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## NEW METHODOLOGY IN GREEN CITY PLANNING - THE WAY TO SUSTAINABLE URBAN DEVELOPMENT

*Mila Pucar<sup>96</sup>; Sanja Simonović-Alfirević<sup>97</sup>, Marina Nenković-Riznić<sup>98</sup>; Snežana Petrović<sup>99</sup>*

### Abstract

In 2018, the City of Belgrade signed the Covenant of Mayors for Climate and Energy in order to reduce carbon dioxide (CO<sub>2</sub>) emissions by at least 40% and enhance the city's resilience to the effects of climate change by 2030. To implement these goals, a team (authors of this paper) was formed to develop a Sustainable Energy and Climate Action Plan (SECAP) based on the results of the Baseline Emission Inventory (BEI) and Vulnerability and Risk Assessment (VRA). The VRA involved determining CO<sub>2</sub> emissions using an approach based on a series of activities and the reduction of GHG emissions. The impact of the provided climate change mitigation measures was assessed on the basis of a hypothetical baseline scenario (increase in demand in the BEI sectors and socioeconomic parameters). To achieve the mitigation objectives, it is necessary to implement projects in the field of energy efficiency, expand district heating, introduce renewable energy sources in the energy potential of the city, rationalize public lighting and traffic, and continue with intensive urban greening.

**Key words:** *integrated baseline emission inventory (BEI), vulnerability and risk assessment (VRA), climate change mitigation and adaptation, energy and energy efficiency*

### Introduction

Efficient and sustainable energy production and utilization are a precondition for energy stability, economic growth and preservation of a healthy environment. On the other hand, the burning of fossil fuels and significant emissions of carbon dioxide (CO<sub>2</sub>) and other greenhouse gases are accelerating climate change and leading to major socioeconomic consequences. While these problems have not been resolved, laws, action plans and strategies are being adopted across the world in the fields of energy, transport, waste management, management of various risks, etc. Serbia is joining international organisations dealing with these issues, it ratifies agreements, such as the Paris Agreement, by which it has committed to reducing greenhouse gas (GHG) emissions by 9.8% by 2030 (relative to 1990)[1], it enforces laws such as the Law on Air

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Protection [2], etc. In 2015, the City of Belgrade, Secretariat for Environmental Protection adopted the Climate Change Adaptation Action Plan and Vulnerability Assessment (2015) [3].

One of the principal ways to solve these problems is by adopting sustainable energy and climate action plans for some cities in Europe and worldwide, particularly large cities. Following the adoption of the 2008 EU Climate and Energy Package, the European Commission established the Covenant of Mayors [4] to support the efforts of local authorities in implementing sustainable energy policies, primarily with regard to climate change mitigation and reduction of fossil fuel consumption. By signing this Covenant in 2018, the City of Belgrade committed to reducing CO<sub>2</sub> emissions by at least 40% in certain sectors, to increasing the city's resilience to the effects of climate change, and to ensuring access to sustainable energy by 2030. To achieve this, projects focused on energy efficiency need to be implemented, the district heating network should be expanded, the city's energy potential should include renewable energy sources, public lighting and transport should be rationalised, and intense urban greening should continue. At the session held on 9 June 2021, the Assembly of the City of Belgrade adopted the Sustainable Energy and Climate Action Plan (SECAP), published in the Official Gazette of Belgrade / Year LXV, No 44 of 10 June 2021 [5], and the Green City Action Plan (GCAP), published in the Official Gazette of Belgrade / Year LXV, No 45 of 10 June 2021 [6]. Strategic environmental assessments were carried out for both action plans. Their aim was to evaluate the activities proposed in the plans [7] [8]. The SECAP Action Plan, which will be partially considered in this paper, is based on the results of the comprehensive Baseline Emission Inventory (BEI) and the Vulnerability and Risk Assessment (VRA), which were also the first step in the development of the SECAP. The VRA entailed determining CO<sub>2</sub> emissions using an approach based on a series of activities and reduction of greenhouse gas emissions. The impact of the provided measures on climate change mitigation, individually and combined, was assessed based on a hypothetical baseline scenario, which is based on a rise in demand in BEI sectors and social and economic parameters. The authors of this paper were involved in some stages of the Action Plan, in particular the development of the Baseline Emission Inventory (BEI), which will be discussed in this paper.

