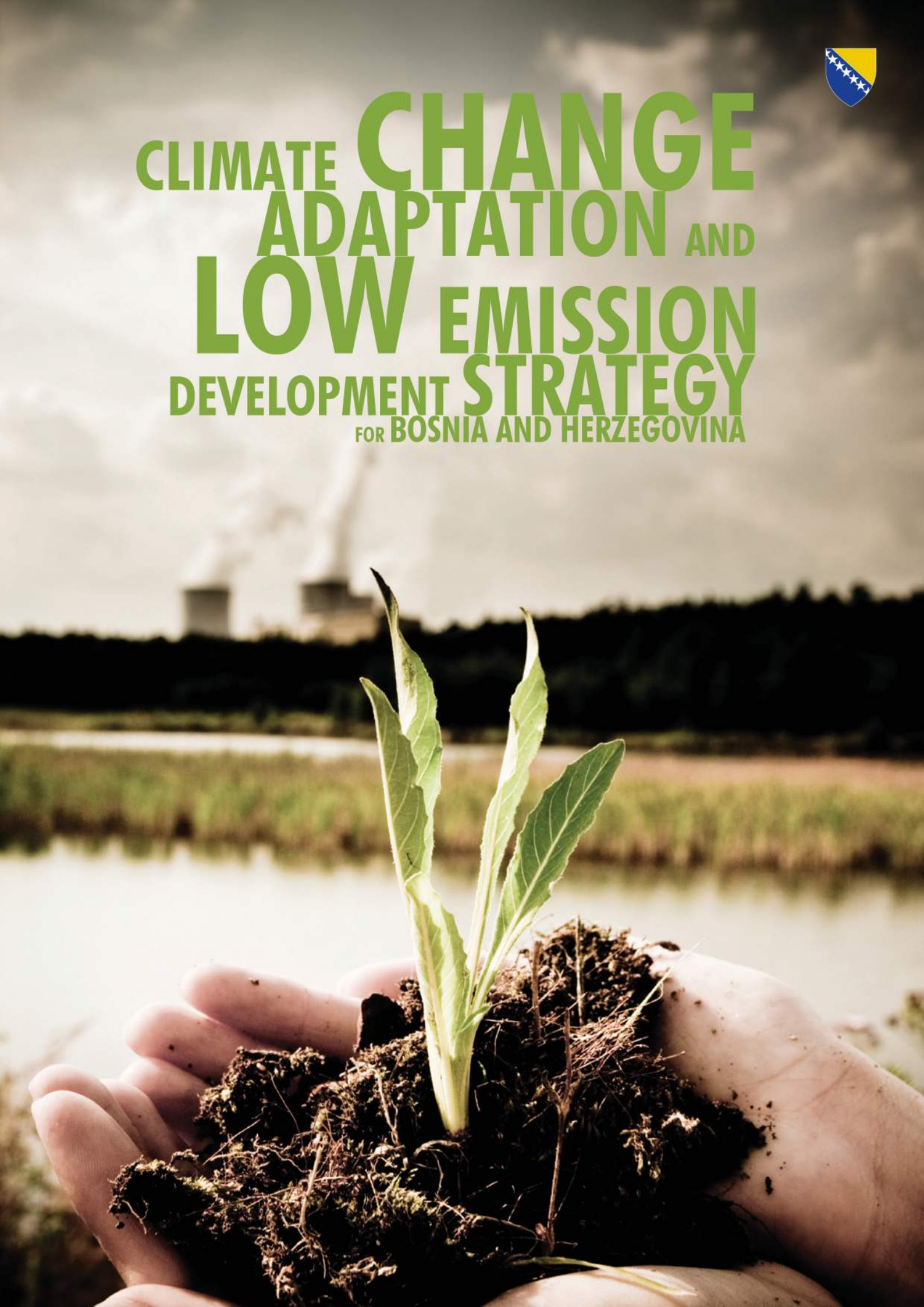
CLIMATE CHANGE ADAPTATION AND LOW EMISSION DEVELOPMENT STRATEGY FOR BOSNIA AND HERZEGOVINA



CLIMATE CHANGE ADAPTATION AND LOW EMISSION DEVELOPMENT STRATEGY FOR BOSNIA AND HERZEGOVINA

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Climate Change Adaptation and Low-Emission Development Strategy for Bosnia and Herzegovina was adopted by the Council of Ministers of Bosnia and Herzegovina on 08 October 2013.

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List of Abbreviations

BAM	Convertible Mark (Bosnia and Herzegovina Currency)
BiH	Bosnia and Herzegovina
CBO	Community-based organization
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CIS	Commonwealth of Independent States
COP	Conference of the Parties to the UNFCCC
DNA	Designated National Authority
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EEA	Energy Efficiency Agencies
EEC	European Energy Community
EU	European Union
EU ETS	European Union Emissions Trading Scheme
FEPEE	Fund for Environmental Protection and Energy Efficiency
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse gases
IF	International Futures (global model)
INC	Initial National Communication
IPA	Instrument for Pre-Accession Assistance (European Union)
IPCC	Intergovernmental Panel on Climate Change

LCPD	Large Combustion Plants Directive
LEAP	Local Environmental Action Plan
LEDS	Low-Emission Development Strategy
LOCSEE	Low Carbon Strategies in southeast Europe
LPG	Liquefied petroleum gas
M&E	Monitoring and evaluation
MRV	Measurement, reporting and verification
MW	Megawatts
NAMA	Nationally Appropriate Mitigation Action
NAO	North Atlantic oscillation
NAS	National Adaptation Strategy
NEAP	National Environmental Action Plan
NEEAP	National Energy Efficiency Action Plan
NMM	New market-based mechanisms
NGO	Non-governmental organization
OECD	Organisation for Economic Cooperation and Development
PDD	Project Design Document
PPA	Public Procurement Agency
PPP	Purchasing Power Parity
PRO-CASH	Promotion of Car-sharing (PRO-CASH)
PUTII	Public transport: Introduction and improvement
R&D	Research and development
RATIP	Railroad transportation: Improvement and promotion
REC	Regional Environmental Centre (for Central and Eastern Europe)
REEEP	Renewable Energy and Energy Efficiency Partnership

SEAP	Sustainable Energy Action Plan
SEE	Southeast Europe
SHPP	Small hydropower plant
SMEs	Small- and medium-sized enterprises
SNC	Second National Communication
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UPITT	Urban planning in terms of transportation
WMO	World Meteorological Organisation

Acknowledgements

The current Climate Change Adaptation and Low-Emission Development Strategy for Bosnia and Herzegovina (BiH) has been developed alongside the Second National Communication of Bosnia and Herzegovina to the United Nations Framework Convention on Climate Change (UNFCCC) coordinated by the United Nations Development Programme (UNDP) in Bosnia and Herzegovina. The strategy development is supported by UNDP Bosnia and Herzegovina and UNDP Regional Programme Office in Bratislava as part of the support to countries in Eastern Europe and the Commonwealth of Independent States (EE&CIS) in formulating and implementing low-emission and adaptation development strategies, and accessing climate change financing under the UNFCCC post- 2012 regime.

The strategy was developed on the basis of prior work on the Initial National Communication (INC) and as part of the on-going work on the Second National Communication (SNC). It is a significant initial step, applying the precautionary principle, towards:

- building the necessary capacity;
- setting the general policy course for low-emission and climate resilient development;
- integrating more specific policies, measures and projects into sectoral strategies; and
- identifying already existing opportunities for adaptation and mitigation actions to attract international support.

However, there were issues concerning the scope, volume and reliability of data available during the preparation, and with limited national capacity within the area of climate change, the current Strategy should be considered as an initial strategy that will require further elaboration during its implementation.

The strategy is also based on the results of the stakeholder workshop held in Teslić during 9-10 July 2012, and the input of national experts on building, district heating, electricity generation, forestry, hydrology, meteorology and transport. The draft National Adaptation Strategy (NAS) and the Low-Emission Development Strategy (LEDS) were then discussed in two stakeholder workshops in Banja Luka and Sarajevo on 22 and 23 October 2012, and the inputs taken into consideration in the writing of this draft.

Executive summary

Bosnia and Herzegovina is taking steps to address climate change both nationally and internationally. Within the country climate change is increasingly recognized as an issue of key strategic importance, particularly by the government and the scientific community. The country's vision for its development is that, by 2025 Bosnia and Herzegovina will be a sustainable and prosperous 'green economy'. When Bosnia and Herzegovina enters the European Union (EU) it will be as a member state with low emissions, a high quality of life for everyone, preserved natural ecosystems, sustainable natural resources management and high level of climate resilience. Increasing levels of energy efficiency, greater renewable energy use, and improved energy and transport infrastructure and services will lead to international investment, job creation and business enterprise in a resource-efficient economy. Negative impacts of climate change will be minimised by reducing vulnerability and taking advantage of opportunities brought about by climate change. The transition to a 'green economy' will particularly benefit the vulnerable and disadvantaged by being socially inclusive and contributing positively to gender equity.

This will be achieved through the implementation of the Climate Change Adaptation and Low-Emission Development Strategy for Bosnia and Herzegovina, which has two main goals on adaptation and on greenhouse gas emission reduction to:

- increase resilience to climate variability and climate change, and in so doing secure development gains;
- reach a peak in greenhouse gas emissions around 2025 at a level that is below the EU27 average per capita emissions.

Bosnia and Herzegovina is a decentralized country comprising two entities (the Republic of Srpska and the Federation of Bosnia and Herzegovina) and Brčko District. The two entities and Brčko District manage environmental issues through laws, regulations and standards. The Bosnia and Herzegovina Ministry of Foreign Trade and Economic Relations has responsibility for the coordination of activities and harmonizing of plans of the entities' governmental bodies and institutions at the international level, in energy, environmental protection, development and the exploitation of natural resources. The designated UNFCCC focal point and Designated National Authority (DNA) for the Clean Development Mechanism (CDM) is the Republic of Srpska Ministry for Spatial Planning, Civil Engineering and Ecology.

Unlike many other environmental problems, the impact of climate change is not geographically linked to its causes. So although Bosnia and Herzegovina has one of the lowest per capita greenhouse gas emissions in Europe (five tons CO_2 equivalent per capita per year; approximately half of the EU average), climate change has already been observed. Bosnia and Herzegovina is particularly vulnerable to climate change due to its geographical position, the economic importance of the agriculture and forestry sectors, and the limited adaptive capacity. Summer temperatures have increased in some places by 1.2° Celsius (C) over recent decades, and rainfall patterns have altered[1].

Climate models predict a 2° - 4° C increase in average annual temperatures over the remainder of this century, with summer temperatures rising by as much as 4.8° C. This situation

1 A 1.2° C temperature change may seem unimportant, however a 1° C drop in temperature caused the European 'Little Ice Age' in the 15th-17th Century. Change of this magnitude can have significant impacts.

will require fundamental changes to agricultural, forestry and land management methods. The predicted reduction by 30% in annual precipitation and up to 50% in summer precipitation in the Posavina area and in the south of Bosnia and Herzegovina[2], will have negative implications for agriculture and forestry. These two major sectors of the economy contribute with 12% to Bosnia and Herzegovina's GDP, employ 20% of the workforce, and are critical for rural development. Changes in the precipitation pattern will also have impacts on hydroelectricity, and without adequate adaptation measures the energy demand of the country may not be met.

The predicted changes provide both opportunities and challenges for tourism, linked with ecosystem protection and protected area management. The climate changes, particularly the increased summer temperatures, are expected to have implications for human health, including a negative impact on the elderly and those with cardiovascular diseases. Effective adaptation measures are a necessity to reduce these vulnerabilities and increase the resilience of both the population and the major sectors of the economy.

Bosnia and Herzegovina has already begun taking measures to address climate change. BiH ratified the United Nations Framework Convention on Climate Change (UNFCCC) in September 2000. The Initial National Communication (INC) was completed in October 2009, and has been adopted by the Council of Ministers and the governments of the entities, and submitted to UNFCCC secretariat in May 2010. However, the strategic approach has lacked integrated climate change mitigation or adaptation measures. Without coordinated and planned approaches to climate change adaptation, Bosnia and Herzegovina will suffer economically and environmentally[3]; and if no strategic action is taken now the costs of future adaptation measures will increase[4].

The approach outlined in this document encompasses two closely linked components: an Adaptation Strategy and a Low-Emission Development Strategy (LEDS).

While mitigation is essential to minimise impacts and ensure that they remain manageable, adaptation is also required to ensure that Bosnia and Herzegovina reduces the risk and vulnerability of society and the economy to, and maximises opportunities from climate change. An Adaptation Strategy has been developed, approaching adaptation in a coordinated way and focusing on the implementation of practical adaptation measures to increase Bosnia and Herzegovina's resilience to current climate variability and long-term climate change, and in so doing secure development gains. This will be achieved through the establishment of an enabling environment for a clear and coordinated adaptation process across all relevant sectors, levels of government, civil society and the private sector. The Adaptation component of the strategy is focused on seven priority sectors, with water management underpinning many of the activities. In addition, a range of cross-cutting issues are also discussed, and considered in the formulation of activities.

The LEDS focuses on mitigation measures that will boost development, including with international support, through Nationally Appropriate Mitigation Actions (NAMAs). The LEDS is focused on an analysis of general scenarios and policy options, identification of concrete NAMAs and links with existing sustainable development goals and strategies, poverty eradication and economic growth strategies in Bosnia and Herzegovina and in the region.

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2 Đurđević. V, *Development of climate models and scenarios for the SNC Bosnia and Herzegovina under the UNFCCC*, ,2012.

3 'Europe', *The Regional Impacts of Climate Change: An Assessment of Vulnerability*, Chapter 5, Intergovernmental Panel on Climate Change, Cambridge University Press, 1997.

4 Preliminary estimates of damage in Bosnia and Herzegovina in 2012 caused by drought, fires, floods and hail already exceed US$ 1 billion according to the Agricultural Institute and farmer associations of Republic of Srpska

The LED component aims at creating a low-carbon and resource-efficient economy through increasing levels of energy efficiency, greater renewable energy use, and improved energy and transport infrastructure and services. This will provide a high level of energy security, encourage international investment, job creation and business enterprise, and will contribute to higher living standards for the population.

The first priority for Bosnia and Herzegovina in addressing climate change mitigation is to strengthen its institutional and professional capacities for developing and implementing climate policy, monitoring greenhouse gas emissions, and planning, implementation, monitoring, reporting and verifying mitigation actions. The capacity building process, combined with the implementation of NAMAs, will put Bosnia and Herzegovina on track to fulfil the requirements of EU membership in terms of legal transposition, administrative capacity and policy implementation.

In addition to capacity building, the LED component focuses on three sectors where the opportunities for emission reduction are highest, and where the economic and social impact of investment into emission reduction is potentially most beneficial. The sectors are: electricity generation, buildings and district heating and transport. In the electricity generation sector, the strategy aims to replace existing coal fired power plants with new, more efficient plans, while promoting investment into renewable energy. In the buildings and district heating sector, the strategy aims to improve the energy efficiency of buildings and heating systems, and replace fossil fuels with biomass and other renewable sources of energy. In the transport sector, the goal of the strategy is to reduce the expected growth of transport emissions by investing in railways and public transport. The sectors are interlinked, and also associated with others important areas, including human health and water resources.

The Climate Change Adaptation and Low-Emission Development Strategy is the first step in the establishment of an adaptive management feedback policy process. There is currently a lack of data and limited national capacity, thus the strategy is an initial step designed to consolidate political support for low-emission and climate resilient development. As the quality of information on emissions and experience with emission mitigation is improved, the strategy will be reviewed and adjusted. The strategy will enable – and will coordinate – enhanced sectoral strategies with detailed policies, measures, programmes and projects. Additionally, the strategy identifies mitigation and adaptation actions and capacity building needs, which will provide the strategic and programming basis for effective international support. The strategy will ensure that climate change mitigation and adaptation measures are gender responsive and will incorporate specific measures to ensure that the most vulnerable groups of population receive adequate support. Governance issues are also addressed.

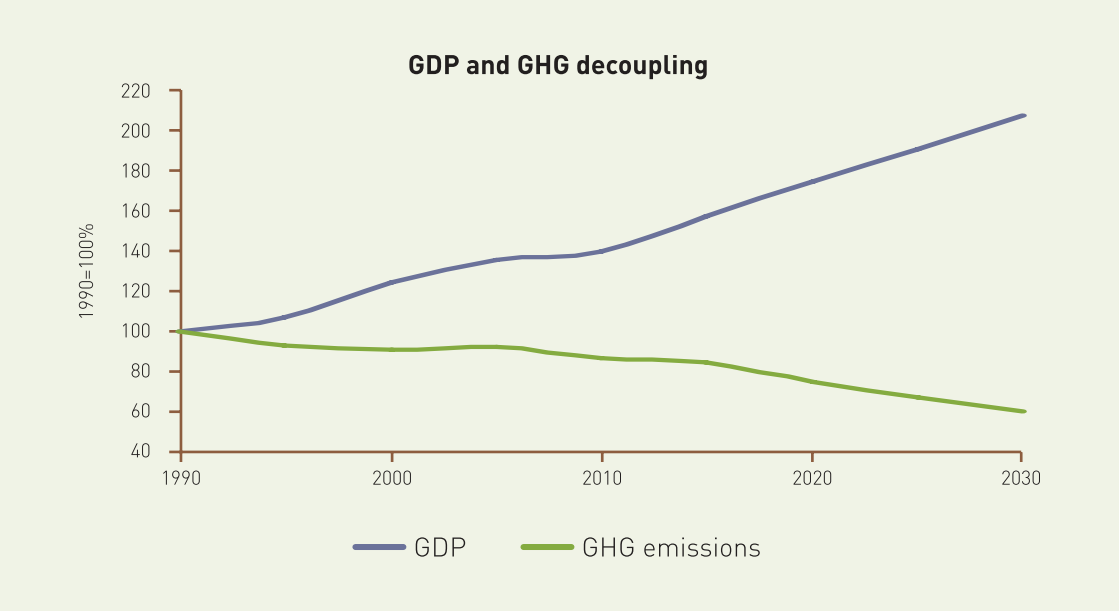
Introduction

The challenges of climate change and the global economic crisis are affecting development patterns, especially in Europe. A new pattern is emerging, contributing to eradicating poverty as well as sustained economic growth, enhancing social inclusion, improving human welfare and creating employment opportunities, while maintaining the healthy functioning of the world's ecosystems. At the United Nations Conference on Sustainable Development in Rio de Janeiro, Brazil in June 2012, global leaders recognised these emerging patterns under the term 'green economy'. Within the context of climate change, a 'green economy' is viewed as being based upon the introduction of measures:

- for adaptation, including preparing for adverse consequences and taking advantage of opportunities brought about by unavoidable changes in climate and climate variability;
- for climate change mitigation, reducing greenhouse emissions through improved energy and material efficiency, and introducing renewable energy sources.

The investment and services involved in the above measures already generate employment in Europe and other regions, and together with the health sector are generators of economic growth. Growing economies without emitting carbon is possible, since 1990 the Gross Domestic Product (GDP) of the EU has increased by about 40% and during the same time, total greenhouse gas emissions fell by over 10%.

Figure 1. Decoupling of GDP and greenhouse gas emissions in the EU between 1990 and 2050



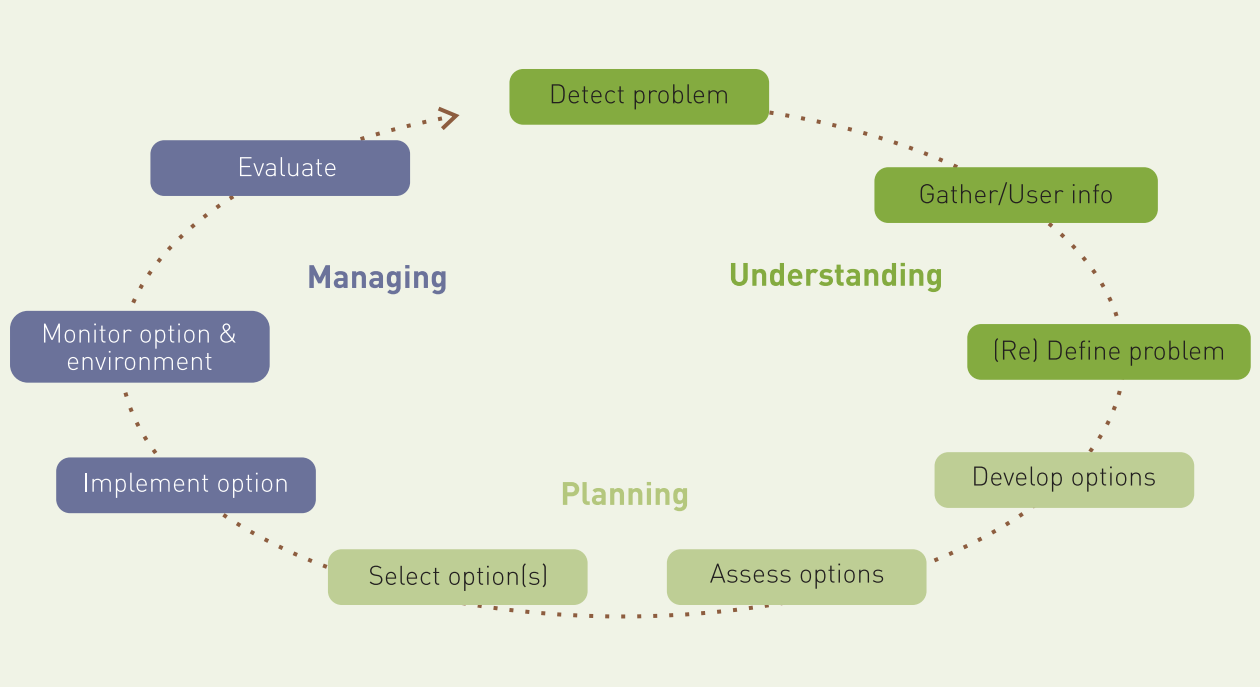
Source: European Commission

The negative consequences of climate change are already visible in Bosnia and Herzegovina even though the country contributes little to the causes of climate change. The per capita emissions of are just over half of the EU average: 5.18 tons CO_2 equivalent per capita per annum in 2008, compared to an EU average of 9.93 tons. But compared to relative wealth, Bosnia and Herzegovina's emissions are almost four times higher than those of the EU. Greenhouse gas emissions per unit of GDP were 1.59 kg CO_2 equivalent per EUR in 2008, while the EU average was 0.4 kg per EUR. These statistics illustrate the economic and social situation of Bosnia and Herzegovina: caught in the poverty trap with low emissions but even lower GDP per capita.

