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Energy Efficiency and Waste Management in Bosnia and Herzegovina compared to Austria

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Abstract

Sustainable development became a very important topic around the world, because it is related to all countries, developed and developing. It covers a broad range of topics: health, reducing poverty and hunger, improving education, development of clean technologies, economic growth, innovations, and climate change, conservation of natural resources and institutions and partnerships for achieving all sustainable development goals.

The aim of this work is to analyze the current state of selected Sustainable Development Goals - SDGs (adopted in 2015 by UN General Assembly), related to the topics of energy efficiency and waste management. These two areas (energy efficiency and waste management) are not developed systematically in Bosnia and Herzegovina, but they are from huge importance, because they are related to the environment protection, human health and safety. The energy inefficient buildings or wild dumpsites, which are very common in Bosnia and Herzegovina, are source of environmental pollution and a significant amount of greenhouse gases that cause damages and negatively impact our environment and our health (increase of water acidity, temperature rise, disruptions in water and soil bodies, health issues like transpiratory diseases, etc.)

The research questions of this work are:

1. How Bosnia and Herzegovina implements SDGs? (Chapter 2. Integration of the SDGs into the Bosnia and Herzegovina's Frameworks regarding SDGs in the European Union and the 2030 Agenda)
2. How developed are the energy efficiency (SDG 7) and waste management (SDG 12) in Bosnia and Herzegovina? (Chapter 4.1 Achievements related to selected SDGs in Bosnia and Herzegovina until April 2019)
3. How the country plans to improve the state of energy efficiency and waste management? (Chapter 5. Current state and relevant projects in Bosnia and Herzegovina)

The definition of sustainable development and SDGs are given in the first chapter, followed by introduction of energy efficiency and waste management as well as their importance to SDGs. The 2030 Agenda is also included in the work and the analysis of its implementation in Bosnia and Herzegovina and European Union with the focus on Austria. And finally, the review of ongoing projects with the focus on improving energy efficiency and waste management in Bosnia and Herzegovina is given. Every relevant project is shortly described and given are the information on objective of the project, needed activities, donors and partners of the project.

The summarized information on ongoing projects in energy efficiency and waste management in Bosnia and Herzegovina should propose the roadmap for the country's development and progress analogous to the members of EU.

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1. Introduction to Sustainable Development

1.1 Brief historic overview of the concept of Sustainable Development

The term *"sustainable"* was used a long time ago by the fisheries managers in term of the *"maximum sustainable yield"* to signify the maximum fish catch per year reliable with a stable fish population. [1] Also, in forestry term sustainability was used 300 years ago. The term was related to the work of Hans Carl von Carlowitz and his book "Sylvicultura oeconomica" from 1713. In this book Hans Carl von Carlowitz had introduced the concept of sustainable use of timber (timber shortage in Europe in 17thcentury). [2] On the global level, the challenge of maintaining sustainability in regard to economic growth and development was firstly introduced at the UN Conference on the Human Environment in Stockholm in 1972. Eight years later, in 1980, publication "World Conservation Strategy: Living Resource Conversation for Sustainable Development" denoted that through the conservation of living resources, sustainable development can be achieved. After that, The Brundtland Commission defined the *concept of sustainable development* as: "Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This definition and concept of sustainable development was adopted at the Rio Earth Summit in 1992. Later, in 2002, at the UN World Summit on Sustainable Development (WSSD) in Johannesburg, the idea of linking three components of sustainable development – economic and social development and environmental protection was accepted. This concept was then also emphasized on the 20th anniversary of the Rio Summit. [1]

1.2 How Sustainable Development Targets can be achieved?

To analyze the pathways of achieving sustainable development, it is important to know that there are different aspects of sustainable development. First aspect is the *analytical* one, which helps to understand relationships between economy, society, environment and politics. And the second aspect is the *normative* one, which deals with implementation of Sustainable Development Goals (SDGs) and their accomplishment. Overall goal should be achieving of inclusive and sustainable economic development that is stimulated together with economic, social and environmental purposes. The basic principle of sustainable economic development is that the environmental problems in developing countries come from the lack of development and from inability to overcome extreme poverty. People in poor countries do not have any other option, but to choose the instant economic benefit at the cost of the long-term sustainability. So, the most important concern of *sustainable economic development* is to ensure the access to sustainable livelihoods to everyone and to reduce the absolute poverty through lasting livelihoods, which reduce the resource

exploitation, environmental degradation, cultural and social division. Additionally, the sustainable economic development requires creation and designing of projects according to the needs of people who should benefit from them. [3]

This can be done only, if a fourth objective is involved – *good governance* of governments and businesses. Good governance means that public and private sector work according to law, transparent and responsible to stakeholders, but also with interaction with public when it comes to climate change, environmental pollution, waste, land use, fairness and honesty in business and politics. [1]

Between 2012 and 2015, the 193 countries of the UN General Assembly worked together to agree on seventeen *Sustainable Development Goals (SDGs)*. These were adopted on September 25, 2015. They combine three pillars of sustainable development: economic development, social inclusion and environmental sustainability. These goals are summarized together with their logos in fig. 1. Additionally, to seventeen goals, 169 detailed targets were adopted. Each country should choose some of the targets according to the national circumstances and priorities. [1]

Figure 1: Sustainable Development Goals (SDGs) and their Logos [4]

SDG 1: End extreme poverty.
SDG 2: End hunger and promote sustainable agriculture.
SDG 3: Ensure healthy lives for all.
SDG 4: Ensure quality education and lifelong learning.
SDG 5: Achieve gender equality and empower women and girls.

SDG 6: Ensure availability and sustainable management of water and sanitation.
SDG 7: Ensure access to affordable, sustainable modern energy.
SDG 8: Promote sustainable economic growth and decent work for all.
SDG 9: Build resilient infrastructure and promote sustainable industrialization.
SDG 10: Reduce inequalities within and among countries.
SDG 11: Make cities and human settlements sustainable.
SDG 12: Ensure sustainable consumption and production patterns.
SDG 13: Take urgent action to combat climate change and its impacts.
SDG 14: Conserve the oceans and marine resources.
SDG 15: Protect and restore terrestrial ecosystems, sustainably manage forests, and halt biodiversity loss.
SDG 16: Promote peaceful and inclusive societies.
SDG 17: Strengthen the means of implementation of the SDGs.
Shortly explanation of the seventeen SDGs is given in the Glossary at the end of the work.

SDGs are designed in order to help the change from the "business as usual" to a new age of sustainable development. It is on the government, business society and world population to implement them, until end of 2030. [1]

Initiative called The World in 2050 (TWI2050) published in July 2018, report "Transformations to Achieve the Sustainable Development Goals". In this report six major transformations are described to help the world to achieve SDGs. [5] Shortly, these six transformations are explained later in the chapter 2.4 Implementation of the SDGs in European Union (EU).

One may ask, is it really possible that some set of goals can make a huge difference? This question can be answered simply on the example of the Millennium Development Goals (MDGs), which were adopted together with the "Millennium Declaration" in 2000 by UN General Assembly. The evidences that these goals were helpful for the improvement are: acceleration of poverty reduction, better disease control, progresses in building better infrastructure and increased schooling rates. [1] The most important achievements of the MDGs were: more than 50% reduction of the number of people living in extreme poverty (1.9 billion in 1990 to 836 million in 2015), in majority of countries the gender parity in primary school has been accomplished, the ratio of kids dying before their fifth birthday has been reduced by more than a half (from 90 to 43 deaths per 1 000 live births since 1990), 45% reduction of maternal mortality, more than 6.2 million deaths from malaria have been prevented between 2000 and 2015 and through better tuberculosis diagnosis 37 million lives were saved between 2000 and 2013, better sanitation for 2.1 billion people worldwide and development assistance from developed lands increased for 66% from 2000 and 2014, reaching $135.2 billion. [6]

Next question which could appear is why do goals matter? The world requires resilience and has to be focused on improving equality, health care and education situation of all generations, reducing poverty and hunger, protect resources and avoid destructing conflicts, accomplishing of sustainable development, which needs a lot of effort, because our planet is overcrowded, divided, distracted and it is very difficult to take in account all of the differences and to proceed in wished direction. Key features of why the goals matter are [1]:

- Goals help governments, organizations and people to agree on directions in which their development should occur;
- Peer pressure is second key characteristic of SDGs. Each country is going to be compared with others. So, here it is important that each country shows an effort in implementing of goals in order to make a progress;
- Mobilizing "knowledge communities" or so-called epistemic communities. Those communities are systems of skilled sciences, knowledge and practices around specific tasks like growing food, fighting diseases or implementing city plans. When the goals are defined, the epistemic communities come together and suggest actions for reaching results and
- Last but not least, goals are not only important for mobilizing networks of knowledge expertise. They are also important for stakeholder networks including community leaders, politicians, government ministries, the scientific community, nongovernmental organizations and foundations. This process is known as multi-stakeholder process.

In order to make SDGs possible and to realize them, two specific instruments are important. First is *backcasting*, which means setting goals for the specific date and then investigate the problem from target to the present – backward in time. [1] So, the desirable sustainable scenario is imagined after which comes to looking back to activities and steps needed in order to achieve wished plan. [7] Question that follows the idea of backcasting is what we need to do today to reach desired outcome. [8] Backcasting is a powerful tool when: addressing complex issues which affect many sectors, incremental change is not enough, externalities are dominant and responsibility is not carried by the one who caused them. [9]

Second tool is *technology road-mapping*. It includes questions like: what are the main challenges, what technological obstacles are between now and future, etc. To achieve sustainable development, different changes in infrastructure such as in energy sector are needed. The technology road mapping should help to analyse best options for storing of wind energy and solar energy, low costs and low carbon energy alternatives. [1]

1.3 Financing for Sustainable Development and Principle of Good Governance

As it is mentioned earlier, for achieving sustainable development new infrastructure in water, energy and transport sector; new educational systems and improved health care are needed. But, who will pay for all these transformations? [1]

Citizens are engaged in markets as *consumers or suppliers* of the services and goods. The Global Outlook on Financing for Sustainable Development (2019) suggested the market analogy for the financing of sustainable development. The markets are based on supply and demand forces. The demand side for sustainable development are the financing needs – need for financing of sustainable development projects. The supply side represents worldwide savings (many forms, shareholders' money, taxpayers' money and investors' money), which are channeled through investments to sustainable development projects. [10] Through *taxes* governments can afford health care, public education, police services; and funding the scientific research that is important for technological progress. Also, from the crucial importance are *international helps* from taxpayers from the high-income land to the poor countries. This last option of financing poor countries with the help of taxpayers from other countries is a strategy of structural funds at EU. There is a controversial issue, since poor countries might have governments and political systems, which might not follow all sustainable goals. But, there is also arguments to improve this way of financing through international organizations, thinking that this is essential, especially when it comes to people who face life-or-death threat every day. [1]

The Addis Ababa Action Agenda of the Third International Conference on Financing for Development was adopted in 2015 and it supports a new universal outline for financing sustainable development. All financing streams and strategies are associated with economic, social and environmental preferences. This action plan consists of over 100 actions, which help in accomplishment of SDGs and include all origins of finance, technology, modernization, commerce, data, etc. [11]

The national planning was already introduced in MDGs Agenda and it still exists in planning of SDGs. National strategies are good associated with the 2030 Agenda. But, financing is very often very weak part of every national plan. 79 of 107 plans (at international level) do not give specific details on their financial strategies. They mostly concentrate on the yearly government budgets as the most important source of financing, also including on-budget development support and/or public-private partnerships. [12]

A sustainable development strategy of one country should define *what* has to be financed and frameworks on integrated financing explain *how* the national strategy is going to be implemented. Key elements of integrated financing frameworks are [12]:

1. "*The main sources of financial and non-financial means of implementation"* – public and private, national and international investment, technology or capacity building have to be organized to support sustainable development;
2. *"A national financing strategy"* – financing strategy should be aligned with the national sustainable development plans. It also prioritizes policies that have best response to the national goals and
3. "*The institutions and processes that underpin these relations"* – policy design and proper implementation.

Three traditional aspects of sustainable development (economic development, social inclusion and environmental sustainability) have to be supported by the good governance. Good governance encircles public and private sector, and large multinational corporations in the private sector. [1]

There are five shared principles of governance for the public and private sector [1]. First principle is *accountability*. Businesses should be accountable to markets and to the court of law and to the court of public opinion. Governments need to be accountable to their citizens, which means that governments will be responsible for the following of the set rules or targets. Second principle is *transparency*. Citizens, as human beings and market participants intending to sustainable development can support government and business as accountable for their actions, if they are informed about government's actions. So, institutions have to prevent secrecy in business and governments. Thirdly, citizens should *participate* in decision making through elections, public discourse, public deliberations and hearing on regulation. Also, business should involve stakeholders through institutional means. Fourth principle is *polluter pay principle*. This is an important rule dealing with the regulation of the production and infrastructure sector. For example, if some company pollutes air or water, it needs to bear the costs or avoid the pollutions to be more efficient. And at the end, the fifth principle refers *to commitment to sustainable development*, which implies development of targets and visions and awareness building. [1]

2. *Integration of the SDGs into the Bosnia and Herzegovina's Frameworks regarding SDGs in the European Union and the 2030 Agenda*

2.1 Integration of SDGs into the Frameworks in all Entities of Bosnia and Herzegovina

One of the biggest obstacles in Bosnia and Herzegovina regarding the implementation of the SDGs is the complex administrative system. The SDG Framework document in Bosnia and Herzegovina outlines priorities for reaching 2030 Agenda and does not cover mechanisms for practical initiation. So, the best solution is that governments incorporate SDGs through strategic documents. The engagement of SDGs through strategic documents will be done by creating strategic framework for the institutions of Bosnia and Herzegovina at institutional level and according to their responsibilities. So, the legal framework for planning the work of the institutions of Bosnia and Herzegovina predicts *two planning documents*, one mid-term (three years) and an annual work program of the Council of Ministers of Bosnia and Herzegovina and their institutions. These documents will name areas of urgency of the SDG framework and also make three-year and annual budgets. The institutions of Bosnia and Herzegovina will on this way contribute to the achievement of the SDGs according to their respective powers. [13]

As an example, Brčko District will design its Development Strategy for time period 2020-2027. The processes will be participatory and the principle of sustainable development will be the main guidance. The strategy will emphasize vision and priority areas, targets and indicators defined by the SDG Framework in Bosnia and Herzegovina. Also, some targets and indicators can be added that are specific priority of Brčko District. The Government of Brčko District is going to make a decision on mid-term and annual plans and reports for more systematic monitoring of SDGs. Form the high relevance is to create connections between strategic, mid-term and annual planning and financial planning, which will guarantee that implementation of SDGs is related to the mid-term and annual budget of Brčko District. Any new strategy which is designed for Brčko District needs to be associated with the country's SDG Framework. [13]

The entity of *Federation of Bosnia and Herzegovina* is obligated to unite its strategic documents with 2030 Agenda and all relevant strategic documents at the state level. The Development Strategy 2020-2027 for Federation of Bosnia and Herzegovina will be designed based on the four pillars of sustainable development: *social, environmental, economic and cultural* and the five P's: *people, prosperity, planet, peace and partnership*. Goals and priorities for Federation of Bosnia and Herzegovina will reflect the priorities defined within the SDG Framework in Bosnia and Herzegovina. This strategy represents a platform for the design of the development strategies of the cantons and local governments in the entity, so that all levels of government in the entity will assist in the accomplishing of the SDGs. Also, all institutions have to monitor progress that will be annually reported. [13]

The second entity of the Bosnia and Herzegovina, *Republika Srpska*, as well, introduced plans for its future strategic planning and development management systems. The working group was made already in July 2018, with the task to propose improvements of the current system, principles for the future systems, including sustainable development. Until now, Republika Srpska has not a development strategy, which defines development preferences. So, the Government of Republika Srpska is about to initiate the design for sustainable Development Strategy for 2030 with all priority areas, indicators and targets. [13]

2.2. Integration of the SDGs in the European Union

The inclusion and mainstreaming of the SDGs into national policies, plans and strategies is from huge importance in the European Union. All countries have had to consider their national realities and circumstances and accordingly set the actions in order to achieve SDGs and targets. There are three steps, which countries can implement in SDGs mainstreaming [14]:

1. Review all strategies and plans at the national, sub-national and local levels and compere them to the global SDGs and targets in order to realize the gaps and provide plans for change;
2. Introduce targets relevant at the national level and
3. Integrate the commendations and the insights from the above steps into plans according to the capacities and resources.

The implementation of the SDGs in the EU has to be internal and external. The internal dimension means that SDGs have to be connected to the Europe 2020 Strategy (COM(2010) 2020) and the EU Sustainable Development Strategy (200l: COM/2001/0264 final, revised in 2006 and 2009). [15]

The *Europe 2020 Strategy* is a ten-year strategy that was recognized as the main path for implementation of SDGs in Europe. It predicts a transition to smart, sustainable and inclusive growth in Europe. It also encourages the action for climate change. On the other hand, there are also critics on the Europe 2020 Strategy, because the strategy itself is not a sustainable development strategy. It is not specified, if it is an appropriate replacement for long-term EU strategy for sustainable development that will be able to take the physical limits of ecosystems into account. [15] At the end of 2019 EU presented The European Green Deal. It represents a guide for future goals for making the EU's economy sustainable. The climate and environmental challenges should be turned into opportunities in all policy areas and make the transition inclusive for all. [16] More information about The European Green Deal is given in the Chapter 2.4.1.

Externally, two processes, EU Global Foreign and Security Policy and the review of the European Consensus on Development determine opportunity for the EU to implant the SDG agenda into EU policies and strategies. [15] The European Consensus on Development was adopted by the EU

Member states in 2017. It represents the vision and outline for development cooperation. The consensus confirms that the poverty eradication is the primary development goal. At the same time it integrates economic, social and environmental pillars of sustainable development and emphasizes the connection between development and other European policies such as peace, security and humanitarian help. [17]

The structure of the consensus is framed around the "5Ps": people, planet, prosperity, peace and partnership. Another important elements are: youth, gender equality, migration, sustainable energy and climate change, investment and trade, good governance and equality, human rights, arrangement with more progressive developing countries and activating domestic resources. [17]

2.3. The 2030 Agenda

The 2030 Agenda presents seventeen SDGs and 169 targets that were adopted in 2015 by all UN Member States. All of this together represent 15-year plan for achieving the SDGs. [18]

The 2030 Agenda should be applied to all countries and all actors, not only for the underdeveloped or developing regions. It is also about building a balance between economy, society and environment. Its *pledge* is to "Leave No One Behind", which means to invest firstly in countries that are at furthest behind living in extreme poverty. The 2030 Agenda also aims for the development that is planned and risk-informed. Also, everyone, scientists, experts in fields of technology and finance, business and academia, as well as civil societies and individuals, should work together to help in reaching the goals. [19]

Since there are only ten years left to achieve SDGs, at the SDG Summit in September 2019, world leaders called for decade of action to accomplish SDGs by 2030, without leaving any country behind. The UN Secretary-General (Antonio Guterres) entitled *three different levels*, on which all sectors of societies should apply in order to achieve the goals. First level is *global action*, which assures bigger leadership, additional resources and cleverer solutions for SDGs. Second level is *local action* that set-in changes in policies, funds, organizations and frameworks of governments, municipality authorities. Last level represents *people action*. It includes youth, mass media, public and private sector and other stakeholders in order to make desired transitions and transformations. [18]

2.3.1 Status of the 2030 Agenda in Bosnia and Herzegovina and Institutional Mechanism

Bosnia and Herzegovina is committed to the 2030 Agenda since 2016. Here it is not only about development, but also about building peace between political unions in the country. With this agreement, Bosnia and Herzegovina strives for a better society and a future, where people, peace, partnership and prosperity together with the care for the planet are fundamental for better future.

The key efforts of Bosnia and Herzegovina's 2030 Agenda are elaboration and adaption of the SDG Framework in Bosnia and Herzegovina. There is also the *"Imagine2030"* initiative that provides a possibility for citizens across the country to help to create the future. This helps to focus on efforts to improve the quality of life and opportunities for the future generations. [20] Bosnia and Herzegovina has a complex administrative system, with over 160 ministries and hundreds of specialized institutions at different administrative levels and 145 local administrations. [20] In September 2017, the Government of Republika Srpska and also the Government of Federation of Bosnia and Herzegovina established the commitment to achieving the United Nations SDGs. Almost one year later, in June 2018, Brčko District joined to Republika Srpska and Federation of Bosnia and Herzegovina in drafting of an Action Plan and a Road Map for utilization of the SDGs. [13]

All institutions in country that are related to the SDGs started in 2018 the creation of the SDGs Rollout Working Group. This group was comprised of the members from following institutions and organizations: *Council of Ministers of Bosnia and Herzegovina* (Directorate for Economic Planning as chief coordinator, the Foreign Ministry of Bosnia and Herzegovina and the Agency for the Statistics of Bosnia and Herzegovina), *Government of Republika Srpska* (Ministry for Economic Relations and Regional Cooperation, the Department for the Strategic Planning of the Secretariat General of the Government of Republika Srpska Institute for Statistics), *Government of the Federation of Bosnia and Herzegovina* (Institute for Development Programming as chief coordinator, the Office of the Prime Minister of the Federation of Bosnia and Herzegovina and the Federal Institute of Statistics), *Government of Brčko District* (Office of the Mayor of Brčko District, the Office of the Brčko District Coordinatior on the Council of Ministers of Bosnia and Herzegovina, the Department for the Economic Development, Sports and Culture and the Brčko District Office of the Agency for Statistics of Bosnia and Herzegovina) and *United Nations in Bosnia and Herzegovina*. [13]

Chief coordinators for the implementation of the SDGs were labeled at the level of the Council of Ministers of Bosnia and Herzegovina, the Government of the Federation of Bosnia and Herzegovina, the Government of Republika Srpska and the Government of Brčko District. They coordinate the activities in respect to their governments, all activities undertaken by the ministries and other institutions, the development of sustainable development strategy, etc. [13]

The *SDGs Rollout Working Group* was organized in order to plan and coordinate all activities of government and other institutions at all levels in the country and also on all levels (regional or international). The members of the working group are suposed to support and give advice to the governments through relevant institutions and to prepare documents and reports for the decision makers at the state, entity, district, cantonal and local level. Members of the group also have to make voluntary reviews for the high-level political forum until 2030. The inputs of reviews are based on the information they get from the respective institutions. The Rollout Working Group is

not connected to any political process in the country and functions independet from the political issues. Another task of the group is to organize workshops and conferences for all citizens, institutions, the private sector, NGOs, academic community, etc. [13]

The Council of Ministers, in coorporation with the institutions of the entities and Brčko District, named responsible institutions for developing an Action Plan and a Road Map for accomplishing SDGs and monitoring all activities.The Ministry for Economic Relations and Regional Cooperation, together with the Strategic Planning and Monitoring Unit of the Secreteriat General of the Government of Republika Srpska and the Institute of Statistics of Republika Srpska is resposible for developing of Action Plan. Also, the Goverment of Republika Srpska has formed the working group, which will promote and apply SDGs in the entity. This working group will also participate in the tasks of the working institutions within the United Nations system in the country and it will coordinate monitoring and implementation of the SDGs in the Republika Srpska. [13]

In the second entity of Bosnia and Herzegovina, Federation of Bosnia nad Herzegovina, the Government assaigned the Federal Institute for Development Programming to coordinate all activities related to achieving and accomplishing of SDGs in this entity. And, Mayor of Brčko District tasked the Government of Brčko District to take a part in drafting of the Action Plan and Road Map for fullfillment of the SDGs. [13]

At the local level, SDGs are implemented accordingly to the internal organization through the cheif coordinatior, who communicates with the ministries responsible for the local authorities, the assocications of municipalities and cities in the entities and local departments. [13]

2.3.2 SDG Index and The "Imagine2030" Initiative in Bosnia Herzegovina

The SDG Index is a number of points that one country scores, between 0 – worst and 100 – best. It describes where the certain country stands in regard to acheiving SDGs. This number is 67.3 for Bosnia and Herzegovina. This represents a lower value than the average regional index value that equals 69.5. [13]

The SDG Index Report from 2018 stated that most countries in Eastern Europe and Central Asia reached good results in addressing poverty, improving health and education, also in providing key infrastructure. But, all of the countries in the region have to put bigger efforts to decouple economic growth from negative impacts on environment. Following figures (fig. 2 and 3) illustrate the SDG Index for Bosnia and Herzegovina and the trend in reaching SDGs. [13]

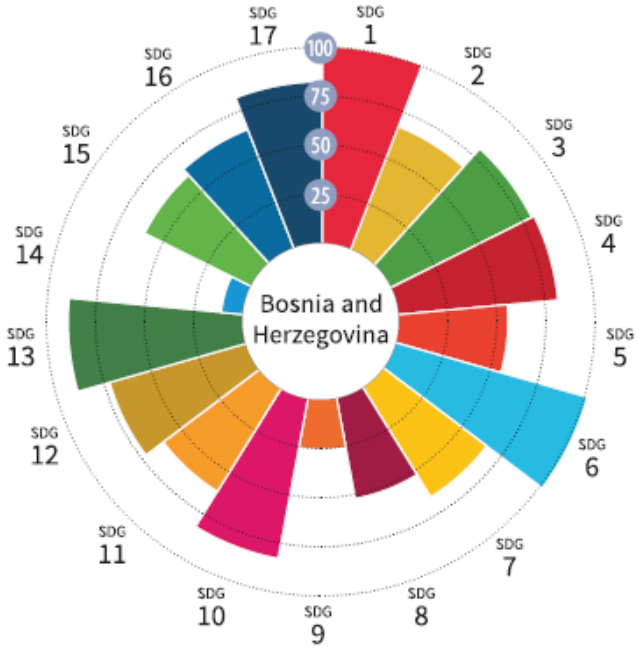


Figure 2: SDG Index for Bosnia and Herzegovina [13]

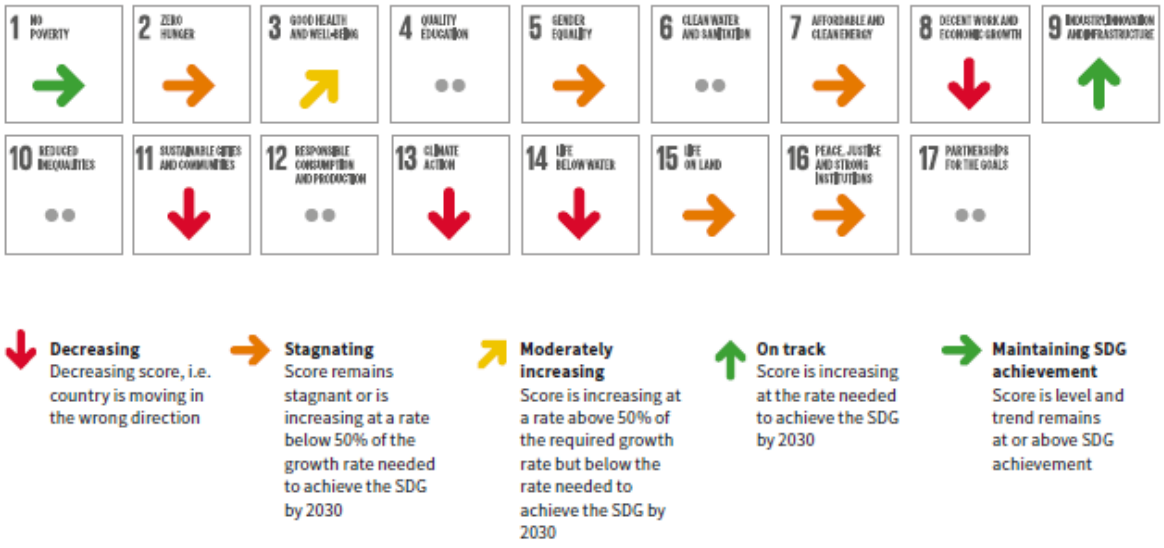


Figure 3: Progresses for each SDG in Bosnia and Herzegovina [13]

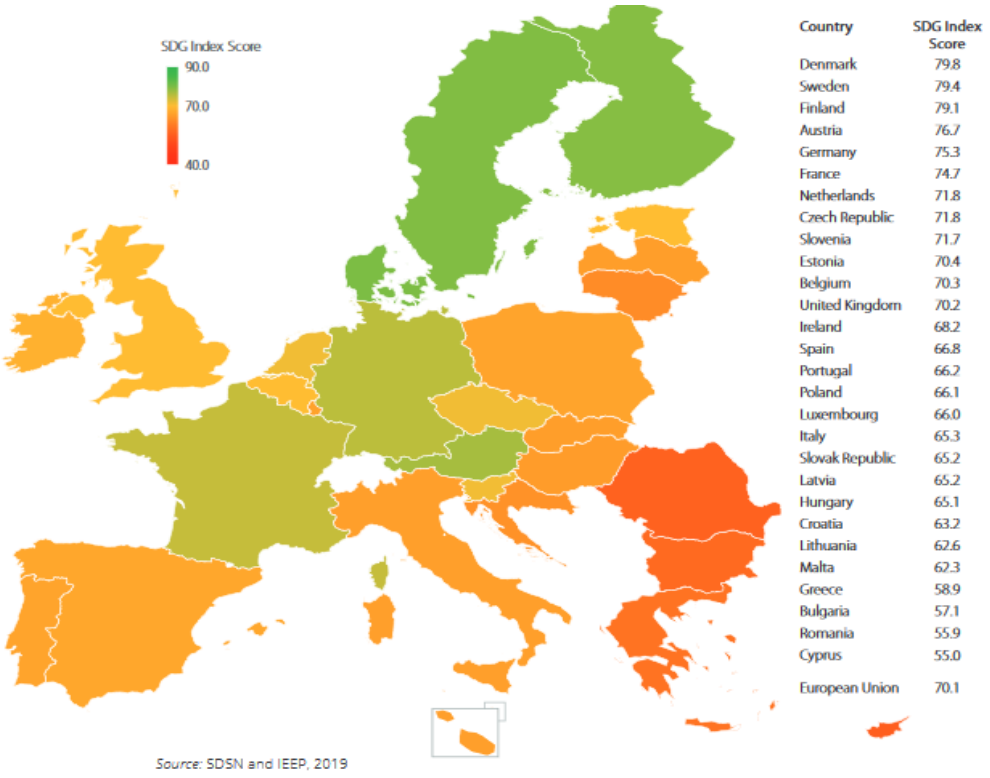
The "Imagine2030" aims to bring voices of citizens into official debates on 2030 Agenda and the SDGs. The Initiative was created and designed in 2016. During the Initiative, until 2019, over 3000 citizens were directly involved through presentations and workshops, also representatives from government, CSOs, the academia, the private sector and citizens in general. [13]

The central effort of the Initiative was to use an innovative *SDG Consultation Tool*. It activates consciousness, discourse and teamwork problem resolving focused on actual problems in society in Bosnia and Herzegovina. It is also a qualitative data collecting method that investigates the positive and negative relations of citizens with past and present, their vision of the future and what needs, values and actions are required to get there. The main idea of the tool is to detect solutions on how to accelerate achievement of the SDGs and their targets. The ideas of the citizens collected through SDG Consultation Tool were analyzed and represent the key input for the creation of Vision 2030 and the SDG Framework document in Bosnia and Herzegovina. [13]

The analysis of the answers and ideas of citizens showed that there is a strong correlation between the SDGs and actual societal urgencies in Bosnia and Herzegovina. They define the needs, problems and answers and prove that citizens want a possibility to co-create the future and take a role in ensuring the changes. [13]

2.4 Implementation of the SDGs in European Union (EU)

The SDGs are highly arranged next to EU's purpose and strategy. According to the SDG Index prepared by the Bretelsmann Stiftung and the Sustainable Development Solutions Network (SDSN), the 10 closest countries to achieving SDGs are in Europe. But, according to The 2019 Europe Sustainable Development Report, no country in EU shows the best score in achieving the SDGs. [21]



Country	SDG Index Score
Denmark	79.8
Sweden	79.4
Finland	79.1
Austria	76.7
Germany	75.3
France	74.7
Netherlands	71.8
Czech Republic	71.8
Slovenia	71.7
Estonia	70.4
Belgium	70.3
United Kingdom	70.2
Ireland	68.2
Spain	66.8
Portugal	66.2
Poland	66.1
Luxembourg	66.0
Italy	65.3
Slovak Republic	65.2
Latvia	65.2
Hungary	65.1
Croatia	63.2
Lithuania	62.6
Malta	62.3
Greece	58.9
Bulgaria	57.1
Romania	55.9
Cyprus	55.0
European Union	70.1

Figure 4: SDG Index in EU [21]

As it is to see from the fig. 4, no EU country has achieved SDGs. The highest scores are in *Northern Europe* (Denmark, Sweden and Finland). The countries in Eastern and South Europe show significantly poorer results. [21]

Countries in the EU perform best results on SDG 1 (No poverty), SDG 3 (Good Health and Wellbeing) and SDG 8 (Promote sustainable economic growth and decent work for all). In contrast to this, the worst results are in accomplishing SDG 2 (No hunger and sustainable agriculture) and SDGs 12-15 that are linked to responsible consumption and production, climate and biodiversity. [21]

The following figure (fig. 5) shows how good or bad the individual SDGs are implemented in the EU.

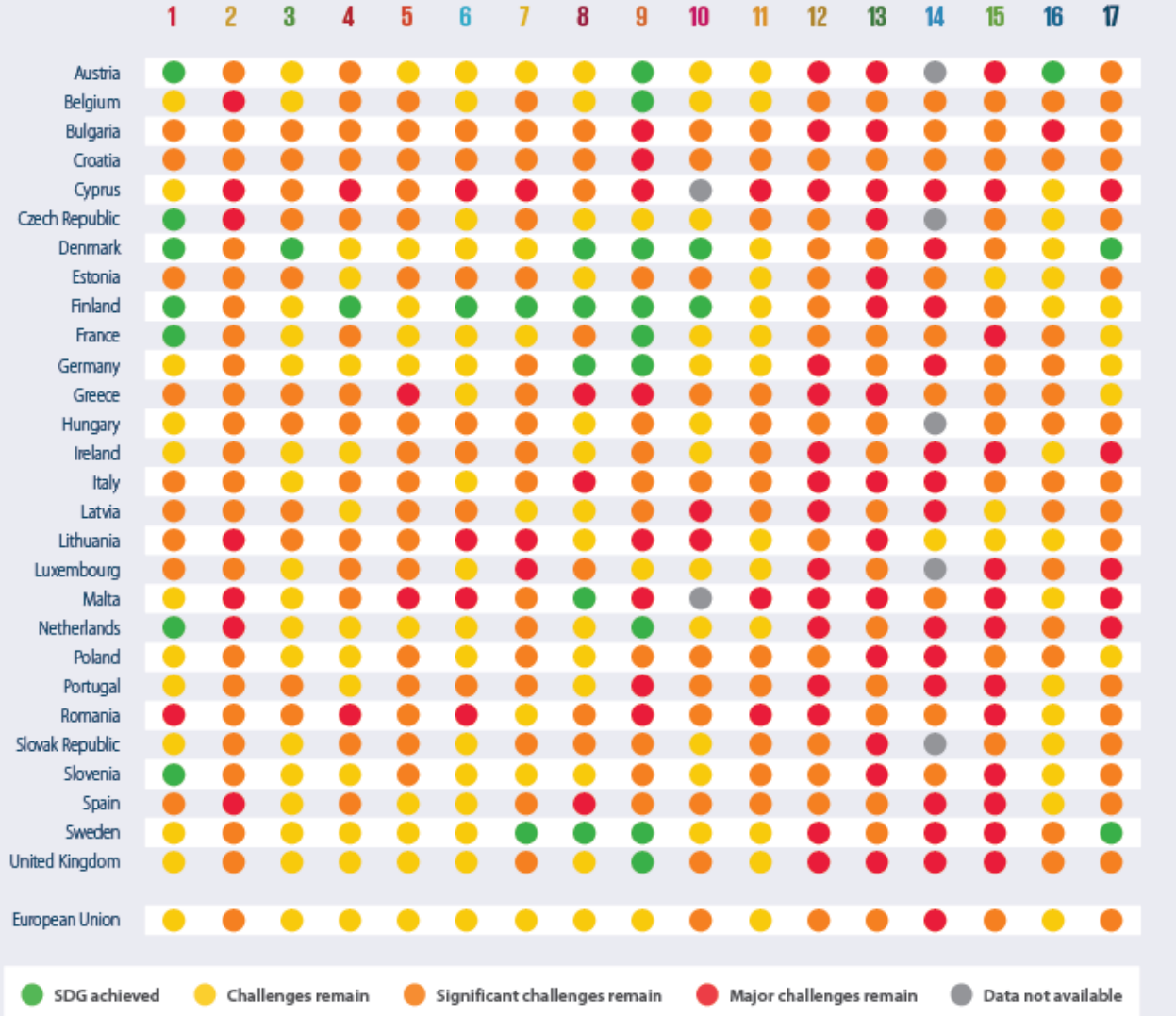


Figure 5: SDG Dashboard for the EU [21]

In order to accomplish the SDGs, SDSN and partners recommend *six SDG transformations*. Each transformation poses challenges for the EU. The six transformations are [21]:

1. Well-educated workforce and innovative economy (based on excellence in education, gender quality and social protection);
2. Health and wellbeing for all (centered on universal health and healthy lifestyle);
3. A climate-neutral and circular economy (built on decarbonising energy systems until 2050 and increasing resource efficiency of industry in Europe);
4. Sustainable food systems, land use and oceans (focused on building of efficient and sustainable agriculture, conservation and restoration of nature, healthy diets, sustainable food and international value chains);
5. Sustainable cities and communities (which are productive, healthy, inclusive, green, with a concentration on small cities and rural areas) and

6. Digital and other modern technologies for sustainable development (built on excellence in key industries by protecting privacy, human rights and social inclusion).

In implementing each SDG Transformation, EU member states face three challenges. The *first* is within the EU itself and its member states and relates to the closing of gap between current realities and SDGs and targets. The *second* is about EU's diplomacy, global leadership and development corporation to promote the SDGs on global scale. And *thirdly*, ensuring coherence between achieving SDGs internally and globally leadership. In order to implement these policies and transformations, the EU needs to find an adequate strategy, line up its budget with the SDGs, ensure reliable reporting and monitoring. [21]

As noted before, there are significant gaps in the EU implementation of and reporting on SDGs, on understanding the overall contribution of the EU budget and policies in achieving the SDGs. Budgets are not systematically aligned with the SDGs. The EU Commission and other European institutions should enable that three key policies are put in place. Therefore, EU needs a *European Green Deal* for sustainable energy circularity, and land use and foods systems, a *supporting infrastructure investment plan and budget* and a *skills and innovation initiative* to promote sustainable development, with a focus on poorer countries. [21]

2.4.1 The 7th Environment Action Programme and European Green Deal for Sustainable Energy, Circularity and Land Use and Food

The 7th Environment Action Programme (EAP) guides the European environment policy until 2020, but it outlines a vision away from that, of where the EU member states want to be by 2050. The EAP contains three aims: [22]

- The EU's natural capital has to be protected, preserved and enhance;
- EU's economy has to become resource-efficient, environmental friendly and low-carbon and
- The Union's citizens should be protected from environment-related pressures.

In order to achieve these objectives, four "enablers" were identified: better application of legislative policies, improving knowledge base by providing relevant information, more investments in environment and climate policies and complete integration of environmental requirements into other policies. Additionally, two priority aims complete the EAP: EU's cities should be more sustainable and to help the EU to address global environmental and climate problems more effective. [22]

The Europe wants to become a first climate neutral continent by 2050. To achieve this, the European Green Deal and the European Climate Law will be the *keystones* for the EU's strategy to accomplish SDGs. The deal must include three components: energy decarbonisation, resource

efficiency and the circular economy and sustainable land use, oceans and food systems. This three strategies have to be coordinated together, but they are divergent to be designed and implemented in parallel. A critical connector between them is the unsustainable use of biomass for competing uses (food, feed, fiber and energy). Second connector are resource implications of the energy transition (for the production and use of batteries). The necessary transformations should be designed to enrich fairness and social cohesion across the EU. [21]

Important part of the European Green Deal are the improvements of the energy system that should be decarbonized, through greater use of renewable energy sources. Countries need to integrate their energy systems to control the intermittency of power generation. From crucial importance is the ensuring of a *fair energy transition*, which means when jobs are lost because of switching from the fossil-fuel use to another type of energy, investments are needed to generate alternative employment. And decarbonisation should be achieved not only in cities, but also in small areas as well as in large metropoles. Because of the different economic structures and reliance on fossil fuels across the EU member states, the social challenges of energy decarbonisation differ across the union. Also needed is a development of policy tools for achieving of net-zero energy systems at minimal costs. [21]

The strategy of decarbonising of industry in EU goes together with the efforts of accelerating the shift to the circular economy. [21] A circular economy is an alternate approach to the traditional linear economy (make, use and dispose), in which the resources are used as long as possible, extracting the maximum value from them and at the end they are reused or recycled (fig.6). [23]

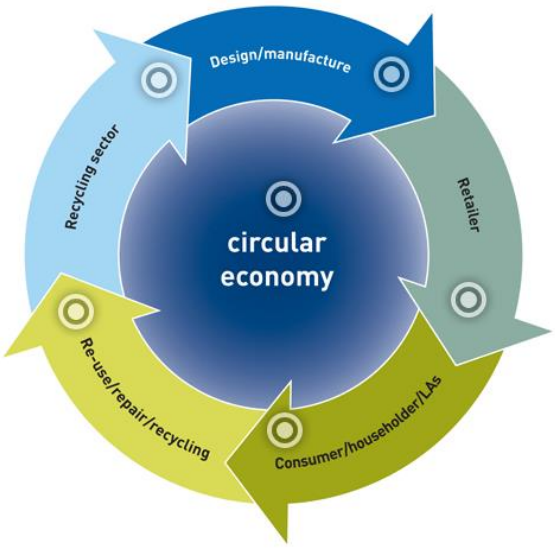


Figure 6: Circular Economy Scheme [23]

In time period 2010 to 2016, the waste generation in EU has increased by 3% or almost 74.7 million tonnes. Absolute total waste (without major mineral waste) has increased by 6% or 48.1 million tons and waste generation per capita became 70 kg. Also, the waste generation in the waste and water sector (2010-2016) grew by 56% or almost 82 million tonnes. This growth was caused mostly by secondary waste generation from countries that have established new waste management treatments, because of the growing amounts of waste. [24]

This represents the urgent need for more strict measures, with focus on the reduction of the material consumption within the economy, on waste prevention, environmental tax reform and eco-design standards. EU needs to reduce material use rooted in its net imports and to reduce waste shipments abroad, like plastic waste that is exported in Asia, where much of it ends up in the ocean. [21]

The third pillar of the European Green Deal is ensuring of sustainable land use, oceans and food systems. This strategy covers three broad perspectives that cut across many SDGs of the EU: resilient and efficient agricultural production systems, forestry and fisheries combined with high productivity and environmental sustainability; healthy diets with low losses of food and waste and conservation and restoration of biodiversity. Integrating healthy diets with sustainable agriculture production should be a focus of the European Green Deal that also has to develop a policy framework for reducing greenhouse gas emissions from agriculture and land use, including forestry, in line with the Paris Agreement. As the fig. 5 shows, the EU member states are far from the achieving of SDG 14 on marine ecosystems. The marine protected areas are heavily threatened, more than unprotected European waters. So, the EU should secure its marine ecosystems much better for the present generation and for the future ones. [21]

The European Green Deal and its three parts must also ensure that the SDGs are implemented across European policies and regulations. The Commission's Better Regulation tool could be highly relevant for integration of the SDGs more fully. Also, all impact assessments and (Regulatory Fitness Platform of the European Commission) REFIT Platform's (brings together the Commission, national authorities and other stakeholders for improving EU legislation [25]) recommendations have to evaluate environmental, social and economic impacts of proposed measures, so that all policies in the EU support the SDGs. [21]

3. Energy Efficiency and Waste Management

In this, third, chapter focus will be on the connection of energy efficiency and waste management to SDGs and the importance of those two aspects.

3.1 Energy Efficiency and its Relation to SDGs

The central element for ensuring economic and social development is *energy supply*. Access to cleaner and affordable energy helps also to achieve health, high level of living standards, clean environment and sustainable economy. [26]

One significant indicator of the country's development is energy sector. The efficient use of energy is challenging for each country. *Energy efficiency* is relation between energy inputs and outputs by means of comparison. [26] It means using less energy, but carrying out the same duty. On this way energy wastes are eliminated. [27]

Energy sufficiency goes beyond energy efficiency and respects planetary boundaries in which we must live, but it also supports needs and wellbeing of everyone. This means that everyone has access to affordable energy and that energy services are shared and environmental limits of the nature are respected. [28]

In order to improve energy efficiency, countries should follow different policies in many sectors. Some of them are: infrastructure sectors (buildings with good isolation of windows, efficient air conditioning, modern gas furnaces, etc.), technological improvements in energy producing and energy saving in households (fridges, water heaters, dishwashers, etc.), energy recovery and reducing CO_2 production in industries, transportation sector (improvements in gasoline and diesel-powered vehicles with turbine turbocharger, fuel injection, better electronic methods, hybrid cars and improved diesel engines, etc.). [26]

Energy efficiency covers all three aspects of sustainable development (economic, social and environmental). To guarantee the sustainable development, countries have to use their resources consciously and thereby minimize the negative impacts on environment. [26]

Some actions linked with energy efficiency that support sustainable development are [26]:

- Increasing energy efficiency of the industries, construction and transportation;
- Reducing use of less efficient coal-fired power plants;
- Using more of the renewable energy resources and investing in them;
- Reducing subsidies linked with the fossil fuels;
- Reducing methane release resulting from the oil and gas production;
- Affordable prices for energy in the regions without energy service;

- Supporting energy efficiency;
- Using advance energy technologies and invest in their development;
- Supporting environmental friendly technologies;
- Empowering the energy regulations;
- Ensuring that energy system can respond to the urgent situations very fast and
- Improving and developing of international cooperation and connections.

To achieve some of these actions, good governance is needed. Good examples are Luxembourg, Ireland, United Kingdom, Norway, Sweden, Austria, France, Spain and Germany. Luxembourg applied energy performance regulations in 2008 for residential buildings and in 2011 for non-residential buildings. With those regulations, energy performance of buildings, minimum of energy necessities for new buildings, extensions and renewed elements of existing buildings are determined. Energy efficiency of the buildings is stimulated with the energy performance certificates. Another example is Ireland, where the first "National Energy Efficiency Action Plan" from 2009 recognized potential energy savings. Also United Kingdom tries to achieve better energy efficiency with the "Green Deal" from 2013. With this program government aims to improve energy efficiency of business and homes. Also "Electricity Market Reform" brought the biggest change in UK, because it makes low carbon production investments attractive by providing safe and reasonably priced electricity for the UK. In Norway oil and gas production is stimulated, so that it comes from safe and sustainable operation. The energy management is so organized that it puts almost none consequences on health and environmental safety. Sweden has a good strategy of supporting of buying environmental friendly cars or vehicles. Those vehicles are exempted of taxes for the first five years. For the full tax exemption cars should use high-mix renewable fuel mixture combined with gasoline. In Austria there are a number of plans and programmes for energy security increasing and also high percentage of use of renewable energy sources. About 70% of the generated electricity is from renewable energy resources (most important part is hydropower). France has invested in programs for low carbon vehicles, smart network projects and in testing of renewable energies and green chemistry. Spain is also a land, which consumes energy from renewable sources. In first half of 2013, about 48% of electricity demand was obtained from renewable sources. Germany is going to reduce primary energy consumption and greenhouse gas emissions, while trying to increase share of renewable energy sources. [26]

Energy efficiency may also contribute to reducing per-unit cost of lighting, heating, refrigeration, etc. United Nations Development Programme (UNDP) encourage market demand for public and private investment in energy efficiency through direct incentives and financial de-risking. Its services promote energy efficiency in households, public and municipal facilities, commercial buildings as well as in residential buildings, and industry. [29]

As it is mentioned in chapter 1.2, SDG 7 is responsible for the ensuring of affordable, reliable, sustainable and modern energy for all. There are progresses in achieving this goal in 2019. In low

income countries there is accelerated access to electricity, improving of energy efficiency and increases in use of renewable energy resources. [30]

3.1.1 Benefits of Energy Efficiency

Upgraded and developed energy efficiency are the best way to address the challenges of high energy prices, energy security and independence. [27] Related to the energy efficiency is the energy awareness building, which consists of understanding: amount of direct and indirect used energy, what we use energy for, where this energy comes from, effects of energy using (impacts on nature and environment, depletion of energy resources) and ways to reduce consumption of energy. [31]

The building sector is vital for accomplishing SDGs. Energy efficient buildings make the quality of citizens' life better and at the same time bring advantages for society and economy. To increase energy performance of buildings, the EU has set up a legislative framework, which includes the Energy Performance of Buildings Directive 2010/31/EU (EPBD) and the Energy Directive 2012/27/EU. Those two directives stimulate policies that will help in: achieving energy efficient and decarbonized building stock by 2050, creation of stable environment for investments and enabling information to consumers and businesses how to save energy and money. [32]

Some important EPBD's policies are [32]:

- EU Member States have to establish long-term strategies for renovation, with the focus on decarbonising the national building stocks until 2050;
- EU countries have to introduce "cost-optimal minimum energy performance requirements" for the new buildings, for buildings under the renovation and for replacement of some building elements like heating or cooling systems, roofs and walls;
- All new buildings from December, 31. 2020 have to be "nearly zero-energy buildings";
- When one building or house is sold or rented, also the energy performance certificates have to be handed out, and inspection schemes for air conditioning systems have to be established;
- Electro-mobility should be supported through presenting of minimum necessities for car parks over a specific size;
- The European scheme for "smart readiness" of buildings is announced;
- Promotion of smart technologies (automatized control systems and devices for temperature regulation in rooms);
- Prioritizing of citizens' health through better of air quality and ventilation system and
- EU lands have to make a lists of national financial measures that will increase the energy efficiency of buildings.

Furthermore, according to the Energy Efficiency Directive (2012/27/EU), all EU countries have to do energy efficient renovations to minimally 3% of the whole floor area of buildings maintained by central governments. National governments should only purchase highly energy efficient buildings. There are also series of endorsements on the renovation of buildings (EU)2019/786 and on modernization of buildings (EU)2019/1019. [32]

Let me proceed with the short example on how to build awareness of energy consumption in one building.

Since the consumption of the energy in buildings is strongly affected by its occupants, it is crucial to make users conscious about their consumption and also to introduce ways of reducing energy consumption. In order to awake or to improve the awareness of building users, firstly data should be gained. With data it is much easier to emphasize the general consumption and waste. Also, it is important to analyze the data and see when is the energy consumption the highest (which part of day, are there exact end uses of energy like lighting or cooling/heating) and are there ways to reduce the consumption. The specific energy waste should be marked, quantified and reduced. The progress should be tracked and results should be demonstrated (in form of figures or diagrams). [33]

As the fig. 7 shows, there are numerous *benefits* of energy efficiency and sufficiency. Some of them are: lower greenhouse gas emissions and emissions of other hazardous pollutants, decreased water use; improved energy efficiency costs less than investing in new generation and transmission of energy, energy efficiency can also lead to growth of local economy and create descending pressure on natural gas prices; it can also provide long-term benefits by lowering base load (large-scale plants that produce power at constant rate and are not designed to respond to peak demands [34]) and peak demand (time, when the electricity consumption is highest [35]) and reducing the need for additional energy generation; it can be a hedge against uncertainty related to fluctuating fuel prices and other risk factors. [36]

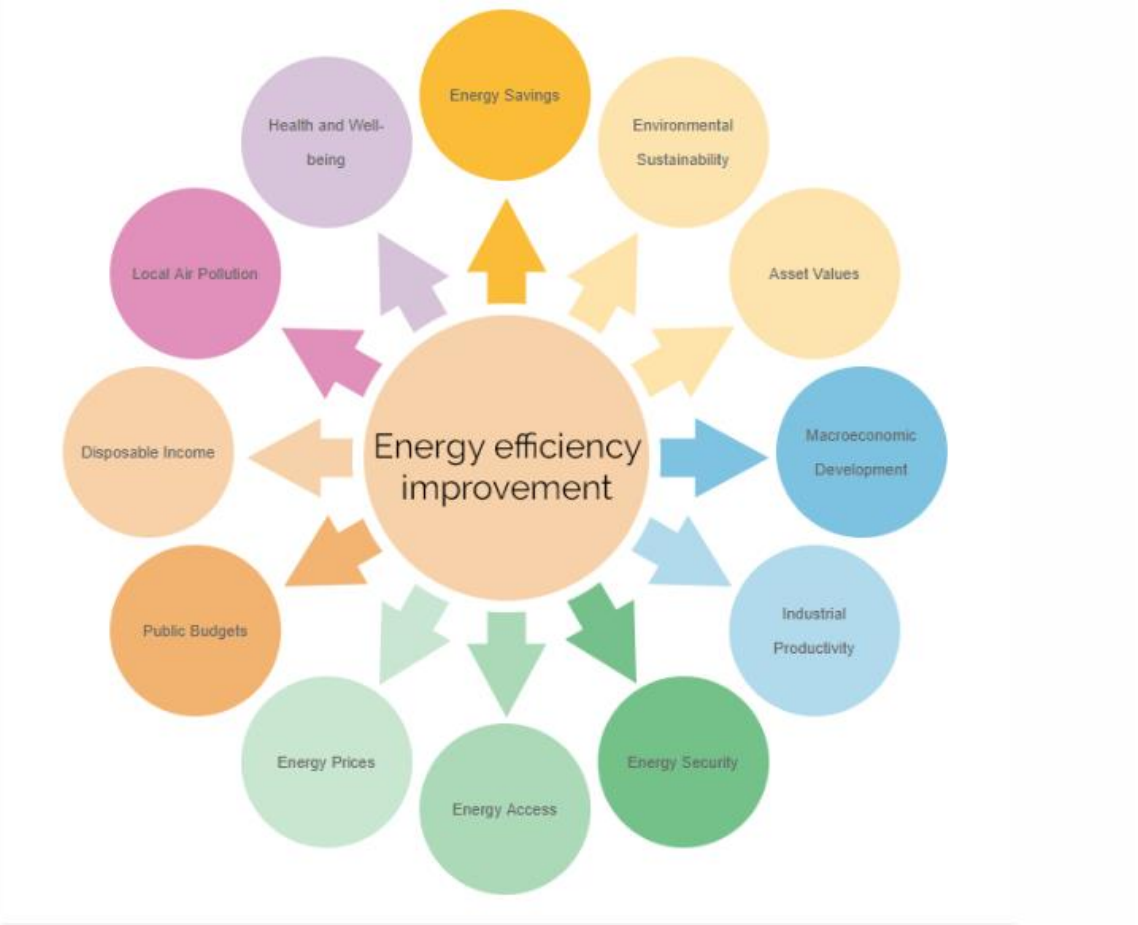


Figure 7: Multiple Benefits of Energy Efficiency and Sufficiency [37]

3.2 Waste Management and its Relevance for Sustainable Development

The term waste is often related to lack of use. It is a side product of human activity, contains the same components as the valuable product, but with the absence of value. Waste can be classified on many different ways. Some of the classification schemes are [38]:

- *According to physical state*: solid, liquid, gaseous;
- *By the original use:* packaging waste, food waste…
- *By the type of material:* glass, paper, metal…
- *By physical properties:* combustible, compostable, recyclable;
- *By the origin:* domestic, commercial, agricultural, industrial... and
- *By the safety level:* hazardous or nonhazardous.

In past, main worries in waste management were health and safety. Waste management should pose minimal risks on human health. Today, these concerns are still applied, but beside health and

safety, waste management has to be sustainable. Main factor in decision making in waste management was economic cost factor. But with the time, environmental development plays a more important role. [38]

There are different ways of disposal. The first method is *landfill* – waste is thrown in the landfills and then it is buried in the land. This method is mostly used in developing countries, but this is not the best idea, because while the waste is buried, very toxic gases are released (e.g. methane, etc.) and pose a risk for water body and air. [39] All around the world, in cities there are waste dumps, which release methane emissions and dangerous pollutants. This way of disposing is hazardous for the land, water supply, air quality and citizens living nearby. Better management of landfills represent huge economic opportunity, because that what is placed into the landfills represent good potential for recycling, industrial processing and energy. [1]

The second method *is combustion or incineration*. By this process, municipal waste is burned at very high temperatures. This method requires high investments for waste gas and waste water treatment to generate energy from waste, reduce the amount (volume) of the waste to 20 to 30% of the original amount and reduces the need for the waste landfilling. [39] The heat from the process can be recovered with the special boilers (refractory-lined furnace coupled to a boiler). These boilers convert the combustion heat into a steam or hot water and allows the energy of refuse to recycle. Such incinerators that can recycle heat energy are called waste to energy plants. [40]

Waste to energy (WtE) or energy from waste (EfW) is a process that converts non-recyclable waste from industries and households into useable heat, electricity and fuel. On this way non-recyclable items can be used over for energy creation. [39] [41] The waste is burned at high temperatures and the heat is used for steam making. The steam operate the turbine and it creates the electricity on this way. [41]

The next way is *recovery and recycling*. In the recovery process useful materials from used products are used in some industrial step or for energy conversion in heat, fuel and electricity. In the process of recycling, new products are generated from waste. It reduces energy use, volume of landfills, water and air pollution and greenhouse gas emissions. [39]

Plasma gasification is another method in waste management. A vessel with plasma torches operates at high temperatures (above 5,000°C) and converts waste (solid or liquid) into a syngas. During the plasma gasification process, molecular bonds in the waste are broken down because of the heat in the vessels. On this way also, dangerous waste and materials can be destructed. [39]

Composting is a process that uses organic waste, like waste from the kitchen or garden and converts it into food for plants. Organic materials are decomposed by microbes. This process is very slow and requires a lot of place. [39]

Waste minimization is an easy method that reduces waste creation by reducing amount of waste that goes to landfills. It can be done by recycling old materials or mending of broken things, avoiding of plastic bags or single-use plastics. [39]

Environmental matters over waste management and waste disposal cover two areas: *conservation of resources and environment pollution*. The older concern is the conservation of the resources. In 1972 in the book "Limits of Growth" was argued that the use of final material and non-renewable energy resources cannot be continued forever. In 1992, the book "Beyond the Limits" stated the same and pointed out that the usage of raw materials is faster as their regeneration rate. These reports resulted in the creation of Sustainable Development or Sustainability. (See the chapter 1.) The conservation of resources is related also to the increased exploitation of water, soil, forest and biodiversity. Beside of these concerns the depletion rates of non-renewables and the pollution rate are a challenge, the generation of pollution and waste goes beyond the planet's ability to absorb or/and convert them into harmless materials. [38]

At the World Summit on Sustainable Development in 2002 in Johannesburg, South Africa, the importance of solid waste management was denoted. The measures were prioritized as waste prevention and minimization, together with reuse and recycling. [42]

As earlier stated, waste management and importance of recycling and "circular economy" are parts of SDGs and their targets (in almost more than half of the seventeen SDGs). So for example, SDG 12 and target 12.3 aim to reduce food waste and losses along production and supply chains. Another target, 12.4, aims to reuse chemicals through their life cycle and to reduce their release in air, soil and water. [42]

The goal is to move from traditional way of thinking of "waste disposal" to "waste management" and to use waste as resources, which is the main idea of circular economy. Many developed countries use this method since many years, but in low- and middle-income countries it is still a challenge to ensure access to waste collection services. So, these countries need to apply innovative policies in order to cut their amounts of waste. [42]

3.2.1 Importance and Benefits of Waste Management

The most relevant reason for the waste collection and proper waste management is the *protection* of the environment and the health of population. Waste influences the air, water and land in negative ways, because it produces harmful gases that combined with the breathing air could cause lungs and transpiratory problems.
Rotting waste and waste emanates a foul smell, which can cause nausea among people who come in contact with it. It can also be a source for waterborne diseases like cholera and abdominal conditions. Because of these hazards that originate from the waste disposal, water sources and

landfills should be secured. Organizations and companies for the waste management have to prioritize landfills, so that water bodies are not affected by garbage and collected waste from households and commercial establishments. [43]

Further advantages of waste management are that the waste collection companies collect the garbage and sort it into recyclable columns. With recycling, natural resources are conserved and prices for the production of new products is reduced. By reducing need for primary production of glass, oil, plastic and paper, natural resources are saved and their exploitation is reduced. [43]

There is no simple way for the solution of solid waste problems. Instead, there is an integrated approach that combines several techniques to achieve economic, environmental and social sustainability. This is so called *Integrated Solid Waste Management (ISWM).* It combines waste streams, waste generation and treatment and disposal methods with the goal of accomplishing environmental advantages, economic development and social acceptability. The ISWM does not only deal with the technical aspect of waste management, but also with its political and social factors. [44].

The difference between traditional waste management and ISWM is that the ISWM approach seeks stakeholder participation, interactions with other systems and includes promotion of different habitat scales like neighborhood or households. The ISWM identifies three important dimensions: stakeholders, waste system elements and sustainability aspects from the following fig. 8. The diagram illustrates ISWM dimensions in a schematic way: stakeholders, different system elements with their interactions with other systems and aspects of ISWM. [44]

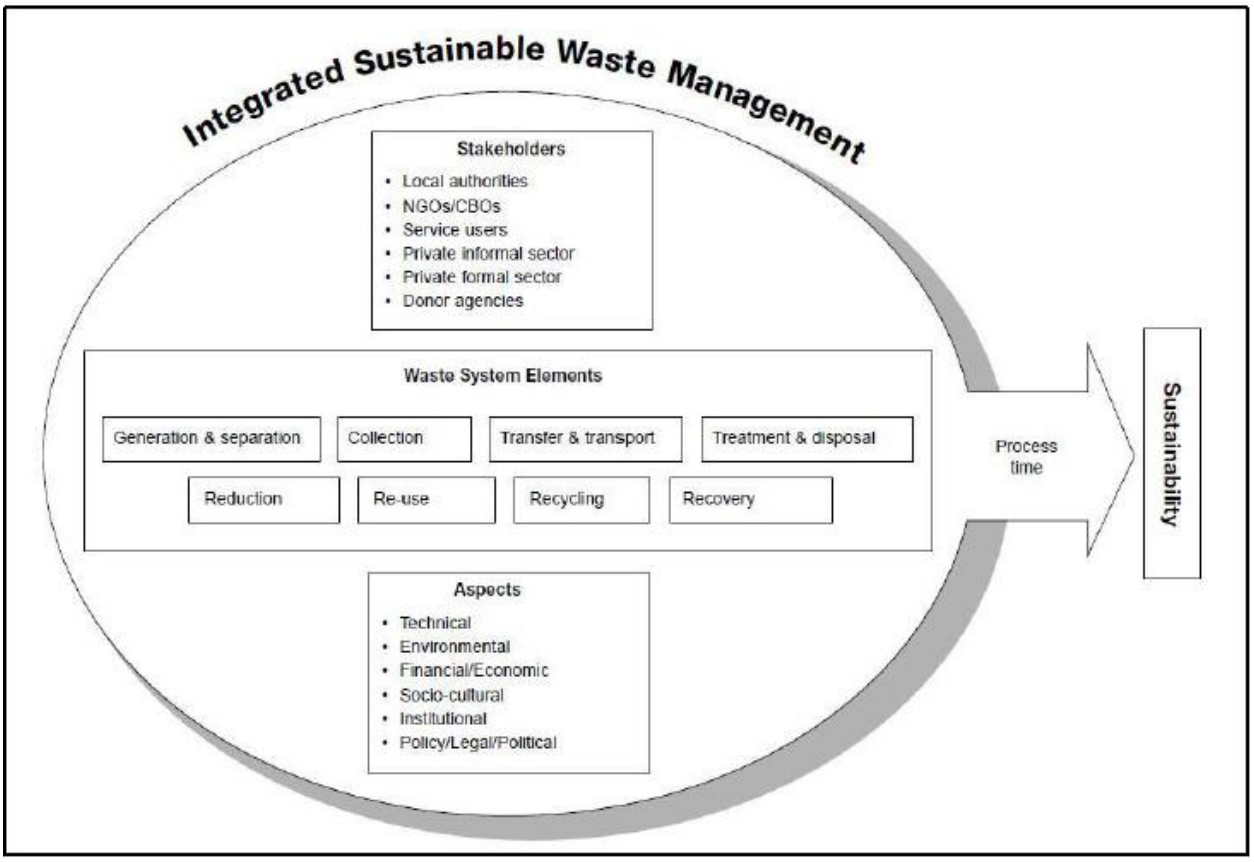


Figure 8: Integrated Sustainable Waste Management [44]

From the figure above, it is easy to conclude that the first dimension are *stakeholders* – all persons or organizations that are associated with the waste management. The second dimension are *waste system elements*, which represent the technical steps in waste management system (from collection to disposal). They are keystone of ISWM, giving opportunity to waste prevention, reduction and recovery (reuse, recycling, etc.). Finally, the third dimension consists of sustainability *aspects*. These aspects can be understood as principles through which current waste systems could be improved and new system planned, by considering all technical, environmental, financial-economic, socio-cultural, institutional, legal and political aspects. [44]

Finally, landscapes could be preserved from littering, loss of their attraction and economic importance, if the waste is not disposed into landfills. Nature and its beauty are a *legacy* for us and also for the future generations. [43] So, everyone has to conserve them and all the other natural resources so that they last for a long time.

As already mentioned, the ambitious Circular Economy Plan has been adopted by the European Commission. Within the Circular Economy Package the legislative proposals on waste have been revised. This should serve as a stimulant for the Europe's transition to circular economy, which

will increase global competitiveness, promote sustainable economic growth and create new jobs. Through revised legislative policies on waste clear goals for waste reductions are set. It creates an ambitious long-term pathway for waste management and waste recycling. The most important elements are [45]:

- EU goal for recycling 65% of municipal solid waste by 2030;
- EU goal for recylcing 75% of packaging waste by 2030;
- Reduction of landfill to maximally 10% of municipal waste by 2030;
- Restriction of landfilling of distinctly collected waste;
- Introduction of economic methods for discouriging of waste landfilling;
- Improvments in calculation of recycling rates in the EU;
- Introduction of measures for promotion of re-use and stimulation of industrial symbiosis – industry's byproduct becomes raw material for the industry and
- Economic incentives for putting green products on the market.

4. Achievements in Water management, Energy Efficiency and Waste Management in Bosnia and Herzegovina and Austria

4.1 Achievements related to selected SDGs in Bosnia and Herzegovina until April 2019

SDG 6 – Clean Water and Sanitation

Bosnia and Herzegovina is *rich in water resources*. Strong effect on the hydrological conditions have geomorphological and hydro-morphological factors. The precipitation is most powerful at the foot of the Dinarides. The precipitation is also connected to the position of the karst area that has a big underground retention hydrological potential. With hydrological insulators, all springs of the significant watercourses arise within the river basins. [13]

But, the great challenge and evidence of the impacts of the climate change are also present and include the volume of the pollutants in urban and industrial wastewater, applied practices in agriculture, groundwater abstraction. [13]

Institutions in the country work toward water resources protection and sustainable water usage, trying to ensure drinking water for all people. For the additional improvement and development of the water sector in Bosnia and Herzegovina needed is the implementation of the strategic papers and plans, the legal framework and harmonization with the EU Law. Most of the laws are already harmonized with the EU Law. Some of the important strategies and plans for the water management in country are: the Action Plan for Protection against Floods and River Management in Bosnia and Herzegovina 2014-2017, the Strategy for Integrated Water Management of Republika Srpska for the period 2015-2024 and the Strategy for Water Management in the Federation of Bosnia and Herzegovina 2010-2022. Brčko District has not its own strategy, but took part in the implementation of the Action Plan for Protection against Floods and River Management in Bosnia and Herzegivina 2014-2017. [13]

The water resources include rivers, natural and artificial lakes as well as the groundwater. The largest part of the water flow is in the direction of the Danube river basin (the Black Sea 75.7%) and the Adriatic Sea (24.3%). There are around 30 mountain lakes across the country and 12 artificial lakes on the major rivers (Drina, Vrbas, Neretva and Trebišnjica) and in the karst field (Livno Field and Popovo Field). [13]

The total water abstraction in 2017 was 331,550,000 m^3. Around 47.4% was abstracted from the underground sources, surface sources accounted for 35%, rivers and streams 14.6%, reservoirs 0.8% and from the lakes 1.2%. Households were the largest water consumers of total water supply with 76.1%. On the other hand, there were 116,916,000 m^3 of wastewater. Most of the wastewater

is directly released into the rivers and streams, 58.5% untreated and 40.6% treated wastewater. [13]

Following graphs (fig. 9 and 10) represent the proportion of the population in Bosnia and Herzegovina, who are using safely managed drinking water services and percentage of population connected to a wastewater treatment plant between 2000 and 2016.

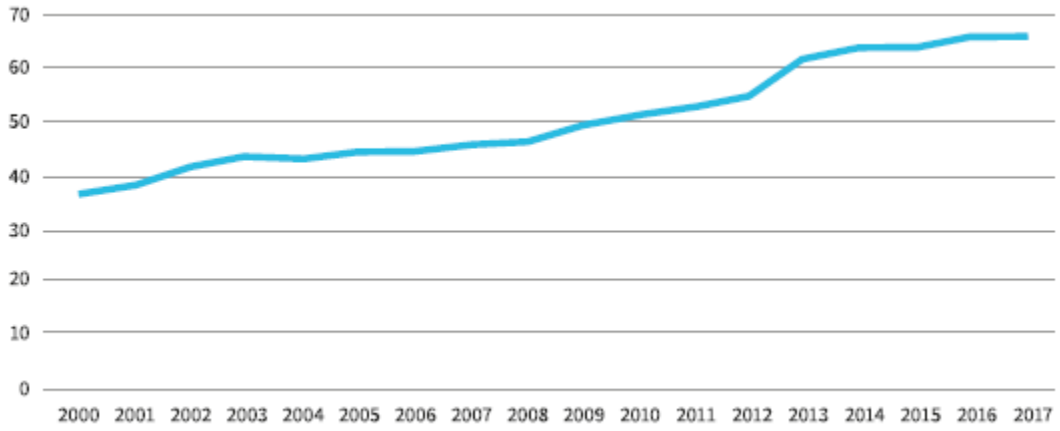


Figure 9: Proportion of the Population using safely managed drinking Water Services [13]

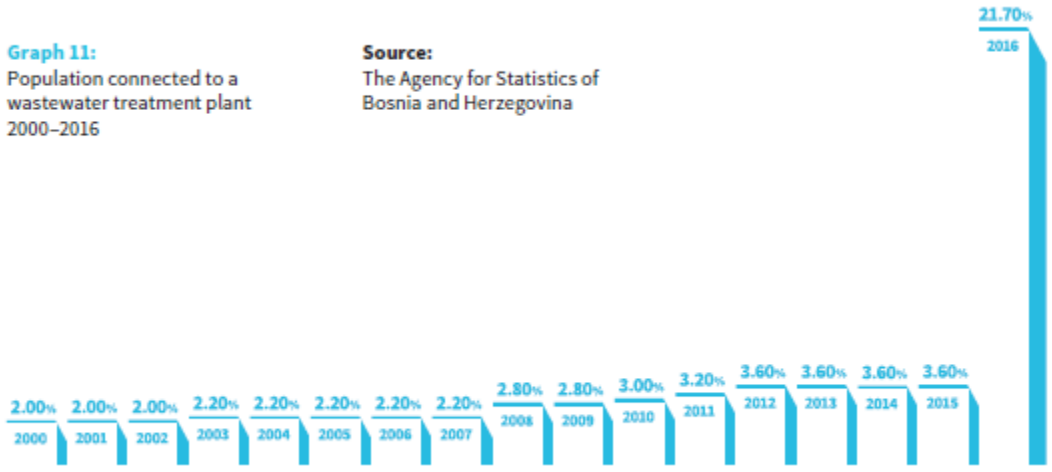


Figure 10: People linked to a Wastewater Treatment Plant 2000-2016 [13]

As it is to see from the above diagrams the number of people, who use safely managed drinking water services has increased, from 200 until 2016, for approximately 30% (fig. 9).

Also the number of citizens connected to a wastewater treatment plant has increased to 21.70% in 2016, compared to only 2.00% in 2000 (fig. 10). Hopefully with existing and new regulations, these numbers will increase even more.

SDG 7 – Ensure access to affordable, sustainable modern energy

The sector of energy is one of the most powerful economic sectors in the country. There is a significant potential for the improvement and development. Bosnia and Herzegovina promised to liberalize the energy market and pass a set of regulations on gas, oil and electricity. It will ensure the formation of a competitive and integrated energy market and set the environments for increased investment in energy sector in order to enable energy security and sustainability. The key public companies control the country's electricity and gas markets. [13]

Investors are interested in power generation from renewable energy resources, from large hydro power generation to smaller hydro power generation, solar energy generation, wind power generation and biomass generation. In 2018, a working group on renewable energy sources in country was recognized for the exchange of practices in this field. The group has also a task to monitor and report the progress and to deal with the coordination of the preparation of recommendations and proposals related to the drafting of the National Action Plan for Renewable Energy Sources and entity action plans. [13]

In 2018, the Framework Energy Strategy of Bosnia and Herzegovina until 2035, aimed at accomplishing the more efficient use of energy and resources, improved security of the energy supply and responsibility toward the environment. [13] (See Chapter 5. for more information on Framework Energy Strategy of Bosnia and Herzegovina until 2035).

Following figures (fig. 11 and 12) show the share of renewables in gross energy consumption in Bosnia and Herzegovina and amount of generated electricity from the renewable sources.

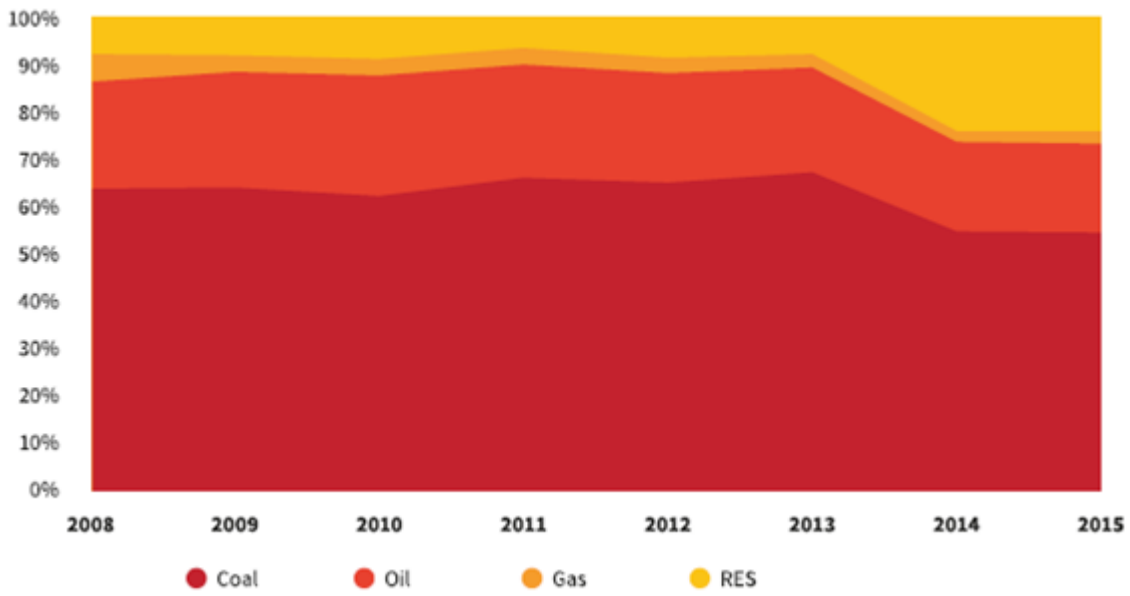


Figure 11: Renewable Energy in Energy Consumption in Bosnia and Herzegovina [13]

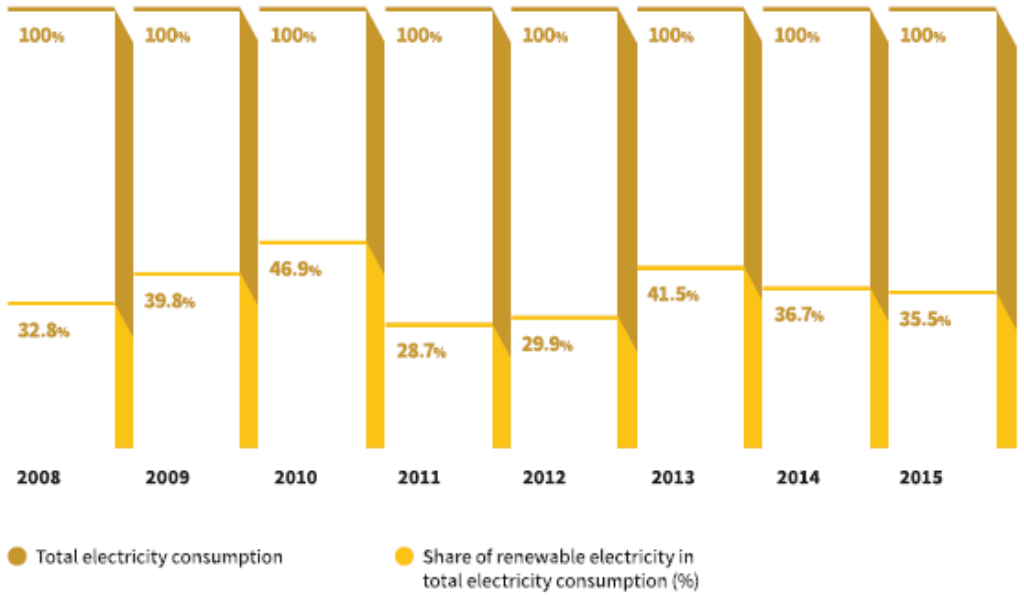


Figure 12: Share of Renewables in Electricity Consumption in Bosnia and Herzegovina [13]

From the fig. 11 is it to see that the coal has the highest share in the gross energy consumption in Bosnia and Herzegovina. After coal, oil is on the second place and gas is on the third place in the share of energy consumption in the country.

The smallest portion in the gross energy consumption represent the renewable energy sources. But, between 2013 and 2015 the share of renewables has increased, from initially 10% to about 20% in 2015.

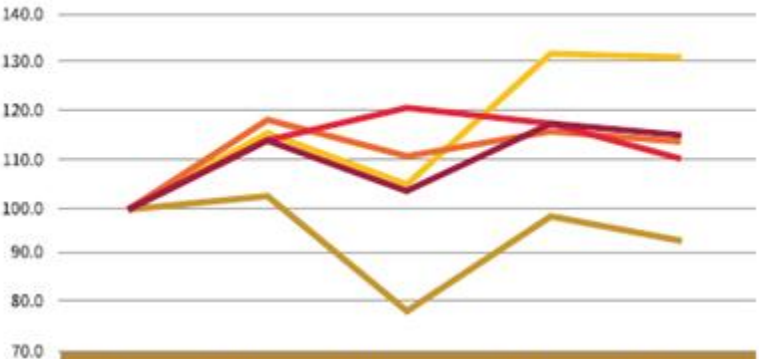
Furthermore, the fig. 12 shows the share of renewables in the electricity consumption in the country. The amount of used renewable resources is fluctuating between observed years (2008 and 2015), but with a slightly increase of 2.7% in 2015 in compare to the 2008.

Resource consumption related to SDG 12 – Ensure sustainable consumption and production patterns

Bosnia and Herzegovina has a strategy called "*Strategy for the Protection of Biological Diversity of Bosnia and Herzegovina"*, according to which the future of the country is nearly connected to sustainable use and protection of its natural resources. It also offers the plan for the managing of species and ecosystems, biodiversity safety and fair distribution of aids of ecosystem services. There is also another strategy, named *"Strategy for the Approximation of Bosnia and Herzegovina Law with the EU Environmental Acquis"*. It represents a prosperity, which creates settings for improving environment and supports sustainable development. The acquis contains eight sets of legislative instruments: water, waste, air quality, climate change; industrial pollution, chemicals, nature protection and environmental noise. [13]

There is an absence of awareness regarding the significance of ensuring the balanced use of the natural resources, appreciation for the nature and the need to keep it clean and unpolluted. Many unregistered and illegal dumping sites are present across the country. The number of them is increasing every year. And, all types of waste are cast off illegally, mostly organic waste, construction waste, bulky household waste, glass, etc. [13]

On the following graph (fig. 13) is the domestic material consumption in Bosnia and Herzegovina to see. Only the use of metal ores is decreasing compared to the pervious years (with the exception in 2012). All other types of materials are increasing or stay close to the pervious numbers.



	2010	2011	2012	2013	2014
Biomass	100.0	102.1	78.3	97.9	92.8
Metal ores	100	113.7	120.9	117.1	109.8
Non-metals	100	115.2	104.7	131.7	130.9
Fossil fuels	100	117.9	110.6	115.5	113.4
TOTAL	100	113.7	103.3	117.3	114.5

Figure 13: Domestic Material Consumption in Bosnia and Herzegovina [13]

SDG 14 – Conservation and sustainable use of the oceans, seas and marine resources and SDG 15 – Sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss.

These two SDGs are closely related to the energy efficiency and waste management, because if some country exploits natural resources or put the waste freely in the landfills or river basins, it influences the environment negatively.

Bosnia and Herzegovina has a short coastline (about 12.2 km) along the Adriatic Sea. The marine environment is in a good condition, but recent investigations of the water body showed that marine water is highly exposed to the human influence. There is an illegal construction without any wastewater treatment system. In the summer, there are a lot of tourists. About 20,000 tourist per day visit the city Neum, which has only 4,000 inhabitants. This large number of tourists on a daily basis has a major impact on the town and on the environment, because the number of tourists represents the maximum capability of local infrastructure. The region along the Adriatic Sea coastline is the karstic nature and leaches from waste dumping sites end up fast in the sea, increasing health risks of local population and environmental risks. [13]

The main cause for the spreading of aggressive species in sea is the ballast waters from maritime transport. Those intrusive species and the loss of biodiversity put pressure on tourism and fishing activities. [13]

There is no declared marine protected area along the coast in Bosnia and Herzegovina, but there are ongoing attempts to organize first marine protected area in country and the botanical reserve.

[13] With the protected marine area and further efforts for the managing wastewater treatment in the country, there should be excellent results in achieving better scores for the SDG 14.

As the fig. 14 shows, there is a rising proportion of the forest in the country compared to the total land area (observed period of time 2010 to 2016).

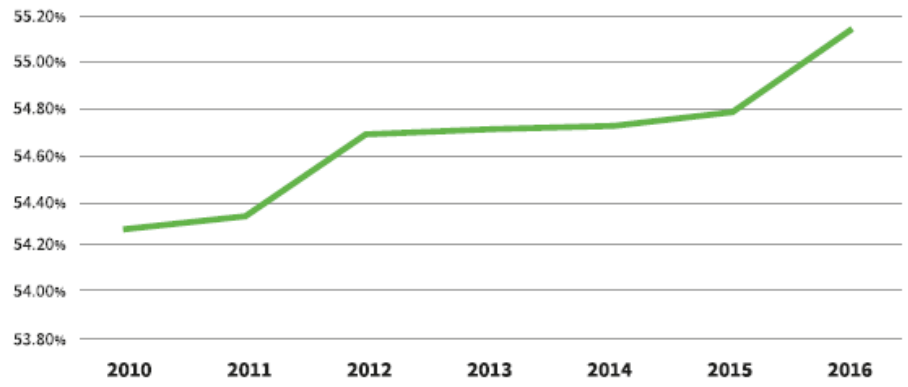


Figure 14: Forest Area in Proportion to the Land Area in km² [13]

Bosnia and Herzegovina has a specific geographical position and it is one of the richest countries in Europe in relations of biodiversity. Over 50% of the overall country's territory is covered by the forests. But there is a deficiency of protected natural habitats. [13]

In the next years country should invest more in protection of environment and reduction of greenhouse gas emissions in order to join EU efforts to reduce GHG emissions and to transpose the EU Emissions Trading System (EU ETS). It will also involve all available national resources and international financial support, but not at the cost of slowing down the economic growth. [13]

Nevertheless, there are *some progresses*, for example in Republika Srpska in 2011 there were only 3 protected areas, now there are 23, which corresponds to the 1.3% of the territory of Republika Srpska. There are also three national parks: Sutjeska, Drina and Kozara. In the other entity, Federation of Bosnia and Herzegovina, there are 12 protected areas and one national park, Una. This corresponds to the 3.24% of its territory. There are also efforts for the expansion of the protected area. On the List of Mediterranean Special Protected Areas and on the List of Internationally Important Bird Areas there is a place named Hutovo Blato, which is the last piece of the old wetlands in Neretva basin. [13]

4.2. Austria's Performance in Implementation of the SDGs until November 2019

As the fig. 4 showed Austria has an overall performance (SDG Index) of 76.7. It ranks the country on the 4th place in EU regarding to the achieving of the SDGs. [21]

Austria has achieved SDG 1, SDG 9 and SDG 16. Challenges remain in the accomplishing of SDGs: 3, 5, 6, 7, 8, 10 and 11. Significant challenges are needed for the implementation of following SDGs: 2, 4 and 17, while major tasks remain for the SDGs: 12, 13 and 15. There are no data available for the SDG 14. The current Assessment – SDG Dashboard for Austria is summarized in the fig.15. [21]

Figure 15: SDG Dashboard for Austria [21]

Also, the European Semester Country Report for Austria has suggested that investments are needed for the eco-innovation, the circular economy, energy efficiency, renewables and sustainable mobility for country's growth in more sustainable way. [46]

Austria is on the road to meet the renewable target for 2020, but it can miss the energy efficiency and targets for GHG emission reduction. The energy efficiency was improved with the measures under the Energy Efficiency Law. But, the consumption in primary and final energy persisted to increase in 2016, putting pressure on the realization of the EU 2020 energy efficiency target. Austria will not accomplish the emission reduction target outside the emission trading system, but the country has set goals for 2030 for the reduction of GHG emissions, energy intensity, and restriction of primary energy consumption, rise of renewable energy share and a complete decarbonisation of the energy sector until 2050. For this purpose, there will be investments in building renovation, technologies for energy-saving, electricity generation from renewables and transport infrastructure. [46]

Although, the greenhouse gas emissions in Austria is below the EU average, it is still higher than in leading EU member states (Sweden or Denmark). The high potential for driving energy efficiency market further could have small and medium-sized companies. In its National Energy and Climate Plan, Austria will offer an overview for needed investments until 2030, for the Energy

Union, together with renewable energy, energy efficiency, security of supply and climate mitigation and adaption. [46]

SDG 6 – Clean Water and Sanitation

Essential for the healthy life is access to clean drinking water and sanitary facilities. [44] The quality of water is important for all communities, because it prevents illness, promotes the economy and assures good health of citizens. Austria is one of Europe's most water-wealthy states and the quality of water in Austria is superior. About 50% of drinking water comes from groundwater and other 50% from springs. [47]

As the 2019 Europe Sustainable Development Report indicates, Austria has almost achieved the SDG 6, clean water and sanitation. About 98.7% of the population is using safely managed water services and 96.8% uses safely managed sanitation services. Practically the whole population (99.8%) is connected to at least secondary wastewater treatment. Improvements are only needed in groundwater depletion, which is 7.5 m^3/capita/year. [21]

From *particular relevance* is maintaining of drinking water supply and keeping waters clean. The Austrian Development Agency (ADA), which is the operational unit of the Austrian Development Cooperation, supports developing countries around the world in building up sustainable water stock and sanitation facilities and reinforces the responsible institutions. Appropriate operator capacities for water and wastewater organization are important, as well as good personnel and institutions that implement the regulations properly. Costs for the water and wastewater should be regulated so that they are affordable for all members of society, but that they also provide enough revenue to pay operating costs. ADA supports water stock and sanitation projects and programmes in Albania, Moldova, Mozambique, Palestine and Uganda. Least but not last, sustainable use of water for supply of water, power generation and food production moderates poverty, while protecting the environment and playing an important part for peace and stability. [48]

In Austria approximately 67% of water is used for supply of industry (cooling water demand is excluded from the calculation) and trade, about 27% goes to households and 7% to agriculture. Huge water savings are detected because of the economic force of supply and disposal costs. These measures were dependent on the change of production processes and on the recovering of wastewater. This has resulted in reduction of contaminations of water bodies. [49]

Water supply is also a fundamental factor in agriculture, not only for the rural families, but also for the plant growth, watering of animals and purity and hygienic conditions on the farms.

Agriculture is high responsible for the water reserves of land management and water pollutants. Austria has programme, the "*Austrian Agri-environmental Programme"* that promotes organic farming, reduced use of fertilizers and protection products for plants. For the water and environmental protection in regions with high nitrate levels in groundwater, the Federal Provinces have raised their extension services. [49] According to the Environmental Performance Index Report from 2018, Austria is on the third place, just after Paraguay and USA, in efficient nitrogen management. That shows that Austria is able to accomplish high crop yields while using nitrogen fertilizers efficiently, which further prevents risks for environment, first of all for groundwater. [50]

SDG 7 – Ensure access to affordable, sustainable modern energy

Important long-term goal for Austria is the reduction of energy consumption and increase of the share of renewable energy. The new technologies and policies are created in order to improve energy efficiency, like thermal renovation of buildings or high standards for new buildings or electro vehicles. The country's target is to reduce primary energy consumption by 25 to 30% compared to 2015. In order to achieve it, the following measures are undertaken under the Climate and Energy Strategy and current government programme [51]:

- Develop the Energy Efficiency Act, the big part of the Energy Efficiency Directive will be altered by the Federal Efficiency Act;
- Use of energy management systems in order to reduce energy consumption;
- A support programmes for application of energy management systems;
- Use heat from commercial and industrial waste – heat potential map;
- Develop pilot projects for energy efficient cities and municipalities;
- Investments for thermal building reconstruction;
- Include energy efficiency trainings and climate change in educational system and technical trainings;
- Improve the skills of professionals in the energy sector;
- Awareness rising of all society members on themes like climate change, energy efficiency and proper use of energy resources;
- The "Energie.Frei.raum" Programme as a preliminary phase for the experimental clause, for companies to test a market models of renewable energy technology;
- Support of commercial energy efficiency improvements and
- Public authorities (federal government, provinces and municipalities) as an example of energy efficiency and savings under the Energy Efficiency Act, agreements of federal government and provinces and support municipalities.

The Energy Efficiency Directive (EED 2012/27/EU) as revised in 2018 in the Clean Energy Package, offers for an EU energy efficiency target of 32.5% for 2030. As already mentioned, Austria has set its own goal for reduction of energy intensity by 25 to 30% compared to 2015. But

in case that the primary energy consumption exceeds 1 200 PJ by 2030, the additional energy has to be covered by renewable energy. Since the proportion of renewable energy consumption and the GHG emission goals are fixed, if energy demand rises, equally more renewable energy is going to be used. [51]

Each EU Member State has to make a roadmap with measures and progress indicators, with the view to 2050 goal of reducing greenhouse gas emissions to ensure a highly energy efficient building sector and to facilitate the reconstruction of existing building to nearly zero energy buildings. The roadmap has to specify the contribution of accomplishing the EU's energy efficiency targets according to the Directive 2012/27/EU. [51]

SDG 12 – Ensure sustainable consumption and production patterns

One of the main proposals of the SDG 12, about responsible consumption and production, is recycling and circular economy.

The global economy is 9.1% circular. In contrast to that number, Austrian economy has a circularity rate of 9.7%, what is a little above the global average. This rate represents the proportion of the secondary materials in all materials required in economy. The rate of 9.7% represents an extraordinary value, for an industrialized, trading and expanding economy. [52]

To expand the circularity, proposal of four steps is required [52]:

1. Shifting from fossil fuels to renewable resources (increase of circularity to 9.9%);
2. Recycling of all recyclable waste (18.8%);
3. Shifting to an economy, where all construction materials are maintained from old building stocks (11.6%) and
4. Ensuring imports with higher secondary content (20.1%).

When all these four steps are combined, Austria can boost the current circularity rate from 9.7% to 37.4%. [52]

About 96% of Austrians sort their waste and separate their packaging waste from all waste. 99% of Austrians take care of paper waste and separate paper from other waste for recycling. Austria's citizens separate and gather more than 1 million tonnes of packaging and paper waste every year and send them to recycling stations. One of Austria's leader services for waste management and recycling (ARA), provides around 1.8 million bins for the collection of waste packaging for paper, plastic, metal and glass. Additionally, they arrange picking-up services for 1.6 million households. Also, the ARA company produces secondary raw materials from waste of electrical and electronic equipment (WEEE) and recycles chlorofluorocarbons-containing (CFC) cooling appliances, which helps in protecting climate. The company has helped in saving of 500,000 tonnes of CO_2 – equivalents in 2016. [53]

According to the 2019 Europe Sustainable Development Report, challenges in accomplishing the SDG 12 in Austria still remain. Country has completed the target built on the production-based SO_2 emissions in kg/capita, the circularity material use rate is increasing as well as nitrogen use management, which was explained before. Major challenges regarding net imported emissions of reactive nitrogen and imported SO_2 emissions in kg/capita still persist. [21]

SDG 14 – Conservation and sustainable use of the oceans, seas and marine resources

The Austrian water legislation (Wasserrechtsgesetz 1959 – Water Rights Act 1959) arranges targets regarding the conservation of surface water bodies and groundwater. Rivers, lakes and groundwater have to achieve the "good status", artificial and heavily modified waters the "good potential". If some water body is damaged, the ambition is to restore the good status. The Austrian water policy supports the provisions of the European Water Framework Directive (EU WFD) that arranges Europe-wide reorientation of water and water protection policies. [54]

According to the statistics of the European Economic Area, industrial pollution profile published in 2018, showed that industrial water pollution has decreased between 2007 and 2016. [55] Following graph (fig.16) illustrates the course of the industrial water pollution in Austria. It shows great decrease of the heavy metals that originate from the industries.

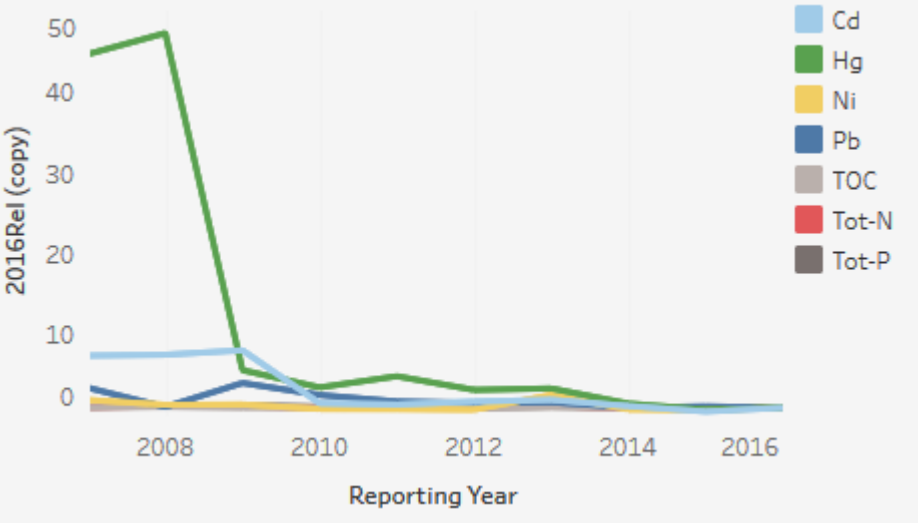


Figure 16: Industrial Water Pollution in Austria, 2007-2016 [55]

SDG 15 – Sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss.

For realizing better results in accomplishing of the SDG 15, life on land, Austria has already succeed in two targets, firstly in the biochemical oxygen demand in rivers (mg O_2/liter) and nitrate in groundwater (mg NO_3/liter). Challenges persist in following targets: mean area, which is protected in terrestrial sites important to biodiversity, mean area that is protected in freshwater sites important to biodiversity, imported biodiversity threat and red list index of species survival. [21]

Austria has a total land cover (at the national level) area 83,861 km^2 and 32% of this area is the agricultural land and 44.1% is covered by forests (fig.17). [56]

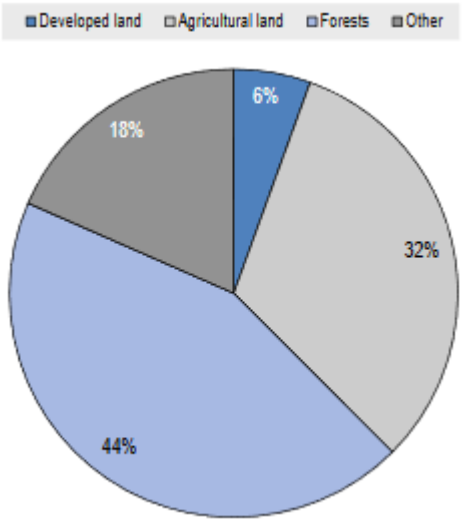


Figure 17: Land Cover in Austria [56]

Compared with European average, Austria uses more land than the rest of the EU. On average, an EU citizen used 389 m^2 of land in 2006. In the same year, Austria's citizen made use of 595 m^2. Also the increase in urban sprawl was faster, +32.2% between 1996 and 2006, whereas in EU it was +8.8% from 1996 to 2006. [57]

The surface of the ground, where the constructions for residential, commercial or infrastructure purposes are going on, has to be covered with impermeable materials like concrete, asphalt, paving stones, etc. This weakens the soil ecosystem. The main problems that come with the constructions are that the rainwater cannot be immersed to provide the moisture to the soil below, which is needed for the plant growth, no supply for maintaining of groundwater (in high productive agricultural land) and higher possibility of the flooding. [57]

Austria is highly developed and industrialized country with high quality infrastructure and energy networks and municipal and regional values like water supply or waste management. The

Environmental Kuznets Curve (EKC) can be used to understand that the power of economic growth (gross domestic product – GDP) determines the resources use, land consumption and environmental effects of economic growth. The EKC suggests that resource consumption rises, if GDP increases to a certain turning point. After this point, economic growth can be additionally improved while, at the same time, the resources use is decreasing. [57] In other words, economic development leads to a weakening of environment, but after a certain point in economic growth, society starts to improve its connection with the environment and the environmental degradation reduces. [58] This behavior is demonstrated on the following graph (fig.18).

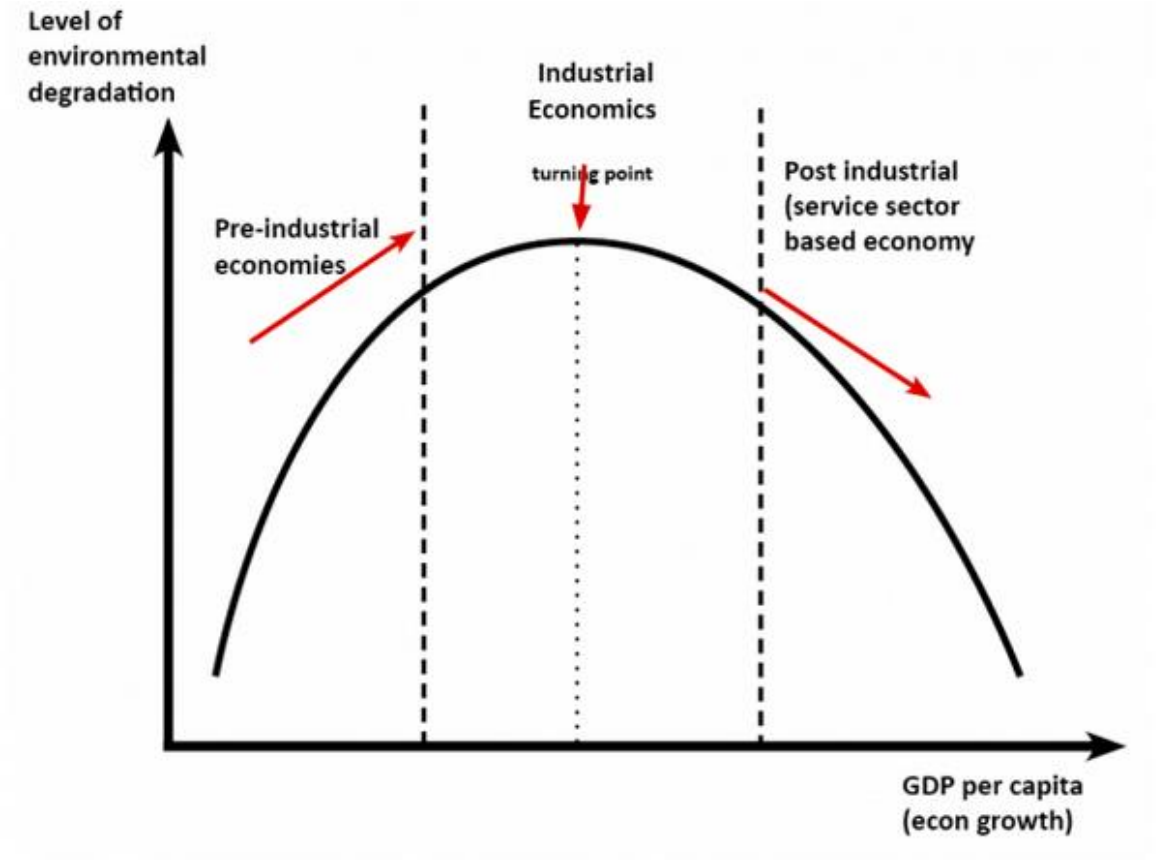


Figure 18: EKC Scheme [58]

Such developments are known as the decoupling of the GDP and resource use after reaching the turning point of the EKC. There is also the inverted-U functional form of the relation between the GDP growth and resource use, when the national economics in the early phase of development tend to grow their economics, while using more resources. When the GDP is high, environmental resources exploitation and pollution grow up. High GDP leads to an increased request on environmental goods and services. After implying environmental protection regulations, changes in economy and service sectors, which use less resources, reduce overall pollution even, if the

GDP levels are high. In regard to this, several tests have been run. First one concerns the CO_2 emissions, which stated that the EKC hypothesis does not hold. Also, the EKC hypothesis was tested in regard to Austrian domestic material consumption and it was found out, that there is no absolute decoupling between the GDP and material intake to the Austrian economy. Until now, there are no available literature on the determinants of land consumption in regard to the EKC. [57]

As reported in the strategy on biodiversity in Austria 2020+, Austria has one of the richest biodiversity in European countries. But, approximately 68,000 species and their habitats are in some way *endangered or threatened.* [59]

About 27% of the Austria's area is under protection, 3% are national parks. There are various national and European projects and programmes for the biodiversity preservation (e.g. Austrian Agri-Environmental Programme – ÖPUL). Austria represents European leader in organic farming and promotes the preservation of rare species. [59]

The strategy on biodiversity in Austria 2020+, set goals and measures for the conservation of biological diversity in Austria. It was confirmed by the National Biodiversity Commission. The strategy also defines responsible institutions for the implementation and parameters for the achievement of the objectives. [59]

One of the most important goals is the transformation of the energy system in order to maintain the high security level of supply. The aim is to make stronger the security of supply and get less dependent on imported energy. Therefore, Austria wants to develop furthermore the domestic energy sources, mostly the renewables. This embraces the goal of generating 100% of total electricity on national balance from own renewable energy sources. [51]

For the period up to 2030 more investments in storage infrastructure, transmission and distribution is going to be needed, especially with the higher energy demand. Also, the efficient maintaining of existing installations is important. The optimal use of existing efficient plants in accordance with the climate and energy targets is needed. [51]

Austria has a *high percentage of recycled waste*. In order to provide sustainable development worldwide, resources should be used on a clever way. The circular economy and sustainable waste management support the idea of sustainable world. The EU efforts are concentrated on changing Europe to a recycling society, which stays away from increasing waste production and which uses waste as an energy source. [60]

Austria is a country with high recycling rate and low landfilling rate. [60] According to the Austrian Climate and Energy Strategy, areas of action and contribution to the waste management

targets until 2030 are: reduction of methane emissions, improving landfill gas capture and aerobic-in-situ stabilization and optimize the nitrogen removal. [61]

5. Current state and relevant projects in Bosnia and Herzegovina

In this section of the work I will focus on the energy framework in Bosnia and Herzegovina, state of the waste management in the country, as well as on the potential roadmap for improving energy efficiency and waste management. Focus will be also on the ongoing projects in Bosnia and Herzegovina related to energy efficiency and waste management.

