storms</li> <li>• Unavailability of drinking water—number of days when water sources are muddied and unsafe to use</li> </ul>

### 2.9.3 Energy Poverty

Energy poverty is a multidimensional issue that requires a multi-sectoral approach. Through the Clean Energy for All Europeans package, the European Union (EU) has incorporated obligations for monitoring and reporting on the implementation of measures aimed at reducing energy poverty into its current energy regulations. Specifically, Directive 2019/944 on common rules for the internal electricity market, along with amendments to Directive 2012/27/EU, requires EU Member States affected by energy poverty to include measures in their national action plans or other appropriate frameworks to address energy poverty. These measures aim to reduce the number of energy-poor households. Energy poverty arises when a household must reduce energy consumption to a level that negatively impacts the health and well-being of its members. It is primarily caused by three factors:

- a high share of household income spent on energy costs,
- low total household income,
- poor energy performance of residential units and devices used in those units.

The directive also specifies that “low income, high energy expenditure, and poor energy efficiency of residential buildings are relevant factors for establishing criteria to measure energy poverty. Member States should ensure the necessary energy supply for vulnerable and energy-poor consumers. An integrated approach could be employed, for example, combining energy and social policies. Measures may include social policies or improvements in the energy efficiency of buildings.”

Energy-vulnerable consumers are defined as those whose socio-demographic characteristics and energy-related indicators make them more likely to experience energy poverty than the rest of the population. This group includes, for example, social assistance beneficiaries, pensioners, persons with disabilities, individuals with chronic illnesses, single-parent families, the elderly, and those living alone.

Energy poverty has far-reaching consequences for health, social status, education, and overall societal standing. It is estimated that one in ten EU citizens is affected by energy poverty. Moreover, in 2022, rising energy prices and increased living costs exacerbated energy poverty. For example, 9.3% of Europeans were unable to adequately heat their homes, a significant increase from 6.9% in 2021.

Energy poverty correlates with low household income, high energy costs, poor energy efficiency of residential buildings, as well as inefficient household appliances and heating and cooling systems with insufficient performance. The most commonly proposed measures to reduce energy poverty include increasing household income, reducing energy prices for end-users, improving the energy efficiency of residential buildings (e.g., insulation and retrofitting), enhancing the efficiency of heating and cooling systems, and replacing household appliances with those of a higher energy efficiency class. To achieve a “just transition” and meet Sustainable Development Goal 7—“Ensure access to affordable, reliable, sustainable, and modern energy for all”—it is crucial to support and implement measures that prevent the emergence of energy poverty and plan and execute actions that contribute to its reduction. In this context, special attention should be given to measures targeting vulnerable or particularly disadvantaged groups of the population.

Energy poverty is a relatively new topic in Montenegro, and a significant portion of the population finds it unclear. This issue must be integrated into public policies and become a focus of interest for the professional community across multiple sectors. Notably, in Montenegro’s Third National Communication on Climate Change (August 1, 2020), energy poverty was not even mentioned as a category.

One of the possible measures to combat energy poverty could be capacity building for addressing energy poverty across all sectors, while another potential measure involves the development of a Program for Energy Poverty Reduction with a defined implementation timeframe. This program should systematically establish actions to tackle energy poverty, most likely through the implementation of



energy efficiency measures and targeted financial support. Additionally, the program must include a specific measure related to the implementation of a system for monitoring socio-demographic and energy indicators that describe energy poverty at the national level. This should facilitate easier and more transparent data acquisition on vulnerable and energy-poor households, or those at a significant risk of energy poverty.

In the event that a Member State determines that there is a significant number of households in energy poverty, it should include a national target for reducing energy poverty in its plan. Furthermore, Article 24 of Directive 2012/27/EU mandates that Member States report on progress toward achieving their national framework target for reducing the number of energy-poor households. These reports should include quantitative information on the number of such households as well as details on policies and measures implemented to address energy poverty.

One of the greatest challenges in addressing energy poverty, particularly regarding the implementation of preventive measures, is the establishment of clear criteria for identifying vulnerable or at-risk groups. Montenegro's Energy Law defines a vulnerable customer as an end-user

of electricity or gas whose social status or health condition could result in their life or health being directly endangered by an energy supply limitation or interruption. Several provisions of this law regulate tariffs, energy supply conditions for vulnerable customers, and the designation of suppliers for such customers.

One of the key challenges in implementing measures to prevent energy poverty is undoubtedly the establishment of clearer criteria for vulnerable or at-risk groups of citizens and the incorporation of these criteria into existing legislation, alongside the development of a methodology for collecting and monitoring data on energy poverty.

Local self-governments should play a role in building capacities to combat energy poverty by providing technical and administrative support to energy-poor households. This would empower households to utilise various measures aimed at improving the energy efficiency of the buildings in which they reside and the appliances they use.



# 3

# BASELINE EMISSION INVENTORY (BEI)



Below, all aspects of the Baseline (Greenhouse Gas) Emission Inventory are elaborated in detail.

### 3.1 Objective of the Baseline CO<sub>2</sub> Emission Inventory

By signing the Covenant of Mayors for Climate & Energy (CoM), the Municipality of Tivat committed to developing a Sustainable Energy and Climate Action Plan (SECAP) for the period up to 2030. This commitment includes reducing CO<sub>2</sub> emissions, and, if possible, emissions of other greenhouse gases, following a unified approach to addressing climate change mitigation and adaptation. The starting point in the process of developing the SECAP is the Baseline Emission Inventory (BEI), which is necessary to define the target for CO<sub>2</sub> emission reductions by 2030. The purpose of creating the BEI is to provide a clear picture of the current situation and historical trends in the Municipality of Tivat (i.e., a geographically defined area) regarding energy consumption and CO<sub>2</sub> emissions from various sectors and activities. Energy consumption and CO<sub>2</sub> emissions at the local level depend on factors such as:

- Economic structure (industries and services with different types of activities),
- Population density,
- Characteristics of residential, service, commercial, and other building units,
- Utilization, organisation, and technological development of various transportation modes,
- Attitudes and habits of citizens,
- Climate conditions, etc.

The Baseline Emission Inventory (BEI) also outlines the measures already implemented in terms of energy management, as well as the results achieved in energy savings and CO<sub>2</sub> emission reductions through these measures. This is done in alignment with adopted national planning and strategic documents, as well as applicable regulations:

- Law on Protection Against the Negative Effects of Climate Change (2019)
- National Strategy for Sustainable Development until 2030 (2016)
- National Renewable Energy Action Plan of Montenegro (2014)
- National Climate Change Strategy (NCCS) until 2030 (2015)

#### Reference Year

When developing the first SECAP, it is essential to define a reference year for the preparation of the BEI. For the Municipality of Tivat, the chosen reference year is 2019. The primary criterion for selecting the reference year was the availability of high-quality input data required by the methodology for calculating CO<sub>2</sub> emissions. Additionally, the chosen year predates the COVID-19 pandemic, ensuring a significantly larger scope and reliability of data compared to the pandemic and post-pandemic periods.

#### Scope of the Baseline GHG Emission Inventory

The scope of the BEI includes the calculation of CO<sub>2</sub> emissions for three energy sub-sectors identified as the main final energy consumers within the Municipality of Tivat, and consequently, as significant GHG emitters. The selection of sectors and their classification aligns with the JRC guidelines. The CO<sub>2</sub> emission calculation encompasses the following sectors:

- Buildings
- Public Lighting
- Transport.

Initially, there was a plan to estimate CO<sub>2</sub> emissions from the Waste Sector; however, following a meeting with municipal representatives, this plan was abandoned due to the unavailability of valid data that would ensure the methodological accuracy of the emission inventory. Regarding the Industrial Sector, the Covenant of Mayors (CoM) guidelines do not consider it a key category for BEI development; therefore, this sector was excluded from further consideration.

The subsequent sections of this document provide an analysis of energy consumption as well as estimated CO<sub>2</sub> emissions for the above-mentioned sectors.

### 3.2 Methodology for Developing the Baseline Emission Inventory

The methodology for developing the Baseline Emission Inventory (BEI) for the Municipality of Tivat includes the analysis of energy consumption in the Buildings, Public Lighting, and Transport sectors, as well as the calculation of CO<sub>2</sub> emissions for these sectors, with 2019 selected as the reference year.

The analysis of energy consumption was conducted based on available national and local statistical data during the preparation of this report. The CO<sub>2</sub> emission calculations



were performed in accordance with the 2006 IPCC Guidelines, an internationally recognised methodology for the relevant sectors.

### 3.3 Energy Consumption in the Municipality of Tivat

The methodology for developing the Baseline Emission Inventory in the Municipality of Tivat encompassed an analysis of energy consumption across the Buildings, Public Lighting, and Transport sectors, as well as the calculation of CO<sub>2</sub> emissions for the same sectors in the reference year 2019.

The analysis of energy consumption was made in accordance with available national and local statistical data that were available during the preparation of this report. The CO<sub>2</sub> emission calculations followed the internationally accepted 2006 IPCC Guidelines for the sectors under review.

### 3.4 Energy Consumption in Tivat

In accordance with the Covenant of Mayors (CoM) guidelines, as well as suggestions from the local administration and available data, the energy consumption in the Municipality of Tivat was analysed for the following categories:

- Buildings, equipment, facilities, and industry:
  - Buildings, equipment, or facilities owned by the Municipality
  - Public lighting
  - Tertiary or commercial buildings, equipment, or facilities
  - Residential buildings
- Transport
  - Vehicles owned by the municipal administration
  - Public and taxi transport
  - Vehicles for personal and commercial use

### 3.5 Analysis of Energy Consumption in Buildings, Equipment, or Facilities and Industry

At the request of the Municipality of Tivat, the energy consumption analysis included only public buildings managed by the local government. State-owned buildings

(such as educational, healthcare, and social institutions, as well as police, judiciary, tax administration offices, and other state bodies) were excluded from the analysis, as the Municipality does not manage these facilities and therefore lacks relevant data on energy consumption and does not implement energy efficiency measures in these buildings.

The analysis of energy consumption in the buildings sector includes energy usage in the Municipality of Tivat building, as well as in the buildings of public institutions and enterprises founded by the Municipality. An overview of electricity consumption (MWh) in public buildings and enterprises under the Municipality of Tivat's jurisdiction for the reference year 2019.

The total electricity consumption in public buildings in 2019 amounted to 2,935.567 MWh. Considering the structure of public institutions and enterprises under the Municipality of Tivat, and given that the Municipality does not have data on the consumption of other energy sources (such as wood, coal, fuel oil, and heating oil), this analysis assumes that these energy sources do not contribute to the energy mix of the analysed facilities. This assumption is supported by the fact that fuel oil and heating oil are predominantly used in industries and public facilities founded by the state.

#### 3.5.1 Analysis of Energy Consumption in Public Lighting Sector

For the purposes of this analysis, an average was calculated based on data provided by the relevant electricity supplier, Functional Unity Supply, regarding electricity consumption for public lighting and traffic signalling during the 2015–2017 period. This aligns with the public lighting consumption trend outlined in the Local Energy Plan of the Municipality of Tivat 2017–2026. Accordingly, the average electricity consumption was determined to be 1.393,070 MWh.

#### 3.5.2 Analysis of Energy Consumption in Tertiary or Commercial Buildings, Equipment, or Facilities

Energy consumption in the commercial sector was calculated based on electricity consumption data provided by the EPCG (national energy company) FU Supply, which is the sole supplier to end consumers in Montenegro's distribution network for the reference year 2019. Since FU Supply categorises households consumption and other consumption, the share of electricity consumption attributed to the commercial sector was determined through an extrapolation of data from the 2015–2017 period. This dataset includes a detailed breakdown of consumption by state administration. The energy consumption of public buildings and enterprises founded by the Municipality of Tivat is analysed in the section titled Analysis of Energy Consumption in Buildings Owned by the Municipality of



Tivat. Data on energy consumption in state administration buildings, public buildings, and enterprises established by the Municipality of Tivat, along with data on electricity consumption for public lighting, were subtracted from the total consumption listed under the other consumption category for the reference year 2019. It is important to note that data for 2019 is available only for two main consumption categories: household consumption and other consumption.

During the specified period, electricity consumption for public institutions established by the State of Montenegro amounted to 895.031 MWh in 2015, 898.864 MWh in 2016, and 687.067 MWh in 2017, with an average of 826.987 MWh for the observed period. Using the same method, as detailed in the subsection Analysis of Energy Consumption in the Public Lighting Sector, electricity consumption for public lighting and traffic signalling was calculated at 1,393.070 MWh.

From the total consumption in the category 'other consumption' i.e. 47,476.419 MWh, for the reference year, the estimated consumption of public institutions in the Municipality of Tivat in the amount of 2,935.57 MWh, the average consumption of public lighting and traffic signalling of 389.019 MWh, and the average consumption of public institutions owned by the State of Montenegro in the amount of 826.987 MWh were subtracted. This results in an approximation of the energy consumption of the commercial sector within the building sector of 42,320.795 MWh for the reference year 2019.

Given the structure and activities of businesses in the Tivat area, which are predominantly service-oriented and focused on tourism, and based on data from the Local Energy Plan of the Municipality of Tivat 2017–2026, the consumption of other energy sources in the building sector, such as wood, coal, fuel oil, and heavy oil, is deemed negligible for this analysis.

### 3.5.3 Analysis of Energy Consumption in Residential Buildings

Total electricity consumption for the residential building sector in 2019 was determined based on data from FU Supply for the 'household' consumption category and amounted to 49,692.439 MWh.

Considering the purchasing power of residents in Tivat, who had the highest average net salary in Montenegro in 2019 – approximately 25% higher than the national average – and the geographical and climatic characteristics of the municipality, the use of coal and heavy oil as energy sources for households is negligible. For this analysis, it

is assumed that these energy sources are not used in the residential building sector.

The last available data on firewood consumption in the municipality of Tivat are from 2011, indicating that 1,675 households used firewood as an energy source, with total consumption of 6,137.90 m<sup>3</sup>. In the same year, at the national level, 703,571 m<sup>3</sup> of firewood was consumed by 70,417 households. Therefore, the consumption of firewood for heating residential buildings was obtained based on the estimated population of the Municipality of Tivat, which is 15,043 inhabitants, representing about 2.42% of the total population of Montenegro, and data on the final consumption of firewood for household needs for 2019, which was 525,157 m<sup>3</sup>. In this way, proportionally to the population share, and considering the climatic conditions characteristic for the territory of the Municipality of Tivat, i.e., an average annual temperature of 15°C, along with a clear downward trend in firewood consumption compared to the aforementioned 2011 year in Montenegro (703,571 m<sup>3</sup> versus 525,157 m<sup>3</sup>), and considering the population increase of the Municipality of Tivat (14,032 inhabitants in 2011 compared to 15,043 inhabitants in 2019), the consumption of firewood was calculated to be 6,354.40 m<sup>3</sup>, which, when converted to energy value, amounts to 15,250.560 MWh.

### 3.5.4 Analysis of Total Energy Consumption in Buildings, Equipment, or Facilities and Industry

The energy consumption balance for the building sector is obtained by summing all subsectors within the building sector (Table 6). The total energy consumption in the reference year was 110,199.361 MWh. Typically, the largest share of energy consumption is in the residential sector (approximately 52%), followed by commercial buildings with 45%. Public buildings have the smallest share in energy consumption (around 0.9%), and therefore the smallest potential global effect of energy efficiency measures. However, due to organisational characteristics, the implementation of energy efficiency measures is most effective in this subsector of buildings, which is why these measures are first implemented in this sector. Of course, the greatest long-term global effect is achieved by involving citizens in the process of implementing measures in their own buildings.

In addition to electricity, which is the most significant energy source with a share of approximately 86%, heating wood makes up 14% of the energy mix in the residential sector. Electricity is predominantly consumed in the residential sector (52%), followed by the commercial sector (45%), while the share of public buildings and companies founded by the Municipality of Tivat corresponds to 3% of the total energy consumption in the building sector (Figure 6).



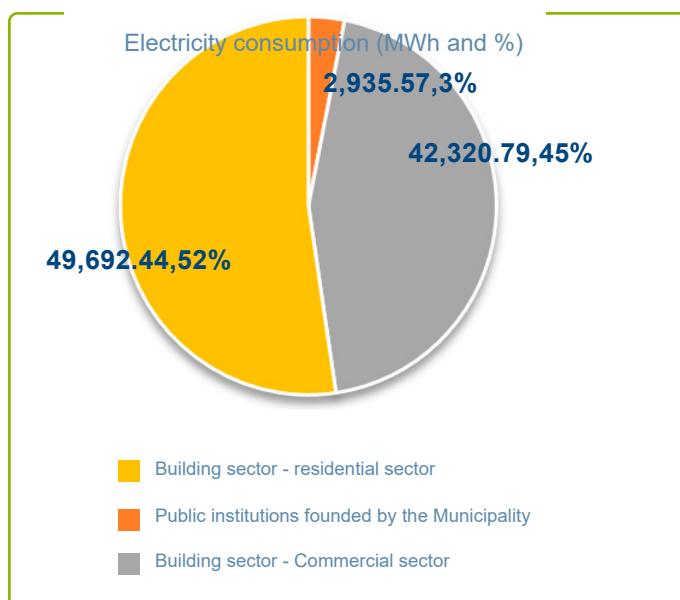
Table 6 Total Annual Energy Consumption (MWh) in the Building Sector in 2019

Sector	Energy consumption (MWh)				
	Electricity	Heating wood	Coal	Fuel oil	Total
Residential buildings	49.692,439	12.708,80	0	0	64.942,999
Public buildings and companies founded by the Municipality of Tivat	2.935,567	-	0	0	2.935,567
Commercial sector	42.320,795	-	0	0	42.320,795
Total	94.948,801	12.708,80	-	-	110.199,361

### 3.6 Analysis of Energy Consumption in the Transport Sector

Below is an overview of the analysis of energy consumption by individual transport sectors.

Figure 6 Structure of Electricity Consumption by Subsector of the Building Sector in 2019



#### 3.6.1 Analysis of Fuel Consumption for Vehicles Owned by the Municipality of Tivat

According to the data provided by the Municipality of Tivat, the local administration, as well as companies and institutions founded by the Municipality, operate 39 passenger vehicles and 24 freight and other vehicles (work machinery).

The total consumption of oil and oil derivatives for the year 2019, based on the aforementioned data, amounted to

45,342 litres of gasoline and 182,165 litres of diesel. When converted into energy values, this equates to 413.788 MWh for gasoline consumption and 1,820.917 MWh for diesel consumption.

#### 3.6.2 Analysis of Fuel Consumption for Municipal and Commercial Vehicles

Since relevant data on the number of private, commercial, and public transport vehicles was not provided by the Municipality of Tivat—only data on the type and number of registered vehicles obtained from the Ministry of Interior—and considering that adequate statistics on mileage, fuel consumption, and types of vehicles in road transport do not exist at either the local or national level, it was not possible to perform a functional separation of consumed energy sources into sub-sectors of road transport for the purposes of this analysis. Furthermore, the Municipality of Tivat does not possess data on fuel consumption for urban and suburban transport operated by Blue Line d.o.o. Herceg Novi.

The estimate of oil and oil derivatives consumption was based on the Study of the Vehicle Fleet Structure of Road Vehicles in Montenegro and data from the Statistical Office on oil derivative consumption for 2019 (National Energy Balance). Based on this data, the calculated consumption of oil derivatives for public transport, personal vehicle use, and commercial activities, reduced by the consumption of municipal administration vehicles, amounts to 2.601.821 litres of gasoline, 7.539.013 litres of diesel, and 188.300 litres of liquefied petroleum gas (LPG). Converted into energy values, this corresponds to 23.744.221 MWh for gasoline consumption, 75.359.969 MWh for diesel consumption, and 1.245.038 MWh for LPG consumption. This analysis excludes air and maritime transport, focusing solely on road transport. For maritime transport, no appropriate data was available for the Municipality of Tivat. Air transport is excluded in accordance with the IPCC methodology, as Montenegro does not have domestic flights, and all flights from Tivat



Airport are international.

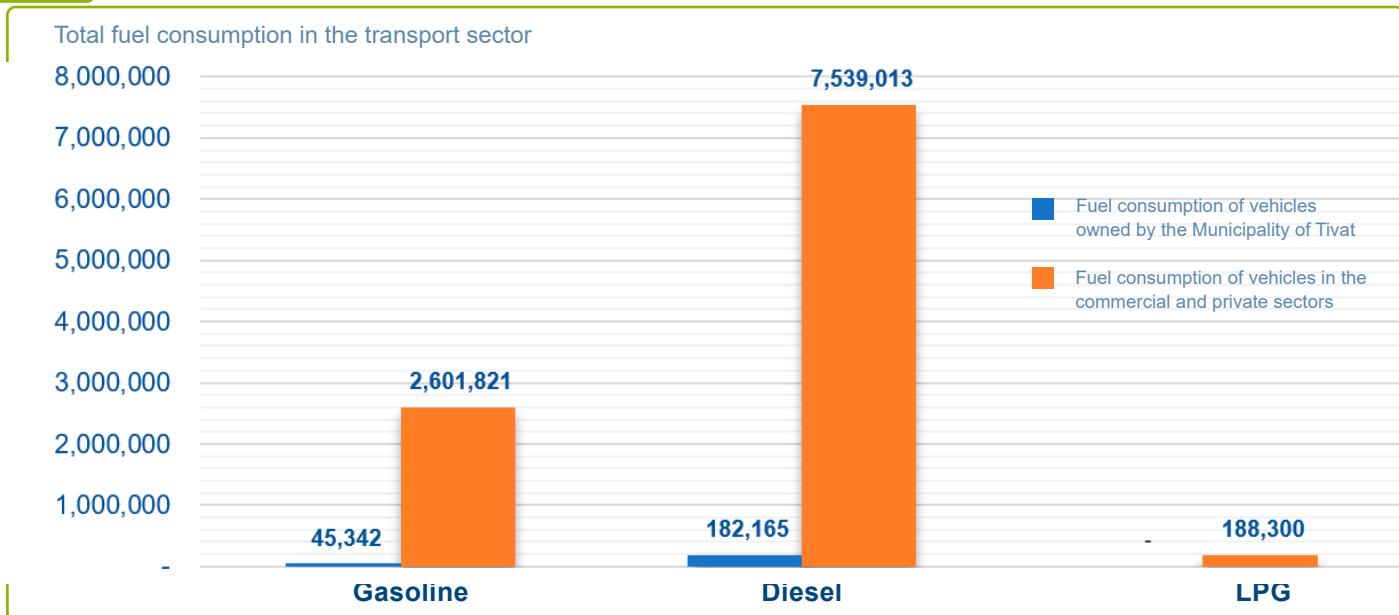
### 3.6.3 Analysis of Total Energy Consumption in the Transport Sector of the Municipality of Tivat

Based on the total fuel consumption in the transport sector, it is clear that the dominant share of total consumption stems from the use of motor vehicles for personal needs and commercial activities. This amounts to 10,329,134 litres, or a weighted value expressed in energy terms of 100,349.229 MWh, which accounts for approximately 98% of total consumption in the transport sector. Finally, the fuel consumption of vehicles belonging to the public administration and businesses founded by the Municipality

of Tivat amounts to 227,506 litres, or 2,234.705 MWh, which makes up approximately 2% of the total energy consumption in the transport sector. An overview of fuel consumption by type of energy in the transport sector is shown in Figure 7.