Regardless of its economic situation, Bosnia and Herzegovina urgently needs to implement activities on adaptation to climate change to reduce the negative impacts of climate change in the future. At the same time, the transition towards low-emission development provides opportunities related to the 'green economy', and in mobilizing and attracting domestic and international investment in energy efficiency and renewable energy sources.

Bosnia and Herzegovina is a decentralized country comprising two entities (Republic of Srpska and Federation of Bosnia and Herzegovina) and Brčko District. The two entities and Brčko District manage environmental issues through laws, regulations and standards. The Bosnia and Herzegovina Ministry of Foreign Trade and Economic Relations is responsible for the coordination of activities and harmonizing of plans of the entities' governmental bodies and institutions at the international level, in energy, environmental protection, development and the exploitation of natural resources. The designated UNFCCC focal point and Designated National Authority (DNA) for Clean Development Mechanism (CDM) is the Republic of Srpska Ministry for Spatial Planning, Civil Engineering and Ecology.

Figure 2. Adaptive policy process for the development and implementation of the strategy



To ensure that Bosnia and Herzegovina systematically addresses and plans for climate change, the UNFCCC focal point for BiH, RS Ministry for Spatial Planning, Civil Engineering and Ecology, supported by UNDP, initiated processes for developing and elaborating the Low-Emission and Adaptation Strategy. The process involved improving understanding of the underlying problems and issues, planning adaptation and mitigation approaches, and developing a management approach. Extensive stakeholder consultation with relevant ministries, research institutions, donor organizations, Non-governmental organizations (NGOs) and civil society contributed to the process.

The strategy is the first step in establishing an adaptive management feedback policy process that will provide for a comprehensive policy framework to respond to climate change, and will facilitate access to international support for implementation. The Adaptation serves as an overarching, integrated framework for developing comprehensive sectoral strategies and action plans. The Low-Emission Development Strategy (LEDS) focuses on mitigation measures to boost sustainable development, including the generation of international financial support for development through Nationally Appropriate Mitigation Actions (NAMAs). The strategy will be continuously updated to enhance action plans, based upon monitoring and assessment and improved knowledge accrued through implementation.

The strategy development process has been developed based upon work from the Initial National Communication (INC) and the ongoing development of the Second National Communication (SNC). Consultative work identified seven priority sectors for the Adaptation Strategy:

- Agriculture
- Biodiversity and sensitive ecosystems
- Energy (hydropower)
- Forestry
- Human health
- Tourism
- Water resources

Water resources and agriculture are regarded as the major priorities, impacting to a greater or lesser extent upon the other sectors.

Four sectors were selected as priority sectors for the Low Emissions Development strategy:

- Electricity generation
- Energy efficiency in buildings
- District heating
- Transport

Climate change is not sector specific, and demands a cross-cutting approach based upon principles and measures that need to be implemented to ensure effective climate change adaptation and mitigation. These are concerned with:

- Governance
- Finance
- Gender
- Key research needs
- Science-policy interactions
- Awareness-raising and knowledge transfer measures

1. SITUATION ANALYSIS

1.1. Impact of climate change on Bosnia and Herzegovina

As a result of historic and current greenhouse gas emissions there are inevitably impacts of climate change already in Bosnia and Herzegovina. The country must prepare itself to respond to climate change – and maximise opportunities where they occur – by understanding vulnerabilities, increasing resilience and building capacity. This section highlights the pressing need to adapt to climate changes and plan for the future to ensure a sustainable economy, environment and communities.

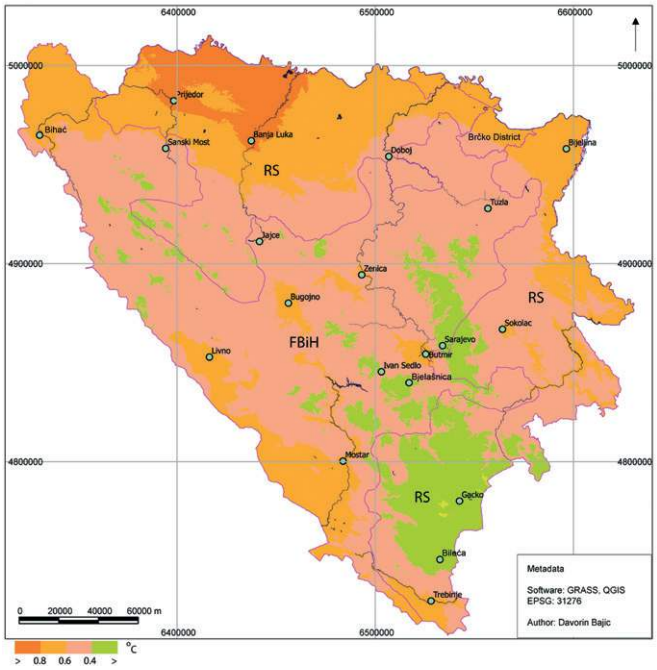
The strategy also considers the eventual entry of Bosnia and Herzegovina into full EU membership and the EU internal climate framework. In April 2009, the European Commission (EC) presented a policy paper (a 'White Paper') describing the framework for adaptation measures and policies to reduce the EU's vulnerability to the impacts of climate change. The framework focuses on building a stronger knowledge base; taking climate change impacts into consideration in key EU policies; financing climate change policy measures; and supporting wider international efforts on adaptation. The Bosnia and Herzegovina strategy has been developed with the EU framework in mind.

Observed climate change to date

The Initial National Communication (INC) and the Second National Communication (SNC) recognise that climate change is affecting Bosnia and Herzegovina, and will accelerate during the remainder of the twenty-first century. Studies of temperature change for the period 1961-2010 indicate that temperatures have increased in all areas of the country. During 1981-2010, the largest increases in average temperature during the summer months were observed in Herzegovina (Mostar 1.2° C) and in central areas (Sarajevo 0.8° C), while the largest increase in spring and winter temperatures was recorded in north-central areas (Banja Luka 0.7° C). The rate of increase in temperature has risen over the last decade. Although increases are over a short time period, it is of concern as it may indicate that the rate of climate change is accelerating.

During 1981-2010, much of the territory of Bosnia and Herzegovina showed a slightly increasing trend in annual precipitation compared to 1961-1990. The largest increase in annual precipitation occurred in the central mountain areas (Bjelašnica and Sokolac) and near Doboj, while the largest deficit was recorded in the south (Mostar and Trebinje). The largest decrease in precipitation was during the spring and summer seasons, in the region of Herzegovina (20%). The autumn season saw the largest increase in precipitation, particularly in northern and central areas.

Figure 3. Changes in annual temperatures in Bosnia and Herzegovina (during 1981-2010 compared with 1961-1990).



Source: Second National Communication of Bosnia and Herzegovina to UNFCCC

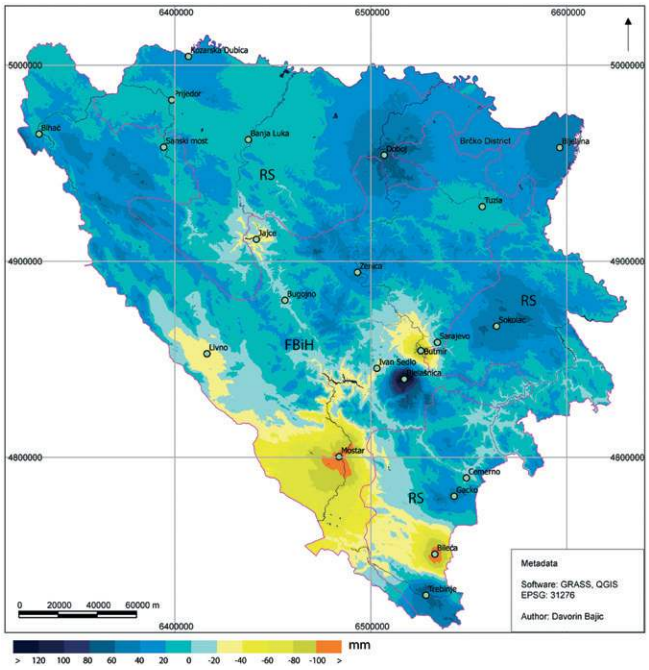
Although the level of annual precipitation has not significantly changed, the number of days per year with rainfall has decreased, while the number of days with intense rainfall has increased. This represents a significant change to the rainfall regime, particularly when combined with temperature increases. The result will be less moisture in the soil (potentially increasing the frequency and magnitude of drought), and an increased likelihood of floods as the frequency of intense rain events increases.

Since 1981, increased climate variability has been noted in all seasons and across the entire territory of Bosnia and Herzegovina. For example, there has been a trend of rapid changes of extremely hot or cold conditions, typically lasting 5-20 days, and for intense rain events. Droughts have also been more frequent and intensive over the last decade: Since 2000, there have been five drought years (2000, 2003, 2007, 2011 and 2012). Although detailed studies have not been conducted in terms of forecasting drought, the more frequent and intense droughts are worrying as they are clear indicators of increasing climate variability. There have also been more hail events and higher levels of maximum wind velocity in central areas of the country[5].

The climate changes already observed are predicted by climate models. This provides the necessary evidence base supporting future trends predicted by the models. There is no longer any doubt that climate change is occurring, and that its impact on Bosnia and Herzegovina will increase.

5 'Hail prevention in the Republic of Srpska', 2012.

Figure 4. Changes in annual precipitation in Bosnia and Herzegovina (during 1981-2010 compared with 1961-1990.)



Source: Second National Communication of Bosnia and Herzegovina to UNFCCC

Predicted climate change

According to climate models, the mean seasonal temperature changes for the period 2001-2030 are expected to range from +0.8°C to +1.0°C above previous average temperatures. Winters are predicted to become warmer (from 0.5°C to 0.8°C), while the biggest changes will be during the months of June, July and August, with predicted changes of +1.4°C in the north and +1.1°C in southern areas.

Precipitation is predicted to decrease by 10% in the west of the country and increase by 5% in the east. The autumn and winter seasons are expected to have the highest reduction in precipitation.

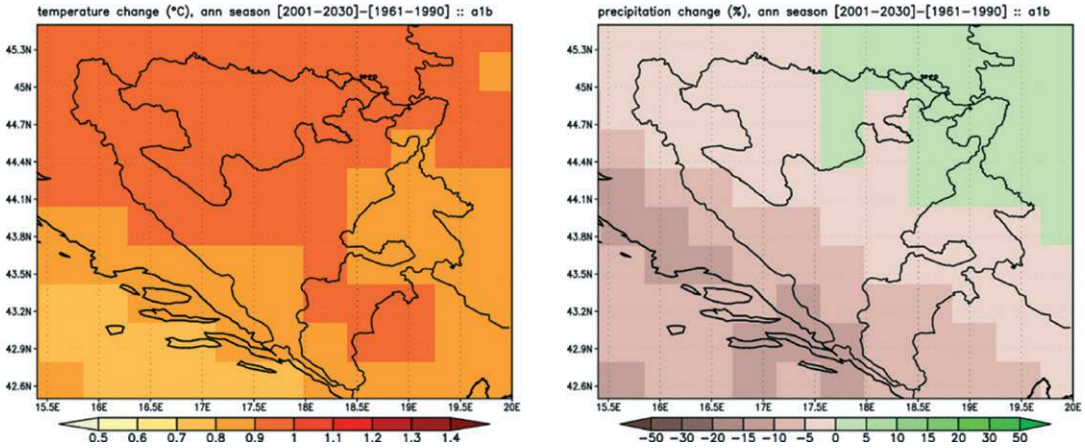
The climate models that have been applied to Bosnia and Herzegovina project further significant temperature increases during the period 2031-2060, with a predicted average rise in temperature of between 1°C to 2°C in coastal areas, and 2°C to 3°C inland[6]. These temperatures, while of levels that are of concern and will have negative impacts, also hide some other alarming changes[7]. The largest temperature increases are expected to occur in inland areas during the

6 Results from running the EH50M model. This is detailed on p.16 of the INC for Bosnia and Herzegovina.

7 At first glance it appears that these changes are within the EU climate protection target ('the 2° C limit': an absolute limit of 2° C of temperature increase over pre-industrial levels) . Global mean temperature increases of up to 2° C, while generally undesirable, should allow adaptation to climate change for human systems at globally acceptable economic, social and environmental costs, although there may still be limitations in the ability of many natural ecosystems to adapt to rapid climate change with these increases, and increased drought and storm responses are likely to occur. However, although mean rises in temperature may be within the 2° C target, inland summer temperature increases are well above this.

summer months: the mean summer temperature could be up to 4° C higher and the maximum summer temperature 5° C higher. The number of days when the temperature exceeds 25° C is likely to be two to six weeks more per year. The number of 'hot' days, where the temperature is greater than 30° C, is modelled as increasing by five-to-six weeks a year in inland areas.

Figure 5. Change in mean annual temperature in °C (left) and precipitation in % (right).



Source: Đurđević. V, Development of climate models and scenarios for the SNC Bosnia and Herzegovina, 2012.

In addition to temperature rises, climate models predict substantial changes in rainfall for the period 2030-2060. The Western Balkans are expected to see a decrease in summer precipitation, when rainfall could be half of current levels. There will more dry days in inland areas.

1.2. Observed and projected climate change impacts on key sectors in Bosnia and Herzegovina

Temperature increases in Bosnia and Herzegovina are likely to have largely detrimental impacts, particularly as predicted higher temperatures are associated with reduced rainfall and higher evaporation rates for inland areas of the country. An average temperature increase greater than 2° C will result in costly adaptation, and impacts that will exceed the adaptive capacity of many ecological systems (such as high mountain and lowland oak forest areas), and a high risk of large-scale irreversible effects including endemic species extinction[8].

According to the INC and as noted above, increasing variability in weather conditions has been noted in all seasons, with rapid changes over short periods (five to ten days) of extremely cold to warm weather, periods with extremely high levels of rainfall to droughts. Climate change is not just a future problem, but something that is happening in Bosnia and Herzegovina now, with serious economic impacts. These are described in more detail below.

8 European Union EG Science Paper, 'The 2° C target: Background on Impacts, Emission Pathways, Mitigation Options and Costs', 2008.

Agriculture

Agriculture, due to its exposure and sensitivity to natural changes, is the sector most vulnerable to climate change: of the total area of Bosnia and Herzegovina, 46% is agricultural land. Climate is the primary determinant of agricultural productivity in the country. The impact of future climate change on the agricultural sector is forecast to be largely – but not entirely – negative.

Despite the abundance of water resources in the country, irrigation infrastructure is very limited, for example, only 0.65% of arable land is irrigated (before the war the total was 1.0%, but has decreased markedly due to war damage, landmines and lack of maintenance). More hot days, reduced rainfalls and higher aridity will increase the probability of droughts. Owing to the current infrastructural restraints current problems cannot be solved through a reliable irrigation system alone. The risks facing the agricultural sector – due primarily to the combination of increasing drought probability and lack of irrigation options – are not uniform: Mostar, Bijeljina, Brod and Tuzla are the areas most affected by soil-water deficiency. Additional risks include an increased fire risk for cereal crops due to reduced moisture content; evidence that hail storms are becoming more common and more intense, with consequences for crops; and concerns that the increased wind velocities and storms observed may also have a detrimental impact on crops[9]. Livestock are also affected by higher peak and average temperatures, potentially leading to overheating, and the spread of disease vectors.

There is a real risk of reduced crop yields leading to increased food prices, which would in turn have negative implications for food security[10].The year 2012 represented the fourth consecutive year when agriculture suffered significant losses due to bad weather. The drought and high temperatures in the summer of 2012 have been estimated to have cost approximately US$1 billion in lost agricultural production[11], and are estimated to have destroyed almost 70% of vegetables and corn in inland areas of the country[12]. This has serious implications for the poor and vulnerable, as it negatively impacts on households and household budgets. The impacts are experienced differently by men and women, due to their gender-based responsibilities in household management.

There are impacts of climate change which provide opportunities: an increase in minimum temperature, for example, enables the breeding of late crops, such as winter wheat, thereby providing greater yields, and which are more convenient to store (although there is also the probability of crop failure from frost damage).

To summarise, the predicted rises in temperature, coupled with changes in rainfall and evaporation, are likely to significantly negatively impact on farming systems in Bosnia and Herzegovina, particularly in Mediterranean areas and in the North. Adaptation approaches will need to focus on improved water management and irrigation, new farming systems appropriate for hotter and more arid environments, and varietal improvements of local crops to maximize agricultural production under more aridified conditions.

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9 Hail prevention in the Republic of Srpska, Documentation and materials, 2012. For example in Northern and Eastern Bosnia and Herzegovina the average number of days with hail is 26.3 over the last five years, with a minimum number of 21 hail days (2008 and 2011). This compares with an average of <10 hail days a year during 1961-1990.

10 Trbić. G., Vojinović. DG., 'Impact of Climate Change for Food Production in the Western Balkan Region: Study of impacts of climate change for food production in Bosnia and Herzegovina', REC Country Office Bosnia and Herzegovina, 2010. Research has demonstrated that the recent droughts caused a significant reduction in maize yields in Bosnia and Herzegovina.

11 Balkan drought highlights years of farm neglect, Reuters, August 2012.

12 Association of Agriculture Producers.

Water

Bosnia and Herzegovina possesses considerable water resources that could, if correctly managed, underpin economic development and a 'green economy'. Water resources comprise two major river basins: the Sava river basin with the Una, Vrbas, Bosna and Drina catchment areas in the north, and the Adriatic basin with the Trebišnjica and Neretva river basins in the south. These resources provide an estimated average flow of 1,555m^3/s. However, the water sector suffers from poor and degraded infrastructure due to the war and a lack of investment. It is estimated that 57% of water leaves the country unused[13]. Moreover, key indicators, such as the quality of potable water, have been deteriorating.

The predicted changes in precipitation and air temperature will impact negatively on the current water management system in Bosnia and Herzegovina. Although there is watershed level information available on water flows, which has been used for determining the total water availability, there is a very limited country-level data available on hydrological resources. Consequently, there has been no assessment of climate change impacts on these systems at the national level.

Water systems are expected to experience climate-related impacts. Reduced rainfall during the spring and summer seasons, linked to the regional reduction in annual precipitation levels and increase in air temperatures, will contribute to the increased frequency of droughts. Conversely, in autumn and winter times, increased frequency of floods is expected. These more extreme weather conditions are expected to occur on average every 5 to 10 years. Aridity is expected to increase, as a result of reduced summer rainfall coupled with increased evaporation rates. River flows will be lowered, particularly during the summer and early autumn, impacting on water quality. The low flows and droughts will occur in the summer months, impacting on the potable water supply (particularly affecting rural communities), and on tourism.

To summarise, the predicted changes in rainfall volumes and distribution (both spatial and seasonal), combined with rises in temperature and evaporation, are likely to cause more extreme events (floods and droughts), and lead to less water being available during summer months, particularly in the Mediterranean area and Herzegovina (most severely in the limestone karst areas). Adaptation approaches are currently limited by a lack of reliable data, a situation which needs to be addressed urgently. Infrastructural improvements (both flood protection and water storage infrastructure) are also needed, along with mechanisms to better manage water supply and distribution.

Hydropower

The hydropower potential of Bosnia and Herzegovina is estimated at 8,000 megawatts (MW), with technical potential of 6,800 MW and economic potential of 5,800 MW, putting the country among the leading nations in southern Europe. Hydropower along with woody biomass, represent key renewable energy sources, with a potential utilization ratio that is 30% higher than the EU average, and the highest in the Balkans (Renewable Energy and Energy Efficiency Partnership [REEEP], 2007). The development of hydropower plants represents a promising source of renewable energy in Bosnia and Herzegovina. This sector offers significant opportunities for 'green economy' development, with the potential involvement of small- and medium-sized enterprises (SMEs) in their construction and operation. The risks associated with climate change have not yet been systematically considered in strategies and management plans for hydropower development.

13 'National Environmental Action Plan, Bosnia and Herzegovina', 2003.

Climate change is expected to exacerbate problems related to low river flows. The expected summer precipitation decreases in inland areas could lead to a fall in the production of hydro-electric power, which could also jeopardize energy security and electricity exports. Prior experience has shown that droughts have contributed to reductions in the production of hydro-electric power. This reduction can be compensated for through the generation of thermal energy or by importing power, although neither is economically viable or environmentally friendly.

The hydropower infrastructure and generation faces an additional impact, in the event of floods: more frequent, intense rain events will lead to intensive runoff and increased peak river flows, when power production may not be possible due to potential (or actual) damage to infrastructure.