### **The main idea and objectives of the SECAP**

As part of the Sustainable Energy and Climate Action Plan (SECAP) [5], a new methodology was developed [9] in relation to somewhat similar documents, such as the Sustainable Energy Action Plans (SEAP) [10], which had not sufficiently covered the area of climate change. The Covenant of Mayors for Climate and Energy requires its signatories to develop studies assessing climate change risks and vulnerabilities so as to highlight the potential and deficiencies of specific areas. The objective of this Action Plan is to ascertain the nature and scope of risks by analysing potential hazards and assessing the vulnerability that may potentially jeopardise or harm the

population, or the property and the environment on which it depends. In this way, appropriate adaptation strategies could be defined, which are included in the SECAP activities, and will directly enhance the resilience of the area. To identify all energy consumers, the obligations under the Covenant of Mayors pertain to the entire geographical area of the local authorities, taking account of the energy consumption in all sectors of activities which the local authorities may influence. The entire initiative is carried out through various activities in public and private sectors, and is mainly aimed at raising energy awareness among stakeholders by promoting successful projects and initiating new activities. As was the case for the SEAP, the SECAP entails the assessment of the local context in terms of geography, demographics and energy, along with the CO<sub>2</sub> Baseline Emission Inventory which relates to a certain baseline year, the clear identification of emission reduction targets, and planned activities within timeframes, assignment of responsibilities and impact and cost assessment. In this sense, the SECAP retains the same methodological framework as the SEAP, but is considerably different in terms of objectives, timeframes and the limited period of development.

The main objective of the SECAP is to define climate change mitigation activities which enable the reduction of CO<sub>2</sub> emissions by at least 40% by 2030, with the SECAP development time limited to two years from joining the Covenant. By signing the Covenant of Mayors in 2018, the City of Belgrade committed to reducing its CO<sub>2</sub> emissions by at least 40% in certain sectors, to enhancing the city's resilience to the effects of climate change, and to ensuring access to sustainable energy by 2030. For the purpose of preparing the Sustainable Energy and Climate Action Plan for the City of Belgrade, a strategic environmental assessment was performed, aimed at conducting a multi-criteria evaluation of the impact of the planned activities on environmental protection objectives. The purpose of preparing a strategic environmental assessment of the impact of this Action Plan was to identify the potential impacts of strategic decisions and targets on the quality of the environment, and the envisaged measures for the mitigation of those impacts and their lowering to acceptable limits, without creating any conflicts in space, and taking into account the capacity of the environment in the observed area [7] [8].

### **The new methodology for climate change mitigation in certain sectors**

The new climate change mitigation methodology relates to initial research in some sectors, such as buildings (public, tertiary and residential); equipment / facilities; transport; industry; waste; local electricity production; and local heat production and public lighting. A part of the activities which this team worked on pertains to the development of the BEI – Baseline Emission Inventory, which included the following activities: defining the baseline year based on analyses and available data; selection of the sector of energy consumption for analysis (in cooperation with the broader team); collection of data for selected sectors; development of BEI forms and SECAP templates;

collection of data for initial projections; development of the baseline scenario; collection of information on existing strategies and action plans for the selected sectors.

Based on the established baseline values, the following steps required coordination with the development of the Green City Action Plan (GCAP), City of Belgrade. The general vision, strategic objectives and a list of potential options / activities were defined. The general objective of climate change mitigation as part of the SECAP is to reduce CO<sub>2</sub> emissions established in the BEI by at least 40% until 2030, compared to 2015 data. A more long-term objective after 2030 was not under consideration. During the project, the role of the Working Group, which also included the authors of this technical solution, entailed the preparation and submission of materials, definition of objectives, proposal of options for implementing measures, etc. All these activities were carried out through the cooperation between the expert consultant team and the working group, including several workshops and communication at various stages of the project.

### **Baseline Emission Inventory (BEI)**

The BEI was developed by calculating the reduction of CO<sub>2</sub> emissions in line with the proposed activities. Impacts of measures on climate change mitigation, individually and combined, were assessed according to a hypothetical baseline scenario. The Belgrade BEI was defined for 2015 and only takes into account CO<sub>2</sub> emissions. To obtain valid data for the year in question, many sources that this team could obtain were used [11], [12], [13], [14]. The BEI covers the following sectors:

- Buildings, equipment and facilities; residential buildings; city buildings [15], [16], [17];
- Public lighting [18] [19];
- Transport: city vehicles; public transport; private transport;
- Local electricity production; heat production [20], [21], [22], [23], [24].

The energy utilised in Belgrade in 2015 in the above sectors equalled 14,376 GWh, and related CO<sub>2</sub> emissions amounted to 7,671 Gg. As Figure 1 below shows, 55% of the energy was used by the residential sector, followed by transport with 38%. The most used source was electricity (36%), followed by diesel fuel (27%). Electricity was used the most by the sector of buildings, and the quantity of used electricity was so great because most households still used electricity for heating and hot water, since the heat pipe network did not cover the entire city. The natural gas distribution network was still in development.

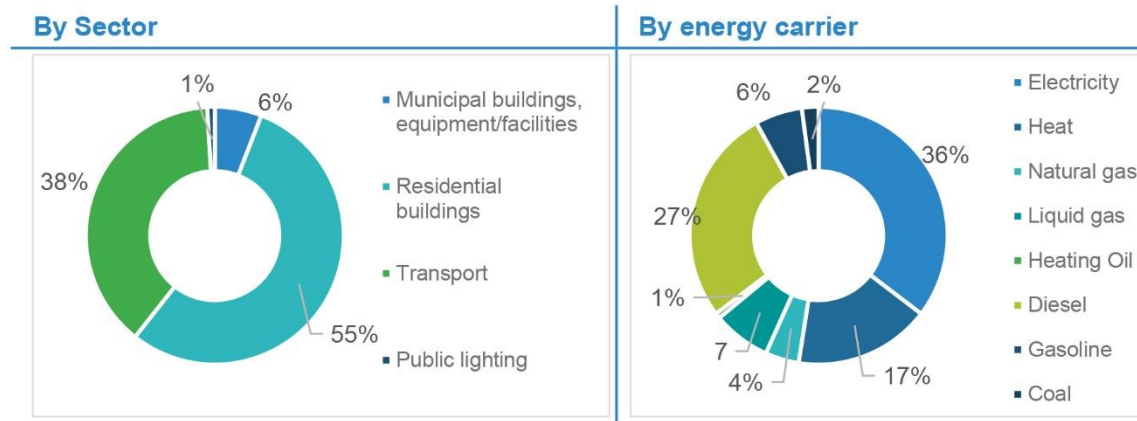


Figure 1: Energy consumption by sector and energy carrier in Belgrade in 2015

Figure 2 shows CO<sub>2</sub> emissions by sector and source for 2015. Of these emissions, 68% originated from the residential sector, which was followed by transport, accounting for only 19%. The sector of buildings accounted for 79% of emissions. As regards energy sources, 68% was emitted by electricity consumption because of the high national emission factor for electricity (1.1 t CO<sub>2</sub>/MWh), which is 3-5 times higher than the emission factor used for fossil fuels.

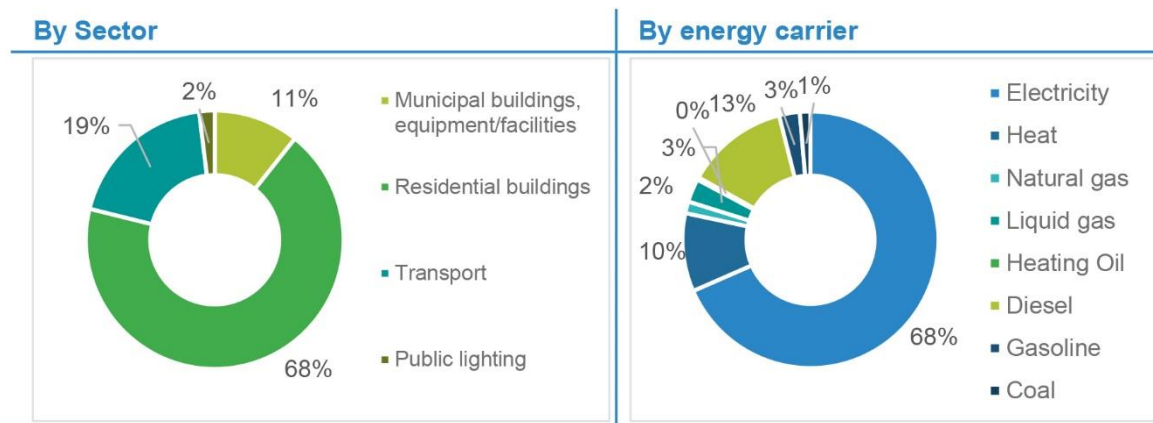


Figure 2: CO<sub>2</sub> emissions by sector and energy carrier in Belgrade in 2015

## Conclusion

The key existing plans by sector were analysed to define potential projects that could be included in the GCAP and SECAP. These options were collected in a “wider list” in the form of a table highlighting all potential projects and deficiencies in order to define challenges. Opinions of technical experts were requested through the City’s Working Group, leading to the shortening of the wider list. Each activity in the short list was subsequently evaluated based on a series of qualitative criteria to ensure that their impact on GCAP and SECAP objectives was efficient and suitable. Finally, a short list

of options was given, along with evaluation details. The SECAP Action Plan will be carried out by the team of the Project Implementation Unit (PIU), which should include all subjects and institutions responsible for large CO<sub>2</sub> emissions. Coordination of this team should be provided by the Mayor's office. The role of the Project Implementation Unit will be to initiate projects, manage their implementation, ensure that SECAP objectives are met, and prepare regular reports for the Covenant of Mayors.

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