An overview of fuel consumption by type of energy in the transport sector, converted into energy values, is shown in Figure 8.

**Slika 7** Overview of Fuel Consumption (litres) by Energy Type in the Transport Sector in 2019



**Figure 8** Overview of Energy Consumption (MWh) in the Transport Sector in 2019

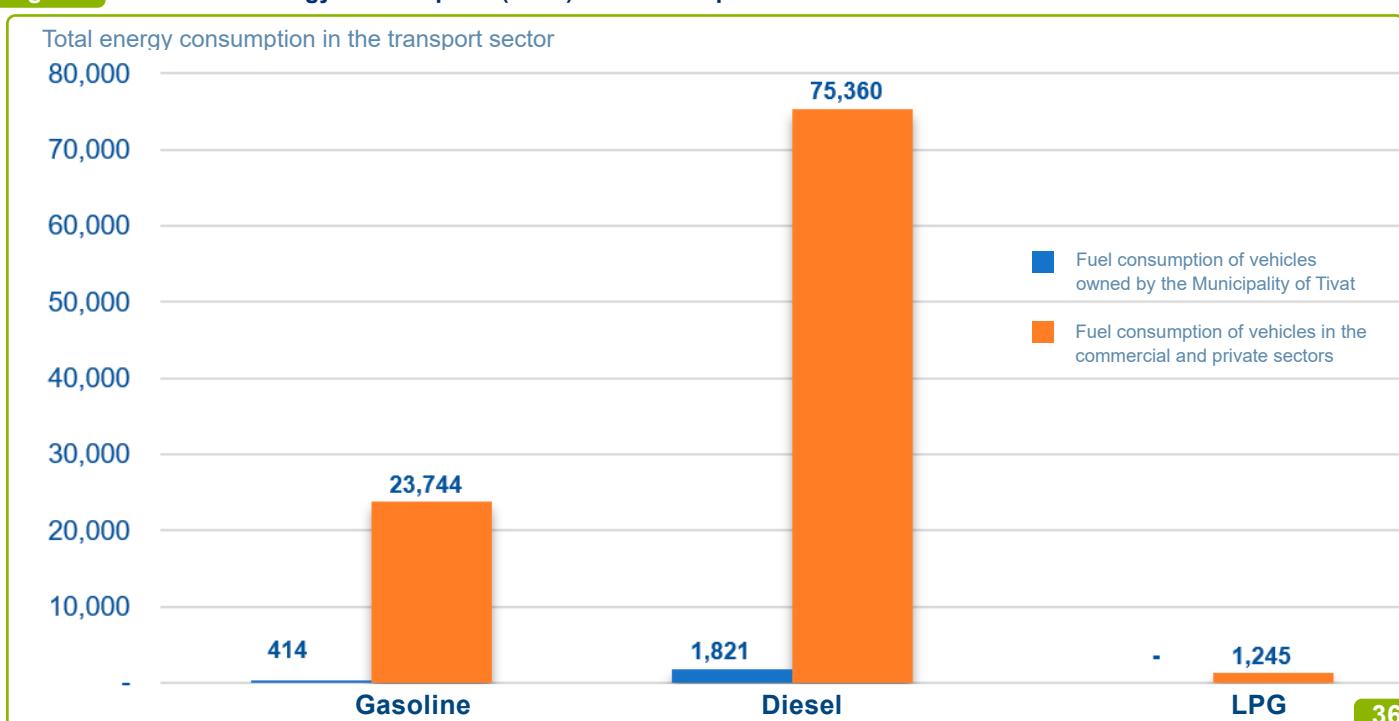
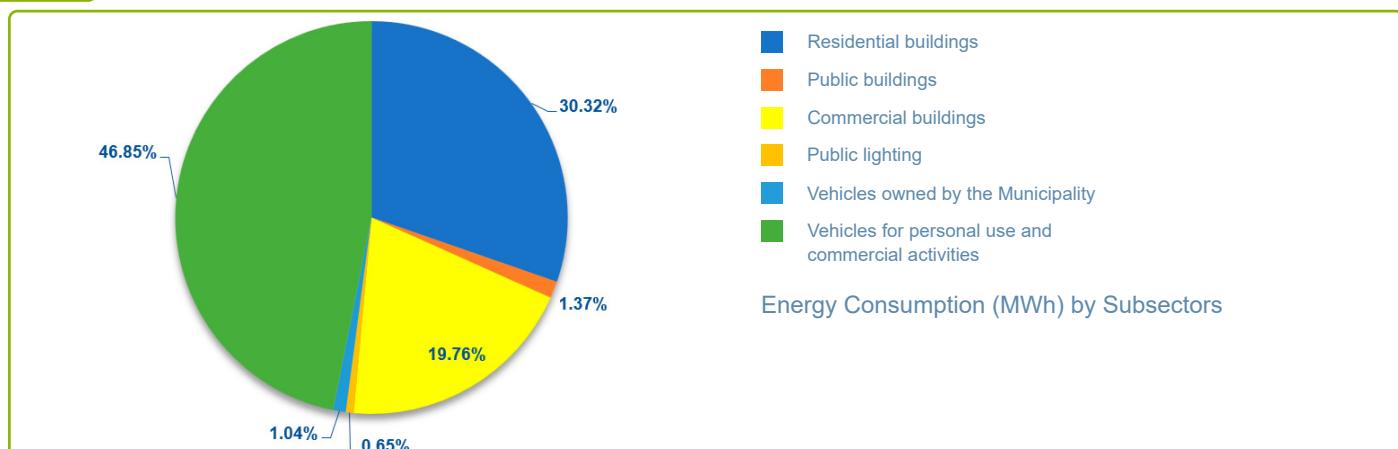




Table 7 Total Energy Consumption (MWh) by Sector in 2019

Buildings	Residential buildings	64.943,00	110.199,36
	Public buildings	2.935,57	
	Commercial buildings	42.320,79	
Public lighting		1.393,07	1.393,07
Transport	Vehicles owned by the Municipality	2.234,71	102.583,93
	Vehicles for personal use and commercial activities	100.349,23	
<b>Total</b>			

Slika 9 Overview of Energy Consumption (MWh) by Subsectors in 2019



### 3.7 Analysis of Total Energy Consumption in the Municipality of Tivat

An overview of total energy consumption across sectors and subsectors for the reference year 2019 is presented in Table 7.

The total annual energy consumption in 2019 amounts to 214,176.36 MWh. Energy consumption intensity is highest in the building and transport sectors, which together account for over 99% of total consumption. Among subsectors, the highest energy consumption is attributed to residential buildings (52%), followed by motor vehicles used for personal needs and commercial activities (33%) (Figure 9).

### 3.8 CO<sub>2</sub> Emissions Calculation in the Energy Sector

Table 8 Total CO<sub>2</sub> Emissions by Subsector of the Building Sector (tCO<sub>2</sub>)

	Electricity	LPG	Coal	Fuel oil	Total	Share
Residential buildings	18.088	0	0	0	18.088	52%
Public buildings	1.069	0	0	0	1.069	3%
Commercial buildings	15.405	0	0	0	15.405	45%
<b>Total</b>	<b>34.561</b>	-	-	-	<b>34.561</b>	<b>100%</b>

#### 3.8.1 Building sector

Considering the presented energy consumption balances and the specified emission factors, it is possible to estimate the total CO<sub>2</sub> emissions for the building sector of the Municipality of Tivat (Table 8). It can be observed that, similar to energy consumption, the majority share of CO<sub>2</sub> emissions also originates from the residential sector (52%). However, this share is significantly lower compared to the total energy consumption of residential buildings (68%). This is due to the use of firewood, which has no associated CO<sub>2</sub> emissions, for heating residential spaces and cooking in households.

It is important to emphasize that all emissions are influenced by the dominant presence of electricity in the energy balance. With the expected future improvement of Montenegro's electricity production mix, there will be a natural reduction in CO<sub>2</sub> emissions at the national level. At that point, sectors utilising other highly emission-intensive fuels, such as fossil fuels, will become more prominent in terms of CO<sub>2</sub> emissions. To prevent this, it is crucial to plan for the replacement of fossil fuels with cleaner and readily available alternatives.

Table 9 Total CO<sub>2</sub> Emissions by Subsector of the Transport Sector (tCO<sub>2</sub>)

Fuel type	Emission factor tCO <sub>2</sub> / MWh	Public administration vehicle consumption (MWh)	Use of motor vehicles for personal needs and commercial activities (MWh)	tCO <sub>2</sub> emissions from public administration vehicles	tCO <sub>2</sub> emissions from vehicles for personal needs and commercial activities	Total tCO <sub>2</sub>
LPG	0,227	0	1.245,038	0	282,62	282,62
Gasoline	0,249	413,788	23.744,221	103,03	5.912,31	6.015,34
Diesel	0,267	1.820,917	75.359,969	486,18	20.121,11	20.607,30
Total	/	2.234,705	100.349,229	589,22	26.316,05	26.905,26

Tabela 10 Ukupne emisije CO<sub>2</sub> po sektorima

Sector	Electricity consumption (MWh)	Emissions[tCO <sub>2</sub> ]	Share of emissions	% of electricity consumption
Building sector	110.199,36	34.561	56%	51%
Public lighting	1.393,07	507	1%	1%
Transport	102.583,93	26.905	43%	48%
Total	214.176,36	61.974	100%	100%

### 3.8.2 Public Lighting Sector

CO<sub>2</sub> emissions from the public lighting and traffic signal sector in the Municipality of Tivat arise from the consumption of electricity used for public lighting and traffic signals. CO<sub>2</sub> emissions in the public lighting sector for the reference year, based on an electricity consumption of 2,935.57 MWh, amounted to 507.077 tCO<sub>2</sub>.

### 3.8.3 Transport sector

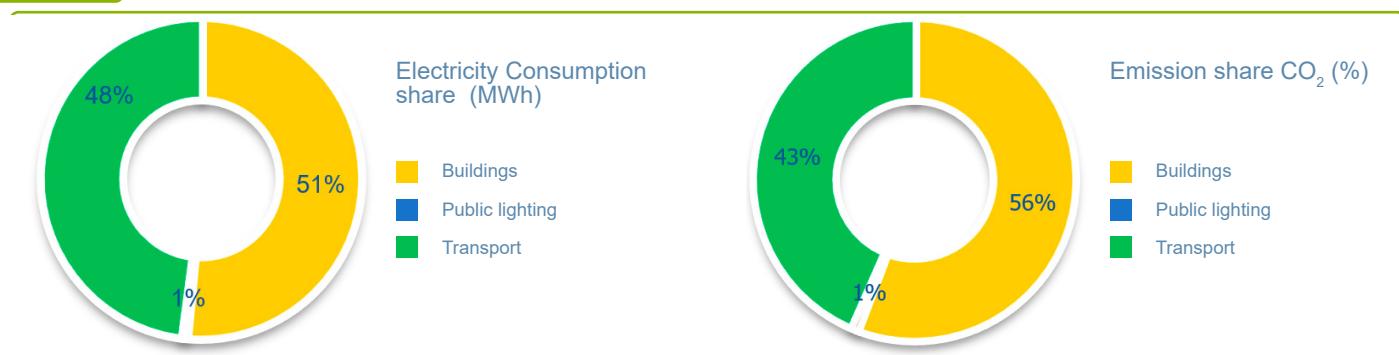
Considering the emission factors and the previously presented energy consumption balance, CO<sub>2</sub> emissions in the transport sector were estimated by subsectors for the reference year (Table 9). Practically all emissions in the transport sector are attributed to the use of motor vehicles for personal needs and commercial activities (over 99%).

### 3.8.4 Total Emissions in the Reference Year by Sector

Summarizing all the results calculated for the sectors, the total CO<sub>2</sub> emissions were obtained (Table 10), along

with the energy consumption converted into equivalent electricity consumption. As shown in Figure 10, for CO<sub>2</sub> emissions, similar to energy consumption, the building sector is dominant (56%). However, it is not as dominant compared to the transport sector (43%) as it is in terms of energy consumption. This difference is due to the significant presence of heating wood in the energy balance of the building sector, which has no CO<sub>2</sub> emissions. This fact should be particularly considered when defining measures aimed at reducing CO<sub>2</sub> emissions in the building sector.

Therefore, measures to reduce CO<sub>2</sub> emissions are particularly significant in the building and transport sectors, especially in the area of electromobility. However, it is also important to consider how the required electricity is produced, meaning it is crucial to influence the energy mix by increasing the share of renewable energy sources. This would reduce the national emission factor associated with the electricity system. Such a change would impact all sectors, as electricity is the dominant energy source.

Figure 10 Structure of CO<sub>2</sub> Emissions and Electricity Consumption by Sectors for the Reference Year 2019



# 4

## RISK AND VULNERABILITY ASSESSMENT (RVA)



This section of the document presents the risk and vulnerability analysis caused by climate change (hereinafter referred to as: Assessment), which was carried out in accordance with the guidelines for developing a SECAP as part of the Covenant of Mayors (CoM)<sup>1</sup>, serving as a mandatory basis for selecting climate change adaptation measures. The Risk and Vulnerability Assessment was carried out under the project "EU for Energy Transition – Covenant of Mayors in the Western Balkans and Turkey," co-financed by the European Union and the Federal Ministry for Economic Cooperation and Development of Germany (BMZ), and implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in the Western Balkans<sup>2</sup>.

One of the key instruments for encouraging strategic and continuous planning of climate change adaptation and mitigation measures at the local level is the development of the Sustainable Energy and Climate Action Plan (SECAP)a<sup>3</sup> for municipalities/local governments, with specific guidelines<sup>4</sup> and instructions<sup>5</sup> for the methodology of preparing the Action Plan, standardised data collection, and reporting<sup>6</sup> to achieve the set goals and meet planned commitments by 2030.

The Risk and Vulnerability Assessment (RVA) is the foundation of strategic planning for local authorities regarding the impacts of climate change on resources and populations within their territory. It allows the identification of critical areas for decision-making. Within the RVA, priority sectors for the given municipality, or the observed area, are analysed by examining the interaction of potential climate hazards (i.e., climate-induced hazards), vulnerabilities, and the exposure of human systems, ecosystems, and biodiversity. Natural climate variability and anthropogenically induced climate change affect the frequency and intensity of extreme events that can lead to disasters. Vulnerability and exposure determine the impacts and the likelihood of disasters (i.e., disaster risk).

## 5.1 Climate and Climate Change Analysis

According to the Köppen climate classification, Tivat falls within the Mediterranean climate zone and belongs to the Csa type (Hot-summer Mediterranean climate). This means it has a moderately warm, rainy climate with hot summers. The average temperature of the coldest month (January) is not lower than  $-3^{\circ}\text{C}$ , and at least one month has an average temperature higher than  $10^{\circ}\text{C}$  (March-November). The dry period occurs in the summer (arid climate in July). Summers are hot with an average temperature of the warmest month being greater than or equal to  $22^{\circ}\text{C}$ . The region is influenced by subtropical anticyclones during the summer and cold waves in the winter, which is mild. Autumn is warmer than spring. The average annual temperature is  $14.8^{\circ}\text{C}$ , with an average annual variation of  $17.3^{\circ}\text{C}$ . Cold air masses from the north (northern wind - "bura") are frequently encountered.

The annual precipitation pattern is influenced by the polar front (zonal westerly winds) and the subtropical anticyclone. The relatively low annual variation in precipitation of 12.7% indicates a highly seasonal distribution of rainfall (Graph 1), with autumn and winter being the wettest seasons. From September to November, 35.3% of the annual rainfall occurs, and from December to February, 35.6%. The number of rainy days is highest in December, averaging around 14 days. The intensity of precipitation is greatest in September and November.

## 4.2 Climate Hazards Relevant to the Municipality of Tivat

The following are the climate hazards for the municipality of Tivat.

### 4.2.1 Observed Changes in Air Temperature

The average annual air temperature has shown an upward trend. The decade 2011-2020, which was the warmest globally, was also the warmest in Tivat, with an increase of  $+0.82^{\circ}\text{C}$  compared to the climatological normal, as shown in Figure 11.

The greatest increase occurs during the summer with a rise of  $+0.03^{\circ}\text{C}$ , followed by spring with  $+0.01^{\circ}\text{C}$ , and autumn with  $+0.004^{\circ}\text{C}$ . During the winter, the trend line slope is nearly zero, indicating no linear relationship between winter temperatures and time.

1 Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)', European Commission, Joint Research Centre, 2018.

2 <https://uom.me/2022/06/javni-poziv-za-podnosenje-prijava-za-realizaciju-projekata-malog-obima-pilot-projekata-iz-oblasti-energetike-saobracaja-i-klime/>

3 CoM SECAP: [https://mycovenant.eumayors.eu/docs/seap/19514\\_1459614153.pdf](https://mycovenant.eumayors.eu/docs/seap/19514_1459614153.pdf)

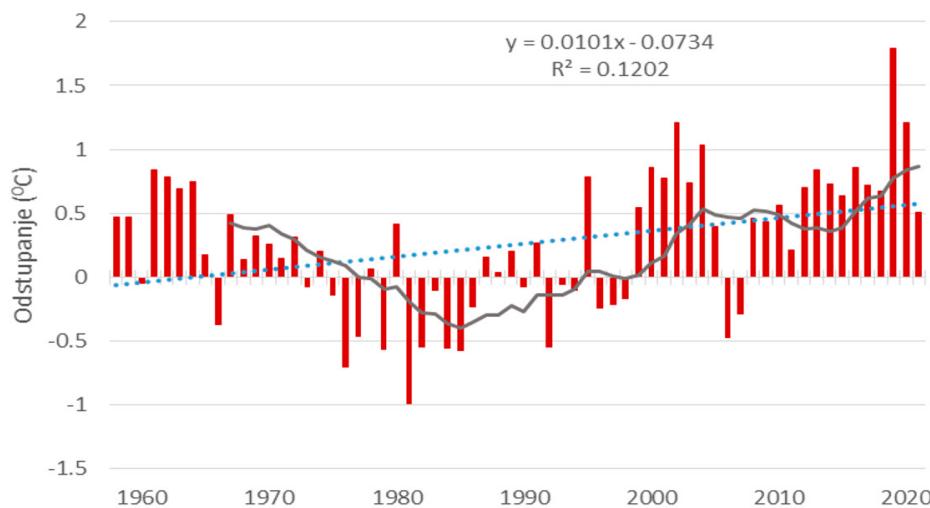
4 <https://op.europa.eu/en/publication-detail/-/publication/a2ac8a5ef134-11e8-9982-01aa75ed71a1/language-en>

5 <https://www.covenantofmayors.eu/support/reporting.html>

6 Recommendations for Reporting under the Covenant of Mayors for Climate and Energy; software tools for planning climate change adaptation measures available on the Urban-Adaptation Support Tool (Urban-AST) website.



**Figure 11** Deviation of the Average Annual Air Temperature in Tivat Compared to the Climatological Normal (1961-1990) (Linear Trend – Dashed Line; 10-Year Moving Average – Solid Black Line)



#### 4.2.2 Observed Changes in Precipitation

Unlike air temperature, precipitation does not show a consistent trend toward either higher or lower values. The linear trend line is negative, indicating a slight decrease, but with a small slope, suggesting a weak connection with time. Isolated events stand out, particularly in the period 2001-2020, indicating extreme precipitation events throughout the year. The driest years were 2011, 2007, and 1989, while the wettest years were 2010 and 2014. Seasonal precipitation shows a tendency to decrease over time. The change is small, with the trend line descending, and in autumn, no linear relationship with years is observed. Variability is most pronounced in winter.

#### 4.2.3 Observed Changes in Extreme Events

Observed changes in extreme events refer to changes in extreme air temperatures, heavy rainfall leading to floods, and droughts.

##### Changes in Extreme Air Temperatures

Extreme temperature indices indicate an overall shift of maximum and minimum temperatures towards warmer conditions, with more hot days and fewer cold days. For example, the number of summer and tropical days and nights has statistically significantly increased compared to the climatological normal in the period from 1958-2020. This also applies to warm days and nights, as well as the duration<sup>7</sup> and frequency of heatwaves. While the number of frost days is decreasing, resulting in a declining trend, other indicators show an upward trend. The highest number of tropical nights occurred during the tropical wave in 2003, lasting 24 days, followed by 2018 (21 days)

and 2015 (20 days).