In summary, hydropower is dependent on the water resource regime. River discharge in Bosnia and Herzegovina is likely to become increasingly erratic, creating significant challenges for the hydropower sector, particularly during the low water periods. This needs to be addressed through improved management of water resources at the watershed level.

Human health

Since the war, the health of the population has been deteriorating, due to a number of socio-economic factors including: high unemployment, migration and high numbers of displaced persons, smoking, poor diet and high levels of post-traumatic stress disorder. Cardiovascular disorders and cancer are highly prevalent, and common communicable diseases include respiratory ailments (influenza), childhood infectious diseases (varicella), and bowel diseases (enterocolitis).

At present, there is no comprehensive system for monitoring of epidemics and disease prevalence correlated with climate parameters in Bosnia and Herzegovina. General observation suggests that changes in climate are expected to impact on the health care sector. The expected increase in temperatures is likely to result in a higher number of cases of cardiovascular and cerebrovascular illness. Humidity is expected to increase and with it the number of respiratory ailments. The impact of 'heatwaves' will be increased risk and mortality for the elderly population in particular.

Due to reductions in river flows, the potential for occurrence of water quality-related diseases and food poisoning is likely to increase. This will have additional negative impacts on human health, potentially leading to illnesses such as cholera and dysentery[14]. Higher temperatures will also contribute to the spread of vector-borne diseases, thus increasing incidence and extent of infectious diseases. Conversely, it is probable that the predicted milder winters will reduce cold-related mortality and illness.

To summarise, increased temperatures, coupled with a possible reduction in water quality, are likely to increase the volume and severity of associated heat and water-based diseases. Effective adaptation will require better information on the potential extent of the problems, and then targeted investment in air conditioning and water purification plants.

14 It should be noted that both reduction in river flows and flooding can both lead to water-borne disease increase. Low water flows result in a reduction in water quality in the river and water supply systems; flooding results in contamination of water supplies (e.g. Posavina, especially in Bijeljina area)

Forestry

Bosnia and Herzegovina has the highest forest cover in Southern Europe (53%), with a diversity and richness in plant and animal life that makes it one of the most important forest regions in Europe. This unique diversity provides resilience for forest ecosystems to adapt to climate change, but there is a risk that some of the unique and more fragile ecosystems may be endangered.

Climate change could affect the forests of Bosnia and Herzegovina in a profound manner, transforming forest ecosystems over time, and altering forest distribution and composition. Some of the forest reserve is more resilient to climate change, although there are still potential impacts. The beech forests, which are largely resilient, could still suffer from pathogens and disease outbreaks, and fire could become a greater risk. The lowland beech forests are at particular risk, especially in low rainfall areas in the northeast of the country. Likewise, low altitude oak forests and high mountain forests are also at risk. Conifers are particularly prone to pest outbreaks in hot temperatures (particularly from beetle attack), as well as from fire risk. Simulations for a 2° C average temperature rise predict significant negative consequences for the distribution of dark coniferous forests. Fir trees are also at risk from increasing temperatures and other species increase their range to higher altitudes. Many tree species, particularly broadleaves, suffer from drought-related stress, and this could have significant impact on many forest species. A particular impact that may occur with climate change is 'multiple stresses', where changes in soil humidity, rainfall, temperature and pathogens all contribute to a hostile environment and high levels of tree mortality. Tree species that are found in the centre of their distribution range will be more tolerant to climate change than those at the periphery.

Other factors likely to impact on forest ecosystems include: changes in soil structure, severe temperatures and climatic conditions causing frost and heat stress and changes in of precipitation amount and distribution (snow versus rain, drought versus flood). Another significant threat to forests is an increase in forest fires: higher temperatures and changes in precipitation levels increase the risk of fires in some areas of the country.

Climate change may also have some positive impacts on forests and forestry: tree productivity may increase in areas with adequate water availability, resulting in faster growth rates, and there is the possibility of new species emerging.

In summary, climate change is likely to affect the more vulnerable forest ecosystems due to multiple stresses on trees and forest environments, including drought, pest and disease attack, increased fire risks and changes in soil. The environmental and economic importance of forests in Bosnia and Herzegovina, mean that these impacts could have serious consequences for the country. Adaptation approaches will require improved information for forest management to support changes in species planted, and management interventions to prevent fire and diseases spreading.

Biodiversity and sensitive ecosystems

Bosnia and Herzegovina has a particularly rich biodiversity, with a high level of biotope diversity and a large number of endemic flora (5,000 species of vascular flora and 30% of the total endemic flora of the Balkans). The strategy on biodiversity defines those areas of Bosnia and Herzegovina that are most vulnerable to climate change: high mountainous systems (above 1,600m); mountain ecosystems (900-1,600m); sub-Mediterranean ecosystems (300-800m); highlands (600-900m), ecosystems of the Peripannonian area (200-600m) and Pannonia ecosystems (up to 200m).

The available data[15] suggests that climatic changes threaten all three macro regions in Bosnia and Herzegovina (Pannonia, mountainous basin and Mediterranean). Dinarides, one of the Balkan's richest areas in endemic species, will be particularly threatened by climate changes. This mountain range is of particular biological and geomorphologic significance.

Climate change models predict that there will be significant changes in precipitation levels caused by the rise in temperatures. This will have a strong effect on the distribution of plant species. Climate change is expected to have a significant impact on flora in mountainous areas, with migration of woody species along the Dinarides, and local reduction in species. Herbaceous species are likely to be lost in the high mountains. Additionally the swamp areas in the Hutovo Blato Park region (a dedicated RAMSAR site)[16], with their bird and turtle populations, and the karst regions, are likely to be particularly affected with a loss of flora and fauna anticipated. The disappearance of a number of endemic species is expected to occur.

Adaptation measures should be centred on expanding the network of protected areas in Bosnia and Herzegovina, and improving management of existing protected areas.

Tourism

The tourism sector does not have the economic significance of the agriculture, forestry and energy sectors, although some areas of the country do have tourism potential. In 2009, tourism contributed 2.5% to GDP, and around 32,000 persons are employed within the sector. Tourism is expected to grow, so that the share of GDP by 2021 will rise to 8.4%.

Key climate change impacts are likely to be felt in winter tourism. Skiing and winter mountaineering are at relatively low altitudes by Alpine standards, and are consequently vulnerable to climate change. Impacts are expected to include shorter seasons and shallower and less reliable snow cover. In summer, the appeal to tourists of Mediterranean beaches may be reduced due to increased temperatures, and may provide an opportunity for increased eco-tourism in the mountain regions of Bosnia and Herzegovina. It is predicted that Mediterranean beaches will be more popular in extended early and late seasons.

City tourism may also be adversely impacted: An increase in summer temperatures, coupled with reduced rainfall, are likely to make internationally famous destinations, such as Sarajevo, less attractive during the summer months (during the summer of 2012 there were reports in western European media of the 'sweltering' Balkans).

Adaptation approaches will require revisiting winter tourism, and snow making capabilities. Tourism marketing strategies may need to focus on more summer ecotourism, and tourism infrastructure needs to be examined regarding future climate change.

Summary of key impacts

The table below shows the key impacts expected across the most affected sectors to 2030.

15 State assessment carried out as part of the National Biodiversity Strategies and Action Plans (NBSAPs); Biodiversity Assessment of Bosnia and Herzegovina, USAID, 2003.

16 Ramsar sites are wetlands of international importance, designated under the Ramsar Convention.

Table 1. Summary of key climate change impacts

Sector	Negative Impacts	Positive Impacts
Agriculture:	Reduced yields as a result of reduced rainfall and increased evaporation; potential decrease in livestock productivity; increased incidence of agricultural pests and crop diseases; and increased food insecurity.	Extended growing season Greater potential for growing Mediterranean cultures in Herzegovina
Water:	More frequent droughts (in western BiH); more frequent and severe floods; and reduction in summer river flow.	None expected
Hydropower:	Lower water quantities reduce energy generation; flood related damage more frequent; and lower quality of water for people.	None expected
Human health:	Warmer winters may increase the frequency and magnitude of epidemics/pandemics; 'heatwave'-related mortality; possible spread of the Asian tiger mosquito (*Aedes albopictus*); and increase in tick-borne diseases (Lyme borelliosis and tick-borne encephalitis).	Less winter cold-related deaths
Forestry	Increased frequency and extent of forest fires; increased risk for rare and endangered forest communities; increased grade bark beetles and gypsy moths (North Atlantic oscillation [NAO] index); risk of transformation of the forest ecosystem resulting in large-scale tree mortality; change of latitude and altitude of forest communities; change of structure of forest communities; impaired preservation of biological and genetic diversity.	Faster growth rates; and potential new economic species.
Biodiversity and sensitive ecosystems	Loss of existing habitats; habitat fragmentation; species extinction; and rapid temperature and/or precipitation changes, affecting ecosystem functions.	Emergence of new habitats
Tourism	An increase in winter temperatures may reduce mountain snow cover and mountain/ski tourism; extreme summer temperatures may reduce the appeal of BiH to tourists (particularly Mediterranean areas and the northeast of the country); and health issues.	BiH becomes a more attractive summer destination as Mediterranean beaches become too hot[17]

17 Amelung. B., Viner. D (in Amelung. B., Blazejczyk. K., Matzarakis. A). 'The vulnerability to climate change of the Mediterranean as a tourist destination: Climate Change and Tourism – Assessment and Coping Strategies', 2007.

Consequences including extreme events and disaster management

It is increasingly acknowledged that climate change is already influencing the frequency and magnitude of extreme events[18]. The Intergovernmental Panel on Climate Change (IPCC) predicts that there will be an increased risk of drought in southern Europe, a decrease in the number of cold days and nights, an increase in the occurrence of 'heatwaves', and increases in precipitation (with the frequency and/or proportion of heavy rains likely to increase). As noted above, many of these changes have been observed in Bosnia and Herzegovina already.

Within the specific context of Bosnia and Herzegovina, five of the past 12 years were very dry to extremely dry, and four of the years were characterised by extreme flood events. The past four years (2009-2012) have all been characterised by extreme events: flooding in 2009 and 2010, drought and high heat in 2011 and 2012, and cold in early-2012 and wind in mid-2012. The economic impact has been estimated at US$ 1 billion[19].

Extreme heat events and flooding have implications for disaster management, including in terms of epidemiology and disease transmission. Although events that lead to disasters cannot necessarily be prevented, adaptation strategies can greatly reduce their impact. The focus of disaster management is to reduce risk. Climate change needs to be incorporated into risk assessment and risk reduction planning processes in Bosnia and Herzegovina, with particular emphasis on floods, and forest fires. Climate change is both a protracted and a complex hazard, and being multi-faceted (e.g. drought, flood, temperature changes, etc) and multi-dimensional (local, entity level, state and global), it has both short and long-term aspects, and unknown outcomes[20]. This has major implications for disaster management in terms of operating at different scales and across different sectors.

Climate change is intensifying a range of existing hazards thereby affecting activities associated with livelihoods, infrastructure and economic activity. In a wider development context, disasters impact most on the vulnerable and marginalised. In the summer of 2012, widespread drought, including in Bosnia and Herzegovina and the wider Balkans, caused a fall in global production of cereals, resulting in grain prices reaching a record level. This has a potential impact on the vulnerable and poor population. Similarly reductions in power generation result in increased energy prices. Climate change increases the need to effectively integrate risk management into development strategies. The economic implications, coupled with the risk of significant climate change-related disasters, require an effective strategy to reduce and manage risks. Without such a strategy, climate change will directly impact on food production and food security, energy supplies, and household welfare.

18 Hansen, Sato, and Reudy, 'Perception of climate change: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation', IPCC, 2012.

19 Preliminary estimates of the Agricultural Institute and Farmer associations of the Republic of Srpska.

20 O'Brien, O'Keefe, Rose and Wisner., *Climate change and disaster management*, 2008.

1.3. International cooperation to combat climate change

The Climate Convention and the Kyoto Protocol

Bosnia and Herzegovina became a party to the UNFCCC on 6 December 2000, and ratified the Kyoto Protocol on 16 April 2007. Under the UNFCCC, Bosnia and Herzegovina is considered a non-Annex I Party, i.e. developing or transitional countries. The non-Annex I parties are not obliged to take emission reduction action, either under the Convention or the Kyoto Protocol, but they are encouraged to do so with financial support from developed countries. Apart from regular bilateral and multilateral development cooperation mechanisms, specific mechanisms have been introduced or are currently under development:

- **The Clean Development Mechanism** (CDM) of the Kyoto protocol enabled Annex I Parties to invest in emission reduction projects in developing countries and count the achieved reductions towards their own emission reduction targets. The current mechanism may no longer be relevant for BiH after the end of the first commitment period at the end of 2012, but it is likely that it will be replaced with a similar mechanism in the future.

- **LEDS** are foreseen by the Copenhagen Accord and reaffirmed and further elaborated in consecutive decisions for both developed and developing countries, as blueprints for decoupling their economic development and emission growth.

- **NAMAs** are mitigation programmes or policies voluntarily undertaken by developing countries in the context of sustainable development, supported and enabled wholly or in part by technology, financing and capacity building from developed countries.

- **A registry** is being set up to record NAMAs seeking international support, to facilitate the matching of finance, technology and capacity-building support with these actions, and to recognize other NAMAs. The deployment of the prototype is expected take place in November 2012.

- **The Green Climate Fund** (GCF) was formally established at the Conference of the Parties to the UNFCCC (COP) in Durban in 2011 and should channel up to US$ 100 billion annually towards mitigation and adaptation actions in developing countries by 2020.

In the next two decades significant international funding is being made available to developing countries that have adopted LEDS and to prepare NAMAs and mitigation projects in their context.

NAMAs may include a wide range of different approaches to mitigation actions, including implementation of policies, programmes and individual projects, or specific changes in the national economy to reduce greenhouse gas emissions. Two types of NAMAs are being agreed: (i) unilateral: mitigation actions undertaken by developing countries on their own; (ii) supported: mitigation actions in developing countries, supported by finance, technology and capacity building from Annex I countries. Another type of NAMA is under discussions, creditable: mitigation actions in developing countries generating credits for the carbon market.

Unilateral NAMAs will be subject a country's domestic monitoring, reporting and verification (MRV) procedures and reported on every two years through biennial reports and national communications, and also recorded in the UNFCCC registry. NAMAs seeking international support (supported NAMAs) will be submitted to the registry along with relevant technology, finance and capacity building support requested, to be matched with the appropriate donor. NAMAs are subject to international MRV procedures in accordance with guidelines adopted by the Conference of the Parties.

Bosnia and Herzegovina associated itself with the Copenhagen Accord, supporting and contributing to the global imperative to stabilize the concentrations of the greenhouse emissions in line with the '2 degree' temperature increase scenario. The first step of the transition to a low emission development path is the establishment of a LEDS. The strategy will allow access to the fast start financing as well as long-term financing committed by developed countries in Copenhagen to support developing countries in implementing LEDS and NAMAs. The strategy outlines the approach to implementation, determining concrete steps and timelines, as well as provisions for monitoring, measurement, reporting and verification of results achieved, and a mechanism for further improvement based upon lessons learned during implementation.

Implications of EU Accession

As Bosnia and Herzegovina is a potential member of the EU, and the EU as a group belongs to Annex I countries under the UNFCCC, Bosnia and Herzegovina would expect to change its status to Annex I shortly after it becomes EU member. As a EU member, Bosnia and Herzegovina will also have to take on legally binding emission reduction targets in line with the EU legislation. This assumption is subject to two sets of uncertainties:

- **Time frame and the process of EU accession**: Bosnia and Herzegovina is a potential candidate for EU membership, but there is no fixed time frame set for the accession process. In view of the present situation in the EU, it is unlikely that Bosnia and Herzegovina will become an EU member before 2020. It is therefore assumed that under the second commitment period of Kyoto, Bosnia and Herzegovina will remain a non-Annex I country, with no legally binding emission reduction commitment and able to benefit from the mechanisms and funding intended for developing countries.

- **Future development of the international climate regime**: Following the Durban Conference in 2011, the international climate regime under UNFCCC is undergoing significant changes and it is uncertain how the regime will be after 2020. With an adopted LEDS, Bosnia and Herzegovina can act to ensure that its future commitments and actions are in line with its capabilities and development needs.

The LEDS provides a general roadmap towards EU membership in the area of climate change mitigation, and an 'Annex I type' regime around 2025. Until that time, the strategy aims to maximise the utilisation of available capacity building, technology transfer and financial mechanisms. These include the new market-based mechanism, EU pre-accession funds and GCF to be operationalised in the period until 2015. In order for the financial mechanisms to generate the expected environmental, social and economic benefits, climate change objectives and projects must be integrated into national economic development policies and strategies in sectors such as poverty alleviation, energy, transport, and industry.

In April 2009, the EC released a policy paper ('White Paper') presenting the framework for adaptation measures and policies to reduce the EU's vulnerability to the impacts of climate change.

The framework focuses on building a stronger knowledge base, taking climate change impacts into consideration in key EU policies, financing climate change policy measures, and supporting wider international efforts on adaptation. Bosnia and Herzegovina's strategy has been developed in accordance with the EU framework.

The EU emission reduction system comprises mainly of:

- The **Emission Trading Scheme** (EU ETS) where a target of 21% emission reduction by 2020 is set for the entire EU. The scheme covers large emitters, including factories, power plants and other installations, and works on the 'cap and trade' principle, whereby there is a 'cap', or limit, on the total amount of certain greenhouse gases that can be emitted. Within this cap, companies receive emission allowances which they can 'trade' with other companies as required. The limit on the total number of allowances available ensures that they have a value. The flexibility that trading brings ensures that emissions are cut where it costs least to do so.

- The '**Effort Sharing Decision**' establishes annual binding greenhouse gas emission targets for Member States for the period 2013–2020. These targets concern emissions from sectors not included in the EU ETS, such as transport, buildings, agriculture and waste. It is part of a package of policies and measures on climate change and energy that will help transform Europe into a low-carbon economy and increase its energy security. The combined target for all EU member states by 2020 is 10%, but individual targets vary from -20% to +20% depending on the national circumstances and the economic strength of individual countries. Poorer Member States are permitted to increase their emissions, while the emphasis is on reduction for the more developed countries.

When Bosnia and Herzegovina becomes a member of the EU, its cap for ETS sectors will be set – based on methodology, together with the non-ETS sectors reduction target based on criteria, all to to be agreed at the time.

An important framework for moving towards the ETS system is the treaty on the **European Energy Community** (EEC) signed by countries in the southeast Europe (SEE) region and the EU. Under this treaty, signatories agree to implement selected EU legislation, including the Large Combustion Plants Directive (LCPD – 2001/80/EC) from 2018 onwards, and the Directive on Sulphur Content in Liquid Fuels (1999/32/EC) from 2012 onwards. The treaty provides the framework for coordinating the energy policies of the region's countries with the EU. At its ministerial session in Budva on 18 October 2012, the EEC adopted the 'Energy Strategy of the Energy Community'[21]. The objectives of the energy strategy are to:

1. Create a competitive integrated energy market

2. Attract investments in energy

3. Provide secure and sustainable energy supply to customers

According to this strategy, energy investments in the order of €44.6 billion are needed in the region over the next eight years to diversify existing resources and replace ageing equipment, as well to meet increasing energy demand. Among the actions related to environmental protection, the strategy envisages reparation of national road maps for greenhouse gas emission reduction/

21 www.energy-community.org

limitation, including setting indicative targets and concrete measures by the end of 2013. The strategy examines a low emissions scenario and recommends that new investments should be directed predominantly towards new renewable energy generation and natural gas fired power plants. Investments in renewable energy could balance the excess demand, resulting in a more sustainable energy mix and helping to meet the renewable energy targets. The region should apply modern, efficient technologies that reduce the impact on the environment. There is potential for energy efficiency in the region, and this can enhance the security of supply, increase competitiveness and reduce energy dependence and energy costs, as well as, the harmful impact of energy systems on the environment.

Bosnia and Herzegovina is also a partner in a regional project under the EU SEE Programme entitled Low Carbon Strategies in SEE (LOCSEE). The project supports the development of a climate strategy for all SEE countries in relation to EU Accession, and covers mitigation and adaptation. All SEE countries must combine the process of transposition and implementation of EU legislation and changing their status under the UNFCCC. Thus, the project aims to set a common regional platform for coordinated climate change mitigation strategies, and assist transition countries toward creating low carbon societies. The project will help develop regional capacity to improve climate change policies through sharing of information, methodologies, experience and good practices.