5.1 Institutional Competence of Energy Sector in Bosnia and Herzegovina

As Bosnia and Herzegovina consists of two entities, Federation of Bosnia and Herzegovina (FBIH) and Republika Srpska (RS) and one separate administration unit Brčko District (BD BIH), there are several relevant institutions in energy sector [62]:

- *The Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina (MOFTER)* – part of the Council of Ministries of Bosnia and Herzegovina. It performs obligations within the capability of Bosnia and Herzegovina, such as determining of policies and principles, organization of activities and association entity plans with the international institutions in the energy sector. MOFTR consists of three energy sectors: Department of Primary Energy and Policy, Department of Secondary Energy and Project and Department of Project Implementation.
- *Federal Ministry of Energy, Mining and Industry (FMERI)* – competence of Federation of Bosnia and Herzegovina in the sectors of energy, mining, industry, geological research and private enterprises. FMERI has Energy Sector and Mining Sector. In addition, every canton in Federation of Bosnia and Herzegovina has, in accordance to their cantonal compositions, their own power, associated to the regulation implementation on local energy facilities.
- *The Ministry of Industry, Energy and Mining of Republika Srpska (MIER)* – energy policies, electric power strategy and balancing, planning, research, building of power plants, use of natural and technological mineral resources, management over the operation over public and other companies as governmental property, development of guidelines and principles within the sectorial competence and harmonization with the EU law. It consists of Sector of Power Engineering, Sector for Energy and Sector for Mining and Geology.

5.2 Framework Energy Strategy (FES) of Bosnia and Herzegovina until 2035

The aim of the Framework Energy Strategy (FES) is to make an energy development plan for Bosnia and Herzegovina. The FES is a part of the project, which was funded by the Department for International Development (DFID) of the Government of Great Britain and realized by PricewaterhouseCoopers and partners. [62]

The FES suggests that the resources and efforts must be so organized that the sustainable growth is enabled. The energy system of Bosnia and Herzegovina has to play a main role in economy growth. Because of the economy situation in the country, priority should be competitive energy sector, which assures residents' standard of living and also has a positive effect on environment and other sectors of economy. [62]

Five priorities are identified in order to provide stable energy system [62]:

- *Resources should be used in an efficient way* – coal is dominant in the production of electricity; coal generation and exploitation in the future should be done with the help of more adequate technologies and methods. Identification of natural resources that could be oriented on the clean energy supply;
- *Safe and affordable energy* – regarding energy security, Bosnia and Herzegovina cannot assure energy security on its own, because of no oil or gas production. Because of that, it is important to accomplish secure market integration with countries in the neighborhood and to establish partnerships with business entities that source the domestic market;
- *Energy efficiency* – three targets: savings in consumption, electricity, gas and heat transformation, processes of transmission and distribution, creation of efficient cogeneration and promotion of district heating systems; additionally improving of regulatory framework and financial measures;
- *Transition of energy and environmental responsibility* – increase the share of renewables and reduction of negative effects on the nature and environment. Bosnia and Herzegovina has set a goal to reduce SO_2 by 95%, NO_x by 67% and dust by 88% in big combustion plants until 2028 (relative to 2014). Application of the environmental protection standards and monitoring of the efforts and results of implemented measures and
- *Improvement and adjustment of regulatory and institutional framework* – changes and reforms of energy sector. Also market regulations should excite more efficiency and competiveness, where most profits will be obtained by the end users. All stakeholders in the energy sector should be involved in the process of its improvement.

Energy efficiency plays a significant role in the modern energy sectors. In the upcoming time, Bosnia and Herzegovina has to implement a set of decisions and measures, which will help the binding EU Directives under the Energy Community Treaty. [62]

The Energy Efficiency Law was adopted in 2017 and entered into force in April 2017. It consists of the measures that regulate energy efficiency in the final consumption, measures for improving energy efficiency, obligations of public sector and large consumers, financing and others. The Law does not include energy efficiency of power plants, energy transmission, distribution and transformation. [62] At the local scale, this Law ensures measures that would lead to more efficient energy consumption, like renovation of local government facilities and public establishments set

up by local governments, as well as public lightening, water supply, waste management and transport. [63]

Energy efficiency strategy is modeled on lasting visions of EU member states, but primary focus lies on the real interests and potentials of Bosnia and Herzegovina and meeting necessities of the Directive 2012/27/EU. The *long term energy efficiency strategy* has three important elements: possible savings in the final consumption, savings in conversions, transportation and distribution of electricity, heat and gas and promotion of efficient district heating systems. Additionally, regulative frameworks, measures and institutional implementations are important parts of the energy efficiency strategy. [62]

5.2.1 Potential Savings in the final Energy Consumption

Savings in the final energy consumption are divided into four sectors: residential sector, service sector, industry and transport. In industry and residential sector most savings are planned. In 2015, at the level of Bosnia and Herzegovina, savings were 5.23 PJ (PJ = 10^{15} J) (3.71 PJ at the level of the Federation of Bosnia and Herzegovina and 1.52 PJ at the level of Republika Srpska). The most savings were accomplished in the service sector (2.50 PJ) and residential sector (2.11 PJ). [62]

Bosnia and Herzegovina has *good potential* for savings, and mostly in the building sector that has more than 50% of total final energy consumption. For the implementation and realization of savings it is essential to form a database on existing housing fund in the country. Some of the options for the planned savings might include: renovations of facilities with room heating and their energy savings, utilization of central heating in these facilities and connection to the district heating system. For the period of 2020 onwards planned savings are 1.5%, which corresponds to 5.35 PJ per five-year stage, where 1.5% refers to the consumption in the base year. Compared to the reference year (2010) planned savings amount to 31.31 PJ (fig. 19). For the entities it means: 20.76 PJ for the Federation of the Bosnia and Herzegovina, 9.67 PJ for Republika Srpska and 0.88 PJ for Brčko District. The expected savings and getting to desired targets by 2035 require EUR 560 million. [62]

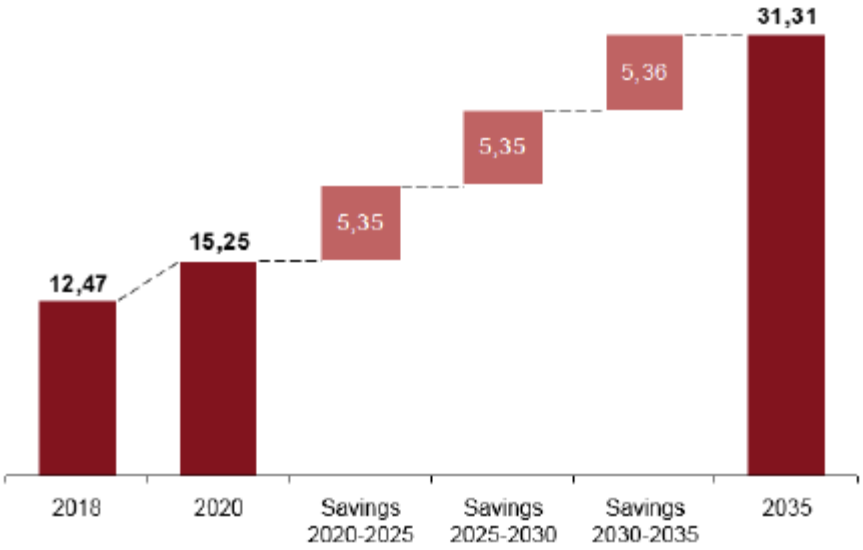


Figure 19: Planned Savings in final Consumption for Bosnia and Herzegovina in PJ until 2035 [62]

5.2.2 Savings in Transformation, Transmission and Distribution

Planned savings cover the whole energy sector, from transformation, transmission and distribution to the end users. The energy balance from 2016 showed that the part of thermal power plants in generation of electricity in Republika Srpska was 65.4% and in the Federation of Bosnia and Herzegovina 66%. For the Republika Srpska the average efficiency of power plants is 33.6% and for Federation of Bosnia and Herzegovina 29.4%. The overall goal is to achieve 35% to 40% of the average energy efficiency of power plant units by 2035. [62]

The trend of reduction of distribution losses in Bosnia and Herzegovina is continuous. In 2010 it was 16%, in 2015 11.7% for Elektroprivreda Hrvatkse Zajednice Herceg Bosne (EP HZ HB), for Elektroprivreda Bosne i Hercegovine (EP BIH) from 9.7% to 8.7% and for Elektroprivreda Republike Srpske (EP RS) from 16.5% to 11.7%. This reduction of distribution losses is an outcome of implemented regulations and technical measures in both entities. [62]

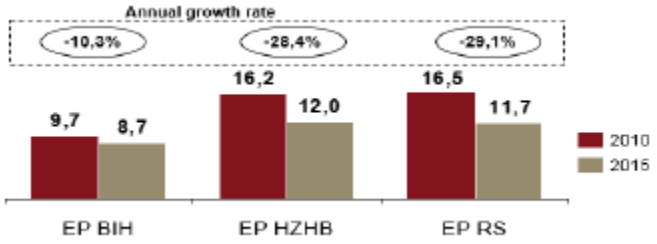


Figure 20: Reduction of Electricity Distribution Losses, 2010-2015 [62]

The strategic goal of the electricity sector is the reduction of the technical and commercial losses. Distribution losses should be reduced to 9% in 2020 and to 6.5% in 2035.

The goal of the reduction to the 9% EP BIH has already achieved in 2015, so in the following table (tab.1) the savings until 2020 for EP BIH are not calculated. [62]

Table 1: Savings in Distribution (estimates without and with the energy efficiency measures) [62]

Goal		Savings (PJ)	
		Consumption estimate without EE measures	Consumption estimate with EE measures
9% by 2020.	EP RS	0,35 (97 GWh)	0,33 (91 GWh)
	EP BIH	0	0
	EP HZHB	0,16 (43,4 GWh)	0,15 (41,3 GWh)
	TOTAL	0,51 (140,4 GWh)	0,48 (132,3 GWh)
6,5% by 2035.	EP RS	0,53 (146,2 GWh)	0,50 (138,3 GWh)
	EP HZHB	0,68 (187,6 GWh)	0,63 (175,9 GWh)
	EP HZHB	0,17 (47,8 GWh)	0,16 (43,2 GWh)
	TOTAL	1,38 (381,8 GWh)	1,28 (357,4 GWh)

These saving goals should be achieved with the technical investment measures, organizational activities and plans. For the technical losses, recommended activities are modernization of the networks, replacement of devices with the new and modern ones, shift to the 20 kV voltage level, automation of network management and setting of new transformation stations to reduce the LV network. For the commercial losses, suggested measures are renovation of connectors, registration of unauthorized access to the meter and electronic consumption measuring. [62]

5.2.3 District Heating Systems

District heating system is a network of pipes that deliver steam or hot water from the generation point to the end users. It is mostly used for home energy use, industries and universities. On this way the production of energy on the consumer site is avoided. The heat can be delivered from different energy sources, like fossil fuel, solar energy, and geothermal district heating plants, electric heat pumps or fuel cells. DHS can also be a consequence of electricity generation in industry or cogeneration plant. [64]

DHS as already said, connects an energy source and energy user. It can offer inexpensive energy by using surplus heat or waste. The origin of these heat sources can be local and they can promote local industries and local productions. Some other benefits of DHSs are low primary energy request due to energy efficiency, security of energy supply through use of local renewable energy sources, if available.

DHSs also use energy resources, which will be wasted otherwise, like industrial surplus heat, waste or heat from electricity generation. Instead of being wasted, surplus heat from industries can be used in DHSs, which means less environmental impact and higher energy efficiency. [65]

DHS also have economic benefits, like: reduction of costs for operation and installation, generation of local employment, avoiding of fuel storage in buildings and so increases the security aspect. Also, some governments give subsidies for the setting up energy efficiency measures. [66]

There are 32 DHS in Bosnia and Herzegovina and 3 are under bankruptcy. In the Federation of Bosnia and Herzegovina 22 of them are located and in the territory of Republika Srpska 13. The entire yearly production of the heat energy in all DHSs in 2017 was 1,608,208 MWh. This amount of energy corresponds to 8% of the total heat need of the building sector. The biggest part in the production of the heat energy is produced by thermo-power plants (TPP) and industrial plants, where the coal is the dominant primary fuel (39%), followed with the natural gas (27%). DHSs are heating approximately 10,048,516 m^2. [67]

After war (after 1995) only some of the thermal power plants have been renovated completely (Sarajevo, Prijedor, Banjaluka, Tuzla, Gradiška, etc.), some of them only partly. In other plants, just the most necessary repairs were conducted, which explains the heat losses in these plants and systems. Usually, DHSs in Bosnia and Herzegovina are placed near to thermal power plants and industrials plants and they are provided with the heat energy from these plants. On this way, DHSs are so constructed to use steam from the thermal power or industrial plants for the heating purposes. On the other hand, there are several DHSs that are recently built and they rely on biomass (Gračanica, Banjaluka, Nemila, Prijedor, Livno, Srebrenik and Bosanska Gradiška). [67]

There are several problems in the DHS: losses of hot water in the network, problems in measuring, calculating and charging of the distributed heat, low acquisition prices and challenging economic position of delivering companies. [62]

For Bosnia and Herzegovina major concerns are savings in transmission and distribution networks. The savings in those two areas should be based on: renovation of already available boilers (fuel oil fired boilers) and switch to biomass-fired boilers, rehabilitation of ruined transmission and delivery networks and better regulation of substations (automatisation), etc.

5.2.4 Promotion and Financing of Energy Efficiency

To increase the citizen awareness, give general information and to point out the benefits of energy efficiency it is important to do informative campaigns. These campaigns should also motivate citizens to undertake actions and accomplish savings.

Some ideas for the priority training are: consideration of best technologies, which increase energy efficiency of the buildings, water sources and street lights; use renewable energy sources; use of energy management in buildings; urban planning and efficient transportation system; cost analysis and measurements of energy efficiency effects; monitoring of energy savings; better heating and cooling systems with applied automatic control and legal frameworks and obligations. [62]

The biggest barrier for the proper implementation of energy efficiency measures represents the financing of energy efficiency projects. The new Directive 2012/27/EU suggests instruments that obligate distributers and/or energy suppliers to carry out energy efficiency projects for all sectors and for final consumption. The undertaken measures of energy efficiency should be measured and monitored. For the successful implementation and good practices certificates and auditing procedures should be introduced. [62]

The Third Annual Report under the Energy Efficiency Directive from July 2019, states that during 2019 trainings were held to build up the capacity of the coordinators of energy consumption manager. But, there were *no developments* in 2019 regarding creation and announcement of instructions and examples of documents connected to presentation of criteria in energy efficiency or implementation of controlling systems which ensure approved use of energy efficiency. [68]

The objective introduction and application of financial framework for improvement of energy efficiency in final energy consumption has a task to create financial, executive and institutional mechanisms for proper application of energy efficiency measures and achievement of planned energy savings. There was *no progress* in: implementing energy taxes (dues for electricity consumption in households in combination with help to socially weak population categories, dues for electricity consumption in industry and small and medium sized enterprises, fees for generation of electricity from coal or oil derivatives, energy dues rely upon the energy class of the building or property), implementation of CO_2 taxes for industrial energy consumers and for registering of motor vehicles regarding CO_2 levels, make financial arrangements for multi-year budgeting for energy performance contracts and capturing mechanism that tracks energy savings. Bosnia and Herzegovina collects dues from polluters (air emissions of SO_2, NO_2 and solid particles). The Environmental Funds of entities collect these dues and routed them to projects in energy efficiency. Also, both entities collect environmental fees with every registration of motor vehicles. Environmental/Energy Efficiency Funds of entities collect theses fees and channel them to convenient projects. [68]

International financial institutions' funds (IFI) gives an access to Bosnia and Herzegovina for energy efficiency measures. It refers to World Bank (WB), European Bank for Reconstruction and Development (EBRD) and Credit Institute for Reconstruction (KfW).

Many agencies are active in Bosnia and Herzegovina, where they implement funding delivered by developed countries. In the area of energy efficiency most dominant are the United Nations

Development Program (UNDP), agencies and organizations that rely on the bilateral agreements: German technical assistance (GIZ), United States Agency for International Development (USAID), Swiss cooperation (DEZA), etc. This funding is mostly used for the technical support in energy efficiency and for contribution for pilot projects in energy efficiency. [68]

The main form of financing of energy efficiency projects and measures in Bosnia and Herzegovina particularly in residential sector and small and medium enterprises, is private financing. Combined with the other financing sources, private financing should contribute in economic feasibility of projects. [68]

5.2.5 Strategic Plans for Energy Efficiency Improvement in Bosnia and Herzegovina

For the time period until 2035 it is necessary to make a *framework* of important measures for accomplishing saving in the final energy consumption, transformation and promotion of DHSs. [62]

For the area of final consumption strategic priorities are: improving energy efficiency in the buildings and for end users (creation of data base for all residential buildings, building renovation), better energy savings in industry (energy efficiency of industrial processes and plants renovation, promotion of renewables and creation of energy management) and better energy efficiency of all vehicles (replacing old cars and vehicles with more energy-efficiency ones and improving of public infrastructure). [62]

For the area of conversion, transmission and distribution strategic targets are: replacement of thermal power plants and reduction of losses in distribution. These targets consist of following guidelines: primary energy savings, monitoring of measures implementation for accomplishing of targets based for distribution area, redesign of grid and higher energy efficiency in the gas and power infrastructure according to Directive on Energy efficiency. [62]

For the DHS planed is the expansion of the system and legal framework legislation. This goal consists of making of countries heat map and legal framework regulation, which will motivate DHS installation and improvement. [62]

The cross sectorial measures that include better public information on energy efficiency, motivation of "green jobs" and creation of financial framework with the task of financing projects in energy efficiency. This measure include promotion energy efficiency, DHSs, etc. educations of workers and engineers in the planning of more efficient systems. Also, opening of new jobs in the energy sector and building, improvements in the energy management and supporting of Environmental Protection Fund. [62]

5.2.6 Roadmap for Improving Energy Efficiency in Bosnia and Herzegovina

As it is to see from the further paragraphs, Bosnia and Herzegovina lacks on the energy efficiency, waste management and improved production systems, etc. Most economic and environmental losses are because of the low energy efficiency standards in domestic and publicly-managed buildings. Owners and decision makers are mostly not aware of the situation and they have not adequate equipment for proper control or handling of energy efficiency costs. [69]

Important to say is that in Bosnia and Herzegovina, the energy consumption in the building sector is 57% of total country's energy consumption. The same rate in EU is 40%. On the global level, this is important because building sector is responsible for about 74% of worldwide GHG emissions. [69]

For the purpose of improving energy efficiency, the Programme called *"Mainstreaming environmental governance: linking local and national action Programme in Bosnia and Herzegovina"* is now going to be introduced.

The main idea of the Programme was to increase local management of environmental resources and service delivery by improving environmental governance and developing reproducible models for environmental planning. The Programme gave grants to municipalities to implement energy efficiency and renewable energy sources projects and to emphasize smaller-scale projects and their importance and impact as they distribute the profits (energy savings, health developments, local economy, etc.). The Programme also allowed municipalities to implement energy efficiency and renewable energy resources projects in public facilities and 28 projects were applied in thermal insulation, biomass furnaces, solar panels and LED street-lightning. The Programme have supported the Sustainable Energy Action Plans (SEAPs) in 5 communities and Local Environmental Action Plans (LEAPs) in 37 municipalities. [69]

The *focus* of the Programme was reduction of usage of fossil fuels, decrease of CO_2emissions and reduction of energy costs in public buildings. There are three reasons, why the focus was on the public buildings [69]:

1. Buildings were accountable for a major amount of the county's overall energy consumption;
2. The standards of efficiency were very low, so that the benefits for upgrade were high and
3. Local policymakers and other stakeholders wanted to track these problems in a broad manner.

Also an Energy Management Information System (EMIS) was installed, so that information of each local project could be recorded and listed into a national database.

The long-term objective was to support the EMIS software to the municipalities, so that public buildings and services are joined into the centralized system. All data generated by this system could be used to monitor the energy consumption in the whole country and also to inspire future energy efficiency and renewable energy sources achievements in public and private sectors. The political authorities recognized a strong incentive and motivation for energy efficiency and renewable energy sources measures in Bosnia and Herzegovina, and recognized that they have to raise the local standards to meet international goals. [69]

The results of the Programme were that local-level planning was improved with increased number of local planning strategies and documentation and engagement of local stakeholders. National environmental consciousness and actions linked with the MDGs were effective and have influenced the release of the first State of Environment Report, analysis of the environmental protection frameworks, the creation of a national climate change authority, energy monitoring of public buildings, improvements in entity environmental funds, analysis of green economy, etc. [69]

This project represents a good example of improvement and development of energy sector and also that projects on smaller-scale are good solution compared to the large-scale projects, because they may have greater impact and could serve as role models to the rest of the country. Important is also that the local authorities are capable to deal with the projects in energy sector. The smaller-scale projects have shorter payback time and could improve benefits for the local municipalities, as it is shown by this Programme. [69]

The measures in energy efficiency and renewable energy sector reduced poverty in the region, because individuals and communities spent less money for energy costs. And at the end, the local ownership is important, as the personnel from local municipalities handled the EMIS database and the local communities participate in financing the projects. So, they claimed ownership of the energy issues in their regions. [69]

This Programme can be replicated in other regions of Bosnia and Herzegovina, but also worldwide, particularly in countries under economic transitions without regulations of energy efficiency. Also, the EMIS is a *sustainable concept*, because data inputs were verified and new data were added by local personnel. This database also shows the benefits obtained from the projects and actions, like project investments, money savings, CO_2 reductions and shorter payback time. [69]

Finally, the local authorities show the ownership of the energy issues in their communities without the engagement of the higher-level authorities. Also, the communities that were not a part of the Programme wanted to start their own SEAPs and/or LEAPs and to add their data to the EMIS by applying energy efficiency and renewable energy sources measures. [69]

So, this Programme serves as a great example of sustainable action, how good idea is quickly spread and how authorities could work together for local profits.

5.3 Institutional Competence of Solid Waste Management Sector in Bosnia and Herzegovina

The institutional set-up of the solid waste management in Bosnia and Herzegovina is separated over several levels [70]:

- *Ministry of Foreign Trade and Economic Relations (MOFTER) – state level:* coordination of all actions and harmonization of entities plans, government and institutions.
- *Ministry of Environment and Tourism of the Federation of Bosnia and Herzegovina – entity level.*
- *Ministry for Spatial Planning, Civil Engineering and Ecology in Republika Srpska – entity level.*
- *Department for Physical Planning and Proprietary Affairs of the Government of Brčko District – entity level.* [71]
- *Ten cantons in the Federation of Bosnia and Herzegovina* with its own governments, where each government has its own laws and policies on waste management that are connected to the legal and strategic framework of Federation of Bosnia and Herzegovina – *cantonal level*. [71]
- *Municipalities in the Federation of Bosnia and Herzegovina (79) and in Republika Srpska (62)* – implementation of municipal utility service departments – *municipal level*. [71]

5.4 Waste Management – Current State in Bosnia and Herzegovina

Due to the complicated government structure and interrelated levels of data collection, data on municipal solid waste in the country are not good structured. Data from the latest national statistics report from 2016 showed that the average waste generation rate equals to 0.89 kg/cap/day, the yearly generated municipal waste amount is 1.3 million tonnes, 74% of generated waste is gathered by waste collection services, 66% of population on entity level uses solid waste collection services, only 33% of collected waste is placed on sanitary landfills and 67% on uncontrolled municipal landfills and only 1% is recovered. [71]

In the cantonal average 25% is organic waste and in the municipal average 50%. Plastic, paper, glass, metals, PET and aluminum cans range from 24% to 38% of the total waste. This amount is lower in the rural areas and higher in the urban areas, particularly in the country's capital, Sarajevo. [71]

The main waste treatment available in Bosnia and Herzegovina is a *landfilling of waste*. There are 6 regional sanitary landfills and 2 are under the construction. 53 out of 143 municipalities in the

country dispose their waste at regional landfills (28 in Federation of Bosnia and Herzegovina and 25 in Republika Srpska). New regional landfills or upgrading of current municipal landfills are needed and also an upgrade of existing landfills (investments in treatment plants) in order to protect human health and environment from negative impacts of waste. There are 93 unruly municipal landfills. It is estimated that there are 340 illegal sanitary landfills in Federation of Bosnia and Herzegovina and 250 in Republika Srpska. But, according the Management Strategy in Republika Srpska for 2016 to 2025 the number of illegal dumpsites is assumed to reach 1 200. [71]

For sorting of mixed waste there are only five separation places in country (Mostar, Konjic, Sarajevo, Tuzla, Doboj). There are no other waste pretreatment or treatment options in the country. Only options for the reduction of waste quantities on the landfills are investigated. The first option is production of Refuse Derived Fuel (RDF) and Solid Recovered Fuel (SRF) for cement plants. Three regional landfills (Zenica, Mostar and Sarajevo) are interested in the SRF and they run the study for mechanical and biological treatment (MBT). [71]

There are no facilities for dealing with special waste sorts like waste sludge, animal waste, medicinal waste, hazardous waste, etc. Just three medial institutions perform sterilization of contagious waste, which means that this type of waste finish up on the landfills, where it poses danger to the environment, nature and human health. Significant amount of waste from industries or some other special waste are transported aboard, according to the Basel Convention. [71]

5.4.1 Perspectives of Solid Waste Management in Bosnia and Herzegovina

In 2000 began the reform of solid waste management in Bosnia and Herzegovina. The project led the EU PHARE, but it the resulting strategy was never implemented by the entities. [71]

The recent study from 2018 on municipal solid waste management in Bosnia and Herzegovina was run by the World Bank and financed by Swedish Development Agency (SIDA). This study gave the review of the solid waste management in the country and recommendations for the improvements in this sector. [71]

The essential recommendations are [70]:

- Improvement of statistical information system;
- Improvement of waste collection coverage (from 67% to 85-90%);
- Harmonization with the EU Law;
- Improving of waste collection efficiency by better collection systems;
- Improving of institutional framework at entity, cantonal and local levels;
- Connecting all stakeholders in the improvements, particularly Association of Municipalities and the Bosnian Solid Waste Association (BASWA);
- Public awareness building programmes;

- Reforming of tariff collection system;
- Enrich the regional landfills;
- Initiate the environmental taxes on non-compliant landfills and
- Introduction of investment projects for improving of gathering, transport, separation and removal of municipal solid waste.

Serious *problem* represents that the awareness rising is very incomplete, because municipalities and collection companies do not invest money in this area. There are no companies or municipalities, where the experts have task to organize some public awareness programme. So, the one of key recommendations is the investing in public awareness building. [70]

High priority is the developing of legislations and policies. Ministries or departments in the government are responsible for the initiation of reforms. The strategies for waste management should be realistic and within affordable boundaries. The further harmonization with EU Directives and developing of guidelines for waste management and packaging improvements. Also, this sector needs experts and better trained staff. It was recommended that the expertise from outside perform tasks and train staff in order to improve solid waste management and improve situation on the short-term. [70]

At the local level, in municipalities, the autonomous solid waste management section should be formed, if possible a distinct collection company and a distinct landfill company. It is suggested, that communities build an association with other municipalities or cities, in order to regionalize gathering and disposal services. So, it comes to better accountability of accomplished results as the companies and managers of gathering and disposal systems are adopted to more profitable way of thinking. With better knowledge of the market and waste management, disinvestments could be prevented. Through the association of municipalities, more international and external contacts on development and effective waste management could be achieved. Also, the guidelines should be developed that specify tasks of all stakeholders (cantons, communities, waste aggregator and generator), fee procedure, charge and tariff procedures, etc. [70]

Table 2: Required Investments (in US Dollars) until 2025 in Waste Management Sector in Bosnia and Herzegovina [70]

Description	FBiH	RS	BD[1]
Equipment			
Waste collection trucks	37.9 million	8.4 million	3.23 million
Containers	5.1-10.2 million	2.25-4.5 million	0.72-1.44 million
Sorting line			1.25 million
Transfer Stations + long haul trucks*	1.5 million	1.5 million	
Landfills			
Upgrading existing RL's	13.82 million	11.89 million	
Upgrading ML's	tbd	tbd	7.49 million
New RLs **	tbd**	tbd**	
Construction new RL's and upgrade of some MLs – (pre-)feasibility studies	tbd	tbd	
Inventory wild dumps	0.050 million	0.050 million	
Institutional strengthening			
Entity level- 2/3 years TA	1.2 million	0.8 million	0.5 million
Municipal level- reorganisation	150,000	150,000	
Strengthening Association of Municipalities and Communal Enterprises	500,000		
Efficiency assessment utility company	300,000	300,000	0.5 million
Pilot project separation at source	400,000	370,000	

*Indicative and should be based on a case by case assessment

** Based on decision for number and location of the new RLs and pending results of site-specific feasibility studies, the amount can be assumed using approximately $5.0 million per RL that will cover initial cells and supporting infrastructure

In the tab. 2 the required investments for waste management sector in Bosnia and Herzegovina are listed up to 2025. The investments are connected to infrastructural projects for waste disposal improvement and building of new landfills and improving of existing ones and closing of dumpsites.

Additionally, about 65 to 85% of the collection trucks with containers should be renewed. [70] (Used abbreviations in the tab. 2: RL – regional landfill, ML – municipal landfill, TA- technical assistance).

5.4.2 Roadmap for Improving Waste Management in Bosnia and Herzegovina

There is a high need for ISWM in Republika Srpska. Improvements in municipal solid waste management bring disintegration of decision-making process. It leads also to increased employment rate: new technologies in waste recycling require additional workforce.

Important part for development of municipal solid waste management are students or young population, because they can contribute in early phase of opening and establishing of recycling facilities or non-governmental organizations. Also, new technologies for waste recovery or recycling lead to better environmental protection. Waste disposal as well as waste treatment would be better controlled and so, it comes to reduction of serious environmental pollution problems. In addition, the concept of *Corporate Social Responsibility (CSR)* would be introduced and could lead to international and local investments, as this concept represents business practices dependent on ethical values and norms, respect for workers, municipality and community as well as on environment. [44]

Development of ISWM depends on the greater involvement of private sector. Many developed countries suggest this option, as the private-public partnerships (PPPs) are essential for development, as they have the needed knowledge (know-how) and financial means for establishing of sustainable systems. The PPPs within the waste recycling enterprises could bring advantages to the stakeholders. One example is waste recycling or separate collection within market value. On this way recyclables provide *substantial financial means* that could be used for other investments and system optimization. [44]

Improvements of waste management system may increase financing chances through funding patterns from national governments or EU funds (credit loans of project co-financing). The banking sector of the country is about to provide loans for environmental friendly establishments and companies that apply environmental management practices. Through improvements of waste management system and upgrade of monitoring of development, further investments could be better planned. [44]

To realize the waste management improvements public awareness and education of citizens should be raised. With better public awareness and education, further environmental degradation should be prevented. [44]

A good example of initiative for improvement of waste management is *"Ekopak"*. It is the first licensed packaging recovery organization in Bosnia and Herzegovina, established in 2011 as a non-profit company. The main idea of the company is to carry out legal obligations for recycling and re-use of packaging waste in Federation of Bosnia and Herzegovina on behalf producers of packaging, importers, distributors and suppliers. The activities of the organization are based on the EU practices from this area. [72]

The strategy contains utilization of legislative on packaging and packaging waste according to the European practices; development of integrated system of packaging waste management for glass, paper, metal, plastic and wood packaging waste and existing communal companies are used for further development. [72]

The Ekopak became 32nd member and Bosnia and Herzegovina 32nd country in the system of "Green Dot". This is a system of packaging waste that has begun in 1980s in Germany and the owner of the trademark has let the management and coordination of the symbol use outside of Germany to the umbrella organization PRO EUROPE. Since 1995 PRO EUROPE has rights on authorization for "Green Dot" trademark use. Also, Austria is one of the PRO EUROPE members. At this way, as a member of PRO EUROPE, Ekopak, provides the import and export of the products with the "Green Dot". [72]

The Ekopak company represents a great example, how one small organization can make great progresses regarding big issues, like improving waste management and fulfilling legal obligations.

5.5 Ongoing Projects in Bosnia and Herzegovina related to Energy Efficiency

As already seen in the previous chapters, Bosnia and Herzegovina is not energy efficient from the energy consumption viewpoint within residential, public, industry and facility sector. But, at the same time country has very highest energy conservation capabilities in the region. The average energy consumption in the country (public buildings) is three times greater than the average in the EU. According to the EU Eco-Management and Audit Scheme (EMAS) these buildings are categorized as completely inefficient. In order to improve energy efficiency, a significant amount of funds has to be invested for energy expenses of public buildings (academic, health, cultural, municipal and state or entity institutions). [73]

Bosnia and Herzegovina has signed the Energy Charter Treaty (ECT) and the Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA). With ratifying these documents, Bosnia and Herzegovina has committed itself to improve energy policies and energy efficiency by reducing negative impacts on environment. [65] Also, ECT brought regulation of the energy market and commitment of reporting on the origin of its guidelines and directives. From 2009, UNDP works in upgrading energy efficiency of public buildings in order to assist in realization of the targets of mentioned directives. [73]

In February 2013 has begun the implementing of a "*Green Economic Development Project (GED)*" financed by Swedish Government, Environmental Fund of the Federation of Bosnia and Herzegovina and Environmental Protection and Energy Efficiency Fund of Republika Srpska. The Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina, entity's ministries for spatial planning, cantonal ministries and other institutions are partners of this Project. The estimated end date of the Project is February 2021. [73]

The aim of the GED Project is to institutionalize the energy management activities in the public building sector in Bosnia and Herzegovina.

The activities are in accordance to the European Union directives and the Energy Community Treaty. Because the country (governments) had not enough human and financial resources to cover the planned activities, the first step was to strength the institutional capacities. [73]

The project components are summarized as following [73]:

1. Extend Institutional Capacities:
   - Capacity for Nearly Zero Energy Buildings
   - Technical Assistance to the Environmental Funds
   - Improving technical and economic capabilities of municipalities, public services, public utilities and activities
   - Creation of energy intensity plotting application and monitoring and authentication within the Energy Management Information System (EMIS)
2. Institutionalization of Energy Management
   - Introduction of EMIS in public buildings
   - Implementation of EMIS in public lighting systems
   - Capacity building for end-consumers
3. Form Financial Mechanisms and Legislative Framework
   - Support Environmental Funds with the development of financial mechanisms
   - Help governments in secondary legislation on energy efficiency and management
4. Apply Infrastructure Measures
   - Implement energy efficiency and renewable energy measures, solar hot water and photovoltaic and make public lightening systems energy efficient
5. Raise Public Awareness
   - Increase public awareness regarding energy efficiency and renewable energy
6. Set up Renewable Energy Sources for Off-grid Households
   - Establishing of hybrid photovoltaic and solar systems to distant and isolated areas without electricity.

The achievements of the Project so far, are [73]:

- Institutionalization of energy management in eight cantons and the obligatory EMIS data input in six cantons;
- Developing of two energy Efficiency Action Plans;
- More than 2,200 users have been educated to use EMIS system;
- More than 270 detailed energy audits on public sector buildings have been operated with the aim of identifying the most useful measures for energy efficiency improvement;

- Since 2016 the Revolving fund is active within the Environmental Fund of Federation of Bosnia and Herzegovina supporting investments in energy efficiency public business projects and industry buildings;
- Developing of study Green jobs "Analysing the Employment Impact of Energy Efficiency Measures in Bosnia and Herzegovina";
- Developing of first "Typology of Public Buildings in Bosnia and Herzegovina";
- Energy efficiency reconstruction of 196 public buildings;
- Modernization of public lightning system in nine municipalities;
- More than 67,000 citizens took a part in educational workshops.

The SDGs 4 and 7 are targeted by the GED Project. The SDG 4 contains a target that help in promotion of sustainable development and skills that are needed to promote it. Among many targets of SDG 7, this Project ensures improving of energy efficiency and required reconstructions of public buildings in order to meet energy efficiency measures and also supporting of energy efficiency public and private businesses.

Another project, related to the improving of energy efficiency and accomplishing SDGs is *"Catalyzing Environmental Finance for Low-Carbon Urban Development (URBAN LED)"*. This is an ongoing project, started in September 2017 with an estimated end date in December 2022. The project Urban LED is implemented by UNDP, the donor is Global Environment Facility and partners are Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina, Ministry of Spatial Planning, Civil Engineering and Ecology of Republika Srpska, Federal Ministry of Environment Tourism, Environmental Fund of Federation of Bosnia and Herzegovina, Environmental Protection and Energy Efficiency Fund of Republika Srpska. [74]

In Bosnia and Herzegovina the socio-economic development is quite dynamic. The urbanization rate is high and mostly unsupervised. Many planned investments in the residential building and public infrastructure cannot be realized. There is also a concentration of work places and population migration within the country is high. This makes low-carbon urban development a great chance and a capable instrument for carbon footprint reduction and reduction of negative impacts on environment, by making cities better places for living. [74]

The aim of the Urban LED Project is to invest in low-carbon urban development in Bosnia and Herzegovina, by reducing greenhouse gas emissions, stimulating cleaner and safer urban areas. The Project invests in low carbon solutions in urban sectors and promotes their further application in municipalities and private sector through financial mechanisms defined within the environmental finance structures in country. It also promotes the conversion of market for low-carbon ideas through creating business possibilities like Energy Service Company (ESCO). Also, waste management companies could take a part in running of low-carbon services and products. [74]

The Project's contributions are: supporting of capacities of Environmental Protection Fund of the Federation of Bosnia and Herzegovina and the Fund for Environmental Protection and Energy Efficiency of Republika Srpska for sustainable financing of environmental protection projects, establishing of ESCO financing schemes for low-carbon urban development with the aim of commitment of local small and medium enterprises. Implementation of direct investments in low-carbon urban development that will reduce greenhouse gas emissions (10 000 tCO_2/year or 210 000 tCO_2 over investment period). Also, carrying out of financing mechanism for low-carbon urban development that results with indirect greenhouse gas emissions reduction ten years after Project end date (more than 10 million tCO_2). And finally, creating an opportunity for the putting into practice of policies in the environment and energy efficiency sector in Bosnia and Herzegovina as well as creating legislative framework. [74]

Urban LED Project components are [74]:

- Financing mechanisms for implementation of low-carbon urban development idea; regulations of polluter pays principle; defining of principles for financial method for low-carbon urban development; arranging of workshops and trainings for ministries and staff from private sector for applying of ESCO financial support; establishing of monitoring and verification systems for cost savings from low-carbon urban development in municipalities that apply this concept;
- Low-carbon waste management and improvements of solid waste management and establishing of database for recycling; provide training and support for measurement, reporting and verification (MRV); control of waste fee system and introduce project of waste recycling;
- Raising awareness on low-carbon urban development harmonization of regulations and coordination of environment authorities across the country.

Expected results of the Projects are [74]:

- Investigation of existing legislative frameworks and guidelines on polluter pays principle;
- Implementation of ESCO in both entities;
- Leastwise 40 workers of relevant institutions were trained for innovative finance options and ESCO mechanism;
- Introduction to repayment mechanisms;
- Establishing of MRV for ESCO-support;
- Expansion of EMIS on 1,500 buildings around the country and trainings on use of EMIS;
- Developing of Sustainable Energy and Climate Action Plans (SECAP) for 15 municipalities;
- Developing of waste management information systems in both entities and workshops for their use;
- Advices for reforms in payment system for municipal solid waste;

- Studies on more environmental transportation and waste management in some municipalities;
- Harmonization of legislative environmental frameworks and
- Rising national awareness about environmental issues.

The Urban LED Project targets SDG 7 and 11. Important parts of the Projects are investments in energy efficiency and developing of low-carbon city areas, investing in better financial mechanisms for planning of the waste management and environmental protection. Some of the targets of the SDG 11 related to this Project are: ensure sustainable urbanization and settlement planning, reduce impact on environment by considering air quality and waste management, support connections between municipalities and cantons, increase the number of communities that implement resource efficiency and support developing and least developed countries with financial and technical assistance in resilient and sustainable building sector. [75]

Since September 2018 there is an ongoing project (estimated end-date 2026) "*Scaling-Up Investment in Low-Carbon Public Buildings"*. The Project donor is Green Climate Fund and partners are: Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina, Federal Ministry of Physical Planning, Ministry of Spatial Planning, Civil Engineering and Ecology of Republika Srpska, Environmental Fund of the Federation of Bosnia and Herzegovina, Environmental Protection and Energy Efficiency Fund of Republika Srpska. Because of the under-investment, public infrastructure in country is on very low state and need an urgent upgrade. In country's Nationally Determined Contribution (NDC) under Paris Agreement identified is the great potential of greenhouse gas emissions reductions in public buildings. The estimated cost-effective energy savings range from 20 to 60%. Additionally, there is a great potential of greenhouse gas reduction by fuel switching. More than 80% of public sector buildings use fossil fuel (coal, light fuel oil or natural gas) or district heating systems also based on coal. [76]

An important role in greenhouse gas emission reductions, combined energy efficiency and renewable energy sources (biomass or biogas, solar and other sources). But, there is a lack of financing funds for low-carbon investments. The existing summarized financing situation of low-carbon retrofits of public buildings in the country [76]:

- There are apparently many, but together insignificant grant-based finances projects form national and international organizations;
- Non-existence of integrated approach for public building retrofits, which leads to better distribution of public funds;
- Private sector is not enough interested in market-based finance and lack of ESCO business model.

The aim of the Project is to enhance investment in low-carbon public building through National Framework for Low-Carbon Investment in Public Buildings, including a joined package of policy,

guiding, technological, informational and economic solutions created to address country-specific threats and barriers to investment. [76]

The expected result is that the investment in low-carbon public buildings increases four to five fold. It will help the country to reduce greenhouse gas emissions in sector of public buildings. The exact numbers are: a direct reduction of greenhouse gas emissions by 2.02 million tCO_{2eq} over the investment duration, reduction of indirect emissions by 7.1 to 8.1 million tonnes of CO_2, around 4% of population will direct benefit from the project and more than 5.630 new full-time equivalent jobs. [76]

The two closely connected outcomes of the Project focus on financial and non-financial obstacles. The first expected outcome consists of supporting and addressing non-financial obstacles to investment in low-carbon infrastructure, giving technical support and assistance at all levels in country (cantonal, municipal, entity and national) to address structural problems to investment. The second expected outcome concentrates on approaching financial problems in low-carbon investments in public building sector, implementation of the National Framework for Low-Carbon Investment in public sector and stimulation of investment of public sector in low-carbon buildings. [76]

Under the mentioned framework, all public buildings could receive technical support for planning of energy efficiency and renewable energy projects. Only the projects that encounter minimum on socio-economic, monetary, technical and environmentally friendly requirements are suitable to receive Green Credit Fund funding to co-finance asset and the Green Credit Fund will be spent at the minimal level to make the project practicable. The financial means should be pay back in at least eight years. This ensures that the resources from Green Credit Fund are not mixed with the International Finance Institutions (IFI). They rather fill the financial gap that cannot be support with IFI's funding. [76]

The Project Scaling-up Investment in Low-Carbon Public Buildings contributes directly to the SDG 7. As some of the targets for the SDG 7 indicates, by 2030 energy efficiency should be improved, also the share of renewable energy in the global energy mix and the share of cleaner technology should be increased and the infrastructure should be expanded in developing countries. [77] As the objective and plan of the project suggest, these targets are covered by the project and expected results and outcomes should lead to a far better energy efficiency in public sector as well as to reduction of greenhouse gas emissions in public buildings.

Indirect these expected results should improve and influence many other aspects, like raising awareness – responsible energy consumption, improving air quality and consequently, less impacts of energy use on environment.

Despite the high potential for energy production based on woods, the country still uses it as low efficiency fuel wood for heating of individual households. There are also very few inducements for wood biomass-based projects in the country. In order to support this type of sustainable development – wood biomass and renewable energy sector, the Czech Development Agency (CzDA) started (October 2009) in 2016 four year project (estimated end is August 2020) of financing *"Biomass Energy for Employment and Energy Security in Bosnia and Herzegovina"*. The Project is implemented by UNDP, and partners are Ministry of Foreign and Economic Relations of Bosnia and Herzegovina, Embassy of Czech Republic in Bosnia and Herzegovina, Federal Ministry of Agriculture, Water Management and Forestry, Ministry of Agriculture, Forestry and Water Management of Republika Srpska and Government of Brčko District. [78]

The overall aim of the Project is the reduction of CO_2 emission on long term and sustainable use of wood biomass. Also, rising of public awareness on positive aspects of this source of energy. It is planned, that the Project contributes to the 3% reduction of tCO_2 per capita until 2030, based on the baseline in 1990 (8.97 tCO_2 per capita). Just for the comparison, the total emission per capital in the country in 2014 was 6.18 tCO_2. [78]

There are three components of the Project [78]:

- Polices for the sustainable wood biomass use: review of legislation in forestry and energetic sectors, adaption of legislative framework and revision of action plans on renewable energy, consolidation of decision making capacities in private sector and local communities involved in wood biomass in country;
- Wood biomass for heating: creating of coordination system of forestry and energetic related institutions in Bosnia and Herzegovina, calculations of wood biomass exploitation, support for consumption of wood biomass for energy purposes and public awareness rising on positive sites of use of wood biomass;
- Accomplishing of projects on renewable energy infrastructure: establishing of the financial funds for wood biomass projects and installing of heating systems based on wood biomass in several public building in the country.

The expected outcomes are [78]:

- Identification of policy gaps in energy and forestry sectors regarding wood biomass (already accomplished);
- Developing of methods for increase of wood biomass share in energetic and forestry sectors (already accomplished);
- Plans for use of wood biomass in public and private forests in two selected areas in Republika Srpska and Brčko District (already accomplished);
- Organization of study tours in Czech Republic for visiting policy decision makers in area of wood biomass sector (already accomplished);

- Organization of trainings on wood biomass business models for 10 local communities and private sector in area of energy efficiency in the country (already accomplished in 7 communities);
- Creation of working group on wood biomass in Bosnia and Herzegovina with legislative bodies from relevant institutions from forestry and energetic sectors (already accomplished);
- Examining of wood biomass potentials in the country and its calculations (already accomplished);
- Leastwise 4.500 individuals are informed about advantages of wood biomass in the country (already accomplished);
- Preparation of the study on the introduction of monetary mechanisms for wood biomass fuel change projects in public buildings within the Fund for Environmental Protection of Federation of Bosnia and Herzegovina and Fund for Environmental Protection and Energy Efficiency of Republika Srpska (already accomplished);
- Establishing of Wood Biomass Innovation Centre (already accomplished).

The ongoing activities are general public awareness rising on positive effects of wood biomass use in the country and development of plans for wood biomass use in selected forest management zones in Republika Srpska and Brčko District. [78]

The Project contributes to the SDGs 7, 12 and 15. Some of the targets of SDG 7 that are related to the Project are: ensure increase of use of renewable energy sources, international cooperation to utilize access to clean energy and improve infrastructure for sustainable energy. The SDG 12 targets sustainable management and well-organized use of natural resources, provide relevant information on sustainable development and support countries to consume and produce in more sustainable way. This Project covers also the SDG 15 that ensures sustainable use of terrestrial ecosystems, promote and finance sustainable forest management, reduce degradation of natural habitats, integrate ecosystems into planning (national and local) and increase financial funds in sustainable use of ecosystems. [79]

Closely related to the topic of forest conservation is also the project *"Fire Risk Management"*. Bosnia and Herzegovina is one of the most forest rich countries in the Europe. During one year there are several forest fires in the country. Total damage from the forest fires during last decade is closely to 60 million US$ and with high indirect harms. In the future there will be more forest fires, according to the climate change predictions. Beside fires, there is a higher risk of floods and droughts. There is lack on the legal framework on fire prevention in the country.

There is no strategic plans and development of early warning signals is very poor. Additionally, the equipment is also very old. [80]

The Project has started in November 2019 and the estimated end is December 2020. Project donor is Government of Czech Republic and partners are Ministry of Security of Bosnia and Herzegovina, Civil Protection Directorate of Federation of Bosnia and Herzegovina, Civil Protection Directorate of Republika Srpska, Municipal authorities of Bileća, Konjic, Jablanica, Nevesinje and other relevant agencies. [80]

The Project goals are to raise fire risk management capacities in municipalities: Bileća, Konjic, Jablanica and Nevesinje by addressing most burning inadequacies. The outcomes of the Project will strengthen the fire risk understanding, improve the awareness and disaster response amongst general public, through fire in danger population and governmental executives. The key activities are training for firefighters and application of small-scale fire prevention measures. [80]

The SDG 16 is directly targeted through this Project. The SDG 16 has many targets, some of them related to this Project are about ensuring comprehensive and representative decision making at all levels, supporting national institutions. [81]

"Energy Efficient Refurbishment of Zenica Hospital" is a project that has been approved in January 2018. The focus of the Project is the energy efficient refurbishment of the Cantonal Hospital in Zenica, which is owned by the Zenica-Doboj Canton. The EBRD gave a loan to the Federation of Bosnia and Herzegovina. The Project is also co-financed by the Regional Energy Efficiency Programme (REEP). The EBRD's loan will be used for financing of most urgent infrastructure needs like improving of energy efficiency of existing facilities, increasing usable area and eliminating of the flooding problem in basement. [82]

The main aim of this Project is to improve energy efficiency of the mentioned hospital and to reduce the CO_2 emissions. There is also a climate adaption element in the Project that consists of eliminating of flooding problems and implementing anti-flooding measures. The Project contributes to the environmental and health advantages, but also to the quality of the provided services. [82]

This hospital was chosen, because it has large capacity (900 patients) and high number of employs (1 600 staff). The hospital buildings are in very poor state, with leaking roofs, insufficient insulation and very old electrical, heating and drainage systems. There is also inadequate disposal of waste (hazardous and non-hazardous). The technical assistance for the operation will be delivered through Project Preparation support for the Canton and the hospital, Development Green City Action Plan for Zenica (financed by the Austrian Government) and Establishing of a Credit Enhancement Programme for the Canton. [82]

5.6 Ongoing Projects in Bosnia and Herzegovina related to Waste Management

In June 2019 started the project *"Environmentally Sound Management of Persistent Organic Pollutants (POPs) in Industrial and Hazardous Waste Sectors in BiH".* The estimated end date is in May 2023. The Project donor is the Government of Sweden and the partners are Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina, Ministry of Spatial Planning, Civil Engineering and Ecology of Republika Srpska, Federal Ministry of Environment and

Tourism, the Department of Spatial Planning and Property Affairs of the Brčko District Government. [83]

The Stockholm Convention in 2001 was about reduction of persistent organic pollutants (POPs) into the environment. Bosnia and Herzegovina ratified the Convention in 2010. Therefore, every country that signed the Convention has to meet the requirements of the Convention, which comprise avoiding of dangerous POPs and switching to safer alternatives and eliminating old materials and tools containing these constituents. [83]

POPs might cause adverse effects on human health and well-being and on the ecosystems. Three categories are formed for the recognized POPs under Stockholm Convention [84]:

- Pesticides (aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex and toxaphene;
- Industrial chemicals (hexachlorobenzene, polychlorinated biphenyls – PCBs and
- By-products (hexachlorobenzene; polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans – PCDD/PCDF and PCBs).

The Project aim is to reduce human health risks and environmental risk by switching to non-POPs chemicals in plastic industry and destruction of 50 tonnes of waste that contains POPs. Project components are [83]:

- Harmonization of POPs related legislation into environmental legislation of Bosnia and Herzegovina;
- Avoidance and monitoring of U-POPs and environmentally sound management of selected dangerous waste stream;
- Application of green chemistry in plastic industry to prevent release of new POPs;
- Organization and disposal of PCBs and POPs from wild industrial premises and
- Monitoring and evaluation.

Mentioned in the Project components, U-POPs are so called unintentional persistent organic pollutants and their reduction is one of the main goals of the Stockholm Convention. The U-POPs are: hexachlorobenzene – HCB, hexaclorobutadiene – HCBD, pentachlorobenzene – PeCB, polychlorinated biphenyls – PCB, polychlorinated dibenzo-p-dioxins and dibenzofurans – PCDD/PCDF and polychlorinated naphtalenes – PCN. [85]

This Project has direct contribution to the achieving of SDG 13. But, this Project contributes also (indirectly) to other SDGs especially SDGs 7, 12, 14, 15. Because hazardous waste affects every ecosystem and human health. And with this Project, it will be tried to reduce the harms and conserve nature.

A new regional, EU-compliant solid waste landfill with waste separation and a recycling yard is going to be constructed in Tuzla Canton. It will serve three municipalities: Živinice, Banovići and Kladanj. The project *"Živinice Regional Solid Waste Project"* is going to be financed by EBRD loan and co-financed with an investment grant from Swedish Government for the building of supporting facilities and recycling yard. The Project approval date was October 2019 and the estimated end date is the end of 2020. [86] [87] [88]

The EBRD loan is going to be on-lent to Eko-Sep, which is a regional waste management company responsible for building of the new facilities in those three municipalities. [87]

With the accomplishment of this Project, the soil and water pollution should be reduced, also the greenhouse gas emissions and the amount of waste. The construction of this regional landfill will improve waste management service in those three municipalities that have together a population of 95 000. The loan and the grant should cover the costs of two phases of the Project – construction of the landfill, amenities for mechanical biological treatment of the waste, composting, a transfer station, amenity for waste sorting and collection of landfills gases. The phases three and four are going to be financed separately and include building of a leachate treatment plant and of a system for generation of electricity form the landfill gas. [86]

Another project related to improvement of waste management in Bosnia and Herzegovina is *"Introduction of management systems for special waste streams in two regions of Bosnia and Herzegovina".* This Project runs according to the improvements of the municipal waste management that is aligned with the Directive 2008/98/EC – European Directive. Leaders of the Project are German Organization for International Cooperation GIZ – Program of the German Federal Ministry for Economic Cooperation and Development (BMZ) – develoPPP and ALBA Zenica d.o.o. The partner for the Project implementation is Regional Development Agency for Central BiH Region – REZ Agency. Two regions that are covered by this Project are Zenica – Doboj Canton (ZDK) and Central Bosnia Canton (SBK). From December 2018 to December 2021 Project should be accomplished. [89]

The overall aim of the Project is to separately collect, dispose and recycle special waste in two cantons. In order to achieve the objective of the Project several activities should be done [89]:

- Creation of management system for special waste: establishing of working group and stakeholders, selection of municipalities, visiting of neighborhood countries that have good practices in waste management, developing of waste catalog and management system for special waste in the region;

- Infrastructure – system for special waste collection: to manage the collaboration with special waste streams operatives needed are analysis of selected communities and obtainment of containers; also the public companies should participate in the Project and employees should be trained for the participation in the Project and construction and arranging of recycling yard in Zenica;
- Test the pilot system for special waste: organize the collection of special waste, support public companies in registration of waste amounts and legal responsibilities, prepare the business plan for ALBA d.o.o and
- Raising of public awareness: awareness raising campaigns and roundtables in selected municipalities.

In August 2018 it was announced that the Regional Environmental Center (REC) Country Office for Bosnia and Herzegovina is about to implement the project *"Preparation of Cantonal Waste Management Plans in three Cantons: Herzegovina-Neretva, West-Herzegovina and Herzeg-Bosnia Cantons".* The Project is financially supported by the Environmental Protection Fund of the Federation of Bosnia and Herzegovina. The purpose of this Project is to enhance the waste management in three selected cantons that represent the precious Eco region with many endemic and also in danger of extinction species. [90]

The following activities should be accomplished in order to improve the waste management situation in those three selected cantons: improving of safe waste collection and waste disposal, waste recycling, raw materials separation and their use for production of energy. The development of waste management plan is legally obligatory for each canton in the Federation of Bosnia and Herzegovina. The plans should provide an economic and investment necessities and also financing ways of waste management system. Additionally, plans should define the fundamentals for ISWM for a period of five years. [90]

The goals of the Project are [90]:

- Establish partnerships between relevant stakeholders;
- Public awareness rising on waste management topics and
- Public engagement in waste management plans.

6. Results

Public, private and civil sectors have to be involved at national level in order to achieve Agenda 2030, because SDGs include environmental, economic and social issues. All development and action plans as well as sector strategies should be reviewed to build a SDG roadmap. The study of the determining of level of alignment with SDG Targets for Bosnia and Herzegovina was conducted between February and April 2018. It reflects the key outcomes of Rapid Integrated Assessment (RIA) study on 69 strategic documents, programmes and action plans, in order to indicate the extent to which the existing progresses in Bosnia and Herzegovina are lined up with the 2030 Agenda. The strategic documents have been preselected by the UN Resident Coordinator's Office in Bosnia and Herzegovina, together with Bosnia and Herzegovina and entity level institutional corresponding persons. [91]

The alignment calculated by the RIA is not an answer on how good or bad agreement with SDGs is, particularly in countries where SDGs are not implemented at national level are not done yet, which is the case in Bosnia and Herzegovina. All relevant institutions have to decide which SDGs and their targets are relevant for their affiliations. According to the RIA, sustainable development is generally good covered in development strategies of Bosnia and Herzegovina. But, there is a high match between several SDG targets and strategic documents, like SDG 8 (Decent work and economic growth that is recognized in 49 out of 69 documents and strategies. On the other hand, some SDG targets are not mentioned often, e.g. SDG 5 (Gender equality), mentioned only in 16 from 69 strategies. The results of alignment of SDGs and their targets to examined strategies in Bosnia and Herzegovina is showed in the following table (tab. 3).

Table 3: Level of alignment with SDG Targets for Bosnia and Herzegovina – at all levels (national, cantonal, entity, international level and municipal) [91]

		BiH level, %	Canton level, %	FBiH level, %	International BiH level, %	Municipal level, %	RS level, %
1	Poverty	71	57	43	43	43	71
2	Hunger	50	63	75	13	50	63
3	Health	38	69	54	69	15	92
4	Education	60	100	50	70	40	100
5	Gender	89	0	11	78	33	89
6	Water	88	88	13	38	50	100
7	Energy	60	100	20	40	60	100
8	Growth and Jobs	58	75	50	50	50	67
9	Infrastructure and industrialization	75	100	63	88	38	88
10	Inequality	30	40	10	40	0	20
11	Cities	60	70	0	40	70	60
12	SCP	18	45	27	9	9	45
13	Climate change	60	60	40	60	60	60
14	Oceans	20	0	0	0	0	0
15	Lands	75	42	58	8	17	33
16	Peaceful and inclusive societies	58	58	17	83	8	93
17	Partnership	53	53	32	63	16	69

Following policy *gaps* were identified in SDG targets: 1.2. National monetary and multidimensional poverty – until 2030, the number of people living in poverty should be reduced by at least a half, 8.10. Financial services for all – improve the capacity of national financial institutions in order to encourage banking, security and financial services for all and 11.1. Housing and basic services represent the absence of policy concentration on economical enclosure of populations living on or under national poverty thresholds; 12.3. Reduce food losses – reduce by 50% the amount of global food waste at retail and customer levels and minimize the food losses in production and supply and SDG 11 – Improve the cities, by making them inclusive, safe and sustainable. Cities targeting disaster risk management, agricultural productivity and rural development in wider context; 5.1. Gender discrimination – end discrimination against girls and women in every form and everywhere across the country and 5.3. Harmful practices to reveal reforms for equal rights and response to national violence and SDG 15 – protection, restoration and promotion of sustainable use of terrestrial ecosystems. Lands not adequately represented to ensure linkage between socio-economic development interventions with nature protection. [91]

According to reviewed documents, it seems that the government of the Bosnia and Herzegovina does not address implementation of SDG 12 (especially 12.a. Science and technology in developing countries and 12.b. Sustainable tourism), SDG 9 (Domestic research and development – R&D) and in SDGs 6 (Clean water and sanitation) and 7 (Affordable and clean energy) – no means for regulation of management and energy sector. The documents of development framework for the entity of Federation of Bosnia and Herzegovina is not associated fully with the targets of SDG 7, SDG 10 (only the 10.4 is associated) and SDG 15. For SDG 6 there is a lack of coordination over the water management. And for the second entity, Republika Srpska, there is a need of: improving water management and climate action, reduction of inequalities and ensuring of responsible consumption of natural resources. [91]

The boost of the sustainable development in Bosnia and Herzegovina requires so called accelerators. Accelerators differ from country to country and they are oriented to country's development priority. For example, one important accelerator is building and strengthening of institutions that bring advantages for many SDGs. This calls for two-stage process. First, the development of a SDG dashboard and the SDG indicators, where each indicator is categorized in one of four classes, using threshold: green – target for 2030 achieved, yellow – target 2030 yet to be achieved, but intermediate target is already achieved, red – intermediate target is not reached and gray – no indicator is available for a target, or judgment is not possible (fig. 21). [91]

On fig. 21 the preliminary dashboard for Bosnia and Herzegovina is shown for target 2030. Each bar corresponds to all indicators for each SDG, and the colors correspond to share of indicators in each category. [91]

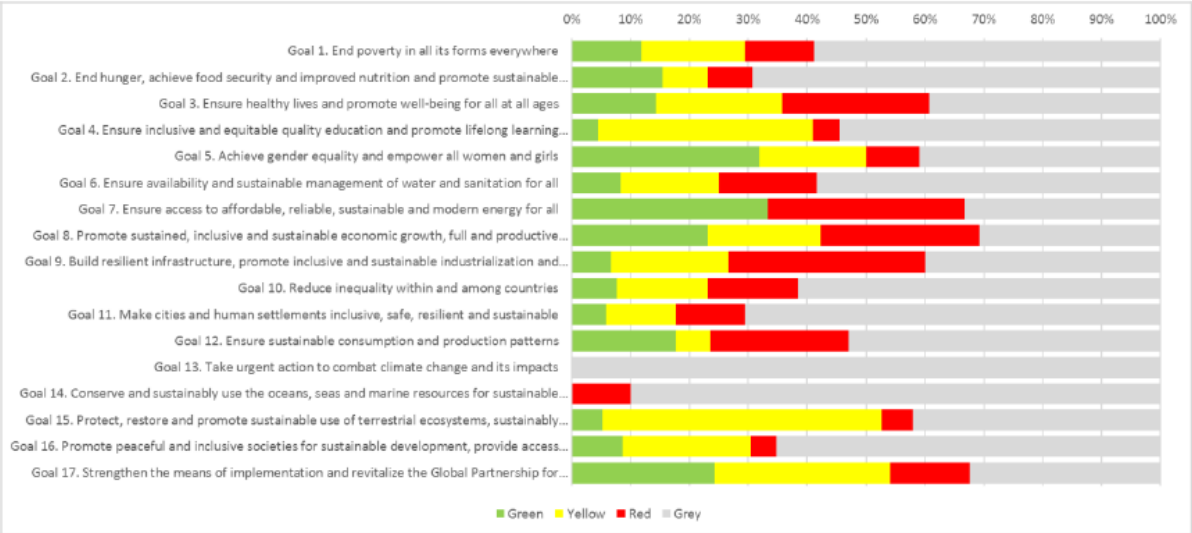


Figure 21: Preliminary SDG Dashboard for Bosnia and Herzegovina [91]

The second stage consists of identifying the distance from desirable levels of SDG accomplishment. This desirable level should be specifically defined for Bosnia and Herzegovina, because global indicators may be deficient for monitoring of situation in a country, as they highlight international comparability. [91]

The SDGs are linked to each other. For instance, poverty can lead to hunger, which lead to health issues, which can further lead that children cannot complete their education or adults to get a job. So, the goals are connected to each other and they cannot be considered separately, but only together. [92] In the following figure the most influential targets (fig. 22) are listed. They represent important priorities for investment through policy actions. There is a difference between green and yellow targets. The green targets are resources for development, accelerators and extra investments that will provide better achievement of SDGs in these areas. These targets also include education and improving of skills of people for high-tech jobs. Yellow targets are not achieved, but not far from being accomplished. With some additional work and support, these SDGs could be achieved faster. [91]

Green Targets	Yellow targets
7.2. Renewable energy	2.3. Agricultural productivity
9.c. Access to ICT	6.5. Integrated water resource management
5.1. Gender discrimination	4.7. Knowledge and skills for Sustainable Development
2.1. Hunger	17.3. Mobilize additional resources
8.1. Economic growth p.c.	17.1. Domestic resources for development
11.1. Housing and basic services	14.1. Marine pollution
3.5. Substance abuse	12.8. Information and awareness on sustainable lifestyle
16.9. Legal identity for all	9.b. Domestic R&D
5.2. Gender violence	6.1. Safe water
1.4. Equal rights for resources	10.4. Fiscal, wage and social protection

Figure 22: Ten, green and yellow, Targets for Achieving SDGs and their Targets [91]

There are also red targets which are off-track and are faced with serious obstacles in progress of SDGs. These targets require significant investments for improvement and new regulation policies (fig. 23). [91]

Figure 23: Red Targets [91]

The potentially invest efforts are: developing and expanding of institutions and addressing systematic institutional obstacles (corruption or establishing better policies), green economy is also one of the accelerators that could utilize renewables, energy efficiency and improve food production systems, reconstructing infrastructure and food production systems are another potential accelerators for better resilience and adaption and finally promoting the gender equality through minimizing gender gaps and concerns through different targets. [91]

Two urgently important points still remain: budgeting and monitoring and evaluation of activities. In strategic documents there is no clear definition of implementation responsibilities. The SDGs require a better monitoring of results and so, there comes a need to strengthen the mechanisms and monitoring and evaluation tool in all administrative levels in Bosnia and Herzegovina. This will promote practical application of strategic documents and periodic public reviews of SDGs progress. It is also important to improve capacities of statistical agencies to balance existing indicators with disaggregated indices and indicators to cover at entities, cantonal and local levels in support of "measuring progress of the 2030 Agenda". [91]

7. Conclusion

As the research questions in the Abstract anticipated, this work was focused on the sustainable development (energy efficiency and waste management) and their implementation (SDGs 6, 7, 12, 14 and 15) in Bosnia and Herzegovina, but also with regard on their implementation in EU and Austria. The results show that Bosnia and Herzegovina due the complex administration system, may face many issues in planning sustainable development strategies. Both entities and the Brčko District have to create their own strategies according to the SDGs and their targets for the period of 2020-2027. Good sign is that the country is committed to the 2030 Agenda, which aims to balance between economy, environment and society.

Responsibilities of actors should be clearly defined in strategic documents and monitoring and evaluation of activities should receive an appropriate budget. Policy gaps should be addressed through research programs and in addition to ongoing international cooperation, national funds should focus on sustainable development targets. As the joint UN Report in Support of Sustainable Development Goals (2018) suggested, beside better monitoring and budgeting of sustainable development actions, improving of statistical agencies at all national levels is really necessary. The initiative "Imagine 2030" is supposed to help citizens to participate in creation of better future through taking a part in presentations and workshops. For better development of the country, Awareness building activities should support society to recognize the importance of waste management or responsible consumption of materials or energy, to deal with the poor results in related SDGs (7 and 12). Considering the fig. 22, I think that top priorities for acceleration of sustainable development in Bosnia and Herzegovina are: use more renewables, prevent gender discrimination and violence and provide housing and basic services for all. In addition, Bosnia and Herzegovina should improve agricultural productivity, water management, skills for sustainable development, use more of domestic resources for development, reduce marine pollution and implement domestic research and development. Bosnia and Herzegovina has already started to harmonize its law with EU. The discussed projects in chapter 5. have also a task to continue the harmonization of the country's law with the EU.

The research showed that Bosnia and Herzegovina needs energy framework in order to accomplish savings in energy consumption. Therefore, the Framework Energy Strategy until 2035 is designed and it focuses on the realizing of stable energy system, reduction of GHG and providing energy efficiency, which would further help better economic development.

As the chapter 5.4.2 showed, Bosnia and Herzegovina requires well-skilled workforce for improvements in waste management. Moreover, country should invest in technology for waste recovery and recycling, which is going to lead to better environmental protection.

Additionally, the introduction of the concept of Corporate Social Responsibility (CSR) would lead to international and national investments, dependent on ethical norms, municipality and environmental surroundings.

For future, there is a need to identify the level of knowledge of citizens in Bosnia and Herzegovina on sustainability and sustainable development. In addition, there is a need for initiatives such as workshop or public presentation regarding SDGs in Bosnia and Herzegovina. Public awareness campaigns should be better promoted, so that the larger amount of people can take part in them and learn about this important matter.

8. Summary

The final chapter gives an executive summary of the presented results of the thesis and initialize the research questions and clarify the aim of the work. This work focused on how well are the SDGs developed in Bosnia and Herzegovina, how energy efficiency and waste management are implemented in the energy and waste frameworks of the country and at the end what does the country to improve energy efficiency and waste management. Also, one part of the work was to study the state of those two topics in EU, focused on Austria.

The first chapter gives an overview of sustainable development. It introduces the sustainable economic development, the principle of good governance, as well as the financing methods for sustainable development. The sustainable development should meet the needs of current population, so that the future generations would also be able to meet their needs. This definition was introduced at the Brundtland Commission (1987). The concept of sustainable development with its definition from Brundtland Commission was adopted at the Rio Summit (1992). And, the three pillars (economy, society and environment) of sustainable development were adopted at the UN World Summit on Sustainable Development in Johannesburg (2002). Furthermore, the concept of sustainable economic development was introduced, which aims to reduce poverty, resources overuse and social division. The sustainable economic development can be only done, if the fourth purpose is added – good governance. The concept of good governance implies that the private and public sectors work in accordance to the law. They also need to work responsible to the stakeholders and in cooperation with public, when it comes to climate change, land use and pollution. In 2015, UN General Assembly adopted 17 SDGs and 169 targets. From those goals and targets, every country needs to choose goals, which represent priorities in their current development. Two instruments are needed in order to achieve desired SDGs. The first one is backcasting – goals are set for a certain date and the problem is explored from the target to the present. Another instrument is technological road-mapping – technologies needed for the future. Financing methods for sustainable development are: through taxes country pays health care, public education, police services and scientific research; international helps from taxpayers from the high-income country to poor countries. But, the greatest importance represents national planning of every country. Until now, the national planning of financial methods for sustainable development was weak part in many national plans (79 of 107 national plans at international level do not provide information and details on financial strategies).

In the second chapter it is briefly explained how Bosnia and Herzegovina and EU integrate SDGs into their frameworks. The best solution is that governments integrate SDGs into strategic documents. In Bosnia and Herzegovina it is going to be done through creating of strategic framework at institutional level and in accordance to their responsibilities. It is predicted that the country creates two planning documents: one mid-term (three years) and an annual work program of the Council of Ministers and their institutions.

The Federation of Bosnia and Herzegovina has to bond its strategic documents with 2030 Agenda and all relevant strategic documents at the state level. For the Development Strategy 2020-2027 Federation of Bosnia and Herzegovina needs to prioritize its needs for the more sustainable future. Also, each canton and its government has to assist in achieving of SDGs and to report its own progresses. The entity of Republika Srpska, also has to introduce its development strategy. But, until now this entity does not have development preferences. And, Brčko District is going to design its development strategy for period 2020-2027. The implementation of SDGs in Bosnia and Herzegovina is coordinated at the level of Council of Ministers, the Government of the Federation of Bosnia and Herzegovina, the Government of Republika Srpska and the Government of Brčko District. In the EU, all countries have had to reflect their national strategies according to the SDGs. The implementation of the SDGs should be external and also internal. The 2030 Agenda is so designed that it can be applied to all countries. Its goal is to harmonize economy, society and environment and also "leave no one behind" – firstly, invest in poor countries with high poverty rates and then in countries that are far away from extreme poverty. In this process, everyone should be involved – scientists, citizens, academia, private sector, etc.

The SDG Index rates countries regarding their scores for accomplishing SDGs. For Bosnia and Herzegovina it is 67.3. In EU, the SDGs are well developed, but there are differences between countries. The highest developments are in the Northern Europe, but Austria is also high on the list with 76.7, just after Denmark, Sweden and Finland. EU states may face three challenges during the accomplishing of SDGs: 1. closing of gap between reality and SDGs; 2. EU's diplomacy and global leadership for promoting SDGs on global scale and 3. coherence between global and internal accomplishing of SDGs. Therefore, EU has established European Green Deal for sustainable energy circularity and land use and food system. It is composed of three parts: energy decarbonisation, efficient use of resources and circular economy and sustainable use of land, oceans and food systems.

In the third chapter, energy efficiency and waste management are explained, as well as their relation and importance to sustainable development. Energy efficiency means to get a desired result by using less energy. It covers all three pillars of sustainable development by using resources more conscious and by supporting needs of everyone through: increasing energy efficiency in industries and transportation, reducing use of fossil fuels, methane release from oil or gas production, ensuring energy regulations and international cooperation. The work is strong focused on the building sector, because energy efficient buildings bring benefits to economy, society and make people's life better. Regarding energy efficiency in building sector, EU established two directives Energy Performance of Building Directive 2010/31/EU (EPBD) and the Energy Directive 2012/27/EU. Both directives aim to accomplish energy efficient and decarbonized building stock by 2050.

Waste management means how to deal with waste in order to reduce its negative impacts on nature, human health and safety. The objective is to reconsider the past way of thinking of "waste disposal" to "waste management" and to use waste as a resource. And so, the concept of integrated solid waste management was introduced. This approach searches for participation of stakeholders and interactions with other systems.

The fourth chapter brings results of implementation of SDGs 6, 7, 12, 14 and 15 in Bosnia and Herzegovina and Austria. The SDG 6 aims for clean water and sanitation. Bosnia and Herzegovina has already harmonized most of its water legislations with the EU Law. The country is very rich in water resources, but the wastewater treatment is not established. More than 50% of wastewater is directly released into the rivers. But, the positive side is that the number of people connected to the wastewater treatment plant is increasing and also the amount population, who is using safely managed drinking water. The purpose of the SDG 7 is to ensure affordable, sustainable and modern energy. The energy sector is almost the strongest economic sector of the country. There are many investors interested in renewable energy sources. The coal has the highest portion in gross energy consumption, then oil and gas. Energy from the renewables is at least present in the country's energy consumption. The SDG 12 is related to sustainable consumption and production. Again, the country lacks on awareness associated to rational use of natural resources. Waste is illegally disposed in the nature and there is no recycling (about 1% of the waste is recycled). This calls for the urgent action, in order to conserve nature and resources. The SDG 14 aims for conservation and sustainable use of oceans, seas and marine resources. Although, the coast line of the country is pretty short (25 km), the water is extremely exposed to the human influences. There are many illegal constructions, without wastewater treatment systems and due the high number of tourists on the daily basis, the marine ecosystem is strongly affected. So, with ongoing efforts to protect marine areas, there should be better results in the implementation of SDG 14. The SDG 15 is about life on land and how to protect forests, preserve land degradation and biodiversity loss. Bosnia and Herzegovina is very rich in terms of biodiversity. More than 50% of the country is covered by forests, but there is absence of protected natural environment. However, the number of protected areas in both entities of the country is increasing.

For Austria, the results in implementation of selected SDGs is far better than in Bosnia and Herzegovina. Mostly the whole population is connected to wastewater treatment and uses safely managed drinking water (SDG 6). Related to the SDG 7, the country targets to reduce primary energy consumption and to reduce GHG emissions from building sector. Regarding SDG 12, Austria has already higher score in circular economy than the economy at the global level. Austria's economy is already 9.7% circular and the global economy 9.1%. There are also proposed measures on how to reach 37.4% of circularity. The measures include: recycling all of the recyclable waste, imports with high secondary content, switching to renewable fuels and use of old construction materials.

Also, Austria has high recycling rate and low landfilling rate. The undertaken actions related to the accomplishing of SDG 14 showed that the water pollution is decreasing and the number of heavy metals from industries in water is strongly decreasing. Regarding SDG 15, 27% of Austria's territory is under protection and there are many programmes and also the strategy on biodiversity that set targets for biodiversity conservation and protection.

The fifth chapter gives an overview of energy framework in Bosnia and Herzegovina and summarizes relevant projects regarding energy efficiency and waste management. The Frame Work Energy Strategy emphasizes the importance of energy sector for economic growth of Bosnia and Herzegovina. It also proposes the priority areas for achieving stable energy system. The priorities are oriented on the safe and secure energy supply from neighboring countries, because the country cannot supply own energy needs alone. Also, important is, to improve energy supply through use of more clean technologies. Reduction of GHG and promotion of energy efficiency and renewable energy sources were identified as relevant objective of energy sector development. In order to improve waste management in Bosnia and Herzegovina, statistical data and waste collection should be improved, the law should be harmonized with the EU Law and the institutional frameworks on all state levels should be improved as well. Another decisive task is to invest in financing waste management projects and in rising of public awareness, because there are no companies and municipalities that have skilled cadre for such a job.

Several progresses in improving energy efficiency and waste management were to see. Country is receiving help and support from the EU donor countries, organizations and banks (UNDP, WB, SIDA, USAID, EBRD, etc.). These funds are from crucial importance for the further development of Bosnia and Herzegovina. But, the aim of sustainable development, beside the help from more developed countries, is that the private sector and domestic resources are used. Good example of the private company, which is sustainable oriented is "Ekopak". It executes legal obligations for recycling of packaging waste in Federation of Bosnia and Herzegovina.

Furthermore, there are many ongoing projects in the country related to energy efficiency and waste management. These projects aim not only to improve the current state of energy efficiency and waste management, but also to raise the public awareness regarding sustainability, environmental issues, climate change, etc. Project "Mainstreaming environmental governance: linking local and national action Programme in Bosnia and Herzegovina" gave a grants to municipalities to finance energy efficiency and renewable energy projects in building sector. Building sector was selected, because it is responsible for the most use of energy in the country and the energy efficiency standards were very poor. The project "Green Economic Development Project" aims to introduce energy efficiency measures, to reduce GHG emissions, to raise public awareness, to support environmental funds and to introduce solar panels for remote locations in the country.

As the building sector is important part of the energy savings, it represents a great target for improvements in energy efficiency. The ongoing projects “Catalyzing Environmental Finance for Low-Carbon Urban Development” and “Scaling-Up Investment in Low-Carbon Public Building” promise reduction of GHG emissions, low-carbon waste management, raising public awareness on low-carbon public buildings and environmental problems, financial assistance in low-carbon development, etc.

In order to conserve natural resources, important project is also “Biomass Energy for Employment and Energy Security in Bosnia and Herzegovina”. The project intentions are to reduce CO_2 emissions, to introduce sustainable wood use and to raise public awareness on wood biomass. Another project that is connected to the pervious one is “Fire Risk Management”. The project should improve the responses to the disasters and to raise public awareness. And, the project “Energy Efficient Refurbishment of Zenica Hospital” focuses on the improving energy efficiency of the hospital in Zenica and on reduction of GHG emissions. “Environmentally Sound Management of Persistent Organic Pollutants” is important as well, because of its purpose to prevent health risks that come from the persistent organic pollutants in plastics and to promote green chemistry. “Introduction of Management Systems for Special Waste Streams in two Regions in Bosnia and Herzegovina” is another important project, which aims to collect and recycle special waste in two areas in the country. “Preparation of Cantonal Waste Management Plans in three Cantons: Herzegovina-Nertva, West-Herzegovina and Herzeg-Bosna Cantons” tries to apply safe waste collection, waste recycling and raw material separation in three regions of the country in order to develop integrated solid waste management basics and to raise public awareness regarding waste problems in the country.

To conclude, the research showed that sustainable development is good covered in the policies in Bosnia and Herzegovina, but there are several gaps. The gaps refer to the SDGs that are not included or only barely included in the country’s strategies. Bosnia and Herzegovina should concentrate on its priorities, like reducing poverty, improve sanitation and water access for all, conserve nature, improve energy consumption and natural resources. The identified SDG gaps in Bosnia and Herzegovina should be filled: reducing poverty, reduce discrimination and propose equal rights for everyone, improve financial institutions, make cities resilient, social inclusive and sustainable, enable basic services for all, reduce food losses and protect environment. The country needs to establish better financing methods for sustainability related projects.

I think that every ongoing project in Bosnia and Herzegovina is very important and promises a lot of improvements not only in energy efficiency and waste management sectors, but also in improving sustainable development, financial mechanisms and raising public awareness regarding relevance of environment problems.

The already completed project "Mainstreaming environmental governance: linking local and national action Programme in Bosnia and Herzegovina" succeed in local management engagement in environmental planning and in establishing information systems, so that every local project is documented. This project should serve as a great example, how governments appreciated the local interests in energy efficiency and use of renewable sources and recognized that the smaller-scale project could bring benefits and increase the local standards in order to accomplish national and international targets. Bosnia and Herzegovina is rich in natural resources and it would be great, if they would be used sustainably. The renewable resources like hydropower or wind energy should be used, because both are available and represent the huge potential due to country's geographical position. Also, Austria's renewable energy comes mostly from hydropower and Bosnia and Herzegovina should take that as a good example and as a model for its future energy development.

Literature

1. Sachs, Jeffry D. (2015) The Age of Sustainable Development. Columbia University Press. ISBN 0231173148
2. Grober, U. (2013). Original texts - Carlowitz and the sources of our concept of sustainability. 88. 46-51. 10.17433/2.2013.50153203, access on April, 28. 2020
3. Barbier, E. (1987). The Concept of Sustainable Economic Development. *Environmental Conservation, 14*(2), 101-110, access on April, 29. 2020
4. UN website, https://www.un.org/sustainabledevelopment/blog/2015/12/sustainable-development-goals-kick-off-with-start-of-new-year/ visited on November, 27. 2019
5. IIASA (2018) TWI2050 - e World in 2050 (2018). Transformations to Achieve the Sustainable Development Goals. Report prepared by e World in 2050 initiative. International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria, access on March, 19. 2020
6. http://www.unis.unvienna.org/unis/en/topics/2013/mdg.html, visited on May, 1. 2020
7. JRC (2020) Backcasting approach for sustainable mobility, JRC Scientific and Technical Reports, visited on March, 20. 2020
8. https://www.naturalstep.ca/backcasting , visited on March, 20. 2020
9. https://sustainablebrands.com/read/new-metrics/backcasting-a-roadmap-to-transformational-change , visited on March, 20. 2020
10. OECD (2018), Global Outlook on Financing for Sustainable Development 2019: Time to Face the Challenge, OECD Publishing, Paris, access on May, 1. 2020
11. https://www.un.org/esa/ffd/publications/aaaa-outcome.html , visited on March, 19. 2020
12. United Nations (2019) Inter-agency Task Force on Financing for Development, *Financing for Sustainable Development Report 2019* (New York: United Nations, 2019), access on March, 19. 2020
13. Relevant institutions at all administrative levels in Bosnia and Herzegovina* (2019) Voluntary Review, Implementation of Agenda 2030 and Sustainable Development Goals in Bosnia and Herzegovina, access on November, 29. 2019 *Representatives from the council of Ministers of Bosnia and Herzegovina, the Directorate for Economic Planning and the governments of Federation of Bosnia and Herzegovina, Republika Srpska and Brčko District. A Private Sector Group established with respect to the SDGs and several other stakeholders from civil society and the academia.
14. https://sustainabledevelopment.un.org/index.php?page=view&type=20000&nr=312&menu=2993 , visited on January, 8. 2020
15. Gregersen, C., Mackie, J., Torres, C. (2020)Implementation of the 2030 Agenda in the European Union: Constructing an EU approach to Policy Coherence for Sustainable Development, access on January, 8. 2020
16. https://ec.europa.eu/commission/presscorner/detail/e%20n/ip_19_6691, visited on April, 30. 2020

17. https://ec.europa.eu/international-partnerships/european-consensus-development_en, visited on April, 30. 2020
18. https://www.un.org/sustainabledevelopment/development-agenda/, visited on November, 29. 2019
19. https://medium.com/@UNDP/5-things-you-need-to-know-about-the-2030-agenda-for-sustainable-development-380405b44e3c, visited on November, 29. 2019
20. https://sustainabledevelopment.un.org/memberstates/bosniaherzegovina, visited on November, 29. 2019
21. SDSN & IEEP (2019) The 2019 Europe Sustainable Development Report. Sustainable Development Solutions Network and Institute for European Environmental Policy: Paris and Brussels, access on November, 29. 2019
22. https://ec.europa.eu/environment/action-programme/index.htm, visited on April, 30. 2020
23. http://www.wrap.org.uk/about-us/about/wrap-and-circular-economy, visited on December, 4. 2019
24. https://www.eea.europa.eu/data-and-maps/indicators/waste-generation-4/assessment, visited on May, 1. 2020
25. https://ec.europa.eu/info/law/law-making-process/evaluating-and-improving-existing-laws/refit-making-eu-law-simpler-and-less-costly/refit-platform_en, visited on December, 4. 2019
26. Türkoğlu, Serap & Ozturk Kardogan, Pinar. (2018) The Role and Importance of Energy Efficiency for Sustainable Development of the Countries. 10.1007/978-3-319-64349-6_5, visited on November, 28. 2019
27. https://www.eesi.org/topics/energy-efficiency/description, visited on November, 28. 2019
28. https://www.energysufficiency.org/about/living-well-within-the-limits-the-credo-of-this-project/, visited on March, 19. 2020
29. https://www.undp.org/content/undp/en/home/2030-agenda-for-sustainable-development/planet/sustainable-energy/energy-efficiency.html, visited on November, 28. 2019
30. https://sustainabledevelopment.un.org/sdg7, visited on November, 28. 2019
31. https://www.energylens.com/articles/energy-awareness, visited on March, 19. 2020
32. https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en, visited on April, 30. 2020
33. https://www.alpine-space.eu/projects/thefourbees/publication/18-09-06_bss18_improving-building-efficiency-through-user-behavior-change-1.pdf, Improving building energy efficiency through user behavior driven by co-created ICT interface, visited on March, 19. 2020
34. https://www.e-education.psu.edu/eme807/node/667, visited on November, 29. 2019

35. https://westernpower.com.au/faqs/connect-to-the-network/what-is-peak-demand/what-is-peak-demand/, visited on November, 29. 2019
36. https://www.epa.gov/statelocalenergy/state-energy-efficiency-benefits-and-opportunities, visited on November, 29. 2019
37. https://www.iea.org/topics/energyefficiency/archive/benefits/, visited on November, 29. 2019
38. McDougall F.R., White, P.R., Franke M., and Hindle P. (2020) Integrated Solid Waste Management: a Life Cycle Inventory, access on March, 20. 2020
39. https://www.conserve-energy-future.com/waste-management-and-waste-disposal-methods.php, visited on March, 31. 2020
40. https://www.britannica.com/technology/solid-waste-management/Solid-waste-collection#ref593305, visited on April, 29. 2020
41. http://www.volund.dk/Waste_to_Energy/How_it_works, visited on April, 30. 2020
42. https://mg.co.za/article/2018-04-20-00-solid-waste-management-and-sustainable-development, visited on November, 29. 2019
43. https://www.linkedin.com/pulse/importance-waste-management-recycling-dee-mohammed, visited on November, 29. 2019
44. Topić, Milan (2014) Waste Management in Republika Srpska: Strategies and Measurements for Future Waste Collection, Treatment, Recycling and Prevention. Print, access on March, 26. 2020
45. https://ec.europa.eu/environment/waste/target_review.htm, visited on April, 30. 2020
46. Country Report Austria (2019) 2019 European Semester: Assessment of progress on structural reforms, prevention and correction of macroeconomic imbalances, and results of in-depth reviews under Regulation (EU) No 1176/2011, access on December, 5. 2019
47. https://borgenproject.org/water-quality-in-austria-among-highest-world/, visited on December, 5. 2019
48. https://www.entwicklung.at/en/themes/water-energy-and-food-security/water-supply-and-sanitation/ , visited on December, 5. 2019
49. https://www.bmnt.gv.at/english/water/Use-of-water/Supply-and-use-of-water-in-Austria.html , visited on December, 5. 2019
50. Wendling, Z. A., Emerson, J. W., Esty, D. C., Levy, M. A., de Sherbinin, A., et al. (2018) 2018 Environmental Performance Index. New Haven, CT: Yale Center for Environmental Law & Policy, access on December, 5. 2019
51. Bundesministerium für Nachhaltigkeit und Tourismus (2018) Draft Integrated National Energy and Climate Plan for Austria, 2021 – 2030, Federal Ministry Republic Austria Sustainability and Tourism, access on April, 9. 2020
52. Circle Economy and ARA (2019) The Circularity Gap Report, Austria, June 2019, https://circle-economy.com/circularity-gap-report-austria , access on December, 6. 2019
53. https://www.earthsquad.global/recycling-in-austria-an-elaborate-and-strictly-enforced-system/ , visited on December, 6. 2019

54. https://www.bmnt.gv.at/english/water/Water-in-Austria/Survey-of-the-Austrian-Water-Management.html , visited on December, 6. 2019
55. https://www.eea.europa.eu/themes/industry/industrial-pollution/industrial-pollution-country-profiles-2018/austria-industrial-pollution-profile-2018#tab-based-on-data, visited on December, 6. 2019
56. OECD (2017) Land-use Planning Systems in the OECD: Country Fact Sheets, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264268579-en, access on May, 1. 2020
57. https://www.tandfonline.com/doi/full/10.1080/09654313.2019.1604634, visited on December, 6. 2019
58. https://www.economicshelp.org/blog/14337/environment/environmental-kuznets-curve/, visited on December, 6. 2019
59. Ministerium für ein lebenwertes Österreich (2016) Zusammenfassung der wichtigsten Ziele und grundlegenden Prinzipien der Biodiversitäts-Strategie Österreich 2020+, access on December, 6. 2019
60. Tausova, Marcela & Mihaliková, Eva & Culkova, Katarina & Stehlíková, Beáta & Tauš, Peter & Kudelas, Dušan & Strba, Lubomir. (2019). Recycling of Communal Waste: Current State and Future Potential for Sustainable Development in the EU. Sustainability. 11. 2904. 10.3390/su11102904, access on April, 9. 2020
61. #mission2030 Austrian Climate and Energy Strategy 2018, Federal Ministry Republic of Austria Sustainability and Tourism, Federal Ministry Republic of Austria Transport, Innovation and Technology, access on April, 9. 2020
62. Framework Energy Strategy of Bosnia and Herzegovina until 2035, access on March, 21. 2020
63. https://balkangreenenergynews.com/bih-adopts-law-on-energy-efficiency/, visited on March, 23. 2020
64. https://energyeducation.ca/encyclopedia/District_heating, visited on March, 24. 2020
65. https://www.intechopen.com/books/sustainable-energy-recent-studies/district-heating-and-cooling-enable-efficient-energy-resource-utilisation, visited on March, 24. 2020
66. https://www.dexma.com/blog/what-is-district-heating/, visited on March, 24. 2020
67. Summary of the Study of the Renewable Energy Sources with Focus on Biomass, Geothermal Energy and Solar Energy in Bosnia and Herzegovina, Sarajevo 2019, access on March, 22. 2020
68. The Third Annual Report under the Energy Efficiency Directive, Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina, July 2019, access on March, 23. 2020
69. Case Study, Energy Efficiency and renewable energy sources in Bosnia and Herzegovina, Sustainable Development Goals Fund, access on December, 17. 2019
70. Executive Summary, Municipal Solid Waste Management Sector Review Strategic Directions and Investment Planning up to 2025, access on March, 29. 2020

71. Waste Management in Bosnia and Herzegovina – Current Situation and Perspectives, M. Cero, I. Silajdzic, S. MidzicKurtagic, access on December, 18. 2019
72. https://balkandiskurs.com/en/2016/07/14/unrecycled-materials-cost-bosnia-millions-in-potential-revenue/ , visited on December, 19. 2019
73. https://www.ba.undp.org/content/bosnia_and_herzegovina/en/home/climate-and-disaster-resilience/GED.html, visited on April, 1. 2020
74. https://www.ba.undp.org/content/bosnia_and_herzegovina/en/home/climate-and-disaster-resilience/URBANLED.html, visited on April, 2. 2020
75. https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-11-sustainable-cities-and-communities.html#targets, visited on April, 2. 2020
76. https://www.ba.undp.org/content/bosnia_and_herzegovina/en/home/climate-and-disaster-resilience/LowCarbon.html, visited on April, 2. 2020
77. https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-7-affordable-and-clean-energy.html#targets, visited on April, 3. 2020
78. https://www.ba.undp.org/content/bosnia_and_herzegovina/en/home/climate-and-disaster-resilience/BiomassProject.html , visited on April, 4. 2020
79. https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-15-life-on-land.html#targets, visited on April, 4. 2020
80. https://www.ba.undp.org/content/bosnia_and_herzegovina/en/home/climate-and-disaster-resilience/FireRisk.html, visited on April, 5. 2020
81. https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-16-peace-justice-and-strong-institutions.html#targets, visited on April, 5. 2020
82. https://www.ebrd.com/work-with-us/projects/psd/grcfenergy-efficient-refurbishment-of-zenica-hospital.html, visited on April, 6. 2020
83. https://www.ba.undp.org/content/bosnia_and_herzegovina/en/home/climate-and-disaster-resilience/POPs.html, visited on April, 6. 2020
84. http://chm.pops.int/TheConvention/ThePOPs/The12InitialPOPs/tabid/296/Default.aspx, visited on April, 6. 2020
85. http://www.pops.int/Implementation/UnintentionalPOPs/UnintentionalPOPsOverview/tabid/370/Default.aspx, visited on April, 6. 2020
86. https://www.ebrd.com/work-with-us/projects/psd/zivinice-regional-solid-waste-project.html, visited on April, 6. 2020
87. https://seenews.com/news/ebrd-eu-sweden-finance-waste-management-project-in-bosnia-677124, visited on April, 6. 2020
88. https://ba.ekapija.com/news/2560660/izgradnja-deponije-eko-sep-dugorocno-i-odrzivo-rjesenje-za-odlaganje-otpada-u, visited on April, 6. 2020
89. https://www.rez.ba/projects/introduction-of-management-systems-for-special-waste-streams-in-two-regions-of-bosnia-and-herzegovina/, visited on April, 6. 2020

90. https://balkangreenenergynews.com/rec-bih-to-implement-project-for-preparation-of-waste-management-plans-in-3-fbih-cantons/, visited on April, 6. 2020
91. A joint UN Report in Support of Sustainable Development Goals (2018), Report on Multi-Stakeholder Consultations and Technical Analysis for Advancing Sustainable Development Goals, access on December, 17. 2019
92. https://sdgzone.com/learn/what-are-the-sdgs/, visited on May. 1. 2020

List of Figures and Tables

Glossary

Sustainable Development Goals (SDGs) with their names and short description [1]:

SDG 1: End extreme poverty. The goal strives to end poverty in all forms everywhere. This was the aim of the Millennium Development Goals (MDGs) and SDGs are trying to finish it.

SDG 2: End hunger and promote sustainable agriculture. This goals is quite complex and it is composed of several tasks like: ending of hunger, better nutrition, ensuring of resilience of the farms to environmental stresses.

SDG 3: Ensure healthy lives for all, meaning reducing under 5-mortality rates, maternal mortality rates and ensuring universal health coverage (UHC).

SDG 4: Ensure quality education and lifelong learning. Aim is to find ways that every child has quality education from pre-school through at least secondary education.

SDG 5: Achieve gender equality and empower women and girls. With this goal, all discrimination against women and girls should be ended, aiming that girls and women have equal economic and social rights. This should be achieved through promoting of women's empowerment like inclusive finance, online education and job creation.

SDG 6: Ensure availability and sustainable management of water and sanitation. Ensuring that every person has access to safe and affordable drinking water, sanitation and hygiene. But this goal also aims to prevent/reduce water pollution and rising efficiency of water use.

SDG 7: Ensure access to affordable, sustainable modern energy. This goal seeks to end "energy poverty" and also to promote low-carbon power and energy efficiency.

SDG 8: Promote sustainable economic growth and decent work for all. This goal can also be defined as the economic development goal. Here is the aim to increase incomes per person and to narrow the gap between poor countries and high-income countries. Targets also highlight decent work and labor rights.

SDG 9: Build resilient infrastructure and promote sustainable industrialization. In many countries the basic infrastructure is missing (quality road networks, power grids, fiber grids, rail networks, suitable ports and airports). But this infrastructure has to be sustainable, which means resilient to environmental stresses, to have little impact on natural environment.

SDG 10: Reduce inequalities within and among countries. The gaps between poor and rich countries are harmful for social stability, social trust and protection of individual rights of the poor.

SDG 11: Make cities and human settlements sustainable. Cities should chase sustainable development in their own rights. Partnerships between cities are also important, because they help in promoting decarbonisation and sustainable development. Targets emphasize the protection of cultural heritage and paths to decrease the deaths and displacement from natural disasters.

SDG 12: Ensure sustainable consumption and production patterns. The focus of SDG 12 is to promote "circular economy" where wastes become inputs and recycled products. The reduction of input of industrial chemicals into the environment and reduction of food waste are also the relevant topics of this goal.

SDG 13: Take urgent action to combat climate change and its impacts. This goal calls on mitigation – reduction of greenhouse gas emissions and adaption – increasing climate resilience.

SDG 14: Conserve the oceans and marine resources. The marine ecosystems are highly threatened from human activities like overfishing, ocean acidification caused by higher concentration of CO_2in water, degradation of coral reefs and pollution.

SDG 15: Protect and restore terrestrial ecosystems, sustainably manage forests, and halt biodiversity loss. Also the terrestrial ecosystems and biodiversity are highly damaged from the human activities. With SDG 12 and targets the conservation of terrestrial ecosystems, the sustainable managing of forests, protection of biodiversity and invasive species should be achieved.

SDG 16: Promote peaceful and inclusive societies. This goal seek to reduce violence, the defense of the rule of law, to end human trafficking, to promote transparent institutions and governance.

SDG 17: Strengthen the means of implementation of the SDGs. With this goal the steps of promoting SDGs, including finance, technology development and transfer, data and monitoring for the SDGs is emphasized.

General information on Bosnia and Herzegovina

Bosnia and Herzegovina is a sovereign, internationally recognized developing country. It is positioned in the western Balkan Peninsula. It has borders to Republic of Serbia to the northeast, the Republic of Montenegro to the southeast and Republic of Croatia to the north, west and south. The country has two administrative entities (Federation of Bosnia and Herzegovina and Republika Srpska) and one autonomous region (Brčko District). Furthermore, the Federation of Bosnia and Herzegovina has 10 administrative cantons, which are divided into municipalities. Republika Srpska has only municipalities, no cantons. Brčko District is a separate administrative unit, which is under Bosnia and Herzegovina's sovereignty. In country live slightly more than 3.5 million

people and with this number of citizens Bosnia and Herzegovina is cultural diverse country. It contains three constituent peoples: Bosniaks, Serbs and Croats. [13]

The Bosnia and Herzegovina started its aspirations to the EU membership in 2003, at the Thessaloniki Summit. Since then the country has made important progress on the transition from post-war economy to an upper middle-income country. In 2016, Bosnia and Herzegovina sign up the formal application to join the EU and in 2018 submitted its answers in response to the EU Questionnaire, to assess the willingness of the country to open accession negotiations to the EU. [13]