The highest number of warm days was around 44% higher in 2018 compared to the climatological normal, while the number of warm nights was about 24% higher (Figure 12). The warm period during the analysed period showed a linear increase of +0.905 days per year, meaning that by the end of 2020, it increased by about 57 days (Figure 2). The number of days contributing to the heatwave increased by +55 days (if calculated based on maximum temperatures), or +11 days (if calculated based on minimum temperatures) compared to the climatological normal.

##### Heavy Rains Leading to Floods

A positive change is observed in the daily intensity of precipitation, meaning that the intensity of rainfall has increased over time. The number of days with heavy rainfall has decreased; however, the trend of annual sums of the 5% largest rainfall events increases by +0.38 mm per year, and the maximum amounts of rainfall over five consecutive rainy days also increase by +0.671 mm per year. There is also a significant increase in the maximum daily rainfall of +0.603 mm per year for the period 1958-2020. Maximum daily rainfall amounts vary widely from 60 mm to 200.1 mm, with an average value of 106.5 mm.

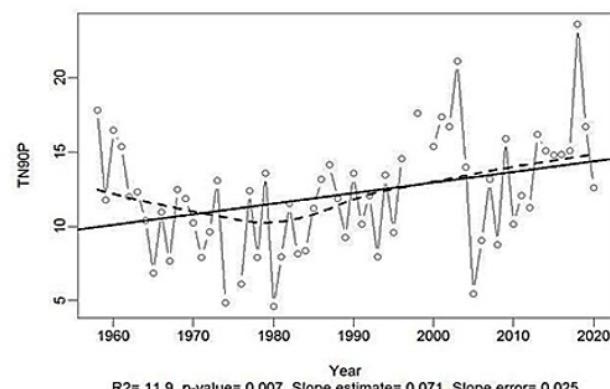
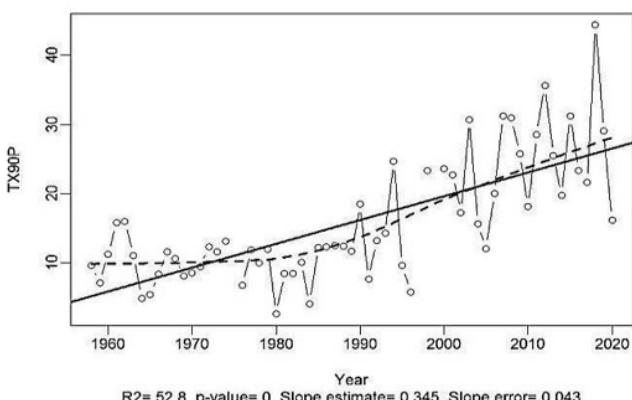
##### Drought

According to the IPCC definition, drought is a period of unusually dry weather that lasts long enough to cause significant hydrological imbalance. It differs from arid climates, which are permanent characteristics of the climate. According to the GausSEN methodology, which takes into account the relationship between precipitation and temperature, the climate in Tivat is arid in July. Analysis of drought periods shows that the longest

<sup>7</sup> Heatwave (HW) is defined as any period of 3 or more days during which one of the following conditions is met: the minimum daily temperature (TN) exceeds the 90th percentile, or the maximum daily temperature (TX) exceeds the 90th percentile. Percentiles are calculated relative to the 1961-1990 climatological normal.



**Figure 12** Trend in the Number of Hot Days (Left in %) and Hot Nights (Right in %) Compared to the Climatological Normal (1961-1990); Solid Black Line Represents the Linear Relationship Between analysed Climate Indicators and Time



droughts occurred in 2017 (99 days) and 2008 (90 days). The maximum number of consecutive dry days shows a positive increasing trend, rising by +0.247 days per year. These changes are statistically significant. The longest dry period for return periods of 2, 5, 10, 20, 50, and 100 years were calculated within the IPA DriDanube project. The longest dry period for Tivat, with a return period of 2 years, is approximately 30 days, and for a return period of 100 years, it is approximately 80 days.

## 4.3 Projected Climate Changes

The climate change projections are based on the Third National Report of Montenegro to the UNFCCC, which used the regional NMMB model and the RCP8.5 scenario for the period 2011-2100. The analysis was conducted relative to the reference period of 1971-2000, with results presented for each 30-year period: 2011-2040, 2041-2070, and 2071-2100.

**Table 11** Projected Changes in Air Temperature for the Tivat Area and Changes in Extreme Events by Indices of Hot Days and Heatwaves

		Projected temperature changes relative to the reference period 1971-2100.		
		Scenario RCP-8.5		
		2011-2040.	2041-2070.	2071-2100.
<b>Average annual temperature</b>		+2,0°C	+ 3,0°C	around +5,0°C
<b>Average seasonal temperature</b>	+2,5°C	around + 2,5°C	around +5,0°C	around + 5,5°C
	+2,0°C	around + 2,5°C	around +4,5°C	+4,5°C to +5,0°C
	around +2,0°C	around + 3,5°C	6,0°C	around + 6,0°C
	+3,0°C	around + 3,0°C	around + 5,5°C	around + 5,5°C
<b>Number of frost days<sup>8</sup></b>		-50%	-70%	-95%
<b>Average duration of heatwaves</b>		2 x longer	8 x longer	10 x longer
<b>Average annual number of heatwaves</b>		5 x more	8 x more	10 x more

<sup>8</sup> Number of days when the daily minimum temperature is below 0°C.



Table 12 Projected Changes in Precipitation Amount for the Tivat Area for Precipitation and its Extremes

		Projections of precipitation relative to the reference period 1971 - 2100.		
		RCP-8.5		
		2011-2040.	2041-2070.	2071-2100.
<b>Average annual precipitation</b>		up to -5%	around -20%	-10 %
<b>Average seasonal precipitation</b>	up to -5%	up to -10%	+10%	+10%
	-5%	around -10%	-20%	-20%
	-5%	-20%	-45%	-45%
<b>Average number of days with heavy rain (&gt; 20 mm) annually</b>		-5%	+5%	+5%
<b>Average number of consecutive dry days (precipitation &lt; 1 mm)</b>		-15%	-15%	-15%
<b>Snow</b>	-80%	up to +5%	+10%	+50%
	-80%	-90%	-90%	-90%

is expected on average. On the other hand, during these days, the accumulation of precipitation may be higher compared to values from the reference period 1971-2000, thus increasing the intensity of precipitation. It is expected that the number of consecutive dry days will increase in the future, which will increase the risk of drought and the need for planned irrigation (Table 12).

#### 4.3.3 Extreme Winds – Maximum Speed

According to the available results for the projection of maximum wind speeds, there is a slight decrease in the average annual maximum wind speed in both scenarios (DNK, A1B, and A2 scenarios). The possible decrease is around -5% compared to the climatological normal from 1961-1990.

Additionally, an increase in intense extreme events during the summer is expected, such as thunderstorms accompanied by strong and stormy winds and intense precipitation, which certainly indicates a high level of vulnerability of this area to damage caused by these extreme events.



# 5

## ACTION PLAN (MITIGATION, ADAPTATION, AND ENERGY POVERTY REDUCTION)



The Action Plan represents a set of measures and activities aimed at achieving the general goal defined in this document. In this Action Plan, the measures and activities reflect the results of the involvement of a number of actors who participated in the development of the SECAP, in accordance with their competencies and the interest they showed in achieving the objectives outlined in this plan. The subsections below provide a detailed analysis of the climate change adaptation action plan with distinct sectors, the mitigation plan for greenhouse gas emissions, as well as the plan to reduce energy poverty and the implementation dynamics.

## 5.1 Action Plan for Greenhouse Gas Emissions Mitigation

Mitigating climate change aims to reduce greenhouse gas emissions. This section provides a comprehensive overview of the identified measures and activities of the Sustainable Energy and Climate Action Plan (SECAP) of the Municipality of Tivat for the period from 2024 to 2030 in the sectors of building construction, transport, and public lighting. From this overview of measures, it is clear that their implementation will result in a reduction of CO<sub>2</sub> emissions by approximately 41.69%. To achieve the set goal of reducing CO<sub>2</sub> emissions by at least 40% by 2030, compared to the baseline year of 2019, it is necessary to implement the proposed measures to the specified extent. For the calculation of CO<sub>2</sub> emission reductions, the internationally recognised IPCC methodology and conversion factors used in the development of the BEI for CO<sub>2</sub> emissions for the year 2019 were applied. The measures presented in this section are shown in a tabular format, with the following parameters associated with each measure:

- Measure number
- Measure name
- Sector
- Responsible body
- Measure description

- Start / end of implementation
- Implementation partners
- Energy savings (MWh)
- Renewable energy production (MWh)
- Estimated reduction (tCO<sub>2</sub>)
- Total implementation costs
- Source of funding
- Key vulnerable/sensitive groups that will benefit from the measure

### 5.1.1 Building sector

In the building sector, approximately 51% of total energy consumption is used, making energy efficiency critical, i.e., minimizing energy consumption to achieve optimal comfort for the occupants and users of the buildings. Energy consumption in buildings depends on the characteristics of the buildings (shape and construction materials), energy systems (heating, cooling, ventilation, electrical appliances, and lighting systems), as well as climatic conditions.

Increased energy consumption implies higher CO<sub>2</sub> emissions into the atmosphere, so it is essential to take the necessary measures to reduce unnecessary consumption and use available energy resources rationally.

Energy efficiency in buildings includes a range of different opportunities for saving thermal and electrical energy, along with the application of renewable energy sources in buildings, wherever it is functionally feasible and economically justified. Thermal protection of buildings offers a significant potential for energy savings. Specifically, by improving the thermal insulation characteristics of a building, it is possible to reduce the total heat loss of the structure by an average of 30 to 60%.



Measure number	1
Measure name	<b>Providing Support to Citizens in Securing Funds for Co-Financing Through Loans or Other Types of Financing Aimed at Improving the Energy Characteristics of Buildings From Donor Funds, or Signing Cooperation Agreements With Local Banks That Will Participate in the Project to Support the Residential (Individual and Collective Housing) and Commercial Sectors.</b>
Sector	Building sector
Responsible body	Municipality of Tivat
Measure description	<p>This measure is defined in the Local Energy Plan for 2017-2026, and aims to provide support to citizens by the Municipality in filling out forms and applications for the Eco Fund, so that they can secure financial resources through loan co-financing aimed at improving the energy characteristics of buildings. Additionally, the Municipality will explore the possibility of obtaining donor grants or establishing cooperation with a local bank, whose funds would be directed towards the implementation of energy efficiency measures. The measures cover 3 segments:</p> <ul style="list-style-type: none"> <li><b>I. Insulating the building</b> (installing thermal insulation on the facade and roof and replacing exterior joinery)</li> <li><b>II. Installing energy-efficient heating and cooling systems</b> (heat pumps, split systems, etc.)</li> <li><b>III. Replacing existing lighting with energy-efficient lighting (LED)</b></li> </ul> <p>To implement this measure, a series of activities need to be carried out, such as:</p> <ul style="list-style-type: none"> <li>• Initiating discussions and negotiations with a local bank about potential cooperation in financing the energy efficiency improvement project.</li> <li>• Developing a detailed financial model that includes loan co-financing between building owners, local banks, and other potential partners.</li> <li>• Defining loan terms, including interest rates, repayment periods, and other key financial parameters.</li> <li>• Creating a campaign to promote the program among residential and commercial property owners.</li> <li>• Providing information on the benefits of financing and improving energy efficiency.</li> <li>• organising workshops and consultations with property owners to provide information on procedures and benefits of the program.</li> </ul> <p>It is assumed that by 2030, 30% of residential (individual and collective housing) and commercial sector owners will implement this measure.</p>
Start / End of Implementation	Continuous
Implementation Partners	Homeowner Associations/Commercial Banks/Eco Fund
Energy Savings (MWh)	24.739,34
Renewable Energy Production (MWh)	N/A
Estimated CO <sub>2</sub> Reduction (tCO <sub>2</sub> )	9.005
Total implementation costs	3.000.000 €
Source of Funding	Municipality of Tivat budget, funds, and donations
Key vulnerable/sensitive groups that will benefit from the measure	The measure contributes to supporting property owners in improving the energy characteristics of residential and commercial buildings, resulting in savings on electricity bills.



<b>Measure number</b>	2
<b>Measure name</b>	<b>Administrative Support from the Municipality of Tivat for the Implementation of Photovoltaic Systems on the Roofs of Family Homes, Smaller Residential Buildings, and Commercial and Service Sector Facilities</b>
<b>Sector</b>	Building sector
<b>Responsible body</b>	Municipality of Tivat
<b>Measure description</b>	<p>By installing solar panels on residential and commercial buildings suitable for PV system installation, citizens and businesses in the Municipality of Tivat will produce part of the electricity required for their own consumption. The amount of electricity produced is calculated using the PHOTOVOLTAIC GEOGRAPHICAL INFORMATION SYSTEM (<a href="https://re.jrc.ec.europa.eu/pvg_tools/en/tools.html">https://re.jrc.ec.europa.eu/pvg_tools/en/tools.html</a>), for 2200 households, with an average PV system capacity of 7 kW per household, and for 70 businesses, with an average PV system capacity of 10 kW.</p> <p>This measure aims to provide support from the Municipality in the implementation of photovoltaic systems on the roofs of individual residential buildings, smaller residential buildings, and commercial and service facilities. The measure contributes to diversifying energy sources, reducing costs for citizens and businesses, and promoting sustainable energy. This measure should be implemented in cooperation with national and international donors (Eco Fund, etc.) and Elektroprivreda Crne Gore (EPCG) - Solar Construction (SOLAR project). The Municipality will provide support in the following areas: gathering information about current public calls, assisting in completing applications, providing information, and verifying the documentation needed to secure financial resources, as well as promoting the implementation of the measure.</p> <p>Implementing this measure contributes to diversifying energy sources, reducing costs for citizens and businesses, and promoting sustainable energy.</p> <p>To implement this measure, the following activities need to be carried out:</p> <ul style="list-style-type: none"> <li>Conducting energy audits of buildings to identify potential for photovoltaic system implementation.</li> <li>Establishing cooperation with EPCG-Solar Construction and the Eco Fund through the SOLAR project for joint implementation of the initiative.</li> <li>Conducting a detailed profitability analysis of the project, including installation costs, expected income from electricity generation, and return on investment.</li> <li>Developing technical documentation for the installation of photovoltaic systems, with a special focus on various types of buildings.</li> <li>organising educational sessions for property owners on the use and maintenance of photovoltaic systems.</li> </ul>
<b>Start / End of Implementation</b>	2024-2030
<b>Implementation Partners</b>	EPCG AD Nikšić Solargradnja / Eco Fond
<b>Energy Savings (MWh)</b>	N/A
<b>Renewable Energy Production (MWh)</b>	22379,805
<b>Estimated CO<sub>2</sub> Reduction (tCO<sub>2</sub>)</b>	8146,24902
<b>Total implementation costs</b>	11.270.000,00€
<b>Source of Funding</b>	Eco Fund / EPCG / Citizens / Businesses
<b>Key vulnerable/sensitive groups that will benefit from the measure</b>	Citizens and legal entities will achieve savings on electricity costs through self-generated electricity.



<b>Measure number</b>	3
<b>Measure name</b>	<b>Development of Detailed Energy Audits for All Buildings and Systems Owned by the Municipality, as well as a Study on the Potential for the Installation of Solar Power Plants on the Roofs of All Municipality-Owned</b>
<b>Sector</b>	Buildings
<b>Responsible body</b>	Municipality of Tivat
<b>Measure description</b>	<p>This measure is defined in the Local Energy Plan 2017-2026 of the Municipality of Tivat, as well as in the Strategic Development Plan of the Municipality of Tivat 2024-2029. Its goal is to conduct comprehensive energy audits for all buildings and systems owned by the Municipality. It also includes the preparation of a potential study for the installation of solar power plants on the roofs of all buildings owned by the Municipality.</p> <p>To implement this measure, a series of activities must be carried out, such as:</p> <ul style="list-style-type: none"> <li>Conducting professional energy audits of all buildings and systems owned by the Municipality to identify energy consumers and system efficiency.</li> <li>Preparing a study of the potential for the installation of solar power plants on the roofs of all Municipality-owned buildings, including the evaluation of optimal locations and capacities.</li> <li>Defining technical specifications for the implementation of proposed energy improvements and solar systems.</li> <li>Analysing the economic feasibility of the proposed measures and solar projects, considering costs, savings, and return on investment.</li> <li>Considering alternative energy sources and technologies that could help reduce costs and increase energy efficiency.</li> <li>Developing a detailed action plan that includes implementation steps, deadlines, and responsible parties for carrying out the proposed measures.</li> </ul> <p><b>The proposed activity has a range of benefits, including the following:</b></p> <ul style="list-style-type: none"> <li>Detailed energy audits provide insight into the efficiency and energy consumption of buildings, enabling the implementation of measures to reduce energy use.</li> <li>Identifying necessary improvements contributes to preserving and extending the lifespan of the buildings.</li> <li>The study on the potential for solar power plants identifies opportunities for utilising renewable energy sources, reducing dependence on conventional sources.</li> <li>The implementation of proposed measures and solar systems leads to long-term energy cost savings.</li> <li>Increased use of solar systems contributes to the reduction of greenhouse gas emissions.</li> <li>Economic evaluation helps the Municipality make sustainable and economically viable decisions regarding energy improvements.</li> </ul> <p>This measure provides a holistic approach to enhancing energy efficiency and implementing renewable energy sources in Municipality-owned properties, thereby achieving numerous environmental, economic, and social benefits.</p>
<b>Start / End of Implementation</b>	2024-2027
<b>Implementation Partners</b>	Institutions and companies founded by the Municipality of Tivat
<b>Energy Savings (MWh)</b>	n/a
<b>Renewable Energy Production (MWh)</b>	n/a
<b>Estimated CO<sub>2</sub> Reduction (tCO<sub>2</sub>)</b>	n/a
<b>Total implementation costs</b>	10.000 €
<b>Source of Funding</b>	Municipality of Tivat Budget, Funds, and Donations
<b>Key vulnerable/sensitive groups that will benefit from the measure</b>	N/A



<b>Measure number</b>	4
<b>Measure name</b>	<b>Thermal Insulation of All Municipal Buildings Based on Detailed Energy Audits (Installation of Thermal Insulation Facades, Roof Insulation, and Replacement of Exterior Joinery)</b>
<b>Sector</b>	Buildings
<b>Responsible body</b>	Municipality of Tivat
<b>Measure description</b>	<p>This measure is a continuation of the activities defined in the Local Energy Plan 2017-2026 of the Municipality of Tivat, as well as in the Strategic Development Plan of the Municipality of Tivat 2024-2029. It aims to improve the energy efficiency of all Municipality-owned buildings through comprehensive energy audits and the implementation of key measures. The focus is on installing thermal insulation facades, roof insulation, and replacing exterior joinery to enhance the thermal properties of the buildings. It is anticipated that by the end of 2030, this measure will be implemented in all buildings owned by the Municipality of Tivat.</p> <p>To implement this measure, a series of activities must be carried out, such as:</p> <ul style="list-style-type: none"> <li>Conducting detailed energy audits of all municipal buildings to identify current energy losses and areas in need of improvement.</li> <li>Based on the audit results, defining specific measures for each building, including the installation of thermal insulation facades, roof insulation, and replacement of exterior joinery.</li> <li>Developing technical specifications for implementing the defined measures, taking into account the characteristics of each building.</li> <li>Developing a financial model that includes cost estimation, funding sources, and an investment return plan.</li> <li>Conducting a selection process for contractors, ensuring the quality of work according to established standards.</li> <li>Collaborating with local contractors, craftsmen, and other partners to ensure local support and work efficiency.</li> <li>Continuous supervision and control during the execution of works to ensure compliance with the specified requirements and standards.</li> </ul> <p><b>The proposed measure brings several benefits, including the following:</b></p> <ul style="list-style-type: none"> <li>Significant reduction in energy consumption for heating or cooling the buildings, resulting in long-term financial savings.</li> <li>Increased thermal comfort within the buildings, improving the quality of life for users.</li> <li>Improved energy efficiency contributes to extending the lifespan of municipal buildings.</li> <li>Achieving more environmentally sustainable buildings through the reduction of greenhouse gas emissions.</li> <li>Improved energy efficiency contributes to increasing the market value of municipal buildings.</li> <li>Stimulating the local economy by employing local contractors and providing business opportunities.</li> </ul> <p>This measure aims to create sustainable and energy-efficient infrastructure owned by the Municipality, bringing a wide range of benefits to the community.</p>
<b>Start / End of Implementation</b>	2024-2030
<b>Implementation Partners</b>	Companies and institutions founded by the Municipality of Tivat
<b>Energy Savings (MWh)</b>	1.174
<b>Renewable Energy Production (MWh)</b>	n/a
<b>Estimated CO<sub>2</sub> Reduction (tCO<sub>2</sub>)</b>	427,16
<b>Total implementation costs</b>	370.000 €
<b>Source of Funding</b>	Municipality of Tivat Budget, Funds, and Donations
<b>Key vulnerable/sensitive groups that will benefit from the measure</b>	n/a