1.4. Greenhouse gas emissions

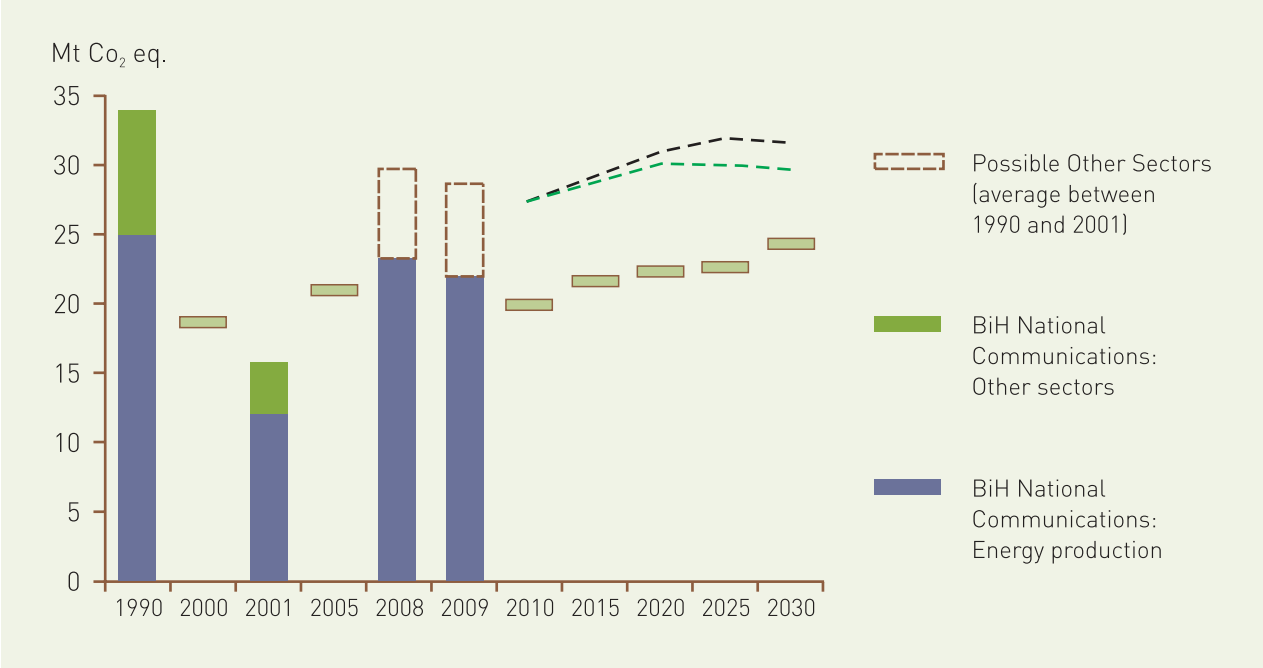
There are a number of important factors to consider in combating climate change in Bosnia and Herzegovina:

- Capacity and experience in responding to climate change are limited, as a result of other priorities taking precedence since the signature of UNFCCC in Rio in 1992.
- Data and information on greenhouse gas emissions is limited: There is no regular monitoring and collection of annual emissions data, which reduces the accuracy of future projections.
- The governance and institutional structure is complex: Policy and strategic documents have been developed and adopted, but implementation is still lacking.
- The roadmap towards EU membership includes uncertainties, such as public administration reform and alignment of legislation with EU standards. Thus, the timeline of the accession process – crucial in relation to greenhouse gas emission reduction obligations – is difficult to predict.

Information on greenhouse gas emissions is limited and domestic capacity to monitor them is insufficient. In Republic of Srpska, the Law on Air Protection authorises the Republic Hydro-meteo institute to develop GHG inventory.

The data which is available on historic and future emissions is presented in Figure 6 below.

Figure 6. Annual GHG emissions and emission projections from available sources



Source: Initial National Communication of Bosnia and Herzegovina to UNFCCC: Inventory of base year emissions in 1990, 2009.

Second National Communication of Bosnia and Herzegovina to UNFCCC: Inventory of emissions in 2001 and estimate of total emissions form energy production in 2008 and 2009 by EU RENA project;

PRIMES model for Europe (IIASSA 2011, http://gains.iiasa.ac.at/models/), the modelling tool used by the EU Commission: greenhouse gas emission projections 2000-2030.

Current emissions

The only official and validated information in Figure 6 are the base year emissions for 1990: All other data has discrepancies and needs to be updated and validated in the future. Thus, for the purpose of the strategy, analysis of different scenarios can only be qualitative and the quantification of scenarios has to be left for future analysis.

The base year emissions of Bosnia and Herzegovina before the break-up of Yugoslavia were 34.04 Mt of CO_2 equivalent, of which energy production (including fuel for transport) was responsible for 26.5 Mt. Emissions dropped significantly during the war period from 1992-1995 and in 2001 were 12.03 Mt CO_2, less than half of the base year figure. Subsequently, energy sector emissions have increased almost to pre-war levels (23.3 and 22.2 Mt in 2008 and 2009). Emissions from other sectors more than halved between 1990 and 2001 due to a fall of more than 80% in industrial emissions and 50% in the agricultural sector. There is a lack of information on emissions from other sectors after 2001, thus they are presented as constant in the figure.

Although emissions in 2010 have almost reached 1990 levels per capita emissions (5.18 t CO_2 equivalent per capita per annum in 2008) are still among the lowest in Europe, while greenhouse gas emissions per unit of GDP (1.59 kg CO_2 equivalent per EUR in 2008) are high. Per capita emissions are just over half of the EU average (9.93 t) and emissions per unit of GDP are almost four times higher than those in the EU (0.4 kg/EUR). These statistics illustrate the economic and social challenges for Bosnia and Herzegovina; caught in the poverty trap with low emissions, but

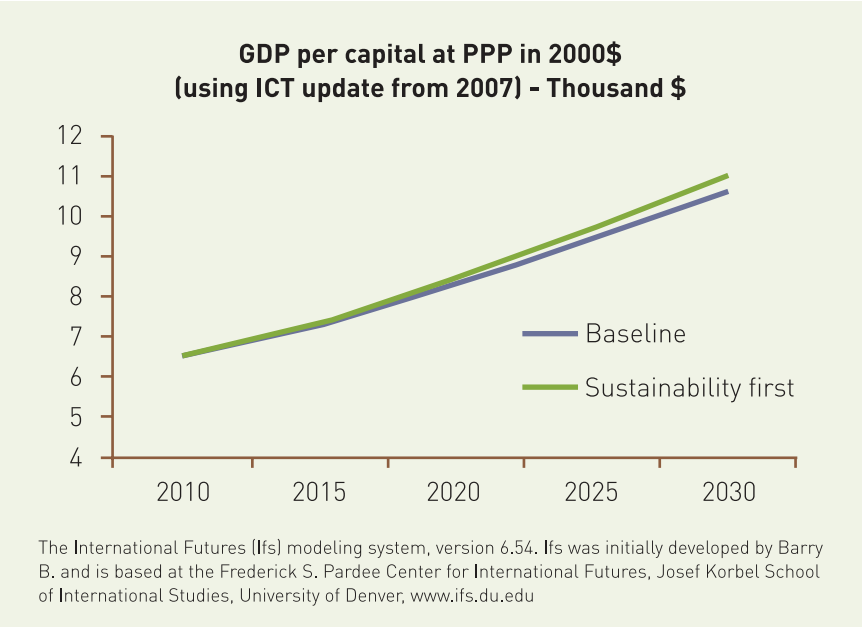
even lower GDP per capita. This situation also justifies the application of the principle of common but differentiated responsibility defined in Article 3.1 of the UNFCCC.

Projections

The emission projections shown in Figure 6 are available through two international modelling systems but are subject to caveats regarding the quality of input data. The PRIMES model, used by the EC in climate policy planning provides a reference scenario for total greenhouse gas emissions of Bosnia and Herzegovina between 2000 and 2030. The total emissions in 2000 of 18.64 Mt is consistent with the SNC energy sector total for 2001 (enlarged for possible emissions from other sectors). The scenario predicts a gradual increase of emissions until 2030, by 21% compared to 2000, or maintaining a decrease of 15% compared to 1990 (assuming the numbers are consistent). However these projections are significantly lower than the actual numbers for 2008, which may reflect the possibility of more dramatic changes taking place in Bosnia and Herzegovina than in EU countries.

The 'International Futures'[22] (IF) is a global model, but results for some small countries are not always exact. In Figure 7 below, CO_2 emissions from fossil fuel combustion are compared under two scenarios: the 'Baseline' scenario and the 'Sustainability First GEO 4 Global Development' scenario developed by the United Nations Environment Programme (UNEP) in 2007[23]. Although the level of emissions in IFs is higher than reported or in other models, the overall trajectory until 2025 is broadly consistent with the PRIMES scenario, but the emissions start falling after 2020. The global 'Sustainability First' scenario leads to 6% lower emissions than the baseline in 2030. The IF also models other environmental, social and economic indicators. The comparison of GDP per capita shows that the 'Sustainability First' scenario anticipates 3.2% higher GDP per capita than the 'Baseline' scenario, confirming that lowering emissions actually contributes to higher economic growth.

Figure 7. GDP per capita in Bosnia and Herzegovina under different UNEP GEO4 scenarios



The International Futures (Ifs) modeling system, version 6.54. Ifs was initially developed by Barry B. and is based at the Frederick S. Pardee Center for International Futures, Josef Korbel School of International Studies, University of Denver, www.ifs.du.edu

22 International Futures (IFs) modelling system, version 6.54at the Frederick S. Pardee Center for International Futures, Josef Korbel School of International Studies, University of Denver, www.ifs.du.edu: Greenhouse gas from fossil fuels emission projections 2010-2030.

23 http://www.unep.org/geo/geo4/media/fact_sheets/Fact_Sheet_17_The_Future.pdf

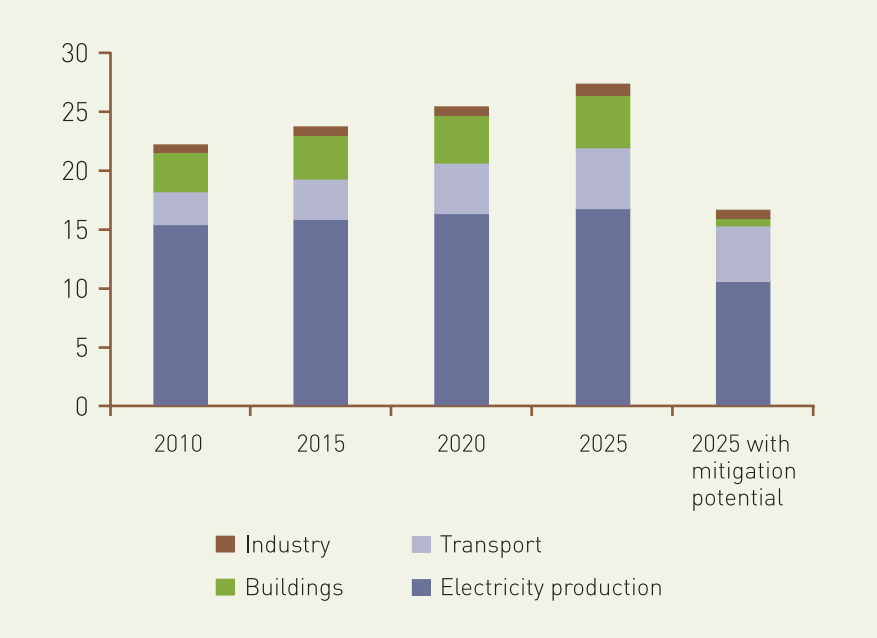
Mitigation potential

The largest proportion of greenhouse gas emissions is produced by the following sectors of the economy:

- Production of electricity,
- Transport, and
- Heating of buildings

The estimated contribution of different sectors to greenhouse gas emissions in 2010 is presented in Figure 8.

Figure 8. Approximate trends of emissions from fossil fuel combustion by sectors between 2010 and 2025, and full mitigation potential in 2025



Source: Second National Communication of Bosnia and Herzegovina to UNFCCC

The majority of greenhouse gas emissions come from coal production and thermal power plants in the electricity production sector. Emissions from heating buildings and transport are currently similar. In the future, transport-related emissions are expected to grow rapidly due to the expansion of the road network and economic growth. The expected growth of fossil fuel use in home heating is more moderate in view of growing prices, possible fuel switching to biomass and gains in energy efficiency. These sectors represent the biggest opportunities for mitigation actions. Other sectors, such as industry and agriculture have not recovered to their former level and produce relatively low emissions (and which are also not well documented). The final column in Figure 8 above shows the level of emissions if all available technical mitigation potential is realised: i.e. all actions and investments that reduce emissions are actually implemented regardless of their economic, social and political feasibility. The potential mitigation measures are described in the following sections. Their cumulative impact could be a 25% reduction of greenhouse gas emissions in 2025 compared to 2010.

Electricity production sector

Bosnia and Herzegovina is an exporter of electricity. Electricity production was about 14,000 GWh in 2008, while consumption was approximately 12,000 GWh. At the same time, electricity consumption per capita is relatively low. Per capita electricity consumption was 1,915 kWh in 2000, increasing to 3,122 kWh in 2008, exceeding the world average. Electricity consumption increased by 15% during the period 2004-2008. A further increase in electricity consumption is expected in the future and the demand in the country may reach the level of supply.

Approximately 50% of electricity in Bosnia and Herzegovina is generated by thermal power plants, (TPP) fuelled by domestic coal and with a rather high emission of carbon dioxide (1.3 t CO_2/MWh). The remainder of electricity is generated mainly by large hydro power plants (HPP), with a minor contribution from small hydro power plants. A conservative assessment of the mitigation potential of renewable energy sources is 0.88 Mt for biomass, 0.11 Mt for hydro and 0.15 for wind, by 2025.

According to recent strategic documents, domestic coal will remain the main source of electricity generation and the generating capacity could more than double. There are significant reserves of coal available and it is a sector which employs a large number of people. Taking this into account, greenhouse gas emissions from electricity generation are set to increase.

There are two areas for mitigation: improving the efficiency of and cutting greenhouse gas emissions from coal extraction and thermal power plants, and in the field of renewable energy sources. If, in line with the projections[24], the current installed capacity in the coal-fired thermal power plants of 1,765 MW increases to 3,200 MW till the year 2025, total emissions will be increased by 4.85 Mt CO_2 annually – even with an improvement of efficiency from 33% to 40%. However, if only the existing capacity were to be replaced, the total emissions would be reduced by some 4.8 Mt/per annum. In addition, 0.15 Mt equivalent of CO_2 annually could be reduced by capturing and using the methane from existing coalmines.

Table 2. Potential emission reduction actions in electricity generation compared to business as usual.

Mitigation action	Technical reduction potential (Mt CO_2 eq)
Replacement of existing thermal power plants (30% efficiency) with new ones (40% efficiency)	4.8
Building all planned thermal power plants: increasing installed capacity from 1,675 MW to 3,200 MW, improving efficiency from 30% to 40%	-4.85
Biomass co-generation plants 200 MW	0.88
New hydro power plants	0.11
New wind generation	0.15
Capturing and utilising methane from coal (Zenica, Breza)	0.15
Total mitigation potential of the electricity sector	**– 3.62 to 6.09**

24 Lahmeyer International: Development the electricity carbon emission factors for Bosnia and Herzegovina, EBRD 2011

The total mitigation potential of the electricity production sector – compared to taking no mitigating action – is between 3.62 Mt to 6.09 Mt CO_2 equivalent annually by 2025, depending on the installed capacity of new thermal power plants. Without taking into account thermal power, the mitigation potential is 1.29 Mt.

Buildings

Buildings are responsible for the highest share of end consumption of energy in Bosnia and Herzegovina (approximately 60% according to the National Energy Efficiency Action Plan [NEEAP] for Bosnia and Herzegovina, final draft, 2012). This accounts for a major share of greenhouse gas emissions (directly, and indirectly through electricity consumption), even though wood fuel is the most important energy source for home heating.

Taking available statistical data from before the war, energy sector studies and the plans of the entities, it can be assumed that there are 1,200,000 housing units in Bosnia and Herzegovina, with an average surface area of 73m² (Statistics Agency of Bosnia and Herzegovina). Thirty percent of units are located in multi-family buildings and 70% are single-family houses. The average number of household members is 3.26. More than 80% of housing units are older than 30 years and built before technical standards on thermal insulation were introduced. Thirty percent of units are heated by central and district heating systems and 70 % by in-room stoves, of which 77% are fuelled by wood (Bosnia and Herzegovina Energy Sector Study, Module 1B, 2008). Commercial buildings are also old: 60% of service sector buildings, and 92% of education buildings are older than 30 years. Eighty-five percent of commercial buildings have central heating and 15% use indoor stoves.

The age of buildings and lack of energy efficiency measures, mean that most have high energy consumption for heating, while consumption for cooling in summer is also increasing (although data on the latter are limited). During the war, a proportion of the housing stock was damaged and has been renovated with improvements to quality. In the Federation of Bosnia and Herzegovina some improvements have been made with the introduction of regulations on energy efficiency of buildings (although implementation of new energy efficiency standards is slow), however in the Republic of Srpska, the Yugoslav standards from 1980 are still in force.

District heating systems were well developed in towns and cities before the war. During the war, many systems fell into disrepair, and after the war could not recover customers due to a fall in the purchasing power of the population that had switched to solid fuel heating with stoves. The maintenance and investment in the remaining functioning district heating has been low, leading to obsolete technologies, and low efficiency and large heat losses on the network. There is almost no regulation in this sector so for example, there are only a few examples of individual heat metering in the country, while district heating providers are struggling with many customers who are not paying their bills.

The inadequate energy efficiency of buildings and poor condition of district heating systems are a problem for health and quality of life of the population, as well as a socio-economic problem due to the high costs of heating in relation to the purchasing power of the population (this is energy poverty). Investment into energy efficiency improvement, renewable energy sources, and district heating systems will have a positive social and economic impact even without consideration of the impact on greenhouse gas emission reduction. Emission reduction in the building sector should therefore be considered as a key priority.

Table 3. Possible GHG emission reduction of identified mitigation actions in buildings compared to business as usual.

Mitigation action	Technical reduction potential (Mt CO_2 eq)
Energy performance of buildings directive + training (5% improvement)	0.21
Green public procurement for new public buildings (5% improvement)	0.21
District heating rehabilitation projects in Livno, Gradiška and Prijedor	0.06
Introduction of heat metering and invoicing according consumption	0.07
Replacing fossil fuels for heating (fuel oil, liquefied petroleum gas [LPG], coal) with biomass	3.65
Total mitigation potential of the building sector	**4.2**

A conservative estimate of the mitigation potential of energy efficiency of buildings is 0.55 Mt annually by 2025, with implementation of EU building standards in private and public buildings, metering and some district heating rehabilitation projects. If all fossil fuels except natural gas (i.e. fuel oil, liquefied petroleum gas [LPG] and coal) were replaced with biomass in home heating, the mitigation potential is 3.65 Mt. There is enough wood available for this purpose in Bosnia and Herzegovina, but the fuel switch should be accompanied by energy efficiency measures. If energy efficiency, improvement of district heating and a switch to renewable energy sources are promoted more intensively, the mitigation potential is even higher, compared to expected increase in demand for home heating due to improving economic situation.

Transport

According to data from the International Transport Forum, Bosnia and Herzegovina has low emissions of carbon dioxide from transport (25% below the global average and 77% below the Organisation for Economic Cooperation and Development [OECD]) average. Furthermore, the proportion of greenhouse gas emissions from the transport sector is lower than in EU countries: less than 7%[25] of total emissions compared to approximately 20% in the EU27[26].

Greenhouse gas emissions in this sector come mainly from road transport (more than 90% of total emissions). According to 2012 data, Bosnia and Herzegovina has 22.740,20 km of roads of all categories – almost 5% more than in 1991. There are less than 100 km of highways, with another 100km under construction or in the negotiation phase. The longer-term plan (to 2025) is to build more than 1,000 km throughout the country. The total number of registered motor vehicles in 2011 was 950.915 – around 130% more than in 1991[27]. Many of the vehicles in use are on average 15 years old. Living standards will not allow technical measures (better combustion with lower emission) to become a high priority in dealing with greenhouse gas emission reduction. However the transit traffic in BiH is on a low level and average speed on roads is slow, which do not add to emissions levels.

25 INC of Bosnia and Herzegovina under the UNFCCC, 2009.

26 http://epp.eurostat.ec.europa.eu/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tsdtr410&language=en

27 'Informacija o ukupnom broju registrovanih i prodatih novih motornih vozila u Bosni i Hercegovini u 2011, godini', Bosnia and Herzegovina AMK, 2011, MUP, RS 2011.

Data from 2007 shows that the rail network consists of 1,031 km of railways: 87 km of which are twin-track railways and 776 km of which are electrified. Although the density of the railway network is comparable with that of many western European countries, the volume of transport of goods and passengers per kilometre of railways is far below the European average. The existing railway network cannot be used to its full capacity, as the rail tracks have not been overhauled, the safety of many level crossings and some stations is inadequate, workshop capacities have not been restored and the rolling stock has not been replaced.

There are 27 officially registered airports in Bosnia and Herzegovina, of which only four (Banja Luka, Mostar, Sarajevo and Tuzla) are registered for international traffic. The annual number of passengers is approximately 450,000 for Sarajevo, while Banja Luka, Mostar and Tuzla have relatively small – but growing – numbers of passengers. The four international airports were restored following the war. Air transport and infrastructure have now assumed a more significant role than before the war.

Bosnia and Herzegovina does not have adequate regulated access to international waters, and therefore does not have regulated sea ports. The international port most important for the economy is Ploče in Croatia (which itself depends on the Bosnian hinterland). The Sava River is the main navigable river, and its 333 km length is also the border with Croatia and Serbia. Water transport along the Sava is linked with the river Danube, which is considered as the Trans-European Transport Corridor VII. This makes Bosnia and Herzegovina a part of the network of European waterways, and this form of transport is significant for the future transport development in Bosnia and Herzegovina.

As road transport is the dominant means of transport – and is expected to remain so in the future – greenhouse gas emissions from transport are set to rise. In 1990, greenhouse gas emissions from transport were less than 7% of total emissions (in the EU27 it was 14% in 1990, increasing to 24% in 2007). If the domination of road transport continues, greenhouse gas emissions will rise and by 2030 will be approximately twice as large as today (more than 5 million t of CO_2 equivalent). Thus, there is potential for mitigation measures in avoiding future emissions in the road transport sector.

Bosnia and Herzegovina has no national strategy on intermodal transport to determine the share of passenger/goods transported by transport modes (road, rail, air or water). Most transport sector studies recommend improvement and increased use of transport modes other than road where possible.