<b>Measure number</b>	5
<b>Measure name</b>	<b>Replacement of Existing Inefficient Heating and Cooling Systems with the Installation of Energy-Efficient Systems in All Municipal Buildings</b>
<b>Sector</b>	Buildings
<b>Responsible body</b>	Municipality of Tivat
<b>Measure description</b>	<p>This measure is a continuation of the activities defined in the Local Energy Plan 2017-2026 for the Municipality of Tivat, as well as in the Strategic Development Plan 2024-2029 for the Municipality of Tivat. It aims to replace outdated and inefficient heating and cooling systems in all municipal buildings with new, more energy-efficient systems by the end of 2030. Implementing modern systems will help reduce energy consumption, costs, and harmful gas emissions, creating more sustainable conditions for municipal buildings. This measure represents a critical step towards establishing an energy-efficient and sustainable environment for municipal buildings, with long-term economic and ecological benefits.</p> <p>To implement this measure, the following activities must be carried out:</p> <ul style="list-style-type: none"> <li>Conduct a thorough review of existing heating and cooling systems to identify deficiencies and energy losses.</li> <li>Identify systems that are outdated, inefficient, or consume large amounts of energy and require replacement.</li> <li>analyse available modern heating and cooling technologies in order to select optimal solutions.</li> <li>Define technical specifications for the new energy-efficient systems, including the potential use of renewable energy sources.</li> <li>Develop a detailed implementation plan, including a financial model that covers the costs of replacement and the expected payback period.</li> <li>Select qualified contractors for the installation of new systems, ensuring quality execution.</li> <li>Replace existing systems with new energy-efficient systems according to the defined specifications.</li> <li>Train personnel who will manage the new systems to ensure efficient operation and maintenance.</li> <li>Continuously monitor the performance of the new systems to ensure they meet expectations and standards.</li> </ul> <p><b>The proposed measure brings several benefits, including the following:</b></p> <ul style="list-style-type: none"> <li>New energy-efficient systems will lead to significant reductions in energy consumption across municipal buildings.</li> <li>Savings in operational costs due to reduced energy consumption.</li> <li>Replacing inefficient systems will contribute to a decrease in harmful gas emissions.</li> <li>The new systems will enhance the longevity of municipal infrastructure and reduce the need for frequent maintenance.</li> <li>The implementation of modern technologies fosters innovation in the field of energy efficiency.</li> <li>Achieving sustainable development goals by minimizing the environmental impact of municipal buildings.</li> </ul> <p>Funds from the Eco Fund are available to provide subsidies for the installation of central heating systems in local government buildings.</p>
<b>Start / End of Implementation</b>	2024-2030
<b>Implementation Partners</b>	Companies founded by the Municipality of Tivat / Eco Fund
<b>Energy Savings (MWh)</b>	685,25
<b>Renewable Energy Production (MWh)</b>	n/a
<b>Estimated CO<sub>2</sub> Reduction (tCO<sub>2</sub>)</b>	249,43
<b>Total implementation costs</b>	216.050 €
<b>Source of Funding</b>	Municipality of Tivat Budget, Funds and Donations
<b>Key vulnerable/sensitive groups that will benefit from the measure</b>	n/a



<b>Measure number</b>	6
<b>Measure name</b>	<b>Replacement of Existing Inefficient Lighting with Energy-Efficient Lighting in All Municipal Buildings</b>
<b>Sector</b>	Buildings
<b>Responsible body</b>	Municipality of Tivat
<b>Measure description</b>	<p>This measure is a continuation of activities defined in the Local Energy Plan 2017-2026 of the Municipality of Tivat, as well as in the Strategic Development Plan 2024-2029 for the Municipality of Tivat. Its goal is to improve the energy efficiency of lighting in all municipal buildings by replacing outdated and energy-inefficient lighting systems with modern, energy-efficient lighting solutions, fully implemented by the end of 2030. This measure represents an effective step toward creating more energy-efficient and sustainable municipal buildings, with the aim of achieving significant economic and environmental benefits.</p> <p>To implement this measure, the following activities need to be carried out:</p> <ul style="list-style-type: none"> <li>Conducting a detailed review of the existing lighting systems in all municipal buildings to identify energy losses and inefficiencies.</li> <li>analysing available modern lighting technologies, including LED technology and other energy-efficient light sources.</li> <li>Defining the technical specifications for the new energy-efficient lighting systems, including optimal lighting parameters.</li> <li>Developing a financial plan that covers replacement costs and potential energy savings.</li> <li>The process of selecting and procuring modern lighting systems in line with the defined specifications.</li> <li>Replacing existing energy-inefficient lighting with new, energy-efficient lighting systems.</li> <li>Training staff for the maintenance and management of new lighting systems to ensure efficient operation.</li> <li>Continuously monitoring the performance of the new lighting systems to ensure they meet established standards and expectations.</li> <li>The measure brings a number of benefits, some of which are as follows:</li> <li>Replacing energy-inefficient lighting systems leads to significant energy savings in municipal buildings.</li> <li>Reduced operational costs related to lighting due to more efficient energy use.</li> <li>Replacing older systems contributes to a reduction in carbon dioxide emissions, supporting environmental goals.</li> <li>Modern lighting systems have a longer lifespan, reducing the need for frequent replacements.</li> <li>Improved lighting quality in buildings contributes to the comfort of users.</li> </ul> <p>The implementation of modern lighting technologies fosters technological advancement and innovation.</p>
<b>Start / End of Implementation</b>	2024-2030
<b>Implementation Partners</b>	Companies and institutions founded by the Municipality of Tivat
<b>Energy Savings (MWh)</b>	95
<b>Renewable Energy Production (MWh)</b>	n/a
<b>Estimated CO<sub>2</sub> Reduction (tCO<sub>2</sub>)</b>	34,2
<b>Total implementation costs</b>	200.000 €
<b>Source of Funding</b>	Municipality of Tivat Budget, Funds, and Donations
<b>Key vulnerable/sensitive groups that will benefit from the measure</b>	n/a



<b>Measure number</b>	7
<b>Measure name</b>	<b>Installation of Photovoltaic Solar Power Plants on the Roofs of New and Old Municipal Buildings, the Cultural Centre, and All Suitable Municipal Properties in the Municipality of Tivat</b>
<b>Sector</b>	Buildings
<b>Responsible body</b>	Municipality of Tivat
<b>Measure description</b>	<p>The installation of solar panels on municipal buildings suitable for photovoltaic (PV) systems will produce part of the electricity for the municipality's own use. The quantity of electricity produced is calculated using the software tool PHOTOVOLTAIC GEOGRAPHICAL INFORMATION SYSTEM (<a href="https://re.jrc.ec.europa.eu/pvg_tools/en/tools.html">https://re.jrc.ec.europa.eu/pvg_tools/en/tools.html</a>), for 8 buildings with an average PV system power of 50 kW.</p> <p>The measure aims to implement renewable energy sources through the construction of photovoltaic power plants on the roofs of new and old municipal buildings, the Cultural Centre, and other municipal properties if they are suitable for PV system installation. This contributes to reducing dependence on fossil fuels, lowering greenhouse gas emissions, and achieving energy independence for the local government. The installation of photovoltaic power plants on municipal building roofs is a key step towards achieving energy sustainability and reducing CO2 emissions.</p> <p>To implement the measure, the following activities are necessary:</p> <ul style="list-style-type: none"> <li>• Detailed assessment of the potential for installing photovoltaic systems on the roofs of new and old municipal buildings, as well as the Cultural Centre.</li> <li>• Preparation of technical documentation covering the installation of photovoltaic panels, selection of optimal locations, and system sizing.</li> <li>• Development of a photovoltaic system design in accordance with the architectural characteristics of the buildings.</li> <li>• Procurement of quality photovoltaic panels and installation of the system on the roofs of designated buildings.</li> <li>• Connection of the photovoltaic system to the building's electrical network and ensuring safe connection.</li> <li>• Training of personnel for the maintenance and operation of photovoltaic systems.</li> <li>• Ongoing monitoring of the performance of photovoltaic systems to ensure their efficient operation.</li> </ul>
<b>Start / End of Implementation</b>	2024-2030
<b>Implementation Partners</b>	Companies founded by the Municipality of Tivat
<b>Energy Savings (MWh)</b>	n/a
<b>Renewable Energy Production (MWh)</b>	556,02
<b>Estimated CO<sub>2</sub> Reduction (tCO<sub>2</sub>)</b>	202,39128
<b>Total implementation costs</b>	280.000 €
<b>Source of Funding</b>	Municipality of Tivat Budget, Funds, and Donations
<b>Key vulnerable/sensitive groups that will benefit from the measure</b>	n/a



### 5.1.2 Public lighting

Public lighting accounts for about 1% of the total energy consumption in Tivat. Public lighting is owned by the local government, and its maintenance and improvement are financed from the local budget. By regulating public lighting differently (reducing intensity), up to 50% of energy can be saved, while a remote control and monitoring system can significantly reduce maintenance costs. On the other hand, replacing light fixtures and adapting the lighting

bodies can also result in significant savings. The basic recommendations for efficient public lighting and savings are the use of energy-efficient light sources (advanced technologies such as LED combined with PV panels), the use of energy-efficient lamps, designing public lighting in accordance with standards, efficient management of public lighting, monitoring the costs and consumption of public lighting (creating a lighting register, selecting an appropriate tariff model), and regular maintenance.

Measure number	8
Measure name	<b>Modernization of Public Lighting through the Installation of LED Bulbs/Solar Lighting and Creation of GIS Layers for Public Lighting</b>
Sector	Public Lighting
Responsible body	Municipality of Tivat
Measure description	<p>This measure aims to improve the efficiency and sustainability of public lighting by replacing traditional lamps with LED bulbs/solar public lighting, as well as implementing a Geographic Information System (GIS) to monitor and manage public lighting. The combination of these activities contributes to reducing energy consumption, improving light quality, and facilitating efficient maintenance and supervision of the public lighting system. This measure not only enhances energy efficiency and reduces maintenance costs but also contributes to the overall modernization of infrastructure and the improvement of the quality of life in the community.</p> <p>To implement this measure, a series of activities are required, such as:</p> <ul style="list-style-type: none"> <li>Assessing the existing public lighting infrastructure to determine the most suitable locations for the installation of LED bulbs and solar PV panels, and, if necessary, renewing and modernizing the infrastructure and poles.</li> <li>Installing LED light fixtures on all public lighting poles and PV panels at selected locations, ensuring proper installation to guarantee optimal efficiency and light distribution.</li> <li>Collecting spatial data about the current location and characteristics of the lights.</li> <li>Creating a digital GIS layer that includes information about each light, such as type, condition, replacement date, energy consumption, and other relevant data.</li> <li>Installing sensors that allow automatic adjustment of light intensity based on actual needs.</li> <li>Connecting sensors to the GIS system for performance monitoring and fault detection.</li> <li>analysing public spaces and areas where solar lighting will be installed.</li> <li>Calibrating sensors and controlling the operation of solar lights to ensure optimal performance.</li> <li>Training local technicians or maintenance personnel on the operation and maintenance of solar systems.</li> <li>Preparing maintenance and fault diagnosis manuals.</li> </ul> <p>It is expected that the remaining approximately 2,100 bulbs will be replaced with new LED lighting units, achieving 100% LED lighting combined with solar lighting by 2030.</p>
Start / End of Implementation	Continuous
Implementation Partners	"Komunalno" d.o.o. Tivat
Energy Savings (MWh)	1.050
Renewable Energy Production (MWh)	n/a
Estimated CO <sub>2</sub> Reduction (tCO <sub>2</sub> )	380
Total implementation costs	500.000,00 €
Source of Funding	Municipality of Tivat Budget, Funds, and Donations
Key vulnerable/sensitive groups that will benefit from the measure	n/a



### 5.1.3 Transport

Transportation accounts for 48% of total energy consumption and around 43% of CO<sub>2</sub> emissions. In line with the goal of reducing GHG emissions and due to increasing air pollution, it is essential to emphasize the importance of cleaner transportation and energy efficiency

in transportation, as well as to encourage projects that increase the energy efficiency of transportation systems and the use of more efficient vehicles, which rely more on renewable energy sources and have reduced CO<sub>2</sub> emissions (e.g., electric vehicles). Measures to reduce CO<sub>2</sub> emissions from the transportation sector in Tivat:

<b>Measure number</b>	9
<b>Measure name</b>	<b>Encouraging the Use of Bicycles and Improving Bicycle Transportation</b>
<b>Sector</b>	Transportation
<b>Responsible body</b>	Municipality of Tivat
<b>Measure description</b>	<p>The introduction of a public bicycle system is part of the measure aimed at improving sustainable transportation. The positive effects on the community include reduced use of motor vehicles, decreased pollution, reduced CO<sub>2</sub> emissions, and reduced noise.</p> <p>The implementation of the proposed measure requires a series of activities, such as:</p> <ul style="list-style-type: none"> <li>• Installing terminals for public mechanical and e-bikes at key locations in the city, with charging stations for e-bikes.</li> <li>• Conducting an educational campaign to inform citizens about the benefits of using public bicycles and promoting sustainable mobility.</li> <li>• Regular maintenance of bicycle terminals, bicycles, and chargers to ensure reliable service.</li> <li>• Integrating the public bicycle system with city traffic planning.</li> <li>• Considering financial programs to encourage citizens to use public bicycles.</li> </ul> <p>It is assumed that this measure will reduce final energy consumption in road transport by 5% by 2030. This assumption is based on the following studies: 1. Active Travel's Contribution to Climate Change Mitigation: Research Summary and Outlook, Christian Brand <a href="mailto:christian.brand@ouce.ox.ac.uk">christian.brand@ouce.ox.ac.uk</a>,</p> <p>Transport Studies Unit, University of Oxford, UK, Centre for Research on Energy Demand Solutions, University of Oxford, UK, UK Energy Research Centre, University of Oxford, UK, <a href="https://activetravelstudies.org/article/1036/galley/4906/view/">https://activetravelstudies.org/article/1036/galley/4906/view/</a></p> <p>2. Study: Cycling can reduce transportation CO<sub>2</sub> by 10%, University of California (UCD), Davis, <a href="https://velo.outsideonline.com/news/study-cycling-can-reduce-transportation-co2-by-10/">https://velo.outsideonline.com/news/study-cycling-can-reduce-transportation-co2-by-10/</a></p> <p>3. Assessing the potential for carbon emissions savings from replacing short car trips with walking and cycling using a mixed GPS-travel diary approach, Author Andre Neves, Christian Brand, <a href="https://www.sciencedirect.com/science/article/pii/S0965856417316117">https://www.sciencedirect.com/science/article/pii/S0965856417316117</a></p>
<b>Start / End of Implementation</b>	2024-2030
<b>Implementation Partners</b>	Parking Service Tivat and private companies
<b>Energy Savings (MWh)</b>	5000
<b>Renewable Energy Production (MWh)</b>	n/a
<b>Estimated CO<sub>2</sub> Reduction (tCO<sub>2</sub>)</b>	1316
<b>Total implementation costs</b>	100.000 €
<b>Source of Funding</b>	Municipality of Tivat budget, funds, and donations
<b>Key vulnerable/sensitive groups that will benefit from the measure</b>	Reducing the need for private car usage results in fuel savings.



<b>Measure number</b>	10
<b>Measure name</b>	<b>Installation of Charging Stations for Electric Vehicles (EV)</b>
<b>Sector</b>	Transportation
<b>Responsible body</b>	Municipality of Tivat
<b>Measure description</b>	<p>This measure aims to establish an optimal number of EV charging stations. To implement the measure, it is necessary to first analyse the optimal number and locations for the charging stations (fast, slow, and number of charging spots) within the municipality, considering the feasibility of installing them on municipally-owned properties. Additionally, it is essential to enable simplified administrative procedures (municipal, CEDIS) for the installation of private charging stations.</p> <p>This measure offers several benefits, including:</p> <ul style="list-style-type: none"> <li>• Promotion of transportation electrification.</li> <li>• Provision of the necessary infrastructure for charging electric vehicles.</li> </ul> <p>Funds from the Eco Fund are available for this measure through a subsidy program for businesses, entrepreneurs, and the public sector for the procurement of charging stations for electric and hybrid vehicles.</p>
<b>Start / End of Implementation</b>	2024-2030
<b>Implementation Partners</b>	Parking Service Tivat and private companies
<b>Energy Savings (MWh)</b>	n/a
<b>Renewable Energy Production (MWh)</b>	n/a
<b>Estimated CO<sub>2</sub> Reduction (tCO<sub>2</sub>)</b>	n/a
<b>Total implementation costs</b>	50.000 €
<b>Source of Funding</b>	Municipality of Tivat budget, funds, and donations
<b>Key vulnerable/sensitive groups that will benefit from the measure</b>	n/a



<b>Measure number</b>	11
<b>Measure name</b>	<b>Introduction of Electric Vehicles for the Municipality's Fleet and Associated Enterprises and Institutions</b>
<b>Sector</b>	New measure
<b>Responsible body</b>	Municipality of Tivat
<b>Measure description</b>	<p>Electric vehicles can offer significant emission advantages compared to conventional vehicles. The emissions of an electric vehicle depend on the energy source used for charging, which varies by region. In geographic areas that utilise relatively low-pollution energy sources for electricity production, electric vehicles have a clear advantage in terms of emissions over similar conventional vehicles powered by gasoline or diesel. For comparison, Montana has a very similar share of fossil fuels in its energy mix as Montenegro, where the average emissions of electric vehicles are three times lower than those of internal combustion engine vehicles (<a href="https://afdc.energy.gov/vehicles/electric-emissions">https://afdc.energy.gov/vehicles/electric-emissions</a>). The aim of this measure is to promote the procurement of zero-emission vehicles for the fleet needs of the local government and the enterprises established by the Municipality.</p> <p>To implement the measure, a detailed assessment of the existing fleet of the local government and the enterprises established by the Municipality is required to identify suitable candidates for fleet electrification, considering factors such as usage patterns, range requirements, and available charging infrastructure. Furthermore, through the public procurement process for renewing the vehicle fleet of the local government and the enterprises established by the Municipality, it is essential to ensure that all passenger vehicles acquired must be electric.</p> <p>This measure proposes the purchase of new passenger cars to replace depreciated vehicles by 2030. The projected replacement rate anticipates that 30% of the fleet will be composed of electric vehicles (10 electric vehicles by 2030).</p>
<b>Start / End of Implementation</b>	2025/2030
<b>Implementation Partners</b>	n/a
<b>Energy Savings (MWh)</b>	670,4115
<b>Renewable Energy Production (MWh)</b>	n/a
<b>Estimated CO<sub>2</sub> Reduction (tCO<sub>2</sub>)</b>	176,763
<b>Total implementation costs</b>	250.000,00
<b>Source of Funding</b>	Municipality of Tivat budget, external funds, and donations
<b>Key vulnerable/sensitive groups that will benefit from the measure</b>	n/a



<b>Measure number</b>	12
<b>Measure name</b>	<b>Support for Promoting the Purchase of Energy-Efficient Vehicles for Legal Entities and Citizens</b>
<b>Sector</b>	Transportation
<b>Responsible body</b>	Municipality of Tivat
<b>Measure description</b>	<p>This measure aims to encourage the acquisition of zero-emission vehicles by both legal entities and private individuals within the municipality. To enhance the adoption of electric vehicles (EVs), it is recommended that the local government implement a differentiated parking fee policy on public parking spaces. Under this policy, vehicles powered by fossil fuels would pay significantly higher hourly parking rates (e.g., at least double the current rate by 2030).</p> <p>The measure offers several benefits:</p> <ul style="list-style-type: none"> <li>Although the upfront cost of purchasing electric and hybrid vehicles is higher, operational and maintenance expenses are often lower than those for fossil fuel-powered vehicles.</li> <li>A direct reduction in harmful gases in the transportation sector within the municipality's administrative area and an increase in the use of renewable energy in transportation.</li> <li>Improved air quality through reduced CO<sub>2</sub> emissions and a decrease in total greenhouse gas (GHG) emissions at both local and national levels.</li> <li>A reduction in noise pollution within the municipality.</li> </ul> <p>Funding for this measure is available through the Eco Fund, which provides co-financing programs for purchasing electric and hybrid vehicles. As of December 31, 2023, there are 8,904 registered passenger vehicles in Tivat (data from the Ministry of Interior). It is estimated that by 2030, 20% of these vehicles will be replaced with new ones. Of these, 15% (1,336) are expected to be hybrid vehicles, and 5% (444) electric vehicles. By 2030, the increased share of low- and zero-emission vehicles, coupled with greater energy efficiency, is anticipated to reduce final energy consumption in road transport by 20%, directly contributing to lower CO<sub>2</sub> emissions.</p>
<b>Start / End of Implementation</b>	2024/2030
<b>Implementation Partners</b>	National and international funds (e.g., Eco Fund)
<b>Energy Savings (MWh)</b>	20000
<b>Renewable Energy Production (MWh)</b>	n/a
<b>Estimated CO<sub>2</sub> Reduction (tCO<sub>2</sub>)</b>	5264
<b>Total implementation costs</b>	50.000.000 €
<b>Source of Funding</b>	National and international funds (e.g., Eco Fund), citizens, and legal entities
<b>Key vulnerable/sensitive groups that will benefit from the measure</b>	n/a



<b>Measure number</b>	13
<b>Measure name</b>	<b>Improvement of Public Urban Transport through the Introduction of Electric Buses and Minibuses</b>
<b>Sector</b>	SECAP
<b>Responsible body</b>	Municipality of Tivat
<b>Measure description</b>	<p>This measure aims to promote the adoption of electric vehicles and enhance urban connectivity in a sustainable manner. To implement this initiative, a feasibility analysis is required to evaluate the potential electrification of public transportation in Tivat. The analysis should assess the viability of introducing electric buses and minibuses, identify potential routes, and determine the optimal percentage of electric vehicles in the fleet. Additionally, it will provide recommendations for the best model for establishing an electric public transport system, including the potential justification for creating a dedicated municipal enterprise to manage it.</p> <p>An educational campaign will also be essential to inform citizens about the benefits of using public transport and to promote sustainable mobility.</p>
<b>Start / End of Implementation</b>	2024/2030
<b>Implementation Partners</b>	n/a
<b>Energy Savings (MWh)</b>	n/a
<b>Renewable Energy Production (MWh)</b>	n/a
<b>Estimated CO<sub>2</sub> Reduction (tCO<sub>2</sub>)</b>	n/a
<b>Total implementation costs</b>	n/a
<b>Source of Funding</b>	Municipal budget of Tivat, grants, and donations
<b>Key vulnerable/sensitive groups that will benefit from the measure</b>	n/a



### 5.1.4 Intersectoral Measures

Measure number	14
Measure name	<b>Education and Knowledge Transfer for Responsible and Technical Personnel in Energy Use, and Promotion of Energy Efficiency and Renewable Energy for the General Public</b>
Sector	Buildings/Transport/Public Lighting
Responsible body	Municipality of Tivat
Measure description	<p>This measure aims to inform citizens, property owners, and managers about the needs and opportunities for reducing energy consumption, as well as the potential for utilising solar energy. It focuses on education and awareness-raising to promote understanding of the importance of energy conservation and the adoption of renewable energy sources, particularly solar resources.</p> <p>This measure has the potential to enhance the energy sustainability of the Municipality of Tivat through education and the promotion of best practices in energy use, contributing in the long term to global efforts in combating climate change.</p> <p>To implement this measure, a series of activities must be carried out, such as:</p> <ul style="list-style-type: none"> <li>organising educational workshops and seminars for citizens, property owners, and company managers.</li> <li>Covering topics such as energy efficiency, solar technologies, and economic feasibility.</li> <li>Creating brochures, flyers, and guides that explain the benefits of energy efficiency and solar energy in detail.</li> <li>Posting information in public spaces and distributing it through electronic and other media.</li> <li>Hosting public lectures and presentations by experts in energy efficiency and solar energy.</li> <li>Including examples of successful implementation of solar systems and reductions in energy consumption.</li> </ul>
Start / End of Implementation	Continuous
Implementation Partners	Municipality in collaboration with institutions and organisations
Energy Savings (MWh)	n/a
Renewable Energy Production (MWh)	n/a
Estimated CO <sub>2</sub> Reduction (tCO <sub>2</sub> )	n/a
Total implementation costs	30.000 €
Source of Funding	Municipal budget, grants, and donations
Key vulnerable/sensitive groups that will benefit from the measure	<p>Education contributes to raising awareness among citizens about the importance of efficient energy use.</p> <p>Citizens gain knowledge about responsible energy consumption, leading to a reduction in unnecessary energy usage.</p> <p>Citizens who apply the principles of energy efficiency can achieve savings on their energy bills.</p>



<b>Measure number</b>	15
<b>Measure name</b>	<b>Mapping of Solar and Wind Energy Potential in the Municipality of Tivat</b>
<b>Sector</b>	Energy
<b>Responsible body</b>	Municipality of Tivat
<b>Measure description</b>	<p>The goal of this measure is to identify areas with high sensitivity where renewable energy sources (RES) should not be implemented, as well as areas with lower sensitivity to encourage the construction of renewable energy systems. The analysis is carried out using international methodology, based on available data and information about the state of natural resources, flora and fauna, cultural heritage, and landscape values (exceptionally valuable natural and semi-natural areas, cultural landscapes, and protected areas such as natural monuments, reserves, areas of outstanding features), considering the current and planned land use. The study defines locations for the development of solar and wind power plants with minimal conflict by identifying areas that present the least ecological and social conflict.</p> <p>The development of a low-conflict scenario for RES location involves:</p> <ul style="list-style-type: none"> <li>• Energy mapping that considers the development of a spatial database for renewable energy sources and location modelling.</li> <li>• Mapping of values that take into account environmental, biodiversity, and social/cultural elements of interest for preservation.</li> </ul> <p>To implement this measure, the local government needs to carry out a series of activities, such as:</p> <ul style="list-style-type: none"> <li>• Provide financial incentives, such as subsidies for legal entities investing in solar technology.</li> <li>• Define guidelines and standards for installing solar collectors in accordance with national legislation to ensure quality and safety.</li> <li>• Offer technical support when planning and implementing solar solutions.</li> <li>• Establish cooperation with solar technology distributors and other relevant partners to ensure support for equipment procurement and installation.</li> <li>• Inform legal entities about the long-term economic benefits of introducing solar solutions, including energy cost reduction and the positive impact on their reputation.</li> </ul>
<b>Start / End of Implementation</b>	2024-2030
<b>Implementation Partners</b>	Ministry of Energy and Mining, Ministry of Spatial Planning, NGOs
<b>Energy Savings (MWh)</b>	n/a
<b>Renewable Energy Production (MWh)</b>	n/a
<b>Estimated CO<sub>2</sub> Reduction (tCO<sub>2</sub>)</b>	n/a
<b>Total implementation costs</b>	n/a
<b>Source of Funding</b>	Funds for the study are provided by international organisations and NGOs.
<b>Key vulnerable/sensitive groups that will benefit from the measure</b>	n/a



<b>Measure number</b>	16
<b>Measure name</b>	<p><b>Implementation and Execution of an Energy Management System According to MEST EN ISO 50001:2020 in the Buildings of Local Government and City Institutions/Enterprises, as well as the Introduction of Complementary Standards:</b></p> <p style="text-align: center;"><b>ISO 9001 - Quality Management System</b></p> <p style="text-align: center;"><b>ISO 14001 – Environmental Management Systems</b></p> <p style="text-align: center;"><b>ISO 45001 - Occupational Health and Safety Management System</b></p> <p style="text-align: center;"><b>ISO 27001 - Information Security Management System</b></p>
<b>Sector</b>	Buildings/Transport/Public Lighting
<b>Responsible body</b>	Municipality of Tivat
<b>Measure description</b>	<p>The goal of this measure is the implementation of an energy management system in accordance with the international standard MEST EN ISO 50001:2020 in the buildings of local government and city institutions/enterprises. The energy management system enables the efficient use of energy, reduction of costs, and contributes to sustainable development.</p> <p>To implement the mentioned measure, a series of activities need to be carried out:</p> <p>To achieve the objectives of this measure, the following activities should be carried out:</p> <ul style="list-style-type: none"> <li>Conducting a Detailed Energy Audit of the buildings of local government and city institutions to identify potential improvements in energy efficiency.</li> <li>Training Staff on energy management principles, the goals of the MEST EN ISO 50001 standard, and their role in the system's implementation.</li> <li>Forming Teams or Appointing Responsible Persons to implement the energy management system in each building.</li> <li>Developing and Implementing Activity Plans to improve energy efficiency, including the identification of measures and priorities.</li> <li>Introducing a Monitoring and Measurement System for energy consumption to continuously track efficiency and identify areas for further improvement.</li> <li>Engaging Energy Auditors or Consultants to regularly evaluate the implementation of the energy management system.</li> <li>Conducting Regular Internal and External Audits of the system in line with the requirements of the MEST EN ISO 50001 standard.</li> <li>Achieving Certification According to MEST EN ISO 50001:2020 to confirm compliance with the energy management system.</li> </ul> <p>Based on available literature (e.g., <a href="https://betterbuildingssolutioncenter.energy.gov/iso-50001/what-iso-50001">https://betterbuildingssolutioncenter.energy.gov/iso-50001/what-iso-50001</a>), it is estimated that the implementation of this measure could reduce CO<sub>2</sub> emissions in the buildings of local government and city institutions/enterprises by 7% by 2030.</p>
<b>Start / End of Implementation</b>	2025-2030
<b>Implementation Partners</b>	Engagement of consultants is necessary.
<b>Energy Savings (MWh)</b>	205,5
<b>Renewable Energy Production (MWh)</b>	n/a
<b>Estimated CO2 Reduction (tCO2)</b>	75
<b>Total implementation costs</b>	30.000 €
<b>Source of Funding</b>	Municipality of Tivat Budget
<b>Key vulnerable/sensitive groups that will benefit from the measure</b>	n/a



## 5.2 Action Plan for Climate Change Adaptation

This section of the action plan dedicated to climate change adaptation in the Municipality of Tivat addresses relevant hazards by sector and defines appropriate adaptation measures that can help the local government better withstand the expected hazards. The implementation of these measures will minimize the consequences of hazard occurrences. The chapter is organised by first elaborating on the hazards for each sector of interest, followed by a tabular presentation of the adaptation measures relevant to the sector and the expected hazards. Each measure contains a set of data that describes the measure and makes it sufficiently clear to be further developed into operational documents that the local government will adopt during the implementation process. This set of data includes at least the following:

- Measure – identification number of the measure
- Name of the measure and activity
- Type of measure
- Key measure (yes/no)
- Responsible entity
- Partners in the implementation of the measure
- Other participants
- Timeframe for implementation
- Estimated financial costs
- Source of financing
- Brief description of the activity

Additionally, the measures are classified by type into the following groups:

- Institutional – involves the adoption of new or changes to existing documents (regulations, decisions, plans, programs) or organisational changes within the Municipality's authority.
- Education and Information – refers to programs, campaigns, and information dissemination in which the Municipality participates or organises.
- Infrastructure – involves investments in construction, municipal, technological, and similar interventions carried out by the Municipality independently or in partnership.
- Financial – includes investments and incentives within the Municipality's jurisdiction.

If a measure relates to multiple sectors and is not strictly confined to one specific area, it is placed in a separate section, defined as a combination of some of the aforementioned types.

It is of particular importance that the local government adequately defines all project activities related to the implementation of each identified measure in a way that ensures full confidence that the measure will be realized. For all measures, measurable quantifiers must be defined to enable the measurement of the success of implementation through periodic review procedures. In this regard, it is crucial to educate the human resources engaged in the implementation of measures in project management, applying the best practices in this area, as established by the requirements of the ISO 21500 standard. Education in this area, as well as the certification of the Tivat local government system in accordance with the requirements of ISO 9001, ISO 14001, ISO 45001, and ISO 20400, will significantly assist in establishing a simpler and more reliable implementation model.

### 5.2.1 Infrastructure Sector

Due to its geographic location within the coastal region, the municipality of Tivat is exposed to several potential hazards, which have been identified and assessed according to the methodology previously described. In general, the impacts of the following climate change-related hazards have been analysed: heavy rainfall leading to flooding, extreme heat, extreme cold, droughts, and storms within cyclonic systems.

Based on historical data and climate change projections, the relevance of these hazards has been identified to varying degrees. Depending on the likelihood of their occurrence, some have been assigned a higher degree of relevance than others.

In the case of the municipality of Tivat, particular emphasis is placed on the climate change impacts related to extreme heat, drought, heavy rainfall and subsequent flooding, as well as induced wildfires and their related consequences. These hazards are often interconnected, where the occurrence of one event triggers the development of a subsequent dependent event, creating a multi-risk situation. This is especially true for extreme heat, drought, and wildfires. Therefore, these events are considered together, and the consequences of their occurrence in terms of damage have been assessed in an integrated manner.

The municipality of Tivat is territorially small but of significant importance to Montenegro's economy. Additionally, important infrastructure facilities critical not only for the local government but also at the national level



are located within the municipality. A synergistic approach to action, both from a prevention perspective and in the event of damage mitigation when the discussed hazards occur, is invaluable. This is especially critical considering the municipality hosts a major airport, as well as significant modern tourist complexes, transport, and energy corridors.

Particular emphasis is placed on vulnerability when discussing the impact of climate change on critical infrastructure. Vulnerability is most pronounced in parts of critical infrastructure managed by transmission and distribution system operators, as well as Tivat Airport and road infrastructure.

The analysis specifically addresses extreme heat and extreme cold, both of which contribute to enormous stress on grid capacities (in the first case due to cooling, and in the second case due to heating), pushing the electricity system to the limits of its technical capabilities. The importance of analysing such operational regimes in terms of the likelihood of failures in network elements and facilities has been highlighted. The need to adequately size electrical power capacities according to energy and power demands has been discussed, along with the necessity of conducting these analyses during spatial planning procedures.

The impact of climate change should be integrated into spatial planning, especially regarding infrastructure development planning. This is essential for all infrastructure sectors but is particularly important for ensuring the efficient construction, operation, and maintenance of new infrastructure. By doing so, even when interruptions occur in critical infrastructure, the damage will be of a lower intensity.

The need to develop an early warning system for the onset of such events has been emphasized, as well as the importance of preventive actions, particularly in terms of educating and training all relevant stakeholders.

Droughts and extreme heat are the most significant expected hazards in the municipality of Tivat. The main anticipated consequences of this hazard include the occurrence of wildfires, shortages of drinking and technical water, impacts on public health, disruption of human and technological functions under extreme temperatures, etc. This hazard encompasses a multirisk situation. The occurrence of multirisk is possible as a result of faults in power lines under high-load operational regimes, where extreme heat combined with the subsequent extreme

drying of the soil and surrounding vegetation makes wildfires more likely.

In terms of impact on the electricity infrastructure, various scenarios can be defined, mostly related to the overloading of energy infrastructure due to the intense use of air conditioners in all consumption categories within the municipality. The superimposed activity of air conditioners directly leads to overloads at all voltage levels, both in transmission and distribution networks.

From the perspective of critical infrastructure, the hazard of extreme cold has also been identified and addressed, albeit with much lower relevance, considering the likelihood of its occurrence and the severity of its potential consequences.

The overall risk associated with these hazards has been assessed as moderate, with a quantifier of 12 for the hazard of extreme heat and drought, and low, with a quantifier of 4 for the hazard of extreme cold, according to the adopted methodology.

A set of measures has been proposed, emphasizing the preventive aspect and the need for a synergistic approach to reduce the severity of the consequences expected from the identified hazards. The need to raise awareness among all stakeholders about the importance of continuously and progressively reducing individual and institutional contributions to the acceleration of climate change has been emphasized. Additionally, there is a call for better preparedness to ensure that infrastructure facilities maintain operational functionality, even under extreme climate conditions.

In this regard, the importance of raising awareness about climate change, particularly regarding its effects on the functioning of critical infrastructure (CI), has been stressed. There is also a need for further development of awareness in line with the EU Green Infrastructure Strategy – The EU Strategy on Green Infrastructure<sup>9</sup>. The vulnerability tables, probability assessments, presentation of consequences, and expected risks for the infrastructure sector are provided in the Appendix of this document.

<sup>9</sup> [https://environment.ec.europa.eu/topics/nature-and-biodiversity/green-infrastructure\\_en](https://environment.ec.europa.eu/topics/nature-and-biodiversity/green-infrastructure_en)



<b>Measure number</b>	1
<b>Measure name and activity</b>	<b>Enhancement of Green Space Systems and Development of a Green Infrastructure Database</b>
<b>Type of measure</b>	Infrastructure
<b>Key measure</b>	Yes
<b>Activity owner</b>	Municipality of Tivat
<b>Implementation partners</b>	„Komunalno“ d.o.o. Tivat
<b>Other participants</b>	NGOs, Citizens
<b>Implementation timeframe</b>	2024-2030
<b>Estimated financial costs</b>	1.000.000 €
<b>Source of funding</b>	Municipality of Tivat Budget, Funds, and Donations
<b>Brief description of activities</b>	<p>The measure involves continuous maintenance and revitalization of existing green spaces and planning and establishing new ones. It focuses on interconnecting green areas into a comprehensive system, equipping them with appropriate facilities (furniture, lighting, walking paths, fitness trails, fountains, playground equipment, etc.). The measure also includes documenting existing green spaces and developing a GIS database, adaptable to real-time changes, for monitoring green area status and updates. This GIS database will incorporate all relevant elements for public green spaces, including dendrometric data (location and size of vegetation), plant species identification, health status, aesthetic value, and garden architectural features (paths, plazas, furniture, channels, curbs, fences, lighting).</p> <p>Training for staff who will use the database for planning, revitalization, and regular maintenance of green areas is planned, as well as additional training for acquiring new knowledge in this domain. The measure also includes acquiring necessary machinery, tools, and equipment for green space maintenance.</p> <p>The goal is to effectively manage green spaces, maintaining, revitalizing, and creating new areas, and integrating them into a connected green network. The GIS database will consolidate data on the existing green spaces, enabling quality and quantity analyses and better planning for the maintenance and development of green areas. Additionally, through the use of green infrastructure in urban design, the measure aims to improve infiltration characteristics during heavy and frequent rainfall while enhancing urban comfort with hygienic, aesthetic, and environmental benefits.</p>



<b>Measure number</b>	2
<b>Measure name and activity</b>	<b>Rehabilitation of Illegal Municipal Waste Disposal Sites and Creation of Conditions for Energy Production from Municipal Waste</b>
<b>Type of measure</b>	Infrastructure
<b>Key measure</b>	Yes
<b>Activity owner</b>	Municipality of Tivat
<b>Implementation partners</b>	Komunalno" d.o.o. Tivat
<b>Other participants</b>	NGOs, Citizens
<b>Implementation timeframe</b>	2024-2030
<b>Estimated financial costs</b>	2.500.000 €
<b>Source of funding</b>	Fonds
<b>Brief description of activities</b>	The measure includes analysing suitable methods for rehabilitating illegal waste disposal sites, exploring the potential use of reclaimed areas, and assessing the possibility of utilising municipal waste generated within the municipality for energy production. It also entails implementing field activities in line with the developed analyses and technical documentation. The goal of this measure is to enhance energy efficiency in waste management while improving the quality management of water, soil, and air affected by unregulated waste disposal and management. Another objective is to green the rehabilitated areas and contribute to climate change adaptation through improved infrastructure.

<b>Measure number</b>	3
<b>Measure name and activity</b>	<b>Assessment of the Current Condition and Capacity of Atomic Shelters and Their Readiness for Hosting Population During Extreme Climate Conditions (e.g., Heatwaves)</b>
<b>Type of measure</b>	Infrastructure
<b>Key measure</b>	Yes
<b>Activity owner</b>	Municipality of Tivat
<b>Implementation partners</b>	State authorities
<b>Other participants</b>	NGOs, Citizens, State institutions
<b>Implementation timeframe</b>	2024-2030
<b>Estimated financial costs</b>	20.000 €
<b>Source of funding</b>	Municipality of Tivat Budget, Funds, and Donations
<b>Brief description of activities</b>	<p>The measure includes identifying the current state, assessing the capacity to accommodate people, and evaluating the level of equipment in atomic shelters within the Municipality of Tivat. It involves the preparation of technical documentation necessary for their rehabilitation and use.</p> <p>Bringing these facilities to full operational readiness, particularly by improving the supply of drinking water and installing modern air conditioning and purification systems, will significantly enhance the safety of larger groups of people, especially vulnerable populations, during extreme climate hazards and their aftermath.</p> <p>The objective is to revitalize these facilities, ensure their effective management and maintenance, and integrate them into an interconnected civil protection system at the inter-municipal level. Implementing this measure also requires educating and informing the population about the purpose and necessity of these shelters.</p>



<b>Measure number</b>	4
<b>Measure name and activity</b>	<b>Intensive Collaboration and Communication with Electricity Distribution System Operators to Enhance Resilience Against Climate-Related Hazards</b>
<b>Type of measure</b>	Institutional
<b>Key measure</b>	Yes
<b>Activity owner</b>	Municipality of Tivat
<b>Implementation partners</b>	CEDIS, Porto Montenegro, EPCG, CGES
<b>Other participants</b>	NGOs, Citizens
<b>Implementation timeframe</b>	2024-2030
<b>Estimated financial costs</b>	5.000 €
<b>Source of funding</b>	Funds, Municipality of Tivat Budget
<b>Brief description of activities</b>	<p>The measure involves initiating meetings and maintaining regular communication with electricity distribution system operators to identify locations at increased risk of climate change impacts on distribution system elements and explore risk mitigation options. Particular attention will be given to heatwaves, high temperatures, floods, and landslides, depending on the location. This includes analysing the need for specific adaptations, such as relocating distribution infrastructure or strengthening and protecting it.</p> <p>The objective is to ensure continuous electricity supply even during crisis periods.</p> <p>Of special importance is the active engagement of local authorities in the following areas:</p> <ul style="list-style-type: none"> <li>Developing new distribution network plans that obligatorily account for anticipated climate changes, especially regarding the observed vulnerabilities of the power system (via appropriate risk assessment).</li> <li>Identifying the most vulnerable sections of the existing distribution network and determining which parts should be prioritised for reinforcement to enhance resilience against identified hazards.</li> </ul>

<b>Measure number</b>	5
<b>Measure name and activity</b>	<b>Implementation of an Early Warning System for Forest Fires, Floods, Heatwaves, Extreme Cold, and Other Relevant Hazards</b>
<b>Type of measure</b>	Infrastructure, Education, and Information
<b>Key measure</b>	Yes
<b>Activity owner</b>	Municipality of Tivat
<b>Implementation partners</b>	Telecommunication Operators
<b>Other participants</b>	Infrastructure
<b>Implementation timeframe</b>	2024-2030
<b>Estimated financial costs</b>	150.000 €
<b>Source of funding</b>	Funds, Municipality of Tivat Budget
<b>Brief description of activities</b>	<p>The measure involves ensuring the provision of drinking water, medical care, first aid equipment, and establishing appropriate equipment for early warning on the occurrence of forest fires. It also includes organising trained rescue and protection teams and identifying individuals who may be in need of medical or health care during a heatwave, as well as proactively monitoring and checking their condition prior to the onset of a heatwave.</p> <p>Additionally, the measure provides for the development of response plans for heatwaves, which, if effectively applied, could reduce mortality by up to 65-70%. The early warning system in the flood risk area could reduce harmful impacts by up to 50%.</p> <p>The goal of this measure is to improve risk recognition and assessment, establish monitoring and warning services, provide timely communication about risks, and develop the ability to respond appropriately when risks arise.</p>



<b>Measure number</b>	6
<b>Measure name and activity</b>	<b>Creating Comfortable Conditions at Bus Stops Across the Municipality, with Priority Given to Locations Near Facilities Where Children and Elderly People Potentially Gather</b>
<b>Type of measure</b>	Infrastructure
<b>Key measure</b>	Yes
<b>Activity owner</b>	Municipality of Tivat
<b>Implementation partners</b>	n/a
<b>Other participants</b>	Infrastructure
<b>Implementation timeframe</b>	2024-2030
<b>Estimated financial costs</b>	150.000 €
<b>Source of funding</b>	Funds, Municipality of Tivat Budget
<b>Brief description of activities</b>	The measure aims to make bus stops more comfortable for passengers while waiting for transportation. This includes equipping the stops with appropriate furniture, shelters, greenery, and water fountains, and positioning them at locations with optimal micro-climatic conditions based on urban and traffic planning possibilities. Additionally, the measure involves greening the bus stops as much as possible, using building materials and colours that minimize heat absorption, thus improving conditions during extreme heatwaves. The stops will also be bordered, where necessary, with surrounding ditches and drains equipped with grates to prevent flooding during heavy rainfall. The goal is to make the bus stops comfortable for use, especially for vulnerable groups of the population.