Table 4. Possible GHG emission reduction of identified mitigation actions in transport compared to business as usual.

Mitigation action	Technical reduction potential ($MtCO_2$ eq)
Reconstruction of the railway infrastructure and improvement of services (5% reduction compared to business as usual)	0.25
Improving public transport (5% reduction compared to business as usual)	0.25
Total mitigation potential of the transport sector	**0.5**

The mitigation potential in transport is around 0.5 Mt CO_2 equivalent annually if it is assumed that improved public transport and rail infrastructure each are reduce by 5% by 2025.

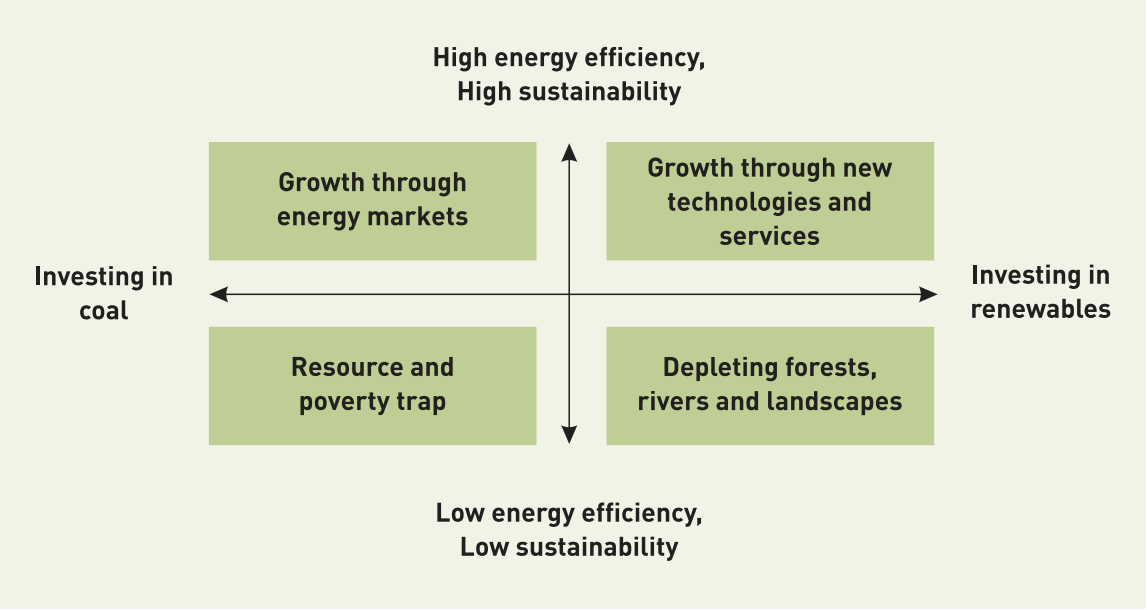
1.5. Choices

Bosnia and Herzegovina has low per capita emissions but per capita GDP is also low compared to other countries in Europe. Therefore, Bosnia and Herzegovina is not committed to significant quantitative emission reductions at this point in time. With uncertainty about the current level and future projections of greenhouse gas emissions it is difficult to establish meaningful mitigation objectives, for example deviation from business as usual. Some projections show that emissions could peak around 2025, as new technologies and international and EU policies are introduced, however, in the medium-term, greenhouse gas emissions will continue to increase, albeit at a rate slower than that between 2001 and 2010.

The key challenge is to use the transition to a low carbon economy to achieve the objectives of rapidly improving the economic situation and social cohesion. In this process, there is potential for economic growth and new workplaces as a result of investment in emission reductions for the electricity, buildings and transport sectors.

Based on the analysis of the existing situation there are two main axes along which the possible development scenarios could be defined. The first is related to the level of energy efficiency and sustainability, and the second to the distribution of investment in new electricity generation between coal and renewables. The possible scenarios are presented in Figure 9 below.

Figure 9. Choices affecting future development and emissions scenarios



The description of these possible scenarios is as follows:

- **Resource and poverty trap**: Bosnia and Herzegovina continues to depend heavily on coal for its electricity production as well as heating of buildings. Modern thermal power plants are built with higher efficiency and lower emissions, but energy demand and energy prices grow. Households and industry, which cannot afford investments in energy efficiency, pay rising costs for energy, especially after the energy sector enters EU ETS and has to pay for the emission quotas.

- **Depleting forests, rivers and landscapes**: Bosnia and Herzegovina attracts major investment in hydropower, biomass and wind energy, accounting for a significant share of energy supply. At the same time, coalmining areas are in decline and require additional government support for restructuring. Due to low energy efficiency, energy demand grows faster than supply, leading to over exploitation of natural resources, such as forests, rivers, and landscape and biodiversity in general. This causes additional problems for adaptation to climate change, and reduces quality of life and tourism potential of the country.

- **Growth through energy markets**: Bosnia and Herzegovina attracts investment in its coal power sector with imported technology, significantly improving its efficiency and reducing specific emissions. The lifespan of coalmines is extended for another generation, making it possible to gradually restructure their economy at low cost. At the same time energy efficiency measures in households and industry keep energy demand below supply, and energy costs within reason. Bosnia and Herzegovina exports electricity to other EU countries and can thus afford the necessary emission quotas under the EU ETS.

- **Growth through new technologies and services**: An energy sector transformation is achieved combining investment into renewable energy and energy efficiency. This generates new business opportunities and workplaces replacing the lost workplaces in the coalmining regions. High technology manufacturing, service and financing businesses emerge that increase the exports of industrial products and services. Energy demand and energy prices are stable; households and industry are not exposed to increasing prices of carbon or the volatility of global energy markets.

The first two scenarios (in the lower half of Figure 9) should be avoided if possible: through investment on the energy demand side, in energy efficiency of buildings, heating, and sustainable transport. In these sectors the abatement costs are negative and co-benefits – in terms of poverty reduction and generating economic growth – are significant.

In addition to the choice in favour of energy efficiency, is that regarding future investment in electricity generation (along the horizontal axis). This choice between coal and renewables most significantly affects the future emissions of Bosnia and Herzegovina. There is international interest to invest in the next generation of coal-fired power plants before Bosnia and Herzegovina enters the EU. Bosnia and Herzegovina also attracts foreign investment in its renewable potential, where biomass, hydropower and wind are already commercially viable and photovoltaics should become competitive without public subsidies before 2020.

In the absence of available domestic capital for investment in electricity production, Bosnia and Herzegovina should pursue both investment tracks up to 2025, thereby improving energy security with more efficient coal-fired power plants, and increasing the capacity of renewable. The investment plans are justified by growing domestic demand for electricity, high demand for electricity in the Mediterranean region of the EU and availability of both coal and renewables in Bosnia and Herzegovina. In the current economic situation, Bosnia and Herzegovina does not have sufficient resources to restructure coalmining regions, should existing thermal power plants reach the end of their life and are not replaced. The strategy aims to mobilize international investment in a new generation of thermal power plants and renewable energy sources, for both heating and electricity production, as well as for energy efficiency of buildings and sustainable transport.

2. VISION AND GOALS

The vision statement for the Climate Change Adaptation and Low-Emission Development Strategy is:

By 2025 Bosnia and Herzegovina will be a sustainable and prosperous green economy.

Bosnia and Herzegovina will enter the EU as a member state with low emissions, high quality of life for everyone, preserved natural ecosystems, sustainable natural resources management and a high level of climate resilience. Increasing levels of energy efficiency, greater renewable energy use, and improved energy and transport infrastructure and services will lead to international investment, job creation and business enterprise in a resource-efficient economy. Negative impacts of climate change will be minimised by reducing vulnerability and taking advantage of opportunities brought about by climate change. The transition to a 'Green economy' will particularly benefit the vulnerable and disadvantaged by being socially inclusive and contributing positively to gender equity.

The adaptation goal of the strategy is to:

Increase Bosnia and Herzegovina's resilience to climate variability and climate change, and in doing so, secure development gains.

The emission reduction goal of the strategy is to:

Achieve a peak in Bosnia and Herzegovina's greenhouse gas emissions around 2025 at a level that is below the EU27 average per capita emissions.

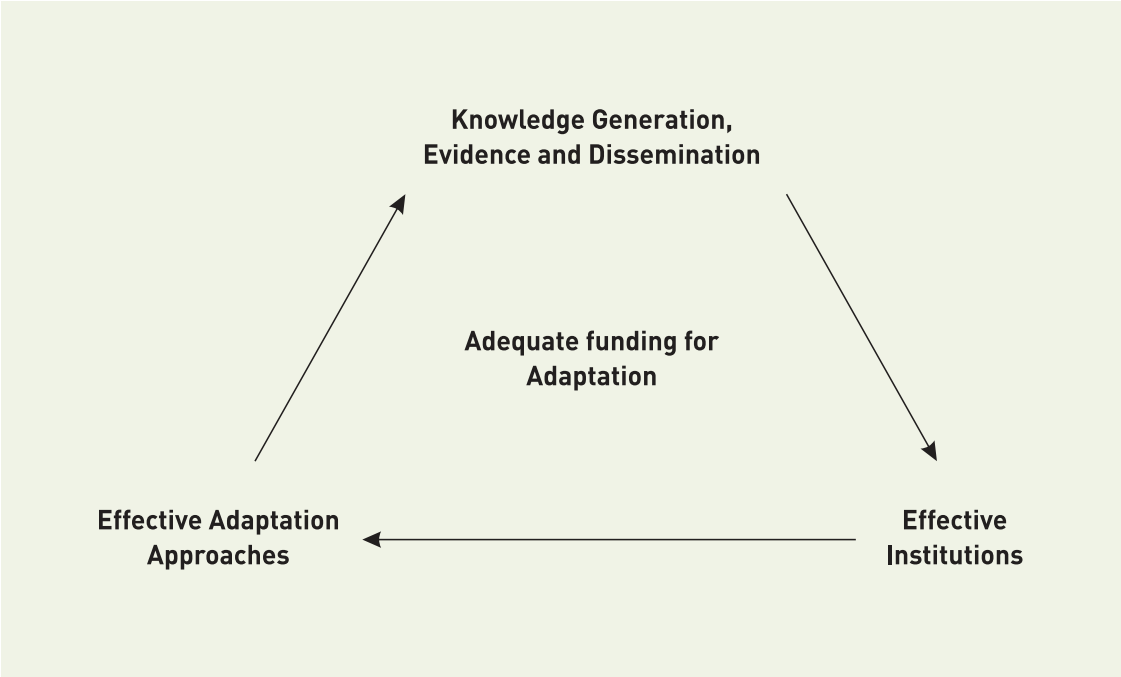
3. THE ADAPTATION STRATEGY

The Adaptation Strategy represents a co-ordinated approach to ensure that Bosnia and Herzegovina is well-placed to adapt to climate change in a sustainable way.

The objective of the strategy is to reduce vulnerability due to climate change by minimising its negative impacts, increasing resilience, and taking advantage of opportunities brought about by climate change. This will be achieved through establishing an enabling environment for a clear and coordinated adaptation process across all relevant sectors, levels of government, civil society and the private sector. The strategy will ensure that climate change adaptation measures are gender responsive and will incorporate specific measures to ensure that the most vulnerable groups of the population receive adequate support.

This strategy has four interlinked priority areas, each with its own outcome:

Figure 10: Priority areas of the Adaptation Strategy



The priority areas logically link with each other, providing a clear conceptual model for the strategy. The outcomes and measures, when combined, should effectively deliver the goal. The goals of the NAS and LEDS are mutually supportive and integrated.

3.1. Knowledge generation, evidence and dissemination

Outcome 1: Climate change risks, vulnerabilities and opportunities are reliably identified, quantified and effectively communicated, supporting evidence-based policy development.

Bosnia and Herzegovina needs reliable information to enable the assessment of climate change and subsequent impacts. Current data monitoring, analysis and modelling need substantive improvement: Gender disaggregated data are not available, research to date has been limited, and approaches have not been fully integrated across disciplines. The lack of reliable data increases uncertainty regarding climate change, making it harder to plan adaptation measures over a longer time scale. Future research needs to be more systematic, comprehensive and better focused on supporting policy and decision-makers. The findings and results need to be accessible and communicated clearly and effectively to policy makers. Adequate research tools, models and reliable data will be available to ensure that predictive knowledge of climate change and associated risk is strengthened, providing a solid foundation for evidence-based policy development.

3.2. Effective institutions and regulatory frameworks

Outcome 2: An effective institutional and regulatory framework supporting adaptation, coupled with delivery capacity, is addressing climate change risks and opportunities across sectors.

Government institutions in Bosnia and Herzegovina face significant challenges that reduce adaptive capacity and the ability to implement and further develop adaptation strategies, plans and programmes[28]. A strong institutional, policy and legislative framework for climate risk management and adaptation is required to support sectoral and horizontal activities, capacity building and innovation. The framework must link institutions and clearly identify their roles, responsibilities, mandates and partnerships. Institutions will need their capacity to deliver enhanced. Legislation will need to be reviewed to ensure there is clarity, focus and an ability to address both risks and opportunities presented by climate change. High-level strategies need to be both localised and developed into sectoral adaptation plans.

Climate change adaptation measures will be mainstreamed into sectoral and regional planning and development, ensuring a reduction in risk and increase in resilience across key sectors, while taking advantage of sectoral benefits brought about by climate change. Government at all levels will be able to understand and effectively integrate climate change vulnerability and risk reduction approaches into policies and programmes, minimising the negative impacts of – and taking advantage of opportunities brought about by – climate change.

28 Smit et al., 'Adaptation, adaptive capacity and vulnerability', Global Environmental Change vol 16, 2006. This identified the following seven factors that determine adaptive capacity: wealth, technology, education, institutions, information, infrastructure, and social capital. All are to some extent still recovering from the war.

3.3. Effective adaptation approaches

Outcome 3: Adaptation approaches are mainstreamed into decision-making, implemented and their objectives and planned delivery are understood by an informed society.

Although the INC discussed and identified adaptation priorities and possibilities, these have not been converted into specific objectives at a central or sectoral level. These objectives need to be strategically embedded in planning, and climate change adaptation issues incorporated into mainstream decision-making. Mechanisms for implementing adaptation approaches also need to be identified, with clarity as to what will be implemented by or with direct support from government and the public sector. Private sector funded or supported, community-based and autonomous measures need to be identified, along with support and co-financing/funding modalities. A key part of the adaptation approach is awareness raising and education. The education system in Bosnia and Herzegovina pays little attention to climate change or associated environmental matters: There is a need to strengthen curriculum and educational programmes at all levels. There is limited awareness of climate change issues and the need for adaptive measures among the public and interested parties. There is also a need for greater involvement of civil society and enhanced advocacy. This requires active communication to raise the profile of climate change issues.

Mechanisms to support adaptation actions at national and local levels will be identified. Much of the activity supporting this outcome is focused on the seven priority sectors, addressing information generation, modelling, pilot activities and specific technical activities. Climate change and the associated risks and vulnerabilities will be embedded in curriculum, capacity building and awareness-raising programmes, leading to more informed and engaged citizens and improved climate change governance. Knowledge and technology transfer will be encouraged through collaborative work between researchers and the private sector for demonstration and research and development (R&D) work funded by EC Framework for research and technological development ('seven/eight') and similar collaborative mechanisms.

3.4. Adequate funding for adaptation

Outcome 4: A well-resourced adaptation strategy being implemented on time, effectively, and delivering the expected outcomes.

The Adaptation Strategy requires funds for implementation, over and above those currently available within Bosnia and Herzegovina. Additional funds will need to be secured to enable this strategy, and associated programmes and plans, to be effectively rolled out. Potential funding sources – in addition to funding agencies – include the private sector, in terms of infrastructure and other investments and to benefit from business opportunities offered by some of the adaptation measures. Opportunities for co-financing, public-private partnerships, and social enterprise-led economic activities need to be highlighted. Innovative partnerships should be developed with multilateral funding agencies (currently reviewing their development assistance in the context of climate-resilient development). The measures contained within the adaptation offer a business opportunity for Bosnia and Herzegovina; not just a requirement for donor assistance and loans. Co-financing will be requested from major donors and, for example, the Green Climate Fund (GCF)[29].

29 The Green Climate Fund (GCF) is a mechanism to assist developing countries in adaptation and mitigation practices to counter climate change.

Adequate resources will be secured to ensure that the Adaptation Strategy and associated programmes and plans are effectively delivered in a timely manner and with sufficient monitoring, evaluation and refinement d to ensure the goal and outcomes are achieved.

3.5. Outputs

The following tables detail the planned outputs and activities for delivering the strategy, together with indicators and indicative budget and timeframe.

Table 5. Planned outputs and activities for delivering the Adaptation Strategy

Outcome 1: Climate change risks, vulnerabilities and opportunities are reliably identified, quantified and effectively communicated, supporting evidence-based policy development.				
	Outputs	**Indicators**	**Indicative Cost BAM[30]**	**Indicative Timeframe**
1.1	An effective network of meteorological monitoring stations established across BiH, with the development of a weather monitoring system and reporting mechanism.	10 new stations established	300,000	2013-2018
1.2	Joint hydrological and meteorological stations for river basin monitoring established and functioning.	4 new stations established	120,000	2013-2018
1.3	Development of national database to collect and analyze weather and disaster data (hardware and software purchase, deployment and data analysis system).	2 functional databases	200,000	2013-2018
1.4	Drought Early Warning System developed (establishment of agro-meteo stations and early warning system software and communications).	4 agro-meteo stations established; and early warning system operating and results effectively communicated	120,000	2015-2020
1.5	Methods and approaches for modeling and assessing socio-economic and environmental change scenarios developed, tested and applied. (hardware, software, staff training).	1 effective ground-truthed modelling application for environmental change scenarios.	105,000	2015-2025

30 1 EUR equals 1.95583 BAM, BiH Central Bank, Jun 2013

	Outputs	Indicators	Indicative Cost BAM[30]	Indicative Timeframe
1.6	Research capacity in pertinent climate change disciplines built, with a more 'joined-up' approach of multi and inter-disciplinary economic, environmental and social research to assess climate change vulnerabilities promoted and adopted (new institutions, new institutional linkages, inter-disciplinary research, public awareness, and publications).	2 new climate change research institutes functioning and producing public awareness information	250,000	2014-2020
1.7	Develop a new mechanism (interactive climate atlas) for communicating results to policy makers through knowledge-transfer mechanisms, including joint briefing meetings, collaborative research design, web-portal or similar.	1 web-based interactive climate atlas	100,000	2014-2015

Outcome 2: An effective institutional and regulatory framework supporting adaptation, coupled with delivery capacity, is addressing climate change risks and opportunities across sectors.				
	Outputs	**Indicators**	**Indicative Cost BAM**	**Indicative Timeframe**
2.1	Climate change adaptation strategies, programmes and plans developed for each sector that is at high risk and vulnerable to climate impacts, and/or climate change adaptation is integrated into the sectoral development policies, strategies, programmes and plans (technical assistance, mentoring and support for each key sector identified in strategy).	7 integrated sectoral strategies	70,000	2013-2014
2.2	Strengthened cross-government and sectoral coordination, through building the capacity of the Inter-entity body for environment, as the coordinating body for the implementation of the strategy. (capacity building and support for meetings, workshops).	1 Inter-entity body mandated and resources provided.	50,000	2013-2014
2.3	Improved understanding and awareness of climate change, risks, vulnerability and adaptation approaches in key institutions through capacity building (a programme of training events for staff from government, research and civil society organizations on thematic topics).	500 person days training	25,000	2013-2017

	Outputs	Indicators	Indicative Cost BAM	Indicative Timeframe
2.4	Processes for climate risk/vulnerability screening and incorporation for development policies and plans developed and implemented (consultancy and training workshops).	1 generic process/ system for screening	15,000	2014-2015

Outcome 3: Adaptation approaches are mainstreamed, implemented and their objectives and planned adelivery are understood by an informed society.				
	Outputs	**Indicators**	**Indicative Cost BAM**	**Indicative Timeframe**
	Agriculture:			
3.1	Increased public awareness of the effects of climate change on agriculture and education among farmers and families (communication plan, leaflets, roadshow, radio broadcast, website, etc).	1 communication plan; 1 website functioning 2013-2025; and leaflets, broadcast or roadshow 2013-2025	50,000	2013-2025
	Improved irrigation approaches, including drip irrigation, promoted and adopted (in conjunction with World Bank initiatives, and pilot programme for research and extension in key climatic zones of BiH).	2 pilot programmes	500,000	2013-2020
	Agriculture included in water management programmes (including reservoir and canal construction), and workshops and team briefings.	6 annual workshops	10,000	2013-2018
	Area of production in greenhouses and similar protected areas increased (direct support to farmers through loans/grants and technical assistance packages for pilot projects).	20 pilot projects	800,000	2013-2020
	Improved hail protection techniques adopted; (pilot programme for research and extension in each major climatic zones of BiH).	1 research programme and 6 pilot trials	300,000	2013-2020
	Agricultural practices (crop rotation, changes in crop mixes) improved and responsive to climate change (farmer trials, research trials, technical assistance).	1 research programme; 4 research trials and 6 farmer trials	200,000	2013-2018
	Development of multifunctional agriculture (pilot projects, for example, on how to use accumulated water for farm fishing and for irrigation).	12 pilot trials	600,000	2013-2020