<b>Measure number</b>	7
<b>Measure name and activity</b>	<b>Education in Environmental Protection, Climate Change, and Energy Efficiency for the Public, Employees in Tourism and Education Sectors, and Local Government Structures</b>
<b>Type of measure</b>	Education and Information
<b>Key measure</b>	Yes
<b>Activity owner</b>	Municipality of Tivat
<b>Implementation partners</b>	Educational Institutions
<b>Other participants</b>	NGOs, Citizen Groups, Firefighting Units
<b>Implementation timeframe</b>	2024-2030
<b>Estimated financial costs</b>	250.000 €
<b>Source of funding</b>	Funds, Municipality of Tivat Budget
<b>Brief description of activities</b>	<p>This measure includes a series of activities aimed at expanding knowledge about ecologically sustainable construction ("healthy" homes, renewable energy sources, rational energy use, ecological materials); coastal, marine, and underwater pollution prevention; the importance of and preservation of biodiversity; water and water resources – the limitations of water resources; wastewater and wastewater management; separate waste disposal and solid waste recycling; soil and land degradation; air pollution and methods of reducing pollution; climate change as a consequence of irresponsible attitudes toward nature; and the need for continuous, conscientious management of resources and infrastructure.</p> <p>The measure includes activities such as organising and financing lectures, seminars, workshops, and similar events; jointly organising and implementing actions for the ecological development and future sustainable use of spaces (e.g., planting trees, organising playgrounds, developing mountain and walking trails, creating viewpoints, designing public spaces equipped with social games for elderly groups, etc.); organising and financing educational field trips for students, professionals, and experts to gain additional knowledge in the aforementioned areas; and encouraging tourism and education businesses to implement and promote ecological activities.</p> <p>The intention is to continuously conduct activities that increase and improve knowledge and the application of environmental protection, climate change, and energy efficiency concepts, while simultaneously providing practical protection and enhancement of spaces.</p>



## 5.2.2 Water Management Sector

The negative impact of climate change is very evident in the water supply sector. Until now, the problem of salinisation of water sources and reduced yields in the summer months has been a limiting factor for the development of the city and tourism. The quality of water supply has varied from year to year, depending on the hydrological situation. The construction of the regional water supply system has partially improved the security of water supply in Tivat.

The impact of climate change and indicators will be detailed further in the text. The most important water management indicators of climate vulnerability are:

- Decreased water source yields,
- Increased water consumption,
- Salinisation of the Plavda and Topliš water sources,
- Turbidity of Plavda (water quality and safety, number of days of turbidity).

Tivat uses groundwater for public water supply, which is highly vulnerable to climate change. In low-lying coastal karst regions, prolonged drought periods lead to the disruption of the balance between saltwater and freshwater, and the salinisation of water sources results in disturbances in the groundwater flow, increased formation of flash floods, and other hazards. The karst spring of Plavda is particularly vulnerable to climate change.

Salinisation of the Topliš water source has become more pronounced due to the lengthening of the dry season, and in recent years it has been used less and now mainly serves as a backup water source.

Indicators in water management that can be used to track reduced water source yields and declining water levels in wells include the amount of water extracted, while the impact of salinisation can be monitored through the quality of the extracted water.

The vulnerability analysis particularly considers the impact of climate change on the water management sector. Several climate factors influence the water supply sector. Most notably, there is an observed trend of climate peaks and irregularity, which has a significant impact on the hydrology of the Tivat municipality.

The increase in temperature and the length of dry periods significantly affect the water levels in wells and the yields of the Plavda water source. Prolonged drought periods increase water consumption, which, combined with reduced freshwater inflow to the springs, can result in the "inflow" of saltwater. These prolonged dry periods in recent years have led to the non-use of water from the Topliš water source.

Rising sea levels will affect the salinisation of groundwater and prolong the period of salinized water sources.

The trend of an increasing number of stormy days with intense rainfall affects more frequent turbidity in water sources, leading to more days with unsafe drinking water.

Plavda and Topliš both face salinisation issues in the summer months. In the case of Topliš, this phenomenon is more pronounced, and "good" water at this source appears much later than at Plavda. In some years, Topliš only provides "good" water during the winter months, and for this reason, Tivat's water supply relies on the regional water supply system to avoid frequent system shutdowns and restarts.

The analysis provides estimates of the likelihood of adverse events and their consequences in the water management sector. The probability of these hazards occurring, according to the adopted methodology, is rated as high, nearly certain.

The consequences of hazards on human life and health in the water management sector have been assessed as minimal. The economic impact of climate change-induced hazards has been rated as moderate, and the damage estimate has been calculated in relation to the annual Budget of the Municipality of Tivat.

The overall risk related to the occurrence of extreme heat and drought hazards, according to the adopted methodology, is rated as high, which, based on the methodology, means that risk treatment is required. The total risk for the hazard of extreme rainfall and flooding has been calculated as moderate, which may indicate the need for actions to reduce the harmful impact of climate change and to adapt to it.

Proposals for measures have been presented, emphasizing the preventive aspect, as well as the need for synergistic action to reduce the severity of the consequences expected from the identified hazards.

These include hydro-geological research necessary for regulating existing resources and discovering new underground water sources, reducing potable water consumption, minimizing water losses, which would help reduce over-extraction from water sources and prevent saltwater intrusion, and finally, the establishment of an early warning system that would allow for preventive action in the event of water source turbidity.

The analysis particularly highlights the expected impacts, the likelihood of their occurrence, the expected level of impact, and the timeline for each identified hazard in the water supply sector.



Tables of vulnerability, probability estimates, and the expression of consequences and expected risks for the water management sector are provided in the appendix of this document.

Measure number	8
Measure name and activity	<b>The Construction of the Missing Sewerage System in the Municipality of Tivat, Improvement of the Wastewater Drainage System, and Establishment of a GIS System</b>
Type of measure	Infrastructure, Financial
Key measure	Yes
Activity owner	Municipality of Tivat
Implementation partners	"Vodacom" d.o.o. Tivat, "Vodovod i kanalizacija" d.o.o. Tivat
Other participants	Citizen groups
Implementation timeframe	2024-2030
Estimated financial costs	28.500.000 €
Source of funding	Funds, Budget of the Municipality of Tivat
Brief description of activities	<p>The measure is directly related to the occurrence of heavy rainfall accompanied by storms, resulting in the overflow of torrential streams and channels and the inflow of pollutants into the final recipient – the sea.</p> <p>The activities include preparing an overview of the current state of the system, preparing technical documentation for the construction of missing parts and (if necessary) the reconstruction of existing parts of the system, procuring, delivering, and installing controllers on all pumping stations and pumps in the Municipality of Tivat, preparing technical documentation for the design of the wastewater SCADA system, and implementing the SCADA system, including:</p> <ul style="list-style-type: none"> <li>a. Completing remote control and management of all pumping stations in the Municipality of Tivat;</li> <li>b. Implementing the SCADA system for wastewater.</li> </ul> <p>The overview of the current state is planned through data collection and integration into a GIS database of the wastewater system. The GIS database should include all relevant spatial and technical data related to the elements of the wastewater drainage system. The developed GIS database should be easily adaptable to changes and updates based on field changes and should serve as the basis for future planning activities.</p> <p>The establishment of the GIS system includes providing appropriate training for employees who will use and input current data into the database. The aim is to ensure continuous, high-quality management of wastewater as a whole and to make system components more resilient to potential hazards.</p> <p>This measure should also take into account rising sea levels and the functionality of the drainage system in relation to a recipient with an upward gradient.</p>



<b>Measure number</b>	<b>9</b>
<b>Measure name and activity</b>	<b>Improvement of the Water Supply System and Creation of the Water Supply GIS System</b>
<b>Type of measure</b>	Infrastructure, Financial
<b>Key measure</b>	Yes
<b>Activity owner</b>	Municipality of Tivat
<b>Implementation partners</b>	"Vodacom" d.o.o. Tivat, "Vodovod i kanalizacija" d.o.o. Tivat
<b>Other participants</b>	Infrastructure
<b>Implementation timeframe</b>	2024-2030
<b>Estimated financial costs</b>	100.000 €
<b>Source of funding</b>	Municipality of Tivat Budget
<b>Brief description of activities</b>	<p>The measure includes activities related to creating a snapshot of the current situation, installing controllers at all pump stations and pumps in the Municipality of Tivat, preparing technical documentation for the creation of a SCADA water supply system, and implementing the SCADA system. The objectives are:</p> <ul style="list-style-type: none"> <li>a. Completion of remote control and management of all pump stations in the Municipality of Tivat</li> <li>b. Implementation of the SCADA system for water supply</li> <li>c. Identification and reduction of losses.</li> </ul> <p>The snapshot of the current situation is planned through data collection and integration into the GIS database of the water supply system. The GIS database should include all relevant spatial and technical data related to the elements of the water supply system. The created GIS database should be easily adaptable to changes and updates in line with changes on the ground and should serve as a basis for future planning activities.</p> <p>Establishing the GIS system also includes providing appropriate training for employees who will use and input current data into the database. The aim is to ensure continuous and high-quality management of the water supply system as a whole, as well as to make the system elements more resilient to potential hazards.</p>

<b>Measure number</b>	<b>10</b>
<b>Measure name and activity</b>	<b>Regulation of Stormwater Drainage</b>
<b>Type of measure</b>	Infrastructure
<b>Key measure</b>	Yes
<b>Activity owner</b>	Municipality of Tivat
<b>Implementation partners</b>	"Vodacom" d.o.o. Tivat, "Vodovod i kanalizacija" d.o.o. Tivat
<b>Other participants</b>	Infrastructure
<b>Implementation timeframe</b>	2024-2030
<b>Estimated financial costs</b>	1.000.000 €
<b>Source of funding</b>	Municipality of Tivat Budget
<b>Brief description of activities</b>	<p>The measure includes analysing the current stormwater drainage system in the urban areas of the municipality and critical infrastructure zones (through the creation of a GIS database), identifying areas with frequent issues related to the accumulation and drainage of rainwater, and preparing technical documentation for stormwater drainage. The measure also includes the construction and reconstruction of stormwater drainage elements based on the developed technical documentation.</p> <p>The GIS database should include all relevant spatial and technical data related to the elements of the stormwater drainage system. The developed GIS database should be easily adaptable to changes and updates in line with changes on the ground and should serve as a basis for future planning activities. Establishing the GIS system also includes providing appropriate training for employees who will use and input current data into the database.</p> <p>The goal of implementing this measure is to improve the current state of stormwater drainage, reduce existing pressures, and mitigate the risks of damage caused by the absence of a system or inadequate stormwater drainage. This measure must also take into account the circumstances resulting from the evident rise in sea levels.</p>



<b>Measure number</b>	11
<b>Measure name and activity</b>	<b>Stream and Torrential Canal Management</b>
<b>Type of measure</b>	Infrastructure
<b>Key measure</b>	Yes
<b>Activity owner</b>	Municipality of Tivat
<b>Implementation partners</b>	„Komunalno“ d.o.o. Tivat
<b>Other participants</b>	Infrastructure
<b>Implementation timeframe</b>	2024-2030
<b>Estimated financial costs</b>	1.000.000 €
<b>Source of funding</b>	Municipality of Tivat Budget
<b>Brief description of activities</b>	<p>The measure includes the management and regular maintenance of stream beds and torrential canals. The management (construction, reconstruction, and rehabilitation) should be carried out based on professional analyses and developed technical documentation in accordance with industry standards (taking into account the potential increase in the frequency of more intense rainfall). The measure also includes regular monitoring of the condition of streams and torrential canals, maintaining and ensuring the passability of the beds for unobstructed water flow. Additionally, the measure involves the installation of various elements (in accordance with the technical documentation and industry standards) aimed at reducing erosive effects, mitigating the strength of the water flow, installing grates to retain solid waste, and more. The goal of this measure is to ensure the effective drainage of rainwater, minimize the risk of damage caused by heavy rainfall accompanied by storms, and prevent the overflow of streams, flooding, and the entry of solid waste and pollutants into the sea.</p>

### 5.2.3 Sektor turizma

Various changes in the climate and overall weather conditions will affect the places people travel to as tourists, as well as the local population residing in these areas, with long-term consequences.

In Montenegro, the most important impacts on tourism and recreation related to climate change (excluding sea level rise) are likely to be connected to the effects of climate change on air temperatures, both in coastal tourist destinations during the summer and in mountain ski resorts in the winter, along with increased rainfall in the mountains during the winter, which will negatively impact skiing. Tourism will also be affected by the impact of climate change on river flows and lake levels, the quality and temperature of freshwater, all of which collectively have the potential to influence market trends and non-market services provided by both the natural and built environments to tourists.

For the Municipality of Tivat, it is crucial to emphasize the impact of climate change on increasing temperatures (extreme heat and drought), the number of fires, sea level rise, changes occurring on the coastal surface and along its length, as well as the impact of various winds and storms. Based on historical data and climate change predictions,

the relevance of these hazards has been identified. The most significant impacts on the tourism sector in Tivat are extreme heat and drought, as well as strong winds and storms from the sea. Additionally, it is important to note that while sea level rise has a significant impact on tourism, these changes occur at a considerably slower pace.

All of the aforementioned hazards impact the following tourism sector indicators:

- Number of tourist arrivals and overnight stays
- Changes in tourist activities
- Annual direct economic losses
- Tourism revenue and the percentage of tourism revenue in the total revenue of the Municipality
- Number of employees in the tourism sector – accommodation and food services, and their share of total employment
- Accommodation capacities (number of registered beds, hotels, motels, and other collective and individual accommodations)
- Number of ships in ports throughout the years



For the purposes of this analysis, the impacts of two hazards—"extreme heat and drought" and "strong winds and storms from the sea"—were specifically analysed. The impact was measured both in terms of vulnerability, analysing qualitative and quantitative indicators, and in terms of its effects on the overall economy of the Municipality of Tivat, as well as its impact on human life and health.

Heatwaves with extreme heat have a significant impact on the tourism sector in the Municipality of Tivat. As temperatures increase, the attractiveness of the municipality from a tourism perspective decreases. This is not limited to coastal tourism, but also affects cultural content, events, excursions, and other activities aimed at attracting tourists. A reduced number of tourist arrivals and

overnight stays directly leads to a decrease in revenue and employment in the municipality.

Strong winds and storms from the sea affect not only the coastal area but also transportation routes and the Tivat airport, which is especially important for the development of tourism, i.e., for tourist arrivals. In terms of the coastal area, storms cause damage to facilities along the coast, disrupt water supply, cause damage to vessels, and so on.

At the end of the analysis, following the assessment of impacts and vulnerability indicators, recommendations are provided, along with proposals for various activities aimed at mitigating the effects of the identified hazards on the tourism sector in the Municipality of Tivat.

Measure number	12
Measure name and activity	Support for Activities and Events Designed to Attract Tourists Outside the Peak Tourist Season
Type of measure	Financial
Key measure	Yes
Activity owner	Municipality of Tivat
Implementation partners	Tourist organisation of Tivat (TO Tivat)
Other participants	Infrastructure
Implementation timeframe	2024-2030
Estimated financial costs	1.000.000 €
Source of funding	Municipality of Tivat budget, funds, and donations
Brief description of activities	This measure aims to enhance existing offerings and develop new activities to stimulate tourism outside the summer peak season. The focus is on promoting nature-based tourism, rural areas of the municipality, agritourism, local cuisine, cultural events, cycling, hiking, and similar activities. The measure includes the development of infrastructure that can be used year-round, such as cycling and hiking trails, adventure parks, swimming pools, and multifunctional halls. The goal is to generate tourism revenue through environmentally sustainable models, including the preservation of land, water, and natural resources, as well as reducing the need for vehicle use.

## 5.2.4 Agriculture and Forestry Sector

The following measures are presented for the forestry and agriculture sectors.

### Agriculture

The impact of climate factors in the Municipality of Tivat has been analysed by examining their effects on soil, crops, livestock production, the emergence of new diseases and pests, and the economic capacity of producers. Climate change affects the soil due to rising temperatures and increased rainfall intensity, which accelerate soil erosion and the loss of organic matter. The growing season is lengthening, and further increases are expected in the near future. Monitoring drought occurrences must be prioritised, as drought is a critical limiting factor for agriculture. New pests and diseases could create significant challenges for agricultural production because farmers may lack knowledge about their symptoms, treatment, and

management practices.

Agricultural activity in Tivat is mostly supplementary due to the limited availability of arable land. Inadequate tax policies have further fragmented already small plots, leading to the marginalization of agriculture. Additionally, water supply issues in some rural areas remain unresolved. Despite these challenges, the past decade has seen a noticeable increase in agricultural and food producers, particularly in olive growing, citrus cultivation, vegetable seedling production, beekeeping, and small-scale livestock farming involving sheep, cattle, and goats. Notably, aromatic and medicinal herbs, as well as wild fruits like pomegranates and figs, are also prominent. Strategic documents reveal a lack of analysis of climate change indicators and vulnerability assessments within the sector.

The vulnerability analysis for agriculture in Tivat indicates a high level of susceptibility to rising average annual



temperatures and reduced precipitation, which alters crop growth cycles, reduces water availability for irrigation, and lowers yields. Additionally, the sector's vulnerability is exacerbated by unfavourable climatic conditions, leading to a decline in the number of farmers. Income reduction is moderately influenced by storm and heavy rain incidents, while sea-level rise and temperature changes lead to economic losses. There is also a risk of emerging diseases and pests.

The consequences in the agriculture sector are reflected in the risk of invasive species that may threaten human and animal health. The reduction of native marine and agricultural species could influence dietary habits and lead to metabolic problems.

There is a danger of new diseases in plant and animal species used for food, increasing their vulnerability, reducing yields, and raising production costs. Declining fish catches and economic losses due to damaged fishing equipment are additional challenges. The impact of climate change on beekeeping, combined with limited or even non-existent adaptation capacities, results in high

vulnerability and reduced economic viability for producers.

The effects of climate change on agricultural productivity are expected to become even more significant in the future. Combined with the ageing population engaged in agricultural activities, this could have consequences for social stability. Low productivity and the fragmentation of agricultural holdings may further lead to the cessation of activities under the influence of climate change. A lack of irrigation infrastructure may negatively affect agricultural production trends. The analysis indicates significant vulnerability in the fruit and vegetable production, beekeeping, and fisheries subsectors. It is recommended to develop adequate adaptation plans for climate change in the agriculture sector, considering the specific characteristics of each subsector. Additional budgetary support lines should be introduced for producers, with specific measures aimed at mitigating the consequences of climate change. Enhancing control over the use of pesticides and artificial fertilizers, strengthening farmer education on good agricultural practices, and fostering collaboration with scientific and research institutions to implement innovative solutions in food production and processing are also essential.

Measure number	13
Measure name and activity	<b>Mapping Water Sources Outside the Public Water Supply System – Natural Springs, Wells, Catchments, etc. (Based on Publicly Available Data and Data Held by Municipal Authorities)</b>
Type of measure	Financial
Key measure	Yes
Activity owner	Municipality of Tivat
Implementation partners	„Vodovod i kanalizacija“ d.o.o. Tivat
Other participants	Infrastructure
Implementation timeframe	2024-2030
Estimated financial costs	80.000 €
Source of funding	Municipality of Tivat budget, funds, and donations
Brief description of activities	This measure involves the identification and documentation of water sources outside the public water supply system, including water testing, an initial health risk assessment, and application of findings based on field surveys, documentation, and laboratory analyses.
	The objective is to gain insight into the availability, capacity, and quality of water at sources outside the public water supply system to ensure their preservation, sustainable use, and to assess the needs and possibilities for constructing catchments and other protective infrastructure.



## Forestry

The vegetation in the municipality of Tivat is characterized by the European-Mediterranean subregion (EU-Mediterranean zone of evergreen vegetation, *Quercion ilicis* alliance, Horvatić S., 1967), which extends up to 300–500 meters above sea level. The climax community of this subregion is the evergreen holm oak forest (*Quercus ilex*). The European-Submediterranean subregion (Sub-Mediterranean zone and Mediterranean-montane belt of deciduous vegetation, *Ostryo-Carpinion orientalis* alliance, Horvatić S., 1967) spans the southern slopes of Vrmac above the evergreen vegetation zone, while on the northern slopes, it descends to the sea level.

Forests represent the most widespread natural category in the Tivat municipality, primarily covering the coastal hinterland. Based on their role in the landscape, forests are classified into two categories: protective forests and forests with special purposes.

Forests located in the southern and central regions are at the highest risk due to high summer temperatures and typical vegetation, which create favourable conditions for wildfires. July and August are critical months due to very low or absent precipitation, as are February and March during dry and warm winters (REC, 2015). Forest ecosystems in southern areas are highly vulnerable to habitat degradation driven by various climatic factors. Beyond the destruction of vegetation, fires significantly accelerate habitat erosion. The primary climate-related risks include:

- Increased tree mortality due to harmful insects
- Increased tree mortality caused by parasitic fungi
- Tree die-off due to water shortages
- Tree mortality due to high temperatures
- Bark damage in vulnerable species
- Quantity of uprooted, broken, and damaged trees

The quality and volume of timber, as well as the vitality and resilience of forests to adverse effects, depend on their structure, tree species composition, and optimal mix in mixed forests. These are key parameters for assessing the vulnerability of individual trees and ecosystems, as well as their response to physical disturbances and the spread of specific tree species. Fire-related damages can be categorised as direct or indirect. Direct damage to forest vegetation is negligible since low forests and thickets dominate, while higher forests are located in elevated areas (e.g., Vrmac). The most significant impacts on forests are indirect or ecosystem-level damages.