	Outputs	Indicators	Indicative Cost BAM	Indicative Timeframe
3.1	Farmer's capacity increased on new approaches for land cultivation and hot weather livestock management (pilot programme for research and extension in each major climatic zone of Bosnia and Herzegovina).	5 pilot programmes	500,000	2013-2017
	Integrated sustainable development and energy efficiency promoted and adopted. Communication programme (website, articles in media, posters, addressing gender issues).	1 communication programme	50,000	2013-2018
	Coordination of improvement work on crops, animals and husbandry to produce drought resistant varieties and practices.	Annual report (for 12 years)	60,000	2014-2025
	New Agro-climatic zoning models, with consideration of potential climate change scenarios (technical assistance, software)	Zoning modeling and maps produced for each scenario	100,000	2015-2025
	Biodiversity and sensitive ecosystems:			
3.2	Monitoring and data collection systems installed, operating, and used to develop management regimes (monitoring programme established by research organizations, data collection systems installed, information transfer mechanism developed for researchers to managers).	1 monitoring programme	300,000	2013-2016
	More and better legally enforced protected areas network; technical assistance, mentoring and workshops to expand and protect protected areas to enable adaptation.	Legislation related to protected areas in line with EU Acquis Communautaire	100,000	2014-2025
	Protected areas management system improved; capacity building and resources provided to enhance protected areas management with regards to adaptation.	Management plans for protected areas developed	50,000	2013-2018
	Inclusion in the Republic of Croatia coastal zones management programme (support for workshops, planning meetings, travel).	3 workshops; 1 coastal zone management programme	50,000	2014-2015
	Seed banks established for native species covering variety of origins to encompass genetic variability and distinct populations.	3 seed banks established	250,000	2013-2025

	Outputs	Indicators	Indicative Cost BAM	Indicative Timeframe
	Energy (hydropower):			
3.3	Planning of energy development within the regional cooperation (SEE) initiative, integrating potential climate change impacts (technical assistance, travel, workshops).	Bosnia and Herzegovina working effectively with and within SEE (attending all scheduled meetings)	50,000	2013-2015
	Integrated water resource management, considering climate change impacts, introduced and implemented (one pilot project in each entity, from the planning stage through to infrastructure and implementation).	2 functioning pilot projects	400,000	2014-2017
	Improved guidelines for the construction of hydropower plants, considering the potential impact of climate change (technical assistance and capacity building programme to develop guidelines, followed by training/ awareness-raising).	1 set of guidelines	50,000	2014-2015
	Improved and functioning license control for hydropower plants (revised regulations, monitoring and enforcement programme).	1 set of revised regulations	50,000	2015
	Forestry:			
3.4	Detailed mapping of forest species composition (field survey, remote sensing and GIS mapping project).	1 forest composition map	400,000	2013-2016
	Research into species selection based on modeled climate change; technical assistance, research programme, species trials.	1 research programme with 10 species/provenance trials	300,000	2013-2020
	Monitoring plots established in vulnerable eco-types to assess changes, disease, mortality and succession; (budget includes monitoring over entire period).	20 monitoring plots	100,000	2013-2025
	Trials of new species, provenance and origin underway; field trails established (budget includes monitoring over entire period).	1 research programme with 5 species/ provenance trials	200,000	2014-2025
	Silvicultural improvement of low forests and shrubs, mainly in small private holdings, for bio-energy production and carbon storage technical assistance and co-financing.	80,000 hectares improved	800,000	2015-2025

	Outputs	Indicators	Indicative Cost BAM	Indicative Timeframe
3.4	Improve forest fire protection system; on the ground forest management (firebreaks, re-structuring, fire-fighting equipment, observation and real-time monitoring).	1 forest fire protection system	750,000	2014-2018
	Research into pest and plant diseases with increased temperature; four PhD students and associated research support.	4 PhDs	200,000	2013-2025
	Capacity of forestry staff to implement integrated forest management approaches enhanced. (technical assistance, training, study tours).	1 study tour to Slovenia/ Austria; and 8 training events	50,000	2013-2016
	Human Health:			
3.5	Improved technical regulations for thermal requirements, heating, ventilations and air-conditioning of buildings.	1 technical regulation	50,000	2013-2015
	Water purification to maintain the quality of potable water; water purification plants updated and/or installed in vulnerable locations.	2 water purification systems modified and updated; 2 water purification plants installed	600,000	2014-2020
	Public awareness campaign on climate change and public health issues, e.g. 'heatwaves' (major media campaign – TV, Internet, Posters).	Annual media campaigns (3)	200,000	2014-2016
	Disaster management plans improved for extreme heat events (capacity building, workshops, multi-agency planning, on the ground implementation)	Disaster management plans (gender responsive)	250,000	2014-2018
	Strengthened capacity of the Institutes of Public Health (training of staff on on-going climate change).	Training programme designed and delivered	100,000	2014-2018
	Establishment of effective statistical monitoring of climate change-related pathology; capacity building research programme designed and implemented; and statistics made available.	1 research programme with accessible publications	350,000	2014-2018
	Tourism:			
3.6	Awareness-raising of tourism sector (communication campaign, workshops, displays, establishment of tourism adaptation working groups).	1 strategy designed and implemented	400,000	2014-2018

	Outputs	Indicators	Indicative Cost BAM	Indicative Timeframe
3.6	Promotion of city-based multi-seasonal tourism summer eco-tourism (promotion campaign focused on Austria and Germany).	2 tree year promotion campaigns	500,000	2014-2018
	Improvement of summer tourism infrastructure priorities to be identified.	To be identified	800,000	2014-2018
	Improved production of artificial snow (snow cannon installation - loans/ incentives).	Number of new snow cannons	400,000	2014-2016
	Water resources:			
3.7	Strengthened system of water quality monitoring in rural areas; technical assistance on water quality monitoring in rural areas; education in rural areas on water quality in wells and local water supply systems.	Water quality monitoring programme for rural areas	150,000	2014-2018
	Functioning river basin management plans (Sava river basin and south Adriatic basin) (multi-sectoral management plans with adaptation approaches as central objective).	2 river basin management plans	500,000	2014-2016
	Effective hydrological information systems developed (guidance, cost-benefit analysis and prioritisation).	2 databases for hydrological information system	300,000	2014-2020
	Functioning early warning system (modelling software, and mechanism for communication, e.g. website/alerts to media.	1 early warning system	300,000	2014-2025
	Dam and accumulation reservoirs facilitate better water management (feasibility study).	1 feasibility study	300,000	2013-2018
	Awareness raised among stakeholders on the efficient use of water resources (awareness-raising campaign – website, TV, media. Incentive programme).	1 awareness raising campaign	200,000	2013-2020
	Development of hydrology models, in line with climate models.	Hydrology models	100.000	2013-2016
3.8	Develop curriculum support materials in conjunction with universities, schools and teacher training institutions.	1 multi-media training pack	50,000	2013-2014

Outcome 4: A well-resourced Adaptation Strategy being implemented on time, effectively, and delivering the expected outcomes.				
	Outputs	**Indicators**	**Indicative Cost BAM**	**Indicative Timeframe**
4.1	Detailed budget requirements developed at an output level (working groups, workshops, technical assistance).	1 budget	20,000	2013
4.2	Potential sources of funding including EC, EU Instrument for Pre-Accession Assistance (IPA), Adaptation Fund, World Bank, the Global Environment Facility (GEF), the Green Climate Fund (GCF), identified and detailed (technical assistance, consultant, and workshops).	3 major proposals	30,000	2013-2014
4.3	Awareness raised among the private sector of the economic opportunities in Adaptation Strategy implementation and on costs and benefits of adaptation (communication materials developed, outreach workshops, pilots projects trialed with companies to provide examples).	6 pilot projects developed, delivered and publicised	50,000	2013-2015
4.4	Capacity and institutional strength for funding proposal development enhanced among stakeholders (capacity building/training for developing effective proposals, mentoring for proposal writing, technical assistance for developing proposals).	1000 participant days of training; 100 proposals developed (8 per year)	140,000	2013-2020
4.5	Effective finance plan developed for securing adequate funds from a range of sources (technical assistance in developing a finance plan).	1 finance plan	50,000	2013-2014
4.6	Effective monitoring and evaluation (M&E) system for the Adaptation Strategy implementation established and maintained, and being used to monitor whether the strategy is effective in reducing climate change impacts on populations and sectors.	1 M&E system	250,000	2013-2025
4.7	Costs and benefits of adaptation measures in BiH evaluated, and results communicated (annual evaluation of the Adaptation Strategy, with advice for continual improvement).	Evaluation reports (1 per year)	150,000	2013-2015

4. THE EMISSION REDUCTION STRATEGY

The priority for Bosnia and Herzegovina in climate change mitigation is to strengthen its institutional and professional capacities in developing and implementing climate policy, monitoring greenhouse gas emissions, and planning, implementing, monitoring, reporting and verifying mitigation actions. Institutional strengthening is required at all administrative levels: from the country level (e.g. UNFCCC focal point, designated authority for international cooperation on mitigation actions and projects, statistical institutes), to the entity level (e.g. ministries responsible for different aspects of climate change policy, agencies for energy efficiency, funding mechanisms for supporting mitigation actions), and the regional and local level, together with the business sector and civil society.

The capacity building process will be motivated by the EU accession process, and through the process of planning, implementing, monitoring and verifying internationally-supported NAMAs in the priority sectors (electricity generation, buildings, district heating and transport). The aim will be to mobilize up to seven billion Euros of foreign direct investment, donor support and private investment for these actions over the period 2012-2025, contributing significantly to job creation and preservation, improved health and quality of life, and poverty alleviation.

The capacity building process combined with the implementation of NAMAs will put Bosnia and Herzegovina on track to fulfil the requirements of EU membership in terms of legal transposition, administrative capacity and policy implementation. As the quality of information on emissions and experience with emission abatement actions is improved, this strategy will be reviewed and adjusted.

In order to ensure that emissions begin decreasing around 2025, the specific objectives during the period 2013-2025 are:

Capacity building

1. Build the institutional and professional capacity for implementation, monitoring, reporting, and verification of the strategy, the mitigation actions, and for managing the process of EU accession and change of status under UNFCCC (to Annex I) by 2025.

2. Transpose and implement the EU *Acquis Communautaire* in the fields of climate change, energy efficiency and environment by 2020.

3. Implement at least ten supported and/or credited NAMAs by 2025.

Electricity generation

4. Improve the efficiency of energy generation in all coal-fired power plants to at least 40% by 2025.

5. Install at least 150 MW new generating capacity for electricity generation using renewable energy sources: biomass (in co-generation), hydropower and wind.

Buildings and district heating

6. Reduce average heating demand of housing from over 200 kWh/m^{2}a to 100 kWh/m^{2}a by 2025.

7. Phase out fuel oil and coal for home and district heating and replace them with energy efficiency gains, biomass, thermo solar and geothermal (with electricity to power the installations) by 2020.

8. Introduce building and individual metering for heat consumption in all district heating systems by 2020.

Transport

9. Reduce transport emissions by 10% in relation to business as usual scenario by 2025.

4.1. Nationally Appropriate Mitigation Actions (NAMAs)

The proposed internationally-supported NAMAs are presented in Table 6 below. They include both supported NAMAs and potentially creditable NAMAs (depending on results of further international and national processes[31]). The table is followed by summaries of individual actions.

31 The information for internationally supported NAMAs to be submitted to the UNFCCC registry can be found at www.unfccc.int

Table 6. Proposed supported and creditable National Appropriate Mitigation Actions

Specific objective	Action	Est. emission reduction (Mt CO_2 eq/a)	Preparation cost	Implementation cost (BAM)	Time frame (years)	Type of support	Expected co-benefits
Capacity building							
Build the institutional and professional capacity for implementation, monitoring, reporting, and verification of the strategy, the mitigation actions and for managing the process of EU accession and change of status under UNFCCC (to Annex I) by 2025.	Capacity building for country and entity level authorities responsible for various aspects of climate change mitigation policy, including establishing annual emission statistics.	Enabling activity		2 million	2013-2015	Capacity building; Financial support	Strengthening administrative capacities in BiH in general
	Establishment of Energy Efficiency Agencies of Republic of Srpska and of the Federation of Bosnia and Herzegovina (entity jurisdiction).	Enabling activity		2 million	2012-2015		
Transpose and implement the EU *Acquis Communautaire* in the fields of climate change, energy efficiency and environment by 2020.	Capacity building in EU climate, energy efficiency and environmental policy at all levels.	Enabling activity		4 million	2013-2015	Capacity building; Financial support;	Contributing to EU Accession process, leading to improved economic and social situation
	Establishing the country framework for EU ETS.	Enabling activity	40,000	4 million	2015-2020	Capacity building; Financial support; Technology	

Specific objective	Action	Est. emission reduction (Mt CO_2 eq/a)	Preparation cost	Implementation cost (BAM)	Time frame (years)	Type of support	Expected co-benefits
Implement at least 10 supported and/or credited NAMAs by 2025.	Designating, strengthening and operation of designated country authorities for the management of NAMAs.	Enabling activity	200,000	10 million	2013-2025	Capacity building; Financial support	Mobilizing international financing and investment leading to 'green' growth
Electricity generation							
Improve the efficiency of energy generation in all coal-fired power plants to at least 40% by 2025.	Improvement of existing coal-fired power plants and construction of new ones	6.5	180 million	9 billion	2015-2024	Financial support; Technology	Social security in mining regions, reduced air pollution
	Installation of equipment for methane combustion and energy co-generation in underground coal mines.	0.15	400,000	13 million	2013-2020	Financial support; Technology	
Install 150 MW new capacity for electricity generation using hydropower and wind.	Use of renewable energy potential for electricity generation.	> 0.26	40 million	600–800 million	2013-2025	Financial support; Technology	Jobs, industrial development, competitive energy market
Buildings							
Reduce average heating demand of housing from over 200 kWh/m²a to 100 kWh/m²a by 2025.	Transposition and implementation of the 2010 EU Directive on energy performance of buildings and training of professionals in the construction sector for the application of new legislation and the principles of designing energy-efficient and 'green' buildings.	0.21	20,000	2 million	2013-2015	Capacity building; Financial support	Improved health of the population, lower heating costs.

Specific objective	Action	Est. emission reduction (Mt CO_2 eq/a)	Preparation cost	Implementation cost (BAM)	Time frame (years)	Type of support	Expected co-benefits
	'Green' public procurement in buildings.	0.21	40,000	4 million	2015-2020	Capacity building; Financial support	Energy cost savings, jobs, industrial development
	New act on management and maintenance of multi-residential buildings.					Capacity building; Financial support	
	Support to completing unfinished housing (initially refugees and internally displaced persons).		20 million	1.8 billion		Capacity building; Financial support	
District heating							
Phase out fuel oil and coal for home and district heating and replace them with energy efficiency gains, biomass, thermo solar, geothermal and electricity by 2020.	Law on production, distribution and supply of thermal energy.	Enabling activity	20,000	2 million	2013-2015	Capacity building; Financial support	
	Use of biomass (wood waste) in distributed co-generation plants (including Livno, Gradiška and Prijedor).	0.88			2013-2025	Capacity building; Financial support; Technology	2,300 jobs, increased energy security, lower heating costs for families
Introduce individual metering for heat consumption in all district heating systems by 2020.	Installation of individual heat metres in multi-residential buildings and creation of the conditions for payment based on actual consumption of heat.	0.04	10 million	200 million	2015-2020	Capacity building; Financial support; Technology	Lower heating costs for families

Specific objective	Action	Est. emission reduction (Mt CO_2 eq/a)	Preparation cost	Implementation cost (BAM)	Time frame (years)	Type of support	Expected co-benefits
Transport							
Reduce transport emissions by 10% in relation to the 'take no action' scenario by 2025.	Railroad transportation: Improvement and promotion (RATIP).	0.25	20 million	700-800 million	2013-2025	Capacity building; Financial support; Technology	Less demand on roads, leading to lower investment and maintenance costs.
Reduce transport emissions by 10% in relation to the 'take no action' scenario by 2025.	Public transport: Introduction and improvement (PUTII).	0.15	2 million	200-400 million	2013-2025	Capacity building; Financial support; Technology	Improved air quality. Improved mobility and lower costs for poorer people
	Promotion of Car-sharing (PRO-CASH)	0.1	20,000	400,000	2013-2015	Capacity building; Financial support	
	Urban planning in terms of transportation (UPITT).	Enabling activity	40,000	2 million	2013-2015	Capacity building; Financial support	

4.2. Capacity building

Capacity building for country and entity level authorities responsible for aspects of climate change mitigation policy (including establishing annual emission statistics)

The administrative capacity of Bosnia and Herzegovina in the field of climate change is limited, and with no strategic approach to capacity building. At the country level, the UNFCCC Focal Point, the RS Ministry for Spatial Planning, Civil Engineering and Ecology is practically the only institution in the administration fully dedicated to the issue. The objective of this measure is to build the minimum capacity required for implementation of the LED strategy. Capacity building would initially target relevant ministries at the country and entity levels and other public agencies, such as the statistical institutes, to enable:

- Regular collection and reporting on greenhouse gas emissions;
- Developing and maintaining a database of buildings;
- Meeting the obligations under the UNFCCC (participation in negotiations, reporting, etc);
- Design, assessment and coordination of NAMAs;
- Development of next generations of the LED strategy and other climate-related policies;
- Transposition of EU legislation in the field of climate change;
- Effective participation in the EU accession process.

Some of the above have already been covered through support in developing the SNC provided by the United Nations Development Programme (UNDP) and the EU-funded LOCSEE regional project, although this work should be continued and expanded. The public institutions responsible for this activity are the RS Ministry for Spatial Planning, Civil Engineering and Ecology of the Republic of Srpska, the Ministry of Foreign Trade and Economic Relations Bosnia and Herzegovina, and Ministry of Spatial Planning in the Federation of Bosnia and Herzegovina. The statistical institutes, ministries responsible for energy and other relevant institutions should also be involved. Particular emphasis will be put on developing potential local funding mechanisms through the two entity's environmental funds and other financial institutions, with a view to mobilizing possible international sources of funding (including bilateral donors and multilateral financing mechanisms such as GEF and GCF).

Establishment of Energy Efficiency Agencies in the Republic of Srpska and Federation of Bosnia and Herzegovina (entity jurisdiction)

The draft Act on Energy Efficiency of the Republic of Srpska and of the Federation of Bosnia and Herzegovina, together with the draft NEEAP for Bosnia and Herzegovina provide for the establishment of Energy Efficiency Agencies (EEAs) in each entity. The planned role of the EEAs is to:

- improve the conditions and measures for the rational use of energy;
- propose incentives to increase energy efficiency;

- promote the importance of energy efficiency;
- manage programmes and projects for the rational use of energy and greater use of renewable energy as a key factor in sustainable development;
- contribute to the improvement of social responsibility towards energy in all structures of entities/state and society.

The first task is to design the two agencies for effective delivery of their mission while ensuring that their performance is not dependent on the government budget funding. The two EEAs could play a major role in implementation of other NAMAs described below: Therefore they should be structured and staffed in such a way as to enable them to work directly with donors and EU funds.

The establishment of EEAs is an enabling action that will significantly increase the capacity and ability of Bosnia and Herzegovina to design and implement mitigation actions in the energy sector and to improve the efficiency of energy use, the use of energy from renewable sources, the effectiveness of the entity/national energy system, and energy security of the country.

The responsible institutions in the Republic of Srpska are the Government of the Republic of Srpska, the Ministry of Industry, Energy and Mining, and the Ministry for Spatial Planning, Civil Engineering and Ecology. In the Federation of Bosnia and Herzegovina, the responsible institutions are the Government of the Federation of Bosnia and Herzegovina, the Ministry of Energy, Mining and Industry, and the Ministry of Spatial Planning. The potential sources of funding are bilateral donors and multilateral financing mechanisms such as Global Environmental Fund (GEF), Green Climate Fund (GCF), as well as EU IPA Funds.

Capacity building in EU climate, energy efficiency and environmental policy at all levels

Stakeholders in Bosnia and Herzegovina – including local leaders, mayors of major cities such as Banja Luka, Sarajevo and Tuzla, and others – are already aware of the need to act against climate change and are taking important initial steps. The momentum for action already exists, even though the country-level climate policy is only just emerging. However, significant efforts are required to translate the political will for change into economically, socially and environmentally sustainable action. An initial step was taken when 14 mayors in Bosnia and Herzegovina[32] joined the Covenant of Mayors. Thirteen mayors submitted Sustainable Energy Plans, the key document in which cities/ municipalities – the Covenant of Mayors signatories – define their activities and measures on how to reach specified CO_2 reduction targets by 2020. In addition to the establishment of and capacity building for the basic functions of state in relation to climate change, a widespread capacity building process is required to design and implement the subsequent measures required. To date some capacity building strengthening has been provided by UNDP, GIZ and EU at the municipal level.

These efforts can be modelled on, and connected to, approaches taken in the EU and individual member states, such as the Covenant of the Mayors and various other city, local community and business networks. The work should initially focus on documenting, developing and disseminating examples of good practice from the policy and practical levels (for example, the UNDP project Climate Change Facility for Bosnia and Herzegovina Cities).

32 As of 3 October 2012

Establishing the country framework for the EU Emissions Trading Scheme (ETS)

Once the basic capacity for climate change policy, monitoring and reporting is established by 2015, and as the EU accession schedule (together with the future EU emission reduction regime becomes clear), Bosnia and Herzegovina can proceed with establishing the EU ETS. Large emitters (thermal power plants) represent a significant proportion of the economy, so the authorities and the emitters should be suitably prepared for emission trading ahead of EU entry. The early implementation and reliability of the scheme will be important in attracting international investors in relation to large coal and other industrial projects.

Initially regular company reporting of emissions and verification by the authorities (which are still to be designated) is required. The next stage would be the issuing of emission rights, based on historic emissions and other elements of the EU ETS Directive, and then development of the national allocation plan ahead of the final stages of EU membership negotiations.