The entire area is characterized by a specific coastal vegetation cover consisting of low forests of sprout origin, thickets, maquis, and shrublands. The climatic conditions of the observed area are marked by extremely long and hot periods without precipitation throughout the year, particularly during the summer months. The aforementioned data on droughts indicate a pronounced risk of wildfires in the municipality of Tivat due to prolonged dry periods. Tivat is classified as a high fire-risk area, placed in the first level of fire risk in Montenegro<sup>10</sup>.

Air temperature, humidity, and wind directly influence the frequency of fires. The forecasted higher temperatures and longer dry periods, combined with wind, will increase the risk of fire outbreaks and spread across Europe, particularly in the Mediterranean region. Significant wildfires were recorded in Montenegro in 2008, 2010, and 2017, occurring after prolonged droughts and unusually high temperatures for those times of the year.

According to previous observations and studies, high temperatures during the growing season cause heat stress, after which weakened forests are attacked by harmful biotic factors, resulting in forest die-off. The key issue is the adaptation of forest ecosystems to rapidly occurring climate changes. Implementing appropriate forest management measures can somewhat mitigate the ecological and socio-economic consequences of potential forest degradation due to climate change. The greatest vulnerability due to fires is reflected in the loss of timber mass, changes in forest structure and composition, erosive activities, and forest die-off due to extreme temperatures, droughts, and soil erosion caused by heavy, short, and intense rainfall.

In the Tivat municipality, the highest fire risk has been assessed. The probability of a wildfire occurring in the municipality of Tivat is moderate (one fire every 2 to 20 years). The assessment of consequences for human health, including fatalities, injuries, illnesses, care needs, evacuations, and relocations, is moderate (201 to 500 people). The economic impact is significant, with estimated economic damages ranging from 10 to 15% of the Tivat municipal budget. The overall risk assessment is classified as "High" and requires risk treatment.

Risk treatment is primarily based on preventive fire protection measures. These measures include procuring adequate equipment for the Tivat Protection and Rescue Service, educating both the population and the Protection Service, and implementing forest management measures such as road maintenance, forest cleaning, reforestation, and other activities.

<sup>10</sup> Disaster Risk Reduction Strategy with an Action Plan (2018 - 2023.)



<b>Measure number</b>	14
<b>Measure name and activity</b>	<b>Encouraging Agricultural Development</b>
<b>Type of measure</b>	Financial
<b>Key measure</b>	Yes
<b>Activity owner</b>	Municipality of Tivat
<b>Implementation partners</b>	n/a
<b>Other participants</b>	Infrastructure
<b>Implementation timeframe</b>	2024-2030
<b>Estimated financial costs</b>	400.000 €
<b>Source of funding</b>	Municipality of Tivat budget, funds, and donations
<b>Brief description of activities</b>	<p>This measure includes the continuous provision of funds, creation of conditions and criteria for various support models for agricultural development, and creating favourable conditions for engaging in agriculture (olive growing, fruit growing, livestock farming, beekeeping, vegetable growing) either as a primary activity or in combination with tourism offerings.</p> <p>The measure also includes promoting traditional agricultural activities of this area, with a focus on rural regions of the municipality (the Luštica Peninsula and Vrmac hills).</p> <p>The measure covers the establishment of facilities, production, and demonstration spaces in public ownership, as well as the improvement of infrastructure that supports agriculture.</p> <p>The goal is to preserve and enhance traditional agricultural activities to maintain arable land, soil, water, and water facilities (canals, catchment areas, wells, springs, etc.), while improving the living conditions for the population and tourists in rural areas.</p>

## 5.2.5 Natural Resources Sector

Given that Tivat is located in the Bay of Kotor, an area with limited communication with the open sea and slow water mass exchange, the waters of the Tivat Bay represent a highly sensitive zone. The problem of pressures from various sources, which have global dimensions, has not spared either the marine or the terrestrial ecosystem in the municipality of Tivat.

The city's commitment to being a tourist destination results in double negative impacts on natural resources from both the land and the sea. Spatial planning, spatial and urban planning directly affect the environment, making them one of the most important tools for its preservation. Building directly along the coastline has particularly negative consequences. One of the key issues related to coastal construction is the concrete reinforcement of the shore, which alters the ecological status of the coast, negatively affects the flora and fauna of the sea, and particularly the seabed, with long-term consequences. This trend has already significantly altered the visual and ecological landscape of much of Tivat's coastline on both sides of the bay (Krašići - in the area below the road to Petrovići, Kakrc, the shore of Duraševići, Bonići, etc.). Intense construction of mostly residential buildings has not been accompanied by proportional development of city roads and public space management.

The vulnerability of the Tivat area to climate change, in

relation to the environment and natural resources, manifests through the dependency of these sectors on specific temperature conditions and water availability, as well as exposure to climate hazards such as droughts and floods. Additionally, the rise in sea water temperature favours the spread, increase, and impact of invasive species, leading to changes in natural habitats and biodiversity loss. Forest fires and heat waves further affect air quality and human health, particularly vulnerable groups (the elderly, those with chronic conditions, pregnant women, and children).

Given the anthropogenic activities that often contradict sustainable principles, combined with climate risks whose consequences are amplified under such conditions, there is justified concern regarding the preservation of the existing biodiversity, air quality, water resources, green spaces, and all segments of the environment.

The climate hazards most likely to occur in the Tivat municipality are:

- Drought/Heatwaves
- Fires
- Heavy rains/Floods
- Storms and strong winds/Hail

The vulnerability indicators pointing to the consequences of these phenomena are: reduction in the quality and productivity of habitats, reduction in coastal ecosystem functions, eutrophication, loss of biodiversity, air pollution,



decreased available water quantities (decline in water levels in wetlands), river overflow in suburban and rural areas, overflow of atmospheric water, sea and coastline pollution, rising sea levels, intrusion of saline water into water supply systems, flooding of lowlands, coastal zone and beach erosion, and devastation of green spaces in urban areas.

For the purposes of this analysis, the impact of multihazards—drought and extreme heat/fires, heavy rainfall/floods, and extreme cold—has been specifically examined. The impact was analysed from both the qualitative and quantitative vulnerability aspects, as well as from the perspective of the overall economic impact

on the municipality of Tivat and the effect on human life and health. The conclusion is that the most likely climate hazards are droughts and extreme heat, accompanied by forest fires, which have the greatest negative impact on the economy, ecology, and the risk to human life and health. Based on the assessment of the most likely climate hazards in the municipality of Tivat, expected impacts of climate change on various sectors of the municipality up to 2040 have been presented, along with their likelihood, expected impact levels, and the timeframe for action. Based on the analysis, recommendations and proposals for different activities have been provided that would proactively reduce the impact of these hazards on the natural resources sector in the municipality of Tivat.

Measure number	15
Measure name and activity	<b>Implementation of Research and Creation of Studies for Sensitive Areas (Potential Landslides, Erosion-Prone Areas, Torrential Streams, Valuable Natural Locations, etc.) for the Purpose of Spatial Planning Documentation</b>
Type of measure	Education and awareness
Key measure	Yes
Activity owner	Municipality of Tivat
Implementation partners	n/a
Other participants	NGOs, Citizen Associations
Implementation timeframe	2024-2030
Estimated financial costs	80.000 €
Source of funding	Municipality of Tivat Budget, Funds, and Donations
Brief description of activities	This measure involves conducting research, gathering necessary data, analysing the data, and creating studies related to landslides, erosion-prone areas, torrential streams and their catchment areas, groundwater, water supply catchments, and biodiversity. The goal is to secure quality data that will serve as a foundation for the creation of spatial planning documentation and the management of space in a way that preserves natural resources and material goods. It aims to protect and appropriately manage sensitive areas, as well as reduce the risk of damaging these areas and their surroundings due to hazards associated with climate change.

## 5.2.6 Health Sector

The impact of climate change on life and health will persist in the coming decades, and as such, it is necessary to mobilize all available resources to implement continuous adaptation measures and ensure resilience to the risks these changes bring.

Strengthening and improving the key functions of the healthcare system is fundamental to enhancing the management of the risks posed by a changing climate on the life and health of the population.

Risk and vulnerability assessment serves as the basis for strategic planning by local governments regarding the impact of climate change on resources and the population within their territories.

The Tivat area is a pleasant tourist coastal location, ideal for health preservation and improvement.

Based on historical data and climate risk projections for the municipality, the dominant risk factors to life and health identified for the population include:

- Heatwaves
- Fire (caused by heatwaves)
- Heavy rains leading to floods
- Floods
- Storms and strong winds/hail

These hazards have a significant impact on vulnerability indicators (both climate and non-climate), as described in this document: a high degree of sensitivity to heatwaves and fires, air pollution, saltwater intrusion into water supply systems, salinisation of water sources, water turbidity,



interruptions in water supply to consumers, increased water consumption (due to a higher number of tourists), increased disposal of wastewater (due to more tourists), reduced water availability for drinking, interruptions in drinking water supply, the occurrence of infectious diseases, and population density.

The impact of climate hazards in the municipality of Tivat is reflected in the rise in temperature and drought periods, which lead to a significant reduction in the availability of drinking water and the yield of water sources, especially noticeable during the peak tourist season. As a coastal town, Tivat is also exposed to occasional rises in sea level above normal heights, often caused by storms. The condition of the water supply network is inadequate, largely due to its deterioration. The sewage network covers the city centre, Kalimanj, Seljanovo, and part of the Krašići settlement, which is further burdened by the increased number of tourists during the summer months.

The components that could affect the preservation and improvement of the health of the population are also linked to the analysis, which shows a significant increase in the number of arrivals and overnight stays by tourists in the municipality of Tivat, which puts significant pressure on the water supply and wastewater management system (especially the disposal of sewage).

Regarding heatwaves, the IPCC report considers the Southeast European region as part of the Mediterranean, and according to projections, climate change will exacerbate conditions in the region due to high temperatures and droughts. This region is already sensitive to climate variability, which poses a threat to the health and well-being of the population in the municipality of Tivat.

In the future, Montenegro does not expect a significant increase in the incidence of vector-borne infectious diseases. The hygiene and epidemiology service is always on standby to prevent and control these diseases in a timely manner.

In healthcare, during high-risk hazardous situations, there is strong solidarity and mutual assistance at the local, national, and international levels, which, in terms of scope, relevance, and results, places the healthcare service in a prominent position.

Based on the vulnerability analysis of the healthcare sector due to climate change (fires, heatwaves, floods, storms), and by assessing the probability, consequences, expected risks, and expected impacts of climate change on the healthcare sector, possible problems were identified. In conclusion, the necessary activities for addressing these issues were recognised and proposed.

Measure number	16
Measure name and activity	<b>Preparation of Project Documentation for the Construction, Reconstruction, and Expansion of Water Infrastructure Protection from the Harmful Effects of Floodwaters on Water Sources, and the Implementation of Works in Accordance with the Technical Documentation.</b>
Type of measure	Infrastructure
Key measure	Yes
Activity owner	Municipality of Tivat
Implementation partners	„Komunalno“ d.o.o. Tivat i „Vodovod i kanalizacija“ d.o.o. Tivat
Other participants	Infrastructure
Implementation timeframe	2024-2030
Estimated financial costs	500.000 €
Source of funding	Municipality of Tivat Budget
Brief description of activities	<p>The measure includes the preparation of technical documentation necessary for protecting water from the negative impact of flood waters on water quality and the implementation of works at water sources.</p> <p>The goal of this measure is to reduce health risks caused by the harmful effects of flood waters on water sources and ensure the permanent availability of safe, potable water.</p>



<b>Measure number</b>	17
<b>Measure name and activity</b>	<b>Construction and Equipment of Outdoor/indoor Spaces with the Aim of Providing Conditions for Physical Activity of Citizens and a Pleasant Stay Outdoors</b>
<b>Type of measure</b>	Infrastructure
<b>Key measure</b>	Yes
<b>Activity owner</b>	Municipality of Tivat
<b>Implementation partners</b>	„Komunalno“ d.o.o. Tivat i „Vodovod i kanalizacija“ d.o.o. Tivat
<b>Other participants</b>	Infrastructure, state institutions
<b>Implementation timeframe</b>	2024-2030
<b>Estimated financial costs</b>	300.000 €
<b>Source of funding</b>	Municipality of Tivat Budget, funds and donations
<b>Brief description of activities</b>	<p>This measure involves the construction and maintenance of shaded points in urban and rural areas (recreation grounds, zones near health and cultural facilities, high-traffic public spaces, etc.), with the goal of utilising existing and newly planned greenery as much as possible. Each location must have optimal shading in relation to the spatial plan, microclimatic conditions, and architectural microenvironment, as well as at least one source of potable water for public consumption on public areas. The measure also includes the installation of playgrounds, recreational facilities for adults, walking zones with accompanying furniture, and similar features that encourage outdoor activities.</p> <p>The measure encompasses determining locations or areas where a large population can be found, designing the layout of these areas, and implementing works to install equipment and amenities in designated locations. It also includes the creation of a publicly accessible application on georeferenced maps, designed for citizens and visitors, with data on zones that offer more comfortable outdoor conditions during extreme heat (areas with more greenery, water fountains, etc.).</p> <p>The goal of this measure is to reduce the pressure on the healthcare sector during extreme heat, improve the green space system, and promote a more comfortable outdoor experience (which reduces the need for vehicles for recreation and daily rest).</p>

<b>Measure number</b>	18
<b>Measure name and activity</b>	<b>Strengthening Civil Capacities for Preventive Action, Especially in Raising Awareness About Climate Change</b>
<b>Type of measure</b>	Education and awareness
<b>Key measure</b>	Yes
<b>Activity owner</b>	Municipality of Tivat
<b>Implementation partners</b>	Educational institutions
<b>Other participants</b>	Infrastructure
<b>Implementation timeframe</b>	2024-2030
<b>Estimated financial costs</b>	50.000 €
<b>Source of funding</b>	Municipality of Tivat Budget, funds, and donations
<b>Brief description of activities</b>	<p>This measure involves the continuous organisation and implementation of training focused on emergency services and volunteer fire associations, as well as activities aimed at encouraging the population to participate in various training sessions and drills to acquire practical knowledge on how to respond in different crisis situations related to hazards that may arise due to climate change. The measure also includes the procurement of equipment for crisis management and demonstrations of hazards and responses in case of their occurrence.</p> <p>The goal of this measure is to achieve a sufficient level of preparedness to act timely and competently in crisis situations. This is primarily achieved by strengthening the capacity of civil protection, including knowledge and skills in providing first aid.</p>



## 5.2.7 Horizontal Measures

This section defines measures that are important for strengthening the capacity of the municipal administration, and the organisation and implementation of these measures are crucial for ensuring an adequate response during crisis periods.

Measure number	19
Measure name and activity	<b>Identification of Departments Within the Municipal Administration that will be Dedicated to Implementing all Activities and Obligations Related to Climate Change and Commitments Arising from the Covenant of Mayors.</b>
Type of measure	Institutional
Key measure	Yes
Activity owner	Municipality of Tivat
Implementation partners	n/a
Other participants	NVO
Implementation timeframe	2024-2030
Estimated financial costs	100.000 €
Source of funding	Municipality of Tivat Budget, funds, and donations
Brief description of activities	This measure aims to ensure institutional focus on planning, coordination, supervision, and control of all obligations arising from documents related to climate change in the municipality of Tivat. It emphasizes the need for both interdepartmental coordination at the local government level, as well as inter-municipal coordination and coordination with relevant state authorities. This measure also includes strengthening the capacities of all decision-makers and institutional capacities in all parts of the municipal administration, especially in planning and finance, in order to provide an optimal response during crisis periods.

Measure number	20
Measure name and activity	<b>Certification of the Municipal organisation in Accordance with ISO Standard Requirements</b>
Type of measure	Institutional
Key measure	Yes
Activity owner	Municipality of Tivat
Implementation partners	n/a
Other participants	Infrastructure
Implementation timeframe	2024-2030
Estimated financial costs	20.000 €
Source of funding	Municipality of Tivat Budget, funds, and donations
Brief description of activities	This measure aims to ensure the certification of the municipal administration in accordance with the requirements of relevant ISO standards, primarily the quality management system ISO 9001, followed by the environmental management system ISO 14001, and the occupational health and safety management system ISO 45001.
	This measure does not exclude but strongly supports compliance with standards in the areas of information security management (ISO 27001) and energy efficiency (ISO 50001). In project management, it is necessary to comply with the requirements of the ISO 21500 standard. Additionally, it is essential to establish criteria and ensure the general implementation of green procurement principles and sustainable procurement practices in line with ISO 20400.
	The goal of this measure is to create the conditions for the successful implementation of all previously defined adaptation measures, for which it is necessary to meet the requirements prescribed by the mentioned ISO standards.



## 5.3 Action Plan for Energy Poverty

To mitigate the impacts of energy poverty, the following actions are necessary:

- Co-financing of energy renovations for buildings and households belonging to vulnerable groups at risk of energy poverty.

- Simple measures for vulnerable groups of citizens at risk of energy poverty.
- organisation and implementation of social protection centres.

A specific measure for the Municipality of Tivat, which also addresses energy poverty, is:

Measure number	1
Measure name	Reduction of the Number of Energy-Poor Households
Sector	Buildings
Responsible body	Municipality of Tivat
Measure description	<p>Mitigating energy poverty at the local level requires a combination of strategies to improve energy efficiency, reduce energy costs, and provide support to vulnerable households. It is necessary to adopt a holistic approach that combines multiple activities and measures, such as:</p> <ul style="list-style-type: none"> <li>Implementing energy efficiency programs aimed at reducing energy consumption in households. This may include distributing energy-efficient appliances, promoting energy-saving practices, and providing information about energy-efficient technologies.</li> <li>Implementing support programs to improve insulation and energy efficiency in homes. This may involve providing insulation, and installing windows and doors to reduce energy losses.</li> <li>Conducting educational programs to raise awareness about energy conservation and energy efficiency. This can empower citizens to make informed choices that reduce their energy consumption.</li> <li>Encouraging community engagement initiatives to involve residents in decision-making processes regarding energy policies and programs. This ensures that solutions are tailored to the specific needs of the community.</li> <li>Implementing systems to collect and monitor data on energy poverty within the Municipality of Tivat. This data can be used to assess the effectiveness of mitigation measures and adapt strategies accordingly.</li> </ul> <p>This measure foresees the provision of grants to households experiencing energy poverty, which are unable to independently carry out energy efficiency improvements in their properties.</p> <p>It is assumed that the municipal budget will annually allocate funds for the adaptation of at least 5 smaller buildings, with a total amount of up to €40,000 until 2030. The adaptation of buildings includes insulating facades, replacing external joinery, and installing energy-efficient heating/cooling systems.</p>
Start / End of Implementation	2025-2030
Implementation Partners	Eco fond/International Partners
Energy Savings (MWh)	887
Renewable Energy Production (MWh)	n/a
Estimated CO2 Reduction (tCO2)	323,2
Total implementation costs	240.000 €
Source of Funding	Municipality of Tivat Budget, Funds, and Donations
Key vulnerable/sensitive groups that will benefit from the measure	In addition to reducing CO <sub>2</sub> emissions, this measure contributes to reducing the number of energy-poor households and improving their quality of life.



<b>Measure number</b>	2
<b>Measure name and activity</b>	<b>Identification of Vulnerable Social Groups and Critical Infrastructure for the Purpose of Increasing Resilience and Reducing Vulnerability in the Event of Flooding</b>
<b>Type of measure</b>	Education and awareness
<b>Key measure</b>	Yes
<b>Activity owner</b>	Municipality of Tivat
<b>Implementation partners</b>	Centre for Social and Child Protection
<b>Other participants</b>	Infrastructure
<b>Implementation timeframe</b>	2024-2030
<b>Estimated financial costs</b>	50.000 €
<b>Source of funding</b>	Funds, Municipality of Tivat Budget
<b>Brief description of activities</b>	This measure aims to enhance flood response readiness and protect vulnerable groups through appropriate public education. It also seeks to establish adequate regulations related to the implementation of special building conditions in flood-prone areas, particularly in parts of the municipality where critical infrastructure and other valuable assets (such as agriculture, industry, and protected natural resources) are at risk.

## 5.4 Timeframe for SECAP Implementation

Several measures for mitigating and adapting to climate change, as well as measures to reduce energy poverty, are already being implemented in Tivat. Most of the adaptation measures are in the planning phase, with a scheduled start by 2025 at the latest. All measures will have an implementation period until 2030.

The overall financial overview of the measures, in relation to whether they are intended for climate change mitigation or adaptation, as well as the alleviation of energy poverty effects, is presented in Table 13.

**Table 13** Financial Overview of Adaptation, Mitigation, and Energy Poverty Reduction Measures for the Municipality of Tivat

Type of measure	Total estimated cumulative value (EUR)
<b>Mitigation measures for climate change</b>	66.306.050,00
<b>Adaptation measures for climate change</b>	37.205.000,00
<b>Measures to reduce energy poverty</b>	290.000,00
<b>Total</b>	103.801.050,00

U nastavku je dat detaljan pregled vremenskog i finansijskog okvira implementacije svake mjeru zasebno i za svaku kategoriju.



No	Measure / Year	2024	2025	2026	2027	2028	2029	2030	Financing Source	Estimated Value (€)	Reduction in tCO <sub>2</sub> Compared to the 2019 BEI (61,974 tCO <sub>2</sub> )	% Reduction in CO <sub>2</sub> Compared to the 2019 BEI (61,974 tCO <sub>2</sub> )
<b>Measures for Climate Change Mitigating</b>												
1	Providing support to citizens in securing funds for co-financing through loans or other forms of financing aimed at improving the energy characteristics of buildings from donor funds or signing cooperation agreements with local banks that will participate in the project to support the residential (individual and collective housing) and commercial sectors.	x	x	x	x	x	x	x	Municipality of Tivat Budget, funds, and donations	66.306.050,00	25.599	41,31%
2	Providing administrative support for the implementation of photovoltaic systems on the rooftops of family houses, smaller residential buildings, and commercial and service sector buildings.	x	x	x	x	x	x	x	Eco Fund/EPCG/ citizens/business entities	3.000.000,00	9.005	14,53%
3	Preparation of detailed energy audits for all buildings and systems owned by the Municipality, as well as studies on the potential for installing solar power plants on the rooftops of all buildings owned by the Municipality.	x	x	x	x				Municipality of Tivat Budget, funds, and donations	11.270.000,00	8.146	13,14%
4	Insulating all municipal buildings based on detailed energy audits (installing thermal insulation facades, roof insulation, and replacing external joinery).	x	x	x	x	x	x	x	Municipality of Tivat Budget, funds, and donations	10.000,00	n/a	n/a
										370.000,00	427	0,69%



No	Measure / Year	2024	2025	2026	2027	2028	2029	2030	Financing Source	Estimated Value (€)	Reduction in tCO <sub>2</sub> Compared to the 2019 BEI (61,974 tCO <sub>2</sub> )	% Reduction in CO <sub>2</sub> Compared to the 2019 BEI (61,974 tCO <sub>2</sub> )
5	Replacement of the existing inefficient heating and cooling systems with the installation of energy-efficient heating and cooling systems for all municipal buildings.	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	216.050,00	249	0,40%
6	Replacement of existing inefficient lighting with energy-efficient lighting in all buildings owned by the Municipality.	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	200.000,00	34	0,06%
7	Construction of a photovoltaic power plant on the rooftops of the new and old Municipality buildings, the Cultural Centre, and all suitable buildings owned by the Municipality of Tivat.	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	280.000,00	202	0,33%
8	Modernization of public lighting by installing LED bulbs/solar lighting and creating GIS maps for public lighting.	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	500.000,00	380	0,61%
9	Promotion of Bicycle Use and Improvement of Bicycle Transportation	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	100.000,00	1.316	2,12%
10	Installation of electric vehicle (EV) charging stations.	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	50.000,00	n/a	n/a
11	Introduction of electric vehicles in the ownership of the local government and public companies established by the Municipality of Tivat.	Planned	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	250.000,00	177	0,29%



No	Measure / Year	2024	2025	2026	2027	2028	2029	2030	Financing Source	Estimated Value (€)	Reduction in tCO <sub>2</sub> Compared to the 2019 BEI (61,974 tCO <sub>2</sub> )	% Reduction in CO <sub>2</sub> Compared to the 2019 BEI (61,974 tCO <sub>2</sub> )
12	Support for the promotion of the procurement of energy-efficient vehicles for legal entities and citizens	x	x	x	x	x	x	x	National and international funds (e.g., Eco Fund), citizens, and legal entities	50.000.000,00	5.264	8,49%
13	Improvement of public city transport by introducing electric buses and minibuses	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	n/a	n/a	n/a
14	Education and knowledge transfer in the field of energy use, for responsible persons, technical staff, as well as promoting energy efficiency and the use of renewable energy sources for the general public	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	30.000,00	n/a	n/a
15	Mapping of solar and wind potential	x	x	x	x	x	x	x	Financial resources for the development of the study were provided by the international non-governmental organisation The Nature Conservancy (TNC)	n/a	n/a	n/a
16	Introduction and implementation of an energy management system according to MEST EN ISO 50001:2020 in buildings of local government and municipal institutions/companies, as well as the introduction of complementary standards ISO 9001 - Quality Management System ISO 14001 – Environmental Management Systems ISO 45001 - Occupational Health and Safety Management System ISO 27001 - Information Security Management System	Planned	x	x	x	x	x	x	Municipality of Tivat Budget	30.000,00	75	0,12%



No.	Measure / Year	2024	2025	2026	2027	2028	2029	2030	Financing Source	Estimated Value (€)
Measures for Climate Change Adaptation										37.205.000,00
1	Improvement of the green space system and creation of a green infrastructure database	x	x	x	x	x	x	x	N/A	1.000.000,00
2	Sanitation of illegal communal waste dumping sites and creation of conditions for energy production from municipal waste	x	x	x	x	x	x	x	Fonds	2.500.000,00
3	Assessment of the current state and capacities of nuclear shelters and bringing them to full readiness for accepting and accommodating the population during extreme climate conditions (heatwaves, etc.)	x	x	x	x	x	x	x	N/A	20.000,00
4	Intensive cooperation and communication with electricity distribution system operators to improve its resilience to climate change hazards	x	x	x	x	x	x	x	Funds, Municipality of Tivat Budget	5.000,00
5	Implementation of early warning systems for forest fires, floods, heatwaves, extreme cold, and other relevant hazards	x	x	x	x	x	x	x	Funds, Municipality of Tivat Budget	150.000,00



No.	Measure / Year	2024	2025	2026	2027	2028	2029	2030	Financing Source	Estimated Value (€)
6	Creation of comfortable conditions at bus stops across the municipality, especially near locations with high concentrations of children and elderly people	x	x	x	x	x	x	x	Funds, Municipality of Tivat Budget	150.000,00
7	Environmental protection, climate change, and energy efficiency education for the public, tourism and education sector employees, and local government officials	x	x	x	x	x	x	x	Funds, Municipality of Tivat Budget	250.000,00
8	Education in the field of environmental protection, climate change, and energy efficiency for the public, employees in tourism and education sectors, as well as management structures at the local level	x	x	x	x	x	x	x	Funds, Municipality of Tivat Budget	28.500.000,00
9	Construction of the missing sewerage system in the municipality of Tivat, improvement of wastewater disposal systems, and establishment of a GIS system	x	x	x	x	x	x	x	Funds, Municipality of Tivat Budget	100.000,00
10	Regulation of stormwater drainage	x	x	x	x	x	x	x	Municipality of Tivat Budget	1.000.000,00



No.	Measure / Year	2024	2025	2026	2027	2028	2029	2030	Financing Source	Estimated Value (€)
11	Improvement of streams and torrential channels	x	x	x	x	x	x	x	Municipality of Tivat Budget	1.000.000,00
12	Support for events and activities designed to attract tourists during the off-season	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	1.000.000,00
13	Mapping of water sources outside the public water supply system (natural springs, private wells, catchments, etc.) based on publicly available data and data held by municipal authorities	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	80.000,00
14	Encouragement of agricultural development	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	400.000,00
15	Conducting research and creating studies for sensitive areas (potential landslides, erosion areas, torrential streams, valuable natural sites, etc.) for spatial planning documentation purposes	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	80.000,00
16	Conducting research and creating studies for sensitive areas (potential landslides, erosion areas, torrential streams, valuable natural sites, etc.) for spatial planning documentation purposes	x	x	x	x	x	x	x	Municipality of Tivat Budget	500.000,00



No.	Measure / Year	2024	2025	2026	2027	2028	2029	2030	Financing Source	Estimated Value (€)
17	Development of project documentation for the construction, reconstruction, and expansion of water infrastructure protection against the harmful effects of flood waters on water sources, and implementation of works in line with technical documentation	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	300.000,00
18	Construction and equipping of outdoor/ indoor spaces to ensure conditions for physical activity and pleasant outdoor living for citizens	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	50.000,00
19	Identification of municipal administration sectors responsible for implementing all activities and obligations related to climate change and obligations arising from the Covenant of Mayors	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	100.000,00
20	Certification of the municipal organisation in compliance with ISO standards	x	x	x	x	x	x	x	Municipality of Tivat Budget, Funds, and Donations	20.000,00

#### Mjere za smanjenje energetskog siromaštva

Reduction of tCO <sub>2</sub> compared to the BEI 2019 (61,974 tCO <sub>2</sub> )	Reduction of tCO <sub>2</sub> compared to the BEI 2019 (61,974 tCO <sub>2</sub> )
323	0,52%



No.	Measure / Year	2024	2025	2026	2027	2028	2029	2030	Financing Source	Estimated Value (€)
1	Reduction of energy poor households	Planned	x	x	x	x	x	x	Budžet Opštine Tivat	240.000
2	Identification of vulnerable social groups and critical infrastructure for the purpose of increasing resilience and reducing vulnerability in the event of floods	x	x	x	x	x	x	x	Fondovi, Budžet Opštine Tivat	50.000



# 6

## MEHANIZMI FINANSIRANJA REALIZACIJE AKCIONOG PLANA ENERGETSKOG I KLIMATSKOG ODRŽIVOG RAZVOJA



Table 14 provides an overview of domestic and international mechanisms for financing the implementation of the Sustainable Energy and Climate Action Plan for the Municipality of Tivat.

**Tabela 14 Domestic and International Financing Mechanisms for the Implementation of the Energy and Climate Sustainable Development Action Plan for the Municipality of Tivat**

Domestic/ International	Financing Source	Type of Financing	Form of Financing
Domestic sources	Local Government Budget	Own funds	Grant
	Environmental Protection Fund of Montenegro	Own funds	Grant
	Budget of Montenegro	Own funds	Grant
	Investment and Development Fund of Montenegro A.D.	Private funds	Loan
	Commercial Financial Institutions	Private funds	Loan
	Private sector	Private funds	Financing/co-financing
International sources	International Credit organisations (WB, EBRD, EIB...)	International funds	Loan
	International organisations	International funds	Grant/ Technical Assistance
	European Financing Programs	International funds	Grant / Technical Assistance
	Private Sector	Private funds	Financing/co-financing



## CONCLUSION



In the section on implementing measures to mitigate the negative effects of climate change and reduce CO<sub>2</sub> emissions, we focused on improving the energy performance of residential buildings, collective housing, individual buildings, municipal property, as well as activities related to the introduction of renewable energy sources. In addition to the building sector, mitigation measures were proposed for the public lighting sector, transportation, and the cross-sectoral area (measures covering multiple sectors).

### Conclusions:

All activities related to measures that are already being implemented, as well as planned measures, should be continuously monitored until the full implementation of the activities. An annual report should be created, clearly stating the percentage of completed and upcoming activities.

The Municipality of Tivat has already started implementing certain mitigation measures, and it is necessary to invest efforts in the coming period to ensure their completion.

For the new proposed measures by the Municipality of Tivat, interest, initiative, and responsibility have been demonstrated in the implementation of these proposed and adopted measures.

### Recommendations:

Continuous monitoring by the Municipality of Tivat in the implementation of existing activities, as well as ensuring the resources needed for their successful implementation.

Establishing more intensive cooperation with the Environmental Protection Fund, the Ministry responsible for energy, to secure financial resources for both citizens (individuals and legal entities) and for local government needs.

Intensifying efforts to implement planned measures, including the replacement of inefficient heating systems and lighting, to achieve the expected results in reducing CO<sub>2</sub> emissions.

Proactively engaging local communities and building owners to ensure support and inclusion in energy efficiency initiatives.

Monitoring and evaluating the progress in implementing measures will be crucial to identifying any obstacles and opportunities for improvements in the future.

As for climate change adaptation, this area was also addressed within the SECAP for the Municipality of Tivat. A total of 20 measures were identified through an analysis that covers six sectors: infrastructure, water management, tourism, agriculture and forestry, natural resources, and health. This analysis took into account the previously conducted Risk and Vulnerability Assessment (RVA) on climate change, considering the consultative process and the opinions of the Municipality of Tivat.

Some of the measures identified in the plan are already being implemented, some are only planned, and others will be subject to adoption through the development of planning and budgetary documents within the municipal administration.

Key activities with priority, in addition to the measures that are already planned or are already being implemented, include:

- Determining the current status and capacity of the nuclear shelter system and bringing it to full readiness to accommodate and shelter the population in extreme climate conditions (heatwaves...).
- Mapping water sources outside the public water supply system (natural springs, wells, intakes, etc.).
- Conducting research and preparing studies for sensitive areas (potential landslides, erosion-prone areas, flash floods, valuable natural sites, etc.) for the development of spatial planning documents

For efficient planning, implementation, and monitoring the effects of all measures planned in this document, it is recommended that the municipal administration system be certified in accordance with ISO standards.

Also, it is equally important to adopt knowledge and skills in project management, which will significantly facilitate dealing with the complex activities of implementing planned measures and contribute to increasing the reliability of project realization, as well as improving overall efficiency and effectiveness.

The benefits of successful implementation of this plan will be multiple, both for the Municipality of Tivat and for all its residents and visitors. By developing, implementing, and monitoring the realization of the SECAP, the Municipality of Tivat will:

- Demonstrate its clear commitment to energy-sustainable local development based on environmental protection, energy efficiency, and renewable energy sources as the foundation for sustainable development in the 21st century.
- Strengthen its capacity to cope with the adverse effects of climate change and adapt to their duration.
- Utilise opportunities for economic and social growth provided by the development of a low-carbon society.
- Strengthen the foundations of energy-sustainable urban development.
- Ensure access to clean energy for all citizens.
- Establish new financial mechanisms for initiating and implementing energy efficiency measures and the use of renewable energy sources within its authority.
- Improve the quality of life for its citizens.



# 8

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## ANNEX 1 – LOCAL VULNERABILITY AND EXPOSURE OF THE MUNICIPALITY OF TIVAT BASED ON PREVIOUS EVENTS, FROM 2003 TO 2020.

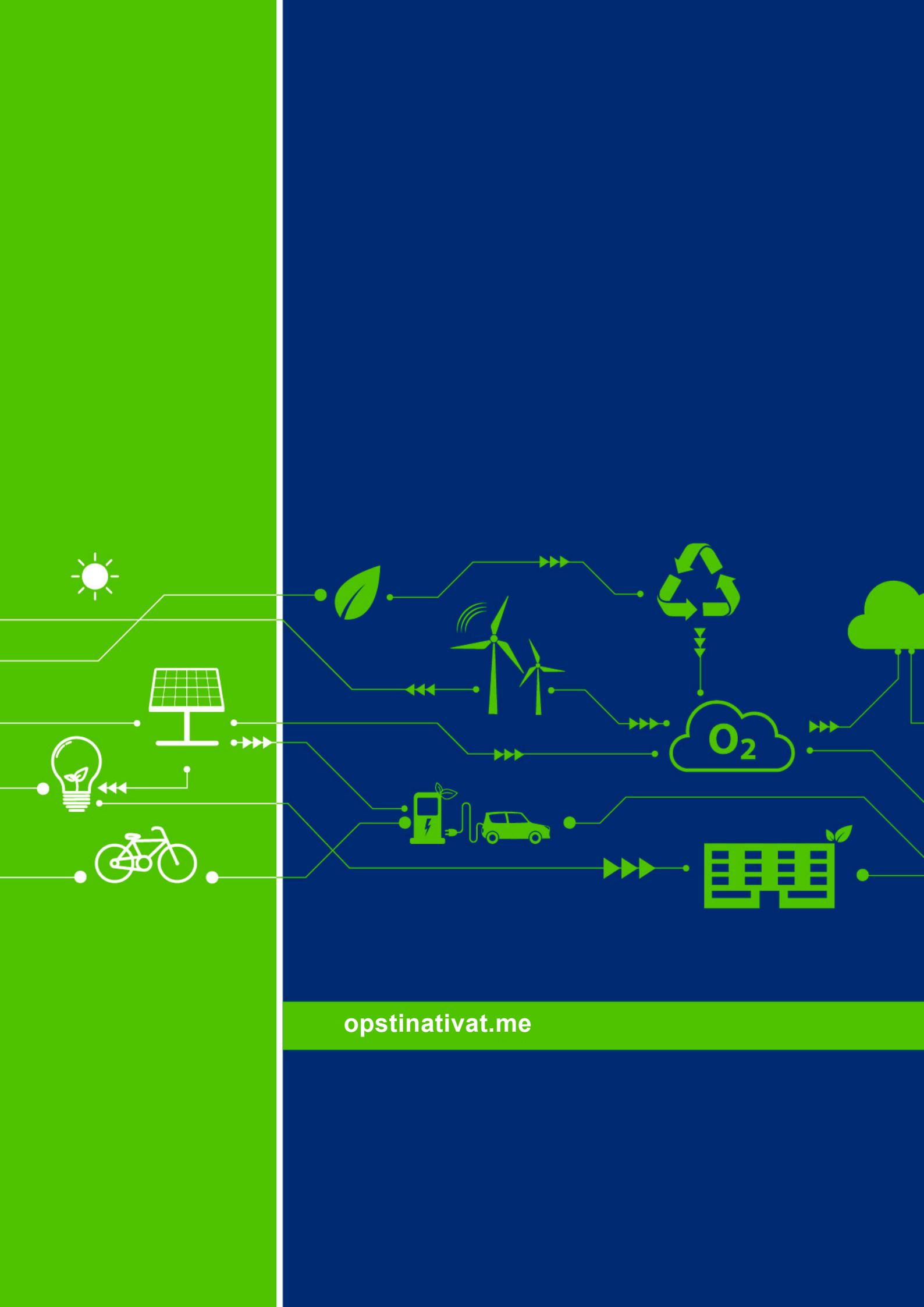
Climate and Weather Hazards	Extreme Weather Events	Consequences	Most Affected Receptors	Area
<b>Heatwaves</b>				
2003		<ul style="list-style-type: none"> <li>Inability to perform construction work on outdoor buildings</li> </ul>	<ul style="list-style-type: none"> <li>Ecosystems</li> <li>Entire plant community</li> <li>Budget of the public company/local government</li> </ul>	
2007-2011	39.7	<ul style="list-style-type: none"> <li>Increased electricity consumption for cooling</li> </ul>	The central urban core, including a large number of buildings and extensive asphalt and concrete surfaces, is particularly affected.	<ul style="list-style-type: none"> <li>Urban areas</li> <li>City parks</li> <li>Park forests</li> <li>Block and linear greenery</li> </ul>
2012	40.1, 39.8	<ul style="list-style-type: none"> <li>Direct and indirect impact (complete and partial drying of plants)</li> </ul>		
2013, 2015, 2017, 2018- 2020	40.2	<ul style="list-style-type: none"> <li>Appearance of plant diseases</li> <li>Reduced vitality and decorative value of plant material</li> <li>Impact on human health</li> </ul>	Vulnerable groups (children, pregnant women, the elderly, individuals with chronic illnesses, socially disadvantaged groups, outdoor workers...)	

Climate and Weather Hazards	Extreme Weather Events	Consequences	Most Affected Receptors	Area
<b>Droughts</b>				
June-August 2000	Consecutive dry days	<ul style="list-style-type: none"> <li>Increased number of forest fires; Increased severity of forest fires; increased costs / economic losses in the year 2000</li> </ul>	<ul style="list-style-type: none"> <li>Low vegetation and maquis</li> </ul>	Area covered by maquis and low vegetation
June-September 2003	Number of tropical days	<ul style="list-style-type: none"> <li>Forest fires in 2005</li> </ul>	<ul style="list-style-type: none"> <li>Forests</li> </ul>	
June -September 2005	higher than normal	<ul style="list-style-type: none"> <li>Increased water consumption and water restrictions</li> </ul>	<ul style="list-style-type: none"> <li>Cultural heritage</li> </ul>	14th-century church and the Blue Horizons coastal complex
July – October 2007	Heatwaves	<ul style="list-style-type: none"> <li>Water scarcity for irrigation in rural areas; Widespread impact on crops; Infestations or diseases caused by drought</li> </ul>	<ul style="list-style-type: none"> <li>Fisheries</li> <li>Water and electricity supply;</li> </ul>	
August-September 2009		<ul style="list-style-type: none"> <li>Increased number of forest fires in September 2009</li> </ul>	<ul style="list-style-type: none"> <li>There will be less than 650 million kilowatts of electricity</li> </ul>	
2011, 2012, 2017, 2018, 2019	Drought has shifted from agricultural to hydrological	<ul style="list-style-type: none"> <li>River water levels near the minimum</li> <li>Increased number of forest fires in 2017; increased burned area</li> <li>Danger to or actual breach of requirements for minimum flow or ecological flow</li> </ul>		



Climate and Weather Hazards	Extreme Weather Events	Consequences	Most Affected Receptors	Area
<b>Heavy rains / floods</b>				
14-15.10.2012			Rijeke	
04-05.03.2015	Serija intenzivnih ciklonalnih aktivnosti praćenih obilnim padavinama	<ul style="list-style-type: none"> <li>Kanalizacioni kanali ne mogu da prihvate toliku količinu vode, pa su uglavnom poplavljenе ulice i trgovi, kao i djelovi saobraćajnica i magistralnih puteva.</li> <li>Velika količina deponovanog otpada;</li> <li>bujice na ulicama, poplavljeni podrumi i pomoći objekti; poplavljenе tehničke prostorije na tivatskom aerodromu</li> </ul>	Javna komunalna infrastruktura	
12-13.06.2016			Putna infrastruktura	
21.-22.12.2011			Aerodrom Tivat	
25-28.09.2020			Saobraćaj	
30-31.03.2022			Kanalizacija; Otežan rad postrojenja za prečišćavanje otpadnih voda	Opština Tivat

Climate and Weather Hazards	Extreme Weather Events	Consequences	Most Affected Receptors	Area
<b>Storms accompanied by strong winds and rain</b>				
09.06.2018	Strong gusts of south-west wind, rain, and hail the size of small eggs	<ul style="list-style-type: none"> <li>Submerged main road</li> <li>Many cars were trapped in the torrents</li> </ul>	Coast, rivers	
21-22.11.2018		<ul style="list-style-type: none"> <li>Rising sea level</li> </ul>	Buildings, houses, construction sites, schools, markets, restaurants	
23-24.02.2019	Short-term strong wind	<ul style="list-style-type: none"> <li>Damage to orchards, vegetables, and olive groves; damage to cars, windows, and building facades</li> </ul>	Overflowing drainage channels for rainfall	
21-22.12.2019	Strong northern wind ('bora') with gusts over 100 km/h	<ul style="list-style-type: none"> <li>Damage to the airport in Tivat and smaller airplanes</li> </ul>	Traffic on main and local roads, maritime traffic	
25-28.09.2020			Damaged water supply network and electrical installations in Tivat	Municipality of Tivat
			190 cubic meters of various materials in torrent channels, on roads, and sidewalks in Tivat	
			Electricity network	
			Greenery	
			Houses: roofs, windows, and doors	
			Human lives	



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