The responsible institutions in the Republic of Srpska are the Government of the Republic of Srpska, the Ministry of Industry, Energy and Mining, and the Ministry for Spatial Planning, Civil Engineering and Ecology. In the Federation of Bosnia and Herzegovina, the Government of the Federation of Bosnia and Herzegovina, the Ministry of Energy, Mining and Industry, and the Ministry of Spatial Planning will be responsible. The potential sources of funding are bilateral donors and multilateral financing mechanisms such as GEF and GCF.

4.3. Production of electricity (including mining)

Improvement of existing coal-fired power plants and construction of new ones

The efficiency rate of existing units in coal thermal power plants in Bosnia and Herzegovina is around 30% and emissions of carbon dioxide are high (approximately 1.3 t CO_2/MWh). Most of existing units should start activities in order to meet requirements of the EU Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants, which requires significant emission reduction till 2017. During construction of new plants, EU standards will be fully met. The potential for new renewable energy generation in the years up to 2025 is insufficient to replace existing coal capacity and meet the increasing demand for electricity.

The new thermal power plants must meet the requirements of the 'Best Available Technique', in that they achieve at least 40% efficiency. This would mean a decrease of emissions from 1.3 t/MWh to around 0.97 t/MWh, of electricity produced. If existing capacity was replaced, the total emissions would be decreased by 4.8 Mt CO_2 equivalent annually.

According to the existing plans of the entities and electricity utilities and taking into consideration current construction dynamics, up to 3,200 MW of thermal power plant generating capacity could be constructed by 2025, replacing the existing 1,765 MW capacity. This growth scenario depends on increasing demand both in the country and in the wider region, including the EU, and on the price of carbon in the EU market. The energy utilities of the two entities are responsible for this NAMA, under the regulatory supervision of the relevant ministry.

A five billion Euro investment is needed in Bosnia and Herzegovina to upgrade power plants and this is expected to come from foreign private sector and international financing institutions.

The investment would generate significant economic growth and employment in the country. Replacing the existing thermal power plants would extend the operation of coalmines for another generation, making it possible to gradually restructure their economy at low cost.

Installation of equipment for methane combustion and energy co-generation in underground coalmines

A commercial technology has been developed to capture methane from coalmine ventilation air. At a methane concentration level in ventilation air between 0.2% and 1.2%, the mixture is oxidized in ceramic bed-chamber containers. Generated energy can be used for the production of thermal energy and/or electricity.

According to a survey conducted during 2007-2009, the technology described can be applied in brown coalmines in the central Bosnian basin (including Breza, Kakanj and Zenica). Table 7 below, provides an estimation of greenhouse gas emission reductions for these mines, as well as the value of Certified Emission Reduction (CER) credits and the investment needed. The figures on greenhouse gas reduction do not include reduction due to replacement of existing sources of energy (electricity from the grid and coal for heating).

Table 7. The potential methane emission reductions for brown coal mines in Central Bosnia, Certified Emission Reduction credit value and amount of investment required

Coal mine	Emission reduction (Gg CO_2eq/a)	Investment value (EUR million)
Zenica	100	4.0
Breza	50	2.5

The projects in Zenica and Breza should be financially sustainable as a result of income generated by CER units under the CDM, if this system continues beyond 2013, and the market price of CER units is above 12 EUR. There are no additional barriers to implementation of these projects and they are expected to be financed by international private investors. The energy utility is responsible for this project.

The projects would create new jobs and a new source of income for the coalmines (sales of energy or reduction of energy costs if that generated energy is used for their own needs). There is no feed in tariff established for electricity produced from such a technology.

Use of renewable energy potentials for electricity generation

Renewable energy sources (RES) in Bosnia and Herzegovina include biomass, hydropower, wind energy, geothermal energy and solar energy. Geothermal energy is not relevant for electricity production. The potential of solar energy for electricity production is attractive and there are some small plants, but high feed in tariff would be needed for their sustainability. As biomass is treated under district heating, this measure focuses on hydropower plants and wind.

According to the entities strategies, constructions of approximately 200 MW of Small Hydropower Plants (SHPP) are predicted, with an annual production of 700 GWh. There is also an economic potential for developing approximately 600 MW of wind-based electricity. Due to nature

conservation, other uses of water and land and other regulatory and logistic concerns, not all of this potential will be realised. If only 50 MW of SHPPs (with a production of 150 GWh/a) and 100 MW of wind parks (with 200 GWh/a of electricity production) are constructed by 2025, taking into account the existing grid emission factor of carbon dioxide, this will lead to a greenhouse gas mission reduction of approximately 110,000 t CO_2 eq/a for hydropower, and around 150,000 t CO_2 eq/a for wind. In both entities, there are support measures (including feed in tariffs) for electricity produced from renewable energy sources, including SHPP and wind turbines. Feed in tariffs in the Federation of Bosnia and Herzegovina is slightly higher than in the Republic of Srpska. Recently, the feed in tariff for SHPP and wind turbines was approximately 0.14 BAM/kWh.

There has been a strong interest from domestic and international investors in the construction of SHPPs and wind parks in Bosnia and Herzegovina in recent years. The development of SHPPs is most economically viable RES in Bosnia and Herzegovina at present. In addition to the hydro energy potential of the major water sources, there is hydro energy potential in smaller water streams. The current utilization degree of SHPP is 4.4% of available power, or 5.7% of the available energy. There are 30 SHPPs installed with a total capacity of approximately 40 MW and an annual electricity production of approximately 200 GWh. A number of additional concessions are in the process of being awarded or are under construction. The preliminary selection of potential locations for installing wind power plants has taken place, and 16 locations identified. One wind park has already been designed, and has the necessary permits. Entity and cantonal ministries of energy, the economy, and the environment are responsible for the implementation hydro energy and wind facilities. It is expected that, other than funding of support measures, the investment in hydro and wind power will come from the private sector.

If implementation of this NAMA is linked to the strategy of developing the industrial sector, it can lead to new job creation in equipment manufacturing. Another benefit is the construction of roads and improved electricity supply for remote villages in the vicinity of power plants and development of infrastructure.

4.4. Buildings

Transposition and implementation of the 2010 European Union Directive on energy performance of buildings, and training of professionals in the construction sector for applying new legislation and the principles of designing energy-efficient and 'green' buildings

The transposition of the European Directive on the energy performance of buildings, as well as other relevant directives relating to energy consumption in buildings, in the legislation of entities will prevent excessive energy consumption in new buildings. The legislation should define several stages of reducing energy consumption and achieve the objectives of EU legislation (strategy for very low energy or passive houses).

Immediately after the adoption of laws and by-laws, a training programme in the application of legislation should be introduced. Engineers (design, execution, monitoring, control of technical documentation, issuance of building permits, investment management) do not have sufficient knowledge on integrated design, or sustainable and energy-efficient building. The training could include:

- Sustainable architecture-design principles of energy efficiency and 'green' buildings
- 'Green' Materials
- Thermo-technical systems and sustainable architecture
- Light and energy efficiency/energy-efficient lighting in buildings
- Certification of energy efficient and 'green' buildings
- Standards of energy-efficient and sustainable architecture
- Laws and by-laws and others.

The target groups for the training are staff of the administration at different levels, including municipalities, designers of all phases (architects, civil engineers, mechanical and electrical engineers), and investors (in the public and commercial sectors).

The Ministry for Spatial Planning, Civil Engineering and Ecology of the Republic of Srpska and Ministry of Spatial Planning of the Federation of Bosnia and Herzegovina and its cantons are responsible for this activity. There are on-going activities concerning the development of a full package of primary and secondary legislation, supported through IPA financing for Bosnia and Herzegovina. The training can be organized by professional associations, associations of municipalities and cities, in cooperation with relevant ministries and consultants.

More stringent requirements related to energy consumption in buildings will lead to implementation of additional measures, and changes in design and construction, for example, buildings will be better insulated, better windows will be installed, and all equipment will generate employment in the production of building materials and products (such as insulation, windows, solar panels and high-efficiency heating systems). An improved energy performance of buildings will also have benefits for the overall health of the population, especially vulnerable groups such as children and the elderly. The improvements will also reduce the financial and human effort required to provide heating in the least wealthy households (e.g. collection, transport and preparation of firewood).

'Green' public procurement in buildings

'Green procurement' should be introduced into the public procurement system as an obligation for all procurement financed by the budget: from equipment to buildings. Public institutions using 'green procurement' will provide the impetus for a 'green economy' and at the same time provide an example to citizens. It will be necessary to amend the existing law on public procurement and related by-laws.

'Green'/sustainable buildings must be defined according to their energy characteristics, the characteristics of materials used in their construction, the characteristics of equipment, etc. A phased introduction of this standard needs to be defined for buildings that are being built or renovated as public institutions.

The use of sustainably-harvested wood as a building material in the construction of sustainable, 'green' public buildings is to be encouraged. Funding to improve energy efficiency of buildings from the Fund for Environmental Protection and Energy Efficiency (FEPEE) must be directed only to the application of 'green' building materials.

The Public Procurement Agency (PPA) and the authorities at the entity level are responsible for the implementation of this action. Funding will partially come from public budgets and also potentially from bilateral and multilateral donors.

The procurement of 'green' building products/equipment encourages technologically advanced production and employment. The introduction of 'green' performance in production capacity, the development of the wood processing industry, and the development of equipment for use in renewable energy sources, will significantly improve economic development at the state, entity and local level and contribute to the development of export-oriented businesses.

New act on management and maintenance of multi-residential buildings

Multi-family dwellings and apartment blocks create significant greenhouse gas emissions due to their poor energy efficiency and use of central district heating systems which use fuel oil or coal as an energy source. Many old buildings need major energy-related restoration (such as insulation of walls and roofs, replacement of windows, and installation of solar collectors), which requires investment capital. Most apartments are owned by their inhabitants and they are unable to raise money in the current management set-up of multi-family buildings. At the same time, there are newer buildings that do not require major maintenance, but whose residents are more able to generate funds that do not need to spend on renovation.

The current legislation prevents rehabilitation of buildings requiring major financial input, as the legal status of buildings is as separate legal subjects. Each building is registered as a legal subject, with its own account in which funds are collected through payments by apartment owners. Thus, there are insufficient funds available for any investment in the building. Many buildings are still not registered as legal subjects, because the legal procedure is complicated.

New legislation is needed that would allow the establishment of a centralized administration of housing stock (for example, at the level of a city, with a fair, accountable system of management and control over financial resources). This would allow companies that manage housing stock to enter into contracts with banks for loans, to enter into contracts with ESCOs, and to apply for grants and loans from the FEPEE.

The Ministry for Spatial Planning, Civil Engineering and Ecology of the Republic of Srpska and the Ministry of Spatial Planning of the Federation of Bosnia and Herzegovina and its cantons are responsible for this activity. The upgrade of buildings can be implemented with donor support and will have an enabling effect on the remaining NAMAs concerned with buildings.

The work on energy repairs of buildings requires speeding up, the result of which will improve living comfort, save energy, reduce CO_2 emissions, reduce the costs of heating/cooling systems, and create employment in the construction sector (for example, production of insulating materials, facade materials, windows, design, construction, etc).

Support for the completion of unfinished housing (initially refugees and internally displaced persons)

There are many unfinished houses in Bosnia and Herzegovina (usually without a facade or with unfinished storeys), some of which are owned by vulnerable groups (for example, refugees and internally displaced persons) who do not have the financial resources to complete the building of their home. This project aims to help socially-vulnerable groups to improve their comfort of living

while reducing heating costs. Installing solar panels can reduce the consumption of electricity, and reduced heating demand may make more firewood available for other users (e.g. district heating), and make biomass more price competitive.

There are no reliable data on the number of unfinished houses, but it is assumed that as many as 200,000 houses could be completed by 2025. The return on investment from roof work is the fastest, slower on façade.

The institutions responsible in the Republic of Srpska include: the Ministry for Spatial Planning, Civil Engineering and Ecology, the Ministry of Finance, and the Ministry of Labour, War Veterans and Disabled Persons' Protection. In the Federation of Bosnia and Herzegovina, the Ministry of Spatial Planning, the Ministry of Finance, and the Ministry of Labour and Social Policy are responsible. Funding should be provided to households either in the form co-financing of works or of co-financing loans for vulnerable populations. A potential vehicle for funding could be the FEPEE, which is currently under-capitalized for such a purpose. The FEPEE could be capitalized by international bilateral and multilateral donors, and by lines of credit from international financial institutions and/or national development banks.

Improvements in living conditions and comfort (such as heating in all rooms to a comfortable temperature), in addition to reducing outdoor and indoor air pollution, will have a positive impact on human health, especially for vulnerable groups, such as children and the elderly. Such improvements will also reduce the workload on those who look after the household, who are often women.

All work undertaken to improve the energy performance of buildings present opportunities for job creation, including in the production of heat-insulating materials and equipment, and building materials, and in service performance. There are also opportunities through the encouragement of solar collector production for hot water heating in households. Moreover, by reducing energy consumption from non-renewable sources, CO_2 emissions will be reduced.

4.5. District heating

The Law on Production, Distribution and Supply of Thermal Energy

The adoption of the Law on Production, Distribution and Supply of Thermal Energy and secondary legislation, will clarify the duties between producers and consumers of thermal energy, which at present are not clearly defined. The Strategic Plan and programme development of the energy sector in the Federation of Bosnia and Herzegovina (2009), the Energy Development Strategy of the Republic of Srpska by 2030, and the Action Plan for Implementation of the Energy Development Strategy of the Republic of Srpska by 2030, also propose the adoption of this law. The Association of District Heating Companies in the Republic of Srpska launched this initiative in 2010, but according to available data, the law has not yet been adopted.

The Law on Production, Distribution and Supply of Thermal Energy, will set the conditions for the production, distribution and supply of thermal energy, the rights and obligations of service providers, and the rights and obligations of customers of thermal energy. The Law should regulate investment in such services and infrastructure (facilities and technical equipment), tariff policy, and enforcement of the law. The Law should be harmonized with European Union Directives, but also take into account the specificity of heating systems in each entity.

The Ministry for Spatial Planning, Civil Engineering and Ecology of the Republic of Srpska and the Ministry of Spatial Planning of the Federation of Bosnia and Herzegovina and its cantons are responsible for this activity. Implementation can be undertaken with donor support and will have an enabling effect on other NAMAs concerned with district heating.

Use of biomass (wood waste) in distributed co-generation

Bosnia and Herzegovina has a significant level of forest cover. The total growing forest stock is 317.5 million m^3 or 203.6 m^3 per hectare (62% deciduous and 38% coniferous). The annual increment is approximately 9.5 million m^3 or 6.1 m^3 per hectare, and the annual allowable cutting is approximately 7.4 million m^3. Biomass, including firewood and wood waste from forestry and the wood processing industry, represents a major source of energy in Bosnia and Herzegovina. Biomass residues from agricultural production also have significant energy potential (in northern and north-eastern Bosnia).

The technical potential of biomass – in terms of forestry wood waste and sawmill waste – is estimated at 12.5 PJ/a. The total potential of co-generation plants based on that potential is about 200 MW installed electric power. The suggested individual power plant is 3-10 MW. Taking into account the annual plants work of 6,000 hours and the efficiency of electricity production at 35%, possible electricity production from these facilities amounts to 1,200 GWh/a. The advantage of these plants (3-10 MW per plant) are that they are close to the end-user of energy, therefore transmission losses are minimized and the possibility of utilizing heat energy is greater than in a centralized system. The Norwegian Ministry of Foreign Affairs financed a capacity building programme for developing greenhouse gas reduction projects in the district heating sector in Bosnia and Herzegovina, during the period from autumn 2009 to December 2010. The outcome of the project was the development of a draft version of Project design Document (PDD) documentation for a potential small-scale CDM project (in Livno, Federation of Bosnia and Herzegovina), and one Programme of Activities (PoA) with two potential small-scale CDM projects (in Gradiška and Prijedor, Republic of Srpska).

The Ministries of Industry, Energy and Mining and of Spatial Planning, Civil Engineering and Ecology of the Republic of Srpska, and Ministries of Energy, Mining and Industry, and of Spatial Planning of the Federation of Bosnia and Herzegovina and its cantons are responsible for the coordination of this activity, but implementation lies with municipalities. In some cities in Bosnia and Herzegovina, which have prepared SEAPs, and joined the Covenant of Mayors initiative, the introduction of renewable energy is already foreseen in existing or new district heating systems (for example, Gradiška, Prijedor and Bijeljina). Implementation can be undertaken with public and private sector investment, including banks, as well as with donor and international financial institution support.

Emission reduction resulting from utilization of the biomass potential in co-generation plants would decrease emissions of carbon dioxide by about 880,000 t CO_2 eq/a. At the same time, the construction of these facilities, fuel supply and maintenance would create around 2,300 sustainable jobs, mainly in rural areas (job losses in the traditional energy sector are taken into account when assessing the number of jobs created). The overall employment benefit is around 16 million BAM per year or about 13 BAM/MWh of electricity.

Another benefit from using biomass is an anticipated increase of energy security, primarily thermal energy; as heat energy biomass plants would replace a portion of fuel that is currently imported (heating oil and natural gas).

Installation of individual heat metres in multi-residential buildings, and creation of conditions for payment based on actual consumption of heat

Currently, district heating companies in Bosnia and Herzegovina charge for delivered heat based on the surface (m^2) of the heated area. The Law on Consumer Protection in Bosnia and Herzegovina, together with the Republic of Srpska Law on Energy stipulate that energy delivered to the consumer should be metred and charged according to actual consumption. Implementation of these laws has been slow and only a small number of cases of individual metering exist. During 2003-2004, in Canton Sarajevo, a pilot project to install heat metres was undertaken. According to the available data energy consumption in buildings covered by the pilot project dropped by approximately 9.3%, while consumer bills were 4% lower. By the end of 2011, cumulative heat metres were installed in all buildings connected to the district heating system (about 1,350 heat metres). Furthermore, all new facilities which will be connected to the district heating system, must have installed the cumulative and individual heat metres.

It is proposed to install heat metres in all buildings connected to district heating systems. This will enable payment based on actual consumption of heat, instead of the current system of payment in which consumers are not motivated to save heat energy. Analysis conducted shows that expected savings could be in the range of 5-10% of final energy consumption (energy delivered to consumers).

The Ministry of Industry, Energy and Mining of the Republic of Srpska, and the Ministry of Energy, Mining and Industry, and the Ministry of Spatial Planning of the Federation of Bosnia and Herzegovina and its cantons are responsible for the coordination of this activity. Activities on the ground will be implemented by district heating providers (companies and municipalities), banks, and possibly private investors.

4.6. Transport

Railroad transportation: Improvement and promotion (RATIP)

Greenhouse gas emissions from rail are almost four times lower than from cars and airplanes, indicating the potential for reducing greenhouse gases. In Bosnia and Herzegovina, 97% of passengers travel by road and just 3% by rail. This creates a large burden on the road infrastructure, leading to overloading on some parts of the road network, and generates increased greenhouse gas emissions. The promotion of rail transport is important in slowing the growth – and eventually reducing – greenhouse gas emissions, and relieving the stress on the existing and planned road network.

Bosnia and Herzegovina does not currently have a long-term state strategy for developing the rail infrastructure. Several studies already conducted on this topic favour the prioritisation of rail transport: direct benefits include a reduction in greenhouse gas emissions, while co-benefits include a reduction in vehicle and plane use, increased safety and reduced noise.

Railway transport in Bosnia and Herzegovina is operated by two public enterprises: the Railways of the Federation of Bosnia and Herzegovina in Sarajevo, and the Railways of the Republic of Srpska, in Doboj.

Public transport: Introduction and improvement (PUTII)

Public transport is a shared passenger transportation service which includes buses, trolleybuses, trams, trains, rapid transit and ferries. The primary mode of public transport in Bosnia and Herzegovina is buses. Sarajevo, the capital city, also has trolleybuses and trams. The modernization and upgrade of the existing infrastructure is needed in all of the larger cities, including Banja Luka, Bijeljina, Mostar, Sarajevo, Tuzla and Zenica. Improving public transportation has benefits including a reduction of greenhouse gas emissions, passenger time saving, cost savings, fewer traffic accidents, and better air quality, which is also beneficial for health.

The following actions will contribute to a reduction of greenhouse gas emissions from transport:

- establishment of an appropriate institutional and regulatory framework for optimization of the public transportation system;
- implementation of changes in the public transportation system, such as the reorganization of routes and concession management;
- optimization of the public transport fleet (for example, switching from diesel to compressed natural gas [CNG]);
- campaigns for raising public awareness.

The result of moving from a reliance on passenger car to public transport use is expected to be a reduction in carbon dioxide emission: depending on the number of cars no longer in use, carbon dioxide emission from transport is estimated to decrease by more than 5%.

The institutions responsible are the Ministries of Transport and Communications of the Republic of Srpska, and of the Federation of Bosnia and Herzegovina, and the larger cities (including municipalities) and public transport companies. Funding could be provided by bilateral and multilateral donors, banks and public private partnerships.

Promotion of car sharing (PRO-CASH)

Car sharing is a model of car rental where people rent cars for short periods of time, often by the hour. The model is appealing to customers who make only occasional use of a vehicle, as well as those who need occasional access to a vehicle of a different type than they use on a day-to-day basis. The organization that provides the cars may be a commercial business or the users may be organized as a democratically-controlled company, public agency, cooperative or *ad hoc* grouping. The type of car sharing scheme implemented is dependent upon particular circumstances and needs, but the principle is simple: individuals gain the benefits of private vehicle use without the costs and responsibilities of ownership. There are more than 1,000 cities in the world that have some kind of car sharing scheme. In Bosnia and Herzegovina there is no car sharing scheme as yet.

The benefits of car sharing include: fewer cars, lower maintenance costs, and lower car-mileage, all of which contribute to lower greenhouse gas emissions. Calculations of greenhouse gas reduction, resulting from car sharing requires deeper analysis, but according to a study conducted by the University of California in Berkeley, the average change in emissions is estimated to be from 0.58-0.84 t/a greenhouse gas per household participating in car sharing. According to the same study, carsharing not only reduces the number of personal vehicles owned, it can also deter carless households from acquiring a vehicle. The applicability of this data for Bosnia and Herzegovina needs to be analysed.

Urban planning in terms of transportation (UPITT)

The objective of urban planning in terms of transportation (UPITT) is to reduce the need for transportation or to reduce the distance (km/passenger) or transported goods (km/ton). These measures mainly refer to spatial and urban planning: road networks and their length in relation to air distance; and distribution of settlements, industrial zones, shopping malls, control centres (place of living, working and controlling should be near). Every spatial and urban plan must contain an analysis of traffic generation and measures to minimize traffic.

Emissions of carbon dioxide from transport not only depends on the characteristics of the engine, fuel types and driving ways, but also on the transport needs of people, and the length and frequency of journeys. Underlying drivers of these factors include the distance between the home and work place, the location of the home, and the distance between supply centres and homes. Modern technologies are non-polluting, and the construction of settlements with industrial facilities enables co-generation (combined heat and electricity production for technological use, and for heating, thereby increasing energy efficiency and reducing greenhouse gas emissions). Such a concept of spatial planning in cities requires less traffic. So, there is a need to apply the concept where the place of residence, work and management are, in different city zones.

In Bosnia and Herzegovina, settlements are largely developed along main roads. This is useful for public transport, but reduces traffic safety (i.e. there are a large number of highway exits and entrances). Settlements should be developed in the same vicinity but away from the main road, with central functions organized within walking distance, so that most activities can be completed without leaving the settlement.

Larger settlements – as generators of employment – should invest in the building of production capacities within a few kilometers of the settlement, thereby reducing the need for travel from surrounding, less developed, areas to industrialized areas.

The Ministry for Spatial Planning, Civil Engineering and Ecology of the Republic of Srpska and the Ministry of Spatial Planning of the Federation of Bosnia and Herzegovina and its cantons are responsible for this activity, with municipalities an important partner. Implementation can be supported by donors and will have an enabling effect on the remaining NAMAs concerned with transport, as well those related to buildings and district heating.

4.7. Monitoring and assessment of the effectiveness of climate change mitigation

Establishing a working system for monitoring emissions and mitigation actions, as well as for evaluating and adjusting the strategy is a major priority of the strategy, and crucial for its success in attracting international investment and finance. A reliable system of monitoring and evaluation is also an important compliance mechanism internationally: facilitating recognition of actions implemented by Bosnia and Herzegovina under the post-2012 climate policy framework and crucial in the EU accession process related to climate policy.

At present measurement, reporting and verification (MRV) is a major weakness as witnessed by the lack of reliable information on greenhouse gas emissions. Initial steps are being

taken through the support provided for the development of the SNC, but capacity building will need to continue. Despite the lack of definitive requirements and procedures towards estimation of greenhouse gases in developing countries, the general direction and the intention of the post-2012 MRV framework are clear. For countries such as Bosnia and Herzegovina post-2012 reporting requirements are essentially related to two core areas:

- National emissions, including monitoring of domestic policies and measures;
- Implementation of specific NAMAs.

Bosnia and Herzegovina is required to submit biennial reports[33], containing updates on national greenhouse gas emissions, including greenhouse gas inventories and the national inventory report, information on mitigation actions, needs for support and support received. The first report is due by December 2014. The biennial reports will be subject to International Consultations and Analysis (ICA) under the Subsidiary Body for Implementation.

All mitigation actions implemented will be subject to monitoring and review. Domestically supported mitigation actions will undergo domestic MRV, while internationally supported actions will require international MRV under UNFCCC guidelines. The strongest reporting and verification provisions are prescribed for actions supported by international finance. The mitigation actions seeking support will be required to register in a newly formed 'Registry' that will facilitate the matching of the proposed mitigation actions by developing countries with available donor support.

It is assumed that the requirements for MRV of a supported measure may not differ much conceptually from the current requirements under CDM. Some variation can be expected depending on whether the supported measure entails actions for which the greenhouse gas emission reductions can be directly monitored. In cases when the supported measure is expected to result in a specific greenhouse gas emission reduction outcome, the underlying MRV framework of the measure and its effectiveness would likely require a greenhouse gas emission output indicator and can be expected to follow the approaches currently used in the CDM. Whereas for measures for which the greenhouse gas emission reduction benefit cannot be directly monitored, for example, in cases of development and enforcement of mandatory standards (e.g. building codes) or certain capacity building measures, the MRV indicators are likely to undergo adjustments in accordance with the availability of appropriate indicators.

Steps to be taken towards implementation of an effective monitoring and evaluation system include:

- Ensuring capacities at the national and sub-national level, with regard to compiling statistical information related to greenhouse gas activity data, specific performance indicators of mitigation actions, and policies;
- Taking actions to identify and implement a system of specific indicators for measuring progress in the implementation of sectoral mitigation measures identified in LEDS, with a view to analysing their current performance and identifying opportunities for enhancement in the future;

33 Guidelines were agreed for biennial update reports and parties are to submit their first biennial update report by December 2014. Guidelines for International Consultation and Analysis (ICA) of biennial reports were also adopted.

- Developing specific approaches and methods of evaluation, emission factors and benchmarks for emission reduction estimation that would be suitable for local conditions;
- Enhancing strategic planning and performance assessment capacities at the national and sub-national level for measurement and analysis of the effectiveness of mitigation measures.

Furthermore, the authorities, industries, businesses, organizations, agencies and bodies of the local public administration should be encouraged to maintain annual accounting of funds utilised on implementing LEDS and measures supporting it, to enable evaluation of its technical and economic effectiveness, together with correct reporting to the international community.

The implementation of adaptation actions must consider the need to reduce greenhouse gas emissions to avoid the most negative impacts of climate change. As such, monitoring and evaluation needs to be integrated with LEDS. However, unlike emissions reduction, there is no standardised unit of measurement to determine how much an institution, organisation, community, economy or environment has adapted. Instead, specific indicators for each output have been detailed in section 5.5.

Measuring and evaluating adaptation means can be interpreted in different ways by different organisations. Therefore, this strategy does not present detailed overarching targets for adaptation. However, two delivery-focused targets can be easily monitored and will provide effective indicators: Mobilization of funds for adaptation outputs and activities; and the number of new adaptation initiatives implemented (as detailed in the output tables in section 5.5).

Further sector specific measures and indicators will be established as part of the future development of local and sector-specific adaptation plans. The approach will focus on assessing the reduction of vulnerability (enabling assessment at a community stakeholder level[34]). Data will be disaggregated by gender. Monitoring and evaluation will also examine whether a process for assessing the risks posed by climate change has been established and built into processes in institutions and organisations, and whether this is being reflected in implementation. Measurement will also consider achievement against the indicators detailed in the tables in section 5.5.

34 UNDP has been central in the development of the 'Vulnerability Reduction Assessment Approach'

5. INSTITUTIONAL AND HORIZONTAL ISSUES

5.1. Governance

Climate change should not be addressed by governments in isolation. The success of the NAS will depend on organizations, communities and businesses preparing for a changing climate, and implementing appropriate responses. Governments must move the agenda forward, and provide leadership, support and an enabling environment, but ultimately they must work collaboratively with a range of local, community, national and international partners.

International experience has shown that developing and implementing adaptation strategies is often constrained by a range of institutional complexities and horizontal issues. Governance institutions were established when climate change issues were of low importance. Due to its multi-faceted nature, climate change adaptation does not always fit into convenient sectoral, departmental or ministerial areas. To date, climate change issues have been peripheral to most institutions in Bosnia and Herzegovina.

Government institutions in Bosnia and Herzegovina (and elsewhere) face significant challenges that reduce adaptive capacity and the ability to implement and further develop adaptation strategies. Key among these are conflicting and overlapping mandates, and weak coordination and a lack of effective arrangements for inter-agency integration. The strategy will be implemented at all administrative levels of Bosnia and Herzegovina by the institutions presented in Table 8 below.

Table 8. Institutions responsible for the implementation of the strategy

Administrative level/responsibility	Institutions
State level	
Participation in the UNFCCC process	Republic of Srpska Ministry for Spatial Planning, Civil Engineering and Ecology (UNFCCC focal point)
Overall coordination of adaptation activities and NAMAs with potential donors and investors	Ministry of Foreign Trade and Economic Relations Bosnia and Herzegovina
Submission of NAMAs to registry reporting results of adaptation activities and NAMAs	Republic of Srpska Ministry for Spatial Planning, Civil Engineering and Ecology (UNFCCC focal point)
Greenhouse gas statistics	Agency for Statistics
Reporting to the UNFCCC and EEA	Republic of Srpska Ministry for Spatial Planning, Civil Engineering and Ecology, Ministry of Foreign Trade and Economic Relations Bosnia and Herzegovina
Review of progress of the strategy and its updates	Republic of Srpska Ministry for Spatial Planning, Civil Engineering and Ecology (UNFCCC focal point)
Entity level	
Integration of adaptation and mitigation objectives into other development policies	Governments of Republic of Srpska and Federation of Bosnia and Herzegovina

Administrative level/responsibility	Institutions
Transposition of EU legislation and standards	Republic of Srpska Ministry for Spatial Planning, Civil Engineering and Ecology Federal Ministry of Environment and Tourism Republic of Srpska Ministry of Industry, Energy and Mining Federal Ministry of Energy, Mining and Industry
Promotion of energy efficiency through EEAs	Republic of Srpska Ministry of Industry, Energy and Mining Federal Ministry of Energy, Mining and Industry
Submission and coordination of adaptation activities and NAMAs with potential donors and investors	Republic of Srpska Ministry for Spatial Planning, Civil Engineering and Ecology Federal Ministry of Environment and Tourism Republic of Srpska Ministry of Industry, Energy and Mining Federal Ministry of Energy, Mining and Industry Federal Ministry of Agriculture, Water-Management And Forestry Republic of Srpska Ministry of Agriculture, Forestry and Water Management Federal Ministry for Spatial Planning Other ministries
Monitoring, reporting and verification of results of adaptation activities and NAMAs	Republic of Srpska Ministry for Spatial Planning, Civil Engineering and Ecology Federal Ministry of Environment and Tourism
Managing the implementation of adaptation activities and NAMAs through appropriate institutions and organizations	Relevant entity ministries and agencies Eco-funds
Regional, local, business level	
Development and implementation of adaptation activities and NAMAs	Cantons, municipalities, agencies, public enterprises, businesses, NGOs
Integration of mitigation objectives into other action/development plans (local development strategies, LEAP, SEAP, etc)	Cantons, municipalities
Promotion of energy efficiency	Cantons, municipalities, EEAs, public enterprises, businesses, NGOs

There have been limited opportunities for civil society engagement in Bosnia and Herzegovina to date (particularly for NGO and Community-based organization [CBO] participation), due to financial, human resource and political constraints. International NGOs have dominated climate change agendas in Bosnia and Herzegovina. This needs to be rectified by increased civil society engagement and ownership, demonstrated by on-the-ground adaptation activities at the local level.

Adaptation and mitigation should be integrated into the planning frameworks of local government and governance structures, and adaptive capacity built at that level. The success of climate change adaptation and low-emission development across Bosnia and Herzegovina will largely depend on the extent to which it is acknowledged and acted upon at the local level.

There will be an increasing need for adaptation and mitigation funding at local and entity levels. Priority must be given to the adaptation needs of the most vulnerable in society (e.g. women and small-scale farmers). Capacities to attract funding and improve accountability must be built at all levels of governance.

5.2. Financing

Both the low-emission and adaptation strategies require funds for effective implementation, over and above those currently available within Bosnia and Herzegovina. The strategies contain opportunities for development, and many of the activities proposed are economically viable without additional support. The required funding identified for strategy implementation is associated with detailed planning, capacity building, trialling new approaches, research and developing models, communication and co-financing. These are essential for the effective adoption of a 'green economic' approach.

It is expected that limited funding will be available from domestic public sources in the foreseeable future. Thus, financing of actions will be structured between the private sector, population, companies, banks, etc., 'classical' donors and EU funds, as they develop in the process of accession and through financial mechanisms under UNFCCC (including GCF, Adaptation Fund, and new market-based mechanisms). Where possible, actions will involve the private sector, public private partnerships, local communities and NGOs.

The most significant funding opportunities are EU IPA funds and the UNFCCC GCF. Resources from both of these sources will be sought to support implementation. Other important potential funding opportunities include GEF, EC FP8 and bilateral donor funding. Innovative partnerships will need to be developed with multilateral funding agencies that are currently reviewing their development assistance in the context of climate-resilient development. In addition, as many of the activities outlined above are linked with further infrastructural developments, loans from the World Bank and European Bank for Reconstruction and Development (EBRD) can be sought.

Funding will also be sought from the private sector, in terms of infrastructure investments and to benefit from the business opportunities offered by some of the measures. Opportunities for co-financing, public-private partnerships and social enterprise-led economic activities will be identified.

Climate Change Adaptation and Low-Emission Development Strategy contains specific actions related to securing financing.

5.3. Gender

The Gender Action Plan for Bosnia and Herzegovina of 2006, and the Law on Gender Equality of 2003 have been considered in developing and implementing the present strategy. The strategy recognises the fundamental goal that equal representation of both sexes in the processes of planning, decision-making and implementation of programmes related to a sustainable environment and strengthening capacities of government institutions dealing with the environment, so that a gender perspective is systematically introduced into the creation of policy on integrated protection of the environment.

Risks associated with climate change threaten to reinforce gender inequalities and have the potential to erode progress that has been made towards gender equity. In relation to the general lack of data related to climate change, there is also a lack of gender-specific data and indicators for climate change and climate change adaptation, and therefore a lack of gender-specific adaptation policies and strategies.

There are still strong traditional gender roles in Bosnia and Herzegovina, including women's limited access to resources and rights, limited mobility, and lack of a voice in community and household decision-making, which can make women more vulnerable than men to the impact of climate change[35]. In their traditional roles, women have a major influence in the stewardship and supply of natural resources in households and communities, and often women's livelihoods are most affected through reductions in livelihood assets (energy, water, agricultural products, production changes and marketability). In certain areas, such as coalmining regions which traditionally employ men, restructuring due to climate-related objectives can also have a negative gender-specific impact on men.

It is important that both genders are represented during community dialogue, and in the monitoring and evaluation of climate change adaptation implementation (with disaggregated indicators where appropriate). Both genders have different strengths in shaping adaptive mechanisms in vulnerable areas[36] and these must be understood and build into the approach.

Particular priority will be given to appropriate gender involvement in capacity building activities for both adaptation and mitigation, and in activities targeting households. Investment into energy efficiency of housing and other buildings will benefit women more, as it will reduce their workload, as well as improve their living environment. Thus, it is crucial to involve women in the planning and decision-making regarding such investments.

5.4. Key research needs

There are important research needs in order to develop a better understanding of adaptation and adaptation approaches. A key requirement in understanding and managing climate is meteorological monitoring. An improved weather monitoring system needs to be installed within Bosnia and Herzegovina, as the current data collected is, by European standards, limited, and

35 More detail can be found in 'Gender, climate change and community based adaptation, a guidebook for designing and implementing gender-sensitive community-based adaptation programmes and projects', UNDP, 2010.

36 Gender in Climate Change Adaptation, in IDSR Workshop proceedings for the development of policy guidelines on Mainstreaming Gender into Disaster Risk Reduction, Geneva, January 2008.

based on fewer observations than the World Meteorological Organisation (WMO) recommends. It will be necessary to establish a more effective network of meteorological monitoring stations across the country.

In tandem with the process described, capacity building of the hydro-meteorological institutes of the Republic of Srpska and Federation of Bosnia and Herzegovina must take place. This will provide core climatic data for Bosnia and Herzegovina, which in turn will enable the development of reliable agro-climatic zoning by different climate scenarios. Complex drought research (agro-climatic indices, rainy and dry series) will enable the development of effective strategies for adaptation of agriculture to climate change.

Modelling needs to be further developed for the changes induced by climate shift, and models developed for the yield of the main crops (maize, wheat and potatoes), and impacts on forests, human health, water supplies and biodiversity.

Hydrological models for various climate scenarios need to be developed to support both risk management strategies and mitigation measures. These will allow for adaptation strategies for water resources to be further elaborated. A hydrological monitoring system needs to be developed for the entire country, which will in turn enable the development of maps and risk charts of the threat of flooding.

In the area of climate change mitigation, the first priority should be the involvement of national researchers in on going international research on greenhouse gas emissions and methods of reduction. More research is required on:

- emissions from various sectors within Bosnia and Herzegovina;
- mitigation potential of these sectors;
- costs and benefits of mitigation actions;
- energy efficiency approaches and technologies;
- social and consumptions patterns influencing emissions and mitigation actions;
- role of and impact on gender equity;
- socio-economic modelling.

There are also opportunities and needs for research and development in energy efficiency and renewables technologies that are or can potentially be produced and implemented in Bosnia and Herzegovina. Producing more of these technologies in the country instead of importing them would have a major positive impact on the economy. The extensive industrial tradition of Bosnia and Herzegovina, as well as its strong raw material base (for example, wood, metals and minerals) provides a good foundation for such development. The most promising areas of technology development are in those concerned with energy efficient buildings, including using domestic wood as construction material, and more efficient use of wood for energy, components and equipment for hydro and wind power.

5.5. Science-policy interactions

Science-policy interactions are core to developing and implementing adaptation and mitigation strategies. It is essential that climate change strategies are based on reliable scientific evidence. Robust scientific evidence of long-term changes in the climate system, and associated impacts, ensures that climate change is a scientifically-constructed policy problem. The scientific evidence gathered in recent decades has put climate change high on political agendas across southern Europe, due to the increased understanding of the vulnerability of sectors, regions and individuals.

Currently, scientific R&D funding is less than 0.5% of GDP, limiting the scope and reliability of information available. The interaction between science and policy for climate change adaptation has many challenges. It is often difficult to identify where the boundary lies between reliable scientific analysis, conjecture and policy development. This can result in the credibility and legitimacy of research results and policy decisions being questioned in public debates.

There is still uncertainty regarding climate change. The global climate is a highly complex and multi-faceted system, and although climate change is generally regarded as indisputable, there are uncertainties regarding both the rate and range of future change. Therefore, policy development has to balance this uncertainty regarding the specifics of change with the knowledge that change is occurring, and therefore inaction is not a viable policy outcome. The strategy contains a focus on gathering information, modelling, and enhanced knowledge about climate change, in order to reduce uncertainty. There is also an application of the precautionary principle within the strategy: precautionary measures are being taken to anticipate, prevent or minimise the adverse effects of climate change.

5.6. Awareness-raising and knowledge transfer measures

There is a need for a greater level of awareness and knowledge about the impacts of climate change among decision-makers and the broader public, in order to enable a systemic response and build resilience.

The focus of the strategy is on supporting organizations and communities across Bosnia and Herzegovina to respond to the impacts of climate change, rather than merely raising their awareness of climate change and its impacts. Communication should support and result in individual, community and organization-led responses to climate change, and the implementation of adaptation measures.

The role of individual citizens in contributing to the mitigation and adaptation to climate change is essential. Environmental education must be improved, enabling children and adults to understand more about climate change and its potential consequences. The topic should be incorporated to a greater extent into the primary, secondary and higher education curricula.

In order to engage communities in the climate change discourse, a broad public-focused, awareness-raising campaign should be conducted, including printed and multimedia materials suitably adapted for different target groups. A series of media events, television programmes, workshops and other relevant awareness-raising events should also be organized. In relation to communication activities, community members, including vulnerable groups, must also have the opportunity to provide input into, and participate in their implementation.

6. NEXT STEPS

The development of the strategies represents a significant and important step towards the development of a sustainable 'green economy' in Bosnia and Herzegovina. The strategy serves as a comprehensive policy framework to deal with the climate change challenge in Bosnia and Herzegovina, and will facilitate access to international support for implementation.

From the activity plans within the strategies, the immediate next steps (2013-2014) are shown to centre around:

- Securing financing. The strategies provide clear justification, structure and specific activities required. Implementation requires effective financing, and efforts will be concentrated on identifying and securing adequate financial resources.
- Specific training and capacity building needs. There are a range of new skills and competencies required for effective implementation of the strategies. It is necessary to further elaborate these through needs assessment exercises, and then to commence a capacity building programme.
- Institutional linkages. Climate change issues are multi-disciplinary and multi-sectoral. Effective responses require new ways of institutions working together, sharing knowledge and information, and integrating planning, monitoring and evaluation. Initial activities will look at quick and simple ways of developing key institutional linkages and information flows.
- Knowledge generation. Both strategies are building on an incomplete knowledge base, as identified in the INC and SNC. Steps are outlined in the strategies for addressing the key gaps in knowledge, and providing an evidence base for future activities.

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MINISTRY OF FOREIGN TRADE
AND ECONOMIC RELATIONS BIH

FEDERAL MINISTRY OF
ENVIRONMENT AND TOURISM

MINISTRY OF SPATIAL PLANNING,
CONSTRUCTION AND ECOLOGY RS

Empowered lives.
Resilient nations.

GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET