

National climate change adaptation planning and strategies

Legal instrument: Regulation on the Governance of the Energy Union and Climate Action

Obligation: National climate change adaptation planning and strategies – GovReg

National circumstances, impacts, vulnerabilities, risks and adaptive capacity

National circumstances relevant to adaptation actions

Biogeophysical characteristics relevant to adaptation actions

Bulgaria is situated in one of the regions that is particularly vulnerable to climate change (mainly through temperature increase and extreme precipitation) and to the increased frequency of climate change-related extreme events, such as droughts and floods. The risks inflicted by climate change-related events may lead to loss of human life or cause considerable damage, affecting economic growth and prosperity, both nationally and transboundary.

Consensus exists in the scientific community that climate change is likely to increase the frequency and magnitude of extreme weather events. Over the past decades, in Bulgaria, this frequency has increased significantly. The most common hydrometeorological and natural hazards are extreme precipitation and temperatures, storms, floods, wildfires, landslides, and droughts. The number of deaths and victims due to natural hazards is considerable, indicating weather and climate vulnerability. The vulnerability of Bulgaria's population and businesses to the impacts of climate change is accelerated by a relatively high degree of poverty in the most affected areas, the continuing concentration of the country's population in several industrial and urban regions, and various consequences of the transition from a state-controlled economy to a free-market economy. A growing body of evidence suggests that economic losses from climate- and weather-related disasters have also been rising.

Demographic situation relevant to adaptation actions

There is a continuing process of population aging, which results in reduction of the share of the population of ages below 15 and increase of the share of ages 65 and above. According to recent United Nations projections, by 2050, one in three Bulgarians is projected to be older than 65 and only one in two Bulgarians will be of working age. Because the proportion of the

population that works is a key determinant of a country's income level, its decline is likely to depress growth. The higher productivity grows, the easier it will be for Bulgaria to manage this demographic challenge. The World Bank Group estimations show that productivity will need to grow by at least 4 percent per year over the next 25 years for Bulgaria to catch up with average EU income levels and thus, boost prosperity.

In 2017, Bulgaria's population was 7,050,034 with people over 65 years accounting for 21 percent of the total. A recent EuroStat survey found that, in 2017, 35 percent of the population (2.5 million Bulgarians, mainly aged below 15 and over 65) is living in poverty. Thus, a serious challenge to the social development of the country is the risk of poverty and social exclusion, which is above the EU average. This unfavorable demographic situation is not only affecting economic development but is also placing a high burden to the national health system threatening its financial stability.

From a regional development perspective, large disparities still exist between urban and rural areas, and between the development regions in Bulgaria. Problems such as negative natural population growth, migration, poor age structure, low level of employment, and poor infrastructure need to be urgently addressed especially in the northwestern region NUTS 2 level and in smaller settlements. The intra-regional disparities are a major problem to achieving sustainable regional development. The development of key economic sectors like tourism, agriculture, and urban development are hindered by these disparities, and these are also designated among the most vulnerable to climate change.

Economic and infrastructural situation relevant to adaptation actions

Currently, 73.2 percent of the total population lives in urban areas, 46 percent out of which is concentrated in six big cities, including the capital Sofia. This concentration places considerable pressure on the urban infrastructure, environment, and natural resources. The condition of technical infrastructure networks and amenities do not adequately meet urban needs and obstructs the proper functioning of cities. The physical environment and the buildings are worn out, while facilities like roads, pedestrian areas, landscaping, urban centers, and so on, are in poor condition.

Almost 99 percent of the population are supplied with drinking water, but the supply systems within settlements is physically and morally outdated with frequent failures, low efficiency of operation and high losses (of over 60 percent). The availability of sewerage networks and wastewater treatment plants are much less developed than water supply systems. According to Eurostat data from 2016, the share of towns and cities with sewerage systems is 67 percent and rural areas is 3.2 percent.

Another major challenge facing the country's economy is low energy efficiency, which has a negative impact on competitiveness. This is due to the outdated energy infrastructure, leading to significant losses in energy transmission. The use of outdated technologies in production processes also accounts for the low productivity and the high energy intensity of the economy. In addition, the energy sector is challenged by its significant dependence on imported energy resources and rising energy prices. More than 70 percent of its gross consumption of

natural gas, crude oil, and nuclear fuel comes from imports, primarily from Russia.

The instrument for overcoming these gaps in technology—investing in new equipment, technology and know-how—is not sufficiently intensive in Bulgaria. Both the state and private sectors allocate very little financial resources to research and development, which deepens the problem of technological backwardness. According to the national statistics data, the expenditure on research and development (R&D) in 2016 amounted to BGN 734 million (€375 million) which, in terms of R&D intensity, represents 0.78 percent of GDP. This is a considerable decrease compared to 2015 when R&D expenditure showed a relative peak of 0.96 percent of GDP. In 2010, Bulgaria adopted, for the first time, a national target to spend up to 1.5 percent of GDP on R&D by 2020. It is still below the current EU average of 2.03 percent, and far from the EU 2020 standards, under which total expenditure on R&D is to reach at least 3 percent of GDP.

Climate monitoring and modelling framework

Main activities on climate monitoring, modelling, projections and scenarios

Monitoring and Reporting under the National Climate Change Adaptation Strategy 2019-2030 (NAS) and its Action Plan should be a participatory process, which enables capacity building and understanding, as well as applying lessons learned from the activities' experience. It will be performed in accordance with the recently approved Regulation on the Governance of the Energy Union , which incorporates the respective provisions of the existing Climate Monitoring Mechanism Regulation and harmonizes them with those of the Paris Climate Agreement. The monitoring and reporting process shall serve several purposes, as follows:

- Facilitating timely identification and resolution of problems;
- Enhancing the performance of the planned activities;
- Providing the basis for technical and financial accountability;
- Building institutional and local capacity to implement and manage the planned actions successfully; and
- Promoting the identification and dissemination of lessons learned by participants themselves.

Monitoring involves the collection and analysis of data about implemented activities. The data should be easy to understand and will be incorporated in the reports. The monitoring should allow stakeholders to keep track of the activities, to determine whether the objectives are being achieved and to make whatever changes are necessary to improve the performance (an outline of the requirements of performance indicators is given in Section 6.2).

Projections - Scientific projections indicate that global temperature will rise between 1.8°C and 4°C by 2100, with the temperature increase in Europe expected to be even higher than the estimated global average.

Research conducted by the Department of Meteorology, National Institute of Meteorology and Hydrology at the Bulgarian Academy of Sciences (NIMH-BAS), projects an increase in annual air temperature in Bulgaria of 0.7°C to 1.8°C by 2020. Even warmer temperatures are expected by 2050 and 2080, with projected increases of 1.6°C to 3.1°C and

2.9°C to 4.1°C, respectively. Generally, the temperature increase is expected to be more significant during the summer season (from July to September).

In terms of the expected changes in rainfall patterns, a reduction in precipitation is likely, leading to a significant reduction of the total water reserves in the country. In this regard, projections suggest a decrease in precipitation by approximately 10 percent by 2020, 15 percent by 2050, and up to 30 percent to 40 percent by 2080. In most climate change scenarios, rainfall during the winter months is likely to increase by the end of the century, but significant decrease in rainfall during the summer months is expected to offset this increase.

According to the available climate change scenarios for Bulgaria, there is a trend toward increased frequency of extreme events and disasters, as demonstrated by frequent occurrences of heavy rainfalls, heat and cold waves, floods and droughts, hurricane winds, forest fires, and landslides.

Biodiversity, land and aquatic ecosystems, as well as water resources, agriculture, and forestry sectors are expected to be affected by the anticipated changes. These changes would furthermore affect society and its citizens as well as the economy as a whole.

Climate change impacts do not affect all people and territories equally due to different levels of exposure, existing vulnerabilities, and adaptive capacities to cope. The risk is greater for the segments of the society and businesses that are less prepared and more vulnerable.

Main approaches, methodologies and tools, and associated uncertainties and challenges

This National Climate Change Adaptation Strategy fills in a gap in the Bulgarian climate change policy by mapping out the country's approach for adapting key sectors of the economy to a changing climate. It is the reference document outlining the strategic framework and priorities with regard to climate change adaptation up to 2030. The Strategy is supported by in-depth vulnerability and risk assessments and highlights key priority areas for action on this basis. It is complemented by an Action Plan setting goals and priorities for improving capacity to adapt, formulating climate change adaptation measures per sector, providing a timeline for implementation of these measures, and pointing out the necessary resources and responsible institutions.

The adaptation action will aim at building resilience of the society and businesses which are able to make timely and well-informed decisions to address challenges and opportunities presented by a changing climate. The vision for such a society has driven the set of general objectives in the Strategy and the choice of adaptation actions related to awareness rising, institutional and capacity building, and mainstreaming of climate change adaptation into the sectoral policies.

The overall strategy of the climate change adaptation process follows and accepts the mission statements of all involved ministries. The long-term objective of the NAS is to proactively pursue long-term high-impact economic, social, and ecological resilience and sustainability, to allow Bulgaria's citizens, private sector, and public institutions to adequately

prepare and protect themselves against vulnerabilities deriving from climate change’

Raising awareness and general education on climate change is, among others, an essential pre-condition for good adaptation. The sectoral analyses performed showed that in Bulgaria the degree of awareness and its implications on the economy is still very low. Overall, people recognize that adaptation to climate change is an urgent matter. However, they have very little knowledge on the implications of changing local microclimates and the measures that could be taken. Generally, local citizens are not aware of what is climate adaptation and why is it so important for the economy and for their cities in the longer term. They also do not have a clear view of how they are contributing to the problem and what they can do to reduce their own impact on the living environment. Therefore, further efforts are needed to improve the degree of awareness among local communities. This is closely linked to the need of providing better education in natural sciences, as well as introducing climate change issues in the curricula at all scholar levels.

Sharing information is an essential tool for building adaptation awareness. Information on climate change, impacts, and possible adaptation actions should be formulated in a user-oriented way to reach different audiences. Various formats for communication exist and have proven to be useful in other countries, such as personal consultations, Internet communication/platforms, and mass media to spread information on climate change, impacts, and possible adaptation actions.

A national web portal gathering tailored information on climate change, including on adaptation of various sectors, could be an excellent tool for disseminating relevant information. Such platform should be connected with other existing portals on sectoral policies (for example, water, biodiversity, forestry) and disaster risk prevention/management. A public repository of data, tools and analyses developed for this Strategy (MCA, CBA, and so on) could be created to serve both the decision-making process and further capacity building in climate change adaptation.

This approach would be fully in line with one of the main priority pillars of the NDP BG2020 which outlines a broad package of measures for the development of e-governance (including achieving an “inter-connected administration”, optimization of information and communication resources through remote access to shared sources, building and maintenance of a National Information Centre, public repositories and so on).

Inter-institutional coordination

Currently in Bulgaria, in addition to the MoEW, a large number of ministries and other institutions, and municipalities, have responsibilities in relation to climate change adaptation. Respective capacity building measures should be envisaged to enable effective communication throughout the Strategy implementation process. Establishing a national portal with reliable climate-related data and information, as well as a repository of tools, analyses and reports developed under this Strategy would in this respect be instrumental

The complexity and cross-cutting nature of climate change adaptation requires that continued and enhanced attention is paid to ensuring efficient communication and coordination within and between the organizations involved if adaptation is to be carried out as effectively as possible. According to the CCMA, the MoEW is responsible for the facilitation of coordinative

action, with other public institutions responsible for full and constructive cooperation in this adaptation coordination process.

The MoEW will be supported in this endeavor by the National Expert Council on Climate Change. Sector-specific working groups (WGs) may be established to coordinate implementation of concrete adaptation actions. The Coordination Council on Climate Change is the best placed platform to build on cooperation at the decision-making level.

Observed climate hazards

Temperature-related - acute

Temperature-related - acute - Heat wave, Temperature-related - acute - Wildfire

Wind-related - acute

Wind-related - acute - Storm (including blizzards dust and sandstorms)

Water-related - acute

Water-related - acute - Drought, Water-related - acute - Flood (coastal fluvial pluvial ground water)

Solid mass-related - acute

Solid mass-related - acute - Avalanche, Solid mass-related - acute - Landslide

Temperature-related - chronic

Temperature-related - chronic - Changing temperature (air freshwater marine water),
Temperature-related - chronic - Temperature variability

Wind-related - chronic

Wind-related - chronic - Changing wind patterns

Water-related - chronic

Water-related - chronic - Changing precipitation patterns and types (rain hail snow/ice), Water-related - chronic - Precipitation and/or hydrological variability

Solid mass-related - chronic

Solid mass-related - chronic - Coastal erosion, Solid mass-related - chronic - Soil erosion

Overview of existing pressures

The main vulnerabilities to climate change are at the different levels of BD&ES. In Bulgaria are summarized as follows:

Loss of genetic diversity. Genetic diversity is subject to threats posed directly by climate change on vulnerable/endangered species (including endemic species with a limited range and opportunities for migration) that may be lost forever. There are also indirect climate change induced effects due to competition for resources between biodiversity and human activities that cause an increase of other pressures (such as water extraction, overexploitation of rare species by vulnerable population groups, land-use change, and fragmentation by infrastructure).

Disruption of species lifecycles and phenological phases. Climate change can affect the life cycles and breeding periods of species, within ecosystems, to affect populations and processes in the ecosystem (food chains and competition for resources), including by invasion of invasive species which compete with native species and replace them from traditional niches, therefore, changing the ecosystem's integrity. Invasive species may also bring opportunities for climate change adaptation (CCA) if used as an indicator in an early warning mechanism or if they are commercially important and contribute to providing ecosystem services.

Deterioration of habitats. The possible consequence of climate change is the deterioration of habitats in the categories of critically endangered, endangered, vulnerable, and nearly threatened as included in the Red Data Book of the Republic of Bulgaria, Habitats (BAS 2011). In particular, high-altitude habitats are vulnerable to these changes.

The energy sector will be among the sectors in Bulgaria that will be affected by climate change. Bulgaria is already exposed to a variety of natural hazards, including floods, droughts, forest fires, earthquakes, and landslides. Increased temperatures, reduced precipitation, changes in river flows and ecosystems and extreme events have caused some damage and disruption to the energy sector. In recent years, extreme weather events have caused some damage and disruption to the energy sector, which has knock-on consequences for other sectors. However, these events have not significantly affected energy infrastructure to date and have mostly led to damages in the electricity grid and temporary power cuts. An increase in the frequency and intensity of such weather events is likely to pose challenges to the sector in the future. Energy infrastructure is vulnerable to a range of climate stressors, including temperature, precipitation, sea-level rise, and extreme events. Specifically, climate change is expected to change the intensity, frequency, and distribution of extreme heat, precipitation, and storms, exacerbating the vulnerability of energy infrastructure. Climate change risks and vulnerabilities for each of the elements of the energy system in Bulgaria are identified in the energy sector assessment report.

There are a wide range of likely interlinked impacts in urban areas from future climate events. These include damage to buildings and urban infrastructures, health effects, endangered key services including food supply and electricity, reduced mobility and accessibility and water stress, as well as increased financial pressures on municipalities for maintenance of infrastructure and on emergency aid facilities and staff. Overall, climate change will have a larger-scale impact in big cities. More vulnerable to extreme weather events will be their central urban areas with higher density, intensive traffic, reduced green and open spaces, and old infrastructure with limited capacity. Extreme weather events will also affect more significantly

vulnerable groups including those living below the poverty line, in poor standard housing, the homeless, the elderly, and the sick.

Identification of key future climate hazards

Temperature-related - acute

Temperature-related - acute - Heat wave, Temperature-related - acute - Wildfire

Wind-related - acute

Wind-related - acute - Storm (including blizzards dust and sandstorms)

Water-related - acute

Water-related - acute - Drought, Water-related - acute - Flood (coastal fluvial pluvial ground water)

Solid mass-related - acute

Solid mass-related - acute - Avalanche, Solid mass-related - acute - Landslide

Temperature-related - chronic

Temperature-related - chronic - Changing temperature (air freshwater marine water),
Temperature-related - chronic - Temperature variability

Wind-related - chronic

Wind-related - chronic - Changing wind patterns

Water-related - chronic

Water-related - chronic - Changing precipitation patterns and types (rain hail snow/ice)

Solid mass-related - chronic

Solid mass-related - chronic - Soil degradation (including desertification)

Secondary effects of the selected hazards, such as forest fires, spread of invasive species and tropical diseases, cascading effects, and multiple hazards occurring at the same time

Affected Sectors (10)

Title of the sector

agriculture and food

Observed impacts of key hazards, including changes in frequency and magnitude

high

Describe your assessment

Agriculture is one of the most vulnerable sectors of the Bulgarian economy. The agriculture sector is highly vulnerable to the impacts of climate change, as a provider of adequate food, pillar for economic growth, deliverer of ecosystem services, and provider of a safe living environment for rural communities. Bulgarian agriculture is inextricably tied to climate, as three-quarters of agricultural outputs is derived from crops. Agricultural land occupies one-third of Bulgaria's total area, from which 86 percent of the utilized agricultural area (UUA) is used mainly to grow cereals and industrial crops. The impact of extreme weather events and anomalies on agricultural productivity and the overall economy was best witnessed in the drought year 2007: the share of agriculture to the gross domestic product (GDP) dropped to 4.7 percent compared to 2006 (6.2 percent) and 2008 (6.0 percent). The crops that experience the most severe impacts are typically rain-fed crops grown in the traditional summer season, such as maize, sunflower, fruits, and vegetables.

Likelihood of the occurrence of key hazards and exposure to them under future climate

high

Describe your assessment

Climate change will be a significant factor in future development of Bulgarian agriculture; the first negative impacts are already a reality. The frequency and intensity of climatic adverse events have increased during the last decades: three distinct periods of droughts have been experienced and more frequent floods caused by prolonged and intense rainfalls are being regularly encountered, yet difficult to predict. Temperature increases from 2°C to 5°C and significant changes in precipitation patterns are projected by the end of this century. Climate change scenarios for Bulgaria indicate an increased frequency of climatic adverse events, such as longer droughts, heat waves, heavy rainfalls, and floods.

Global climate change has substantially increased the probability of various recent extreme weather and climate events in Europe. Improved climate projections provide further evidence that the frequency of such events will intensify, with significant impact on ecosystems

and societies. The impacts of climate change across regions in Europe are not uniform. Climate change impacts do not affect all people and territories equally due to different levels of exposure, existing vulnerabilities, and adaptive capacities to cope. Southeastern and southern Europe are projected to be hotspot regions, having the highest numbers of severely affected sectors and domains. The risk is greater for the segments of the society and businesses that are less prepared and more vulnerable. Bulgaria is situated in one of the regions that are particularly vulnerable to climate change (mainly through temperature increase) and to the increased frequency of climate change – related extreme events, such as flash floods and droughts.

Vulnerability, including adaptive capacity

high

Describe your assessment

The vulnerability to climate change is worsened by insufficient agricultural extension services and inadequate information flows from results of research, policy, and market developments related to the farming community. While individual sectors of agriculture are represented at the national level by associations and despite a relatively large network of research institutes, the missing agriculture extension services lead to knowledge gaps among the farming community about the vulnerabilities and options to improve resilience to climate change.

Bulgaria is missing a risk management framework for agriculture. The insurance sector lags the EU-28 average, with the participation rate of 2.1 percent per capita income compared to 7.6 percent in case of most European countries. Bulgarian agriculture insurance is limited to hail, while losses from drought and floods are not covered. Given the lack of access to credit, smallholders try to diversify their production to reduce revenue variability, rather than purchase insurance.

Risk of potential future impacts

high

Describe your assessment

Most climate models simulate an increase in air temperature in Bulgaria from 2°C to 5°C by the end of the century. The projected changes in temperature and precipitation, as well as potential related climate extremes in AR5 (IPCC 2013) show, that depending on the scenario, the average air temperature will increase by 2081–2100, compared to the norm from 1961 to 1990 by 2°C (RCP2.6) to 7°C (RCP8.5), or by 3°C (RCP4.5) to 4°C (RCP6). Winters classified as cold under the current climate will occur less often in the 2020s and will probably disappear by 2080s. In contrast, hot summers will occur more often and almost every summer is expected to be unusually hot in the 2080s. In 2014, the Department of Meteorology of the NIMH-BAS

conducted a research that projects an increase in annual air temperature in Bulgaria of 1.6°C–3.1°C by 2050 and of 2.9°C–4.1°C by 2080.

In most climate change scenarios, rainfall during the winter months is likely to increase by the end of the century. However, significant decrease in rainfall during the summer months is expected to offset this increase. The projected changes in precipitation in AR5 (IPCC 2013) show fluctuations in annual rainfall averages within 10 percent and 10–20 percent. All climate models predict that after 2065 and until the end of the century rainfall in the summer will decrease by 10–20 percent and according to RCP8.5 until 2081–2100 it can reach 30–40 percent. The results from the studies of water resources in Bulgaria, based on current trends of air temperature and precipitation as well as on simulation models and climate scenarios show that the overall annual river runoff is likely to decrease during this century.

Climate change scenarios for Bulgaria indicate an increased frequency of extreme events and disasters, such as droughts, heat waves, heavy rainfalls, and floods. The analysis of the expected extreme weather events, based on the use of temperature and precipitation indexes in AR5, shows that the number and intensity of dry and hot periods in summer will increase in the country, droughts and floods will occur with greater frequency, and torrential rainfall and dangerous natural phenomena and processes associated with these changes will occur. The northeast, southeast, and Thrace regions will be the most affected from these events.

Title of the sector

biodiversity (including ecosystembased approaches)

Observed impacts of key hazards, including changes in frequency and magnitude

medium

Describe your assessment

According to climate projections, droughts and extreme climate-related phenomena (storms, floods, landslides, winds, hailstorms, and so on) can be expected in the medium term, along with an increase of the vegetation period. Along with seasonal extreme temperature differences, large temperature differences on a daily basis can cause temperature shocks for species in the country. As a result, in the short term, adverse effects can be expected at all levels of ecosystems. Genetic diversity may be reduced due to the disappearance of endangered species—specialists and endemic species with a limited range and opportunities for migration. Climate change can also affect the life cycles and breeding cycles of species, within ecosystems, to affect populations and processes in the ecosystem (food chains and competition for resources), including by invasion of invasive species. These numerous manifestations of climate change are expected to have different impacts on different types of ecosystems and affect

biodiversity and ecosystem services in a range of ways including in an abrupt and even catastrophic manner. On the other hand, the projected annual increase in average temperatures may help the adaptation by extending the vegetation periods and allowing for the migration of species in natural ecosystems or the controlled introduction of species for agriculture, green infrastructure, or other adaptation purposes.

Likelihood of the occurrence of key hazards and exposure to them under future climate

medium

Describe your assessment

Droughts are projected to be the most common impact due to climate change in Southern Europe, including Bulgaria. The adverse effects of droughts on BD&ES are very serious because of the potential for regime shifts. Changes in the water habitats of the lowlands can be disastrous—the water bodies are completely or largely dry, the river beds have been changed, and many riverside habitats destroyed. Many new artificial water bodies and irrigation systems have been built and some plant communities together with their accompanying fauna have colonized them. At the same time, floods caused by short-term, heavy precipitations are happening more frequently. This very high dynamic between drought and wet periods with heavy precipitations also has adverse effects on wider BD&ES.

In addition to temperature extremes, other weather-related events are projected to be increasingly frequent. These include floods, storms, and forest fires. The highest environmental risks for BD&ES services that may be related to climate change were posed by the increased incidence and severity of floods and dry periods, storms, and forest fires.

Key impacts of climatic trends in Bulgaria and the effects on BD&ES services include the following:

There is a strong tendency towards increasing the maximum summer air temperatures and the number of tropical nights (with a minimum temperature above 20°C), as well as increase in the length of the dry periods.

Large seasonal and diurnal temperature fluctuations are observed, and this does not act favorably for adaptation of different levels of biodiversity in the long term.

The largest decrease in rainfall is expected in the summer (10 to 30 percent) and winter precipitation is expected to be up to 10 percent higher than in the reference period.

The results obtained for the analyzed expected changes in the temperature values during the growing period (average daily temperature > 5.0°C) show an increase in the values of the indicator for all scenarios and for all future periods. During 2016–2030, the growing period is expected to increase from 10 to 20 days in Northeastern and Southern Bulgaria compared to the reference period and from 20 to 30 days in the rest of the country. Under the RCP8.5 scenario, this increase is expected to be over 50 days for most of the country.

Vulnerability, including adaptive capacity

medium

Describe your assessment

Policies such as improving air quality; reducing nitrate pollution, waste, noise, and stress for biodiversity; and avoiding overexploitation of resources will enhance the adaptive capacity of BD&ES to climate change. To this end, we identify two adaptation options: Assessment of the carrying capacity of ecosystems (the limits of all pressures in each location that would not impair ecosystem functioning) and the ecosystems' capacity to produce ecosystem services; and Use of regional/local data for local projections and effectively tracking pressures.

Using the 'invisible ecosystems' for adaptation and human benefit. Healthy ecosystems provide more ecosystem services to society. Protecting biodiversity in synergy with the other options outlined above, allows the efficient use of undervalued ecosystem services—both regulatory and cultural. They have the potential to reduce the adaptation costs and support the development of the local economy, including in the priority tourism sector. This group consists of four adaptation options: (1) the use of genetic resources for adaptation; (2) increasing the role of cultural ecosystem services for recreation and tourism; (3) the long-term business opportunities arising from ecosystem restoration projects; and (4) the benefits to local communities from local 'production' of ecosystem services that provides both employment and welfare.

Risk of potential future impacts

medium

Describe your assessment

Scientific projections indicate that global temperature will rise between 1.8°C and 4°C by 2100, with the temperature increase in Europe expected to be even higher than the estimated global average.

Research conducted by the Department of Meteorology, National Institute of Meteorology and Hydrology at the Bulgarian Academy of Sciences (NIMH-BAS) projects an increase in annual air temperature in Bulgaria of between 0.7°C and 1.8°C by 2020. Even warmer temperatures are expected by 2050 and 2080, with projected increases of between 1.6°C and 3.1°C and between 2.9°C and 4.1°C, respectively. Generally, the temperature increase is expected to be more significant during the summer season (from July to September).

In terms of the expected changes in rainfall patterns, a reduction in precipitation is likely, leading to a significant reduction of the total water reserves in the country. In this regard, projections suggest a decrease in precipitation by approximately 10 percent by 2020, 15 percent

2050, and up to 30–40 percent by 2080. In most climate change scenarios, rainfall during the winter months is likely to increase by the end of the century, but significant decrease in rainfall during the summer months is expected to offset this increase.

According to the available climate change scenarios for Bulgaria, there is a trend toward increased frequency of extreme events and disasters, as demonstrated in more often occurrences of heavy rainfalls, heat and cold waves, floods and droughts, hurricane winds, forest fires, and landslides.

Biodiversity, land and aquatic ecosystems, as well as water resources, agriculture, and forestry sectors are expected to be affected by anticipated changes. These changes would furthermore affect society and its citizens, as well as the economy.

Climate change impacts do not affect all people and territories equally due to different levels of exposure, existing vulnerabilities, and adaptive capacities to cope.

Title of the sector

energy

Observed impacts of key hazards, including changes in frequency and magnitude

medium

Describe your assessment

Climate change is of significant importance for energy security not only because floods and natural disasters can damage power plants and power lines, disrupt the supply of fuels to electricity generation facilities and destroy renewable energy infrastructure, but also because they have a strong impact on food security and health. Energy plays a major role in maintaining all aspects of modern life. The smooth functioning of social and political systems, as well as economic growth and sustainable development, is essential. Ensuring a reliable energy supply, which will also be able to meet demand in the face of a changing climate, will become a growing challenge in the future.

The energy sector shall face numerous threats from climate change, in particular extreme weather events and increasing pressure on water resources. Greater resilience to the impacts of climate change will therefore be essential for the technical viability of the energy sector and its ability to meet energy demand in a cost-effective way. Energy stakeholders, including governments, regulators, energy companies and financial institutions, will need to identify the challenges of resilience to climate change and adaptation and identify the actions needed to address these challenges.

Likelihood of the occurrence of key hazards and exposure to them under future climate

medium

Describe your assessment

Changes in climate and weather extremes will affect the energy sector both positively and negatively, though negative impacts prevail. Energy infrastructure is vulnerable to a range of climate stressors, including temperature, precipitation, sea level rise, and extreme events. Specifically, climate change is expected to change the intensity, frequency, and distribution of extreme heat, precipitation, and storms, exacerbating the vulnerability of energy infrastructure. According to all climate change scenarios, projections for Bulgaria show increasing temperatures and decreasing summer precipitation by the end of the current century, therefore an associated increase in the number of dry spells and droughts. Power plants will experience some reduction in output as higher air and water temperatures affect the efficiency of their cooling systems. In the medium term, thermal power (thermal power plant [TPP] and nuclear power plant [NPP]) is expected to be the main contributor to electricity generation in Bulgaria (80 percent of electricity generation in 2024), hence the importance of addressing climate change risks to generation assets. Warming temperatures due to climate change may create favorable conditions for some invasive species that can damage energy infrastructure. Transmission lines already face damage and disruption from extreme precipitation, floods, and winter storms. Climate change will likely lead to higher numbers of disruptions: exposed cables/trunk routes due to erosion or damage of transportation infrastructure, increased transmission line losses, increased damage to aboveground infrastructure from extreme storms and wind. Hydropower generation is likely to suffer from reduced precipitation, particularly in the summer season due to changing climate patterns.

Climate change has the potential to affect energy demand through changes in demand for heating and cooling. Projected increases in summer temperatures will result in increased use of air conditioning. Since the beginning of the 1980s, Europe has started experiencing a markedly declining overall trend in heating degree days (HDDs) and a markedly increasing trend in cold degree days (CDDs), pointing to a general increase in cooling needs and a general decrease in heating needs.

Vulnerability, including adaptive capacity

medium

Describe your assessment

The vulnerability and risk analysis shows that the energy sector will be among the sectors in Bulgaria that will be affected by climate change. Bulgaria is already exposed to a variety of natural hazards, including floods, droughts, forest fires, earthquakes, and landslides. Increased temperatures, reduced precipitation, changes in river flows and ecosystems, and extreme events have caused some damage and disruption to the energy sector. Fortunately, extreme

weather events have not significantly affected the energy infrastructure to-date and have mostly led to damages in the electricity grid and temporary power cuts. However, given the importance of energy infrastructure and supply to other sectors, through their use of energy, even minor outages can have cascading consequences and amplify the initial impact. An increase in the frequency and intensity of such weather events is likely to pose challenges to the sector in the future.

Therefore, the challenges that Bulgaria must meet are immense and colored with uncertainty. To reduce the vulnerability of the sector, there is a need to direct efforts to reducing energy intensity and energy dependence of the country while at the same time improving its energy security.

Risk of potential future impacts

medium

Describe your assessment

Climate change is a substantial energy security concern not only because direct flooding and natural disasters can damage power plants and transmission lines, disrupt the delivery of fuels to power generation facilities, and destroy renewable energy infrastructure but also because it has severe impacts on food security and health. Energy plays a fundamental role in supporting all aspects of modern life. It is essential to the smooth running of social and political systems as well as to economic growth and sustainable development. Ensuring a reliable energy supply, which will also be able to satisfy the demand in a changing climate, will become a growing challenge in the future.

The energy sector faces multiple threats from climate change, in particular from extreme weather events and increasing stress on water resources. Greater resilience to climate change impacts will therefore be essential to the technical viability of the energy sector and its ability to cost-effectively meet the energy demand. Energy sector stakeholders, including governments, regulators, energy companies, and financial institutions will need to define climate change resilience and adaptation challenges and identify actions needed to address these challenges.

Title of the sector

forestry

Observed impacts of key hazards, including changes in frequency and magnitude

low

Describe your assessment

According to the Sixth National Communication on Climate Change (2013), in the years between 1988 and 2011, the Land Use, Land Use Change, and Forestry (LULUCF) sector of Bulgaria compensated about 12 percent of the total GHG emissions of Bulgaria. There was a highly varying share mostly due to strong reduction of GHG emissions in the country which dropped from 105 million tons CO₂ equivalent in 1990 to 55 million tons CO₂ equivalent in 2014 (EUROSTAT report). The highest share for the absorption of GHGs was forests, which accounted for 93 to 95 percent under the LULUCF emissions assessment. The total estimated carbon stock of Bulgarian forests is 202 million tons, which together with the accumulation in the soils and forest floor litter amounts to 733 million tons (Raev et al. 2011). Following the Paris 2015 Agreement, that was ratified by Bulgaria, the role of forests for the absorption of GHGs has to increase in the next few decades. In the agreement the forest sector was accorded prominence, through a specific clause (Article 5) dedicated to reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks. At present, deforestation is not a problem in Bulgaria. The potential beneficial role of the forest sector is high, because forests are among the most important carbon sinks in the agreement. Governments and forest sector stakeholders should reach an understanding on the role of forests and land-use planning and management in meeting their national long-term climate change mitigation and adaptation goals.

Likelihood of the occurrence of key hazards and exposure to them under future climate

medium

Describe your assessment

The future development of the forestry sector is largely dependent on several simultaneous processes, the general policy of the governments for the forests role and management, climate change effects, land use and land-use change effects, and timber processing industry and market evolvement. Policy is reflected in various legal acts and especially in the National Strategy for Development of the Forest Sector in the Republic Bulgaria (NSDFSRB) 2013–2020 and provide the basis for the solid role of the forest and continuous growth of the importance of the Bulgarian forests for the national economy and environment. The main priorities of this strategy are:

- sustaining vital, productive and multifunctional forest ecosystems, contributing to the mitigation of the effects of the climate changes;
- protection, restoration, and maintenance of the biological and landscape diversity in the forest territories;
- increasing the vitality and competitiveness of the forest sector; and
- usage of the forest sector potential for the development of the green economy. The 20

operational targets (OTs) of this strategy are based on the expectation of increase in the forest area, growing stock and carbon storage, improvement of management strategies, protection of genetic diversity and biodiversity, and general increase of forest resilience to the various biotic and abiotic challenges for the forests. The overall forest area is expected to increase slightly, mostly due to plantations in eroded lands and abandoned agriculture lands. While the forest area cannot grow substantially due to land-use restrictions, the growing stock and hence, carbon accumulation is expected to increase in the next decades mostly due to growth of the currently young forests. The expected increase in the total growing stock is to 743.5 million m³ in 2020 and 812 million m³ in 2030, which is about 20 percent of total increase compared to 2015.2 The amount of stored carbon in trees is expected to increase to 264 million tons of carbon in 2020 and 288 million tons of carbon in 2030. The main risks for the overall forest state, growing stock, and ability to serve various ecosystem services are related to the potential negative effects of climate change, which are listed in sub-chapter 1.3. There is high uncertainty linked to some of these effects and their magnitude.

Vulnerability, including adaptive capacity

medium

Describe your assessment

There are several groups of vulnerabilities in the context of climate change.

- High uncertainties for species-specific responses to modified climate conditions;
- Large areas with coniferous plantations at too low elevations and related to this, the potential for growth decline and various health problems;
- Increased probabilities of large fires and other disturbances such as windthrows, damages from wet snow and ice, attacks from insects;
- Improved conditions for invasive species with high potential for considerable damages to forests;
- High prevalence of firewood as a timber product that contributes little economic value to the economic sustainability of the sector and its ability to self-fund resilience actions and sequester carbon.

Bulgaria engages in several adaptation measures. These include the following:

Conducting research, education, capacity building, and knowledge extension to provide a solid foundation for informed decision-making process and adaptive management. Building resilience in regenerating, expanding, and strengthening forest resources to increase resilience of forests and meet challenges in recovery operations and higher demand of wood; Building and maintaining systems to cover national rapid forest fire detection, long-term disturbance monitoring, and forest resource monitoring and in this way minimizing the losses from disturbances and enabling proper management planning and adaptation of forests in areas with the highest risks:

Improving the potential for long-term use of higher-valued wood products and in this way,

raising the revenues from wood-processing industries.

Risk of potential future impacts

medium

Describe your assessment

For Bulgaria, scientific projections indicate that climate change will be associated with increase in temperature, warmer winters and more summer droughts. At the same time, the number and magnitude of extreme climate events such as prolonged or short-lived periods of intense heat or cold, severe storms, wet snow, and ice accumulation are expected to increase. This will reduce forest health and tree growth, increase attacks from insects and fungi, including invasive species and cause serious losses due to fires and storm-related damages. This could contribute to very high economic losses, degradation of the ability of forests to sequester carbon and affect the quality of life in Bulgaria by reducing the delivery of valued ecosystem services. According to one study (Expected Climate Change and Options for European Silviculture [ECHOES]), wood growth could be reduced by up to 3.5 million m³ per year. This is equivalent to 42 percent of the annual harvest and would have a devastating effect on the primary production of forest products and the rural economy. Impact of a similar scale could be expected on the forests' ability to protect drinking water supplies, attenuate extreme rainfall and flooding, stabilize vulnerable soils and slopes, facilitate a growing recreation and tourism sector, capture carbon, and support a rich resource of natural biodiversity. Probably the most important effect of continuous dry and warm periods is the increase of fire risk. The fire statistics of the EFA revealed almost 14,000 forest fires for 1970–2014, with a dramatic increase after 1990. The number of fires that occurred annually in forests peaked at more than 1,000 in several years with dry summers in the last decades (n=1,150 with 10,147 hectares burnt area in 1993; n=1,700 with 58,000 hectares burnt area in 2000 and n=1,400 with 43,000 hectares burnt area in 2007) causing huge economic losses. A recent analysis of historical data (Panayotov et al. 2017) revealed that, although most forest fires were located in the lowlands, in the mountain coniferous forests, there were also extensive fires with burnt territories of more than 500 hectares (up to 10,000 ha) and many of them also occurred in dry years.

Title of the sector

health

Observed impacts of key hazards, including changes in frequency and magnitude

medium

Describe your assessment

Climate change in Bulgaria is manifested by an increase in the average annual air and water temperatures, an increase in over-warming and over-cold rushes, a change in the annual rainfall, an increase in heavy rainfalls, an increase in dry periods, wind, thunder, and snow storms, contrast shifts of weather, river floods, as well as droughts, and UV radiation. These changes affect the bio-status of man and his health in a complex and individual way, depending on various climatic, socioeconomic, health, personal, and other factors.

The numerous, health-influencing factors of the changing climate in Bulgaria can generally be attributed to two broad groups: sudden (such as storms, floods, fires) and gradual, emerging (as changes in heat-humidity, precipitation, and solar conditions).

The health effects of these climate change phenomena can be extremely varied, and in general they can be differentiated as primary and secondary. Primary effects directly affect human health such as, for example, heat waves and cold spells, ultraviolet radiation, and floods. Secondary effects indirectly affect human health through other climatic-influenced factors such as pollen, vector-carriers of diseases (ticks, mosquitoes and phlebotomies), fires, contaminated food, water and air, and compromised crops. The primary and secondary health effects of climate change can be differentiated into the following groups: heat-related morbidity and mortality, extreme weather-related morbidity and mortality, cardiovascular diseases, including Strokes, asthma, respiratory allergies and airway diseases, cancer, vector-borne and zoonotic diseases, foodborne diseases and nutrition factors, waterborne diseases, mental health and stress-related disorders, and neurological diseases and disorders.

Likelihood of the occurrence of key hazards and exposure to them under future climate

medium

Describe your assessment

Uncertainty about future changes in health risks varies significantly across climate-sensitive health issues and regions, depending on the complexity of the causal web linking climate and disease, availability of projections for relevant climatic and non-climatic risk factors, availability of relevant epidemiological data on the cause-effect relationship, and availability of resources for the assessment.

Especially important practical impediment to the application of quantitative risk assessment approaches in CCA assessments are large uncertainties about future exposure scenarios. In general, uncertainties in future climate scenarios are larger for precipitation and wind speed than for temperature, for extreme events than for mean values, and for local characteristics than for average values referring to large geographical regions. Of course, the level of

uncertainties also depends on the data, expertise and resources available in a specific region for developing state-of-the-art regional climate change scenarios. All these variations have important implications for the choice of quantitative or qualitative assessment methods, and for the design of adaptation strategies.

Data collection

Strict procedures and requirements for the data collection of the health status of the population in terms of climate change related morbidity are needed; as are mechanisms to detect diseases through data on socioeconomic determinants of health.

Urgency of adaptation

Because of resource constraints, health managers typically need to prioritize adaptation measures based on their urgency. The National Development Programme Bulgaria 2020 points that the most vulnerable sectors, including health, need to be addressed with priority to limit any economic losses in the long run. None of the guidelines addresses this topic comprehensively enough.

Inventory approach

There is need for development of inventories of adaptation measures/strategies to provide examples for different contrasting types of adaptation, including anticipatory versus reactive adaptation, spontaneous versus planned adaptation, adaptation decisions based on 'monetary and nonmonetary valuation approaches', 'no/low regrets' and 'win-win' adaptation, and integrated approaches to adaptation and mitigation.

Vulnerability, including adaptive capacity

medium

Describe your assessment

In addition to the research needs identified in the individual research categories, there are crosscutting issues relevant to preventing or avoiding many of the potential health impacts of climate change including identifying susceptible, vulnerable, and displaced populations; enhancing public health and health care infrastructure; developing capacities and skills in modeling and prediction; and improving risk communication and public health education. Such research will lead to more effective early warning systems and greater public awareness of an individual's or community's health risk from climate change, which should translate into more successful mitigation and adaptation strategies. For example, health communications research is needed to properly implement health alert warning systems for extreme heat events and air pollution that especially affects people with existing conditions such as cardiovascular disease. Such a risk communication pilot project might demonstrate communication practices that are effective in multiple areas and contribute to a comprehensive strategy for addressing multiple health risks simultaneously.

Other tools are needed and should be applied across multiple categories to close the knowledge gaps, including predictive models to improve forecasting and prevention, evaluations of the

vulnerability of health care and public health systems and infrastructure, and health impact assessments (HIAs).

Risk of potential future impacts

high

Describe your assessment

In Bulgaria, the number of individuals age 65 years and older (who are more susceptible to heat effects) is expected to increase from 12.4 percent in 2000 to 20 percent in 2060.

A standardized definition and methodology for identifying heat-related health outcomes is needed for surveillance and to evaluate temperature-related illness and death.

Based on numerous studies from all over the world, the general conclusions about the expected health consequences of projected temperature changes are the following (Mihaylova 2014):

- A 40 to 60 percent increase in the number of deaths from cardiovascular diseases and strokes in the big cities in summer due to heatwaves and the urban heat island effect;
- A 10 to 30 percent rise in vector-borne morbidity, owing to the vectors' longer vegetation cycle, and particularly that of the I. Ricinus ticks, which transmit the *Borrelia burgdorferi*;
- A 50 to 100 percent increase in the incidence of salmonella infections due to the longer growing period and more favorable conditions;
- A 10 to 100 percent surge in campylobacteriosis infections due to the longer growing period and more favorable conditions. The campylobacteriosis morbidity risk grows further when compounded with higher temperatures and humidity;
- A 10 to 30 percent increase and exacerbation of respiratory diseases due to the higher concentration of carbon dioxide (CO₂), dust, and PM in the air;
- A 10 to 30 percent rise in the number of allergic diseases due to earlier flowering and increased concentration of pollen, spores, and other allergens in the air.

Title of the sector

tourism

Observed impacts of key hazards, including changes in frequency and magnitude

Annex I: 1.3c-i

low

Describe your assessment

Climate change is a reality and already affects tourism. In Bulgaria, this includes weather extremes, declining snow reliability, and storms, with repercussions for tourist arrivals and behavior, and holiday satisfaction. It is important that more stakeholders become aware of the challenges implied in climate change, as well as adaptation risks and opportunities. The mainstreaming of information about climate change vulnerabilities and the sector's contribution to climate change is of great significance to increase the overall level of preparedness.

Likelihood of the occurrence of key hazards and exposure to them under future climate

Drawing upon the best available climate modelling science, Annex I: 1.3c-ii

low

Describe your assessment

Due to its spatially concentrated, weather-dependent, and highly seasonal character, tourism in Bulgaria is vulnerable to climate change. Extreme events that have been observed in the past are expected to become more frequent under scenarios of climate change, including heat waves, intense rainfall events, coastal flooding, and storms. In the short- to medium-term future, ski areas are likely to become economically unviable; in the long-term future, summer temperatures are expected to exceed biophysically acceptable threshold levels, while sea level rise and flooding will cause the loss of coastal areas. Climate change may also become indirectly relevant for tourism, for instance where fresh-water availability becomes more restricted. Climate change thus poses various short- and longer-term threats to tourism in Bulgaria, even though warmer temperatures earlier and later in the year may make the country more attractive in the shoulder season

Vulnerability, including adaptive capacity

low

Describe your assessment

There is considerable growth potential for tourism in Bulgaria as illustrated by important tourism indicators forecasts. However, the sector's current mainstays, beach and winter tourism, are increasingly questioned by climate change. Summer tourism faces a prospect of temperatures increasing beyond optimum levels, as well as heat waves and other extreme weather events such as intense periods of rainfall with associated flooding and landslides. Winter tourism is already suffering from higher temperatures and there is a risk that it will become increasingly unviable in the future.

To reduce the vulnerability of the sector, there is thus a need to diversify the tourism sector while simultaneously reducing its energy intensity and resource dependency. New tourism products may, for instance, include culinary, wine, wellness, or cultural tourism. Tourism

businesses can also expect an extended summer season, with opportunities to attract visitors particularly in early summer and early autumn. Management for reduced resource use, technological innovations, and legislation for new tourist sites and infrastructure can make a major contribution to reducing vulnerabilities related to mitigation and future climate change. To achieve this, the Bulgarian tourism industry, as a whole, and the individual economic units within it must develop strategies and implement legislation. The main risks related to expected climate change and extreme weather events faced by the Bulgarian tourism sector can be summarized as

- Lower number of tourists;
- Shorter winter season;
- Shorter average stay;
- Health problems with tourists;
- Poorer conditions for outdoor recreation;
- Damage of tourist infrastructure and superstructure; and
- Poorer access to tourist destinations.

Risk of potential future impacts

low

Describe your assessment

It is important to note that Bulgaria tends to attract lower-middle-income and older visitors. In 2016, the median age of the Bulgarian population was 42.4 years and the age of domestic tourists is tending to rise in the future. Anecdotal evidence suggests that international tourists are tending to get even older. This is caused mainly by the fact that the Bulgarian tourist product is predominantly lower cost and attracts both pensioners and people from the lower-than-average socio-economic status. All this is making visitors more vulnerable to climate related risks (high summer temperatures and extremely warm days are not comfortable for elderly people) (Gössling et al. 2012). Budget tourists are also more susceptible to cost changes, which can be expected because of mitigation policies (taxes or duties on fossil fuels) (Scott et al. 2016).

For the most part, tourism is unlikely to develop 'differently' because of climate change until 2030, unless there are heat waves or other extreme weather events, which affect short-term behavior (mostly day tourism, which paradoxically may increase beach tourism, for cooling down in the sea). However, there may be daily changes, more tourists in the morning and evening, fewer in the middle of the day. Air-conditioning requirements in hotels may increase. In the longer-term future, after periods of consecutive 'hot' summers (exceeding 35°C for prolonged periods of time), it is possible that a considerable share of elderly travelers reconsiders their destination choice or timing of the visit.

Title of the sector

transport

If sector is 'Other', please explain

-

Observed impacts of key hazards, including changes in frequency and magnitude

low

Describe your assessment

A general review of the climate dynamics is made by Alexandrov et al. (2010) who summarize the main changes to climate in recent years in Bulgaria. Some of the factors, which potentially affect the transport sector are as follows:

- since the 1990's the average annual temperatures have increased;
- since the middle of the 1990's the annual volumes of rainfall have increased in most regions of the country;
- the frequency of extreme weather events has increased;
- the notable increase of the average number of days with rainfall of more than 100 mm;
- the number of registered cases of extreme rainfall has increased;
- the frequency of storms and hails between April and September has increased.

Likelihood of the occurrence of key hazards and exposure to them under future climate

medium

Describe your assessment

The Risk and Vulnerability Assessment states that the high resilience of the transport sector is due firstly, to the expected moderate climate change to 2035 and secondly, to the transport system being designed and constructed with consideration of the local climate conditions. The study concludes that no drastic climate change impact is expected in the short-term on the transport system and on the level of its economic efficiency

- In the mid- and long-term, climate change is expected to impact most strongly the development and costs of road and railway transport;
- The impact would mainly consist of rise of maintenance and infrastructure construction costs as a result of the expected increase of thermal stress on the road and railway infrastructure;
- Serious adaptations costs are required to handle the issues due to thermal stress –

annual increase of adaptation costs by 0.4 to 0.6 percent per year for road cover until 2070, and by 83 percent in total for the railway transport;

- Because of milder winter conditions in winter months, winter road maintenance costs are expected to decrease by 2.4 percent annually for the period 2040–2070;
- Extreme weather events are of local significance and it is expected that they would have a significant impact on operational costs and a lesser impact on the functioning of the transport system as a whole.

Vulnerability, including adaptive capacity

low

Describe your assessment

- Extreme heat affects asphalt concrete pavements by softening their binding component – bitumen. This decreases the bearing capacity of the pavement and, combined with the load from the vehicles, may lead to its deformation and the formation of ruts. Furthermore, the combination of high heat and sunlight results in increased oxidation of bitumen, which makes it less elastic.
- Extreme cold also has an adverse effect on asphalt concrete pavements, as it makes bitumen less elastic, resulting in the formation of surface cracks. Extreme cold negatively affects the vehicle fleet. Mainly, it reduces the output of car batteries and may result in them becoming unable to start vehicle engines. And even bigger problem is that extreme cold may cause failures to traffic management equipment that is part of the transport infrastructure.
- Regarding railway infrastructure, extreme heat is known to cause rail buckling. Regarding extreme heat, the RVA from 2014 notes that the adaptation costs for dealing with thermal stress for both roads and railways will be substantial.
- Railway signaling, and telecommunication equipment is particularly vulnerable to cold – most notably the railway switches, which are prone to freezing. For this reason, heaters are installed to keep the switches at temperatures above freezing. Even in this case, however, freezing is possible at locations where the traffic is high and chunks of ice fall from passing trains on the switches.

The list of adaptation options identified is long, and could nevertheless be further extended, especially after collecting historical data and carrying out mode-specific studies. However, in the short term, most important seems to be to focus the efforts on adaptation options that aim at building adaptive capacity. The reason is that on the one hand these are relatively easy to implement, and on the other hand provide a suitable basis for development and implementation any other adaptation options.

Risk of potential future impacts

medium

Describe your assessment

Direct consequences of a lack of systematic studies on the longer-term impacts of climate change, specifically in the Bulgarian transport sector, are not only the relatively low climate change interest among transport sector stakeholders, but also a stronger focus on short term actions as a response to emergencies rather than developing strategies and long-term action plans to address future problems. This results in a relatively low adaptive capacity of the sector. The lack of availability and quality of statistical data over a longer period, required to support the planning process, is another barrier for setting sound programs that can address the challenges that the transport sector faces and is expected to further and increasingly face. Although a positive trend was observed, much remains to be done in pursuing a more systematic approach and understanding of Climate Change issues and their importance by stakeholders.

Title of the sector

Urban

Observed impacts of key hazards, including changes in frequency and magnitude

high

Describe your assessment

The 'Risk and Vulnerability Analysis and Assessment of the Bulgarian Economic Sectors to Climate Change' (2014) implements six types of urban environment components in terms of their functions and type of buildings by height: (a) Areas with high-rise buildings, complex type; (b) Areas with medium height buildings; (c) Areas with low-rise buildings; (d) Industrial zones; (e) Green and recreational areas; and (f) Areas for public services. For the purposes of the current assessment, these components are further developed to determine potential climate impact and vulnerability of different functional zones, public services, transport, and technical infrastructure and buildings.

Likelihood of the occurrence of key hazards and exposure to them under future climate

high

Describe your assessment

The potential impact of climate change on the urban environment is examined through the identified weather-related events which are most likely to occur in different regions and cities—extreme temperatures (high and low), intensive precipitations, and because of them, floods and landslides, and urban water and air pollution. Prioritization of the risks considers the complexity of the urban environment, impact of different groups of factors, variety of urban settings, and urban morphology.

Appropriate CCA of cities and risk-based urban planning will reduce the pressure on human health, will make people live longer, and provide them with a better life. The most important challenges for the adaptation of the urban environment in Bulgaria will be information exchange and knowledge communication, capacity development, and awareness raising among decision makers and the public.

The 'Risk and Vulnerability Analysis and Assessment of the Bulgarian Economic Sectors to Climate Change' (2014) implements six types of urban environment components in terms of their functions and type of buildings by height: (a) Areas with high-rise buildings, complex type; (b) Areas with medium height buildings; (c) Areas with low-rise buildings; (d) Industrial zones; (e) Green and recreational areas; and (f) Areas for public services. For the purposes of the current assessment, these components are further developed to determine potential climate impact and vulnerability of different functional zones, public services, transport, and technical infrastructure and buildings.

Vulnerability, including adaptive capacity

high

Describe your assessment

Under the conditions of climate change, the urban environment in Bulgaria is vulnerable and at considerable risk. The data supporting such conclusion include the obsolete and often inadequate infrastructure in the big and small settlements alike and the large proportion of aging population, predominantly with low income and below the poverty line. These could be considered 'objective' factors, reflecting the demography and the relatively low level of economic development and living standards in the country, which is the poorest in the EU. In addition, there is a very important 'subjective' factor, namely the poor level of awareness of the problems under consideration, of their causes, possible prevention and management, among both the decision makers and the general public.

The analysis also suggests that the policies and initiatives addressing the adaptation to climate change should be oriented in two directions—toward the big cities, where there is a concentration of a considerable part of the population and which enjoy considerably more potential and expertise, and toward the smaller cities and the villages in the periphery, with less numerable but much more vulnerable population, keeping in mind the specifics of each region and settlement

Reducing the risk of disasters calls for a solid institutional basis, which should be strengthened

by building capacity, good governance, promotion of appropriate policies, facilitating the flow of information, adoption of effective coordination mechanisms, and appropriate education. All these can contribute to the effectiveness of municipal adaptation actions.

Risk of potential future impacts

high

Describe your assessment

In future, the most important issue resulting from higher temperatures and longer drought periods will be linked to fresh water supply. A baseline scenario is used to evaluate the development trend of the performance indicators under the +2°C and +4°C temperature rise scenarios. The baseline scenario reflects a continuation of current policies and plans, that is, a future in which no new measures are taken to address climate change. The results of the analysis of past and present weather events show that in the future, Bulgarian cities will be affected most by extreme temperatures and increased precipitations intensity and frequency. The consequences of the latter—floods and landslides—will be among the priorities of the government, municipalities, and population in the next 20 years.

Title of the sector

Water management

Observed impacts of key hazards, including changes in frequency and magnitude

medium

Describe your assessment

Bulgaria has four river basin directorates (RBD): Danube River Basin Directorate (DRBD), Black Sea River Basin Directorate (BSRBD), East Aegean River Basin Directorate (EARBD) and West Aegean River Basin Directorate (WARBD). The overall Freshwater Exploitation Index shows that since 1990 there has been no stress on the Bulgarian aquatic ecosystem. Compared to other European countries, Bulgaria has relatively significant freshwater resources, both in absolute terms as well as on per capita basis (MoEW and EEA 2016). However, the water resources are unevenly distributed throughout the country and by season. If broken down by river basin district, it becomes apparent that the renewable water resources are unevenly distributed. Two-thirds of surface water resources are generated in the East Aegean and Danube River Basin District, with 36 percent being generated in the East

Aegean and some 33 percent in the Danube River Basin District. With nearly 19 percent, a significant portion of total runoff is generated in the West Aegean River Basin District, while the Black Sea rivers contribute just slightly over 10 percent. Regarding the quality of the water resources, only nearly a third of surface water bodies meets the objective of a 'good ecological' water status (River Basin Management Plans [RBMPs] 2016–2021). Again, the Black Sea River Basin has the lowest rate – 5 percent. Groundwater bodies perform better than surface water bodies. At the national level 63 percent (106 of total 169) meet the objective of 'good status' (described in Article 4 of the WFD and in Section 5 of the RBMPs).

Likelihood of the occurrence of key hazards and exposure to them under future climate

medium

Describe your assessment

Water resources: availability.

- At country level, there is no annual water resource deficit. The seasonal flow variations of surface water bodies are regulated by sufficient numbers of reservoirs. However, there are regions, suffering from water shortage for water supply needs in the summer months. The weakest river basin is the Black Sea Riber Basin with both the smallest amount of available water resources and the smallest available volumes per capita.

Water resources: quality.

- Two-third of the groundwaters and one-third of the surface water bodies are in a good ecological status.
- The Black Sea River Basin has the smallest percentage of achieved objectives (5 percent) for surface water bodies and the highest number of groundwater bodies in 'poor condition'.

Water resources: use.

- In the period 2007–2015 there was a steady reduction in the volumes of abstracted water (decline of population, irrigation, and industrial use).
- Surface water resources are used mainly for industrial needs (cooling and energy production), while groundwater resources are used mainly for domestic water supply.

Water supply and sanitation.

- Despite the highest improvement dynamics in this subsector, in general till now the biggest part of the infrastructure is outdated as well as designed and operated without climate change considerations.

Hydro-melioration.

- The hydro-melioration infrastructure is either destroyed or in an extremely poor condition. Insufficient maintenance and monitoring related to engineering safety has created a situation, which poses significant risks to the population, settlements, agricultural land, and the infrastructure. In view of climate change, the probability of these risks increases.

Hydropower.

- While the major HPPs are maintained and operated properly, the state of the small HPPs represents a potential safety threat.

Industrial water use

- Lack of data for comprehensive assessment.
- Increased registered use of groundwater resources, which in case of water shortage may cause a problem of competing with water use for domestic needs.

Vulnerability, including adaptive capacity

medium

Describe your assessment

Regions most vulnerable regions to drought risks:

- Black Sea River Basin

Vulnerability

- Overwhelmed, aging, poorly maintained infrastructure, and therefore highly vulnerable and most probably inadequate to cope with climate change
- Population and operators of infrastructure lack historical experience and good practices with floods and droughts, and therefore, are highly vulnerable
- Hydropower production systems – vulnerable to operation during droughts
- Water services – vulnerable during droughts

Major risks to managed systems

- Risks to infrastructure and services – damage, improper operation, and low-level or insufficient services
- Risks to hydroelectric - generation from low or high river flows

Major risks to natural systems

- Impaired biodiversity

The long-term strategic objective for the water sector is formulated in the Water Sector Strategy as “Sustainable use of water resources, providing to the optimal extent the present and future needs of the country's population and economy as well as of the water ecosystems”. There are four specific objectives and two of them relate to climate change:

- Objective 1: Guaranteed provision of water to the population and businesses in times of climate change leading to drought.
- Objective 4: Reduce the risk of flood damage.

For two of the subsectors, specific strategies have been prepared. The Strategy for Development and Management of the Water Supply and Sanitation Sector in the Republic of Bulgaria 2014–2023 was approved in 2014

The key sector issues include the following:

- Water supply services largely meet standards, but water losses are high and

investments in water supply are far below the level needed to sustain good quality and uninterrupted service in the long run.

- Wastewater services fall short of standards.

Risk of potential future impacts

medium

Describe your assessment

The Intergovernmental Panel on Climate Change (IPCC 2014) notes that risks arise from interaction of climate hazards with exposure and vulnerability to impacts. Two climate hazards are identified as most relevant to the water sector – floods and droughts. Floods cannot be predicted based on location, time and intensity; therefore, this hazard concerns flood-prone areas in the entire country. Droughts create higher risk in regions with water scarcity. The report suggests a simplistic approach to identify the regions with water scarcity risk. Projections show that climate change will not affect groundwater availability. This fact, together with the projected decline of Bulgaria's population and slow growth of industrial and agricultural activities, results in high likelihood for low scarcity risk in regions which use groundwater. However, if for example, water supply systems continue wasting more than 50 percent of the water produced, the risk might increase. The risk will also increase if water thirsty industries and crops are situated in this region. High scarcity risk is likely to appear in regions supplied with surface water and having high touristic activities, which are projected to increase. The Black Sea region appears to be the most vulnerable to scarcity risk because it uses surface water and is the most visited by tourists. Poor condition of the infrastructure in this region adds another dimension toward increasing the risk.

Based on the analyzes, the report identifies and discusses three major types of risks: risk to infrastructure, risk to services, and risk to natural water systems.

Title of the sector

other

If sector is 'Other', please explain

Disaster risk management

Observed impacts of key hazards, including changes in frequency and magnitude

medium

Describe your assessment

Bulgaria is exposed to a range of natural hazards, such as floods, landslides, earthquakes, wildfires, droughts, strong winds, heavy snowfalls, extreme temperatures, and hail – the first three are the most prominent events in the country. Disasters caused by these events have adverse social and economic impacts on the country. According to the National Statistical Institute (NSI) of Bulgaria, from 2010 to 2016, natural disasters and fires caused damages of almost US\$1 billion. During this period, over US\$600 million was spent on recovery and over US\$100 million was spent on rescue and emergency works. Disaster risks that the country faces are further expected to grow with the increasing urbanization and industrial development and climate change. Because of this, disaster risk management (DRM) plays an important role in the sustainable development of the country and is among the priorities of the government of Bulgaria.

According to the International Emergency Events Database (EM-DAT), since 1977, 45 major disasters were recorded in Bulgaria with more than 85 percent of these events related to weather. These disasters resulted in over US\$1.4 billion of direct damage.² Flood and extreme temperature were most frequent, with flood responsible for the greatest direct damage and affected population.

Likelihood of the occurrence of key hazards and exposure to them under future climate

medium

Describe your assessment

Flood risk assessment was undertaken by the World Bank and the Global Facility for Disaster Reduction and Recovery. The districts with the highest flood risk are Yambol, Plovdiv, and Pazardzhik. In 2015, modeling predicted that 50-year return period floods could affect US\$2 billion of GDP, but by 2080 (considering change in socioeconomic and climate conditions) this may double or even quadruple (depending on the future scenarios selected). Current increases in flood risk are being driven by urbanization and increased exposure of assets and people in flood-prone areas, but in the coming years the influence of climate change will overtake urbanization as the driver of increased flood risk.

Bulgaria is prone to droughts due to its climatic, geographic, and topographic characteristics. Future climate change scenarios indicate that present day mild droughts will probably shift to future severe droughts within less than 60 years. Estimates also suggest that there is a 20 percent chance of drought in the next 10 years, affecting the western and southeastern districts the most, with a likely increase in the number of drought events in the future. Extreme heat events have already occurred in Bulgaria and are likely to worsen as the climate warms. For instance, in July 2000, Southeastern European countries, including Bulgaria, faced record-breaking temperatures that caused deaths due to heat stroke, high blood pressure, and

heart attacks across the region

Wildfire susceptibility maps have been produced for Bulgaria highlighting areas affected in the past by wildfire. However, given the changing climatic conditions which bring extended dry and hot periods and increased concentrations of more flammable vegetation such as commercial pine plantations, it is expected that wildfire events are likely to intensify in the future and occur in areas not historically prone to wildfire.

Landslides are another prominent threat in Bulgaria. To date, more than 920 have been recorded in 350 settlements, mostly along the Danube shoreline in Northern Bulgaria where 10 catastrophic landslides have occurred for the last 30 years.

Vulnerability, including adaptive capacity

low

Describe your assessment

In support of the government's efforts to reform the Disaster risk management system, a thorough peer-review of the disaster response capacity in Bulgaria was carried out in 2015 (European Commission 2015). It found that there was a well-established civil protection or emergency and disaster response system which has clear roles and responsibilities under the Unified Rescue System, excellent cooperation with the EU on civil protection, exercises and training, and integration with the Bulgarian Red Cross and civil society for disaster response. Therefore, this aspect is not reviewed further in this document. However, the peer review report clearly pointed out areas that need improvements and gave concrete recommendations to move towards a system that places equal value on prevention, preparedness, response and recovery.

To put in place this new concept, Bulgaria amended the Disaster Protection Act with the aim to:

- Enact priorities from the Hyogo Framework for Action and the Sendai Framework for Disaster Risk Reduction
- Establish Councils for Disaster Risk Reduction to the Council of Ministers, Regional Governors and Mayors which serve as platforms for disaster risk reduction
- Enact disaster risk reduction planning at national, district and municipal level
- Provide guidelines for development and subsequent implementation of the planning documents
- Create possibilities for prioritizing the disaster risk reduction activities

Following the adoption of the Sendai Framework for Disaster Risk Reduction in 2015 and in response to recommendations from the 2015 peer review, Bulgaria drafted a new National Disaster Risk Reduction Strategy for the period 2018–2030 which recently passed public consultations.

Risk of potential future impacts

medium

Describe your assessment

During the past two decades, climate-related events such as floods, storms, heatwaves, snowfalls, and drought have accounted for about 90 percent of major disasters. Climate change is expected to increase the frequency and intensity of weather-related hazards, significantly affecting economic and social development, with cascading impacts on poverty, the supply of food and water, urban systems, the spread of disease, people movements and conflicts. With regard to agricultural land use, no relation is established to climate change risk evaluation and management and crop insurance from climatic impacts is largely avoided by insurance companies and producers as there are few who buy such policies. There is a need for updated risk evaluation and mapping and then evaluation of needed measures, investments, and long-term planning.

To develop effective risk reduction instruments, it is necessary to establish homogenous, unified, and up-to-date baseline assessment for Disaster Risk Reduction/Disaster Risk Management and CCA at the national level, including the identified gaps in historical data and the quantified costs of previous disasters. Drawing on a regional-scale climate models or disaster risk modeling is crucial for creating the national risk profile.

Legal and policy frameworks and institutional arrangements

Legal and policy frameworks and regulations

The legal framework and policies for CCA in Bulgaria should be understood in the context of its commitments under international conventions and EU legislation. At the national level, a number of key strategies and programs provide a foundation for legislation on climate change in general (in particular, Third National Action Plan on Climate Change [NAPCC]) but up to now the focus has been on mitigation, and there are no explicit adaptation strategies developed at the national or sector level in Bulgaria. Similarly, the climate change-related institutional framework in Bulgaria has, over recent years, focused mainly on mitigation. The institutional framework related to CCA is an element of the overall climate change institutional framework set out in the Climate Change Mitigation Act (CCMA).

National Adaptation Strategy (NAS) (1)

NAS title

National Climate Change Adaptation Strategy and Action Plan

NAS status

actual NAS - adopted

Year the NAS was adopted

2019

Period covered by the NAS

2020-2030

Link to the NAS

<https://www.moew.government.bg/en/climate/international-negotiations-and-adaptation/adaptation/>

National Adaptation Plan (NAP) (1)

NAP title

National Climate Change Adaptation Strategy and Action Plan

NAP status

actual NAP - adopted

Year the NAP was adopted

2019

Period covered by the NAP

2020-2030

Link to the NAP

<https://www.moew.government.bg/en/climate/international-negotiations-and-adaptation/adaptation/>

National Adaptation Plan (SAP) (1)

SAP title

National Climate Change Adaptation Strategy and Action Plan

SAP status

actual SAP - adopted

SAP sector

agriculture and food, biodiversity (including ecosystembased approaches), civil protection and emergency management, energy, forestry, health, other, tourism, transport, urban, water management

SAP sector (other)

Macroeconomic Implications of Climate Change

Year the SAP was adopted

2019

Period covered by the SAP

2020-2030

Link to the SAP

<https://www.moew.government.bg/en/climate/international-negotiations-and-adaptation/adaptation/>

Overview of institutional arrangements and governance at the national level

Climate vulnerability and risk assessment

The specific challenges due to climate change faced by sectors in Bulgaria are analyzed in detail in Bulgaria's sector assessment reports (available separately as appendices to this strategy) that were developed in 2017 for agriculture, biodiversity, and ecosystems, energy, forestry, human health, transport, tourism, urban environment, and water management. These reports use the terms and definitions of risk, vulnerability, and adaptation options as introduced by WGII Assessment Report 5. Risk of climate-related impacts results from the interaction of climate-related hazards with the vulnerability and exposure. Changes in both the climate system and socioeconomic processes including adaptation and mitigation are drivers of hazards, exposure, and vulnerability. This understanding reveals the importance of the adaptation options. Vulnerability, hazard, and/or exposure will be reduced, and thus the risk will be mitigated when adaptation options are properly identified and timely implemented.

Planning, implementation, monitoring, evaluation and revision of adaptation policy

Bulgaria is already implementing its 3rd National Action Plan on Climate Change and the present Strategy is providing an additional tool to create synergies between adaptation and mitigation actions on national level. By identifying and integrating the relevant adaptation and mitigation aspects at all levels of respective sectoral planning, budgeting, program and project cycles, there is a tangible potential to scale up and mainstream more synergy into the climate policies, including streamlining into the available funding.

To achieve an adequate level of adaptation to climate change, the Bulgarian Government will apply a number of leading and overarching guiding principles in the implementation of this adaptation strategy. These principles are straightforward and will provide clear direction and benefits to the country. They are inspired by and highly coincide with those included in the EC's 'Guidelines on developing adaptation strategies'

Principles (based on Adger and Vincent 2005; Brown et al. 2011; Prutsch et al. 2010; UKCIP 2005) that have internationally been recognized as key factors for good adaptation and that the Government of Bulgaria (GoB) herewith makes her own, are the following:

- Any adaptation action undertaken should be sustainable.
- Carry out adaptation in partnership Evidence-based adaptation is the preferred approach. Latest research, data, and practical experience should be applied in support of robust decision making. Closing of data gaps is a priority.
- Apply a balanced approach.
- Address risks associated with past and current climate variability and weather extremes.
- Adaptive action should be prioritized.
- Adaptation must be tailored to the scale required by the climate change challenge.
- Adaptation should be flexible.
- Adaptation needs to be transparent.
- Continuously review the effectiveness, efficiency, equity, and legitimacy of adaptation decisions.

Monitoring and Evaluation (M&E) of the Action Plan requires deciding which information provides the best measure of progress and performance. Guidance on M&E is given in a number of sources including EC . Arrangements to monitor and evaluate progress can focus on processes and outcomes of implemented actions in meeting objectives and should also be able to capture unintended maladaptive consequences.

Identifying appropriate indicators should take account of the following:

- Existing indicators and datasets, which may already measure the required outcomes or can be adjusted for the purposes of the action plan. To the extent feasible, indicators from the Eurostat database should be used, as well as from the information system for monitoring the government program and for implementation of the annual objectives of the administration of the CoM (Council for Administrative Reform 2010).
- Other influences on the indicator parameters, which may partly account for progress (or lack of progress) toward objectives. This includes autonomous adaptation which may occur

alongside planned actions.

- The cost of collecting the information for the indicator which should not be more than the value of the information for M&E purposes.

Each of the activities listed in the Action Plan includes a proposed indicator or set of indicators for monitoring performance. To the extent possible, current and expected outcomes have been given. Further agreement and development of these indicators will be needed in consultation with implementing institutions.

Integration of climate change impacts and resilience into environmental assessment procedures

The development of this Strategy and Action Plan has followed, to the extent possible, the principles and methodology for strategic planning in the Republic of Bulgaria. This document builds on the National Climate Change Risk and Vulnerability Assessment of the Bulgarian Economic Sectors and draws extensively on the information, analyses, and recommendations of the nine sector assessment reports, the Disaster Risk Management Assessment report, and the report on the 'Macroeconomic Implications of Climate.

Collection, ownership and re-use of relevant data and access to it

Information about both climate change and ecosystems as a complex system is not communicated easily. Furthermore, data gaps in climate and biodiversity models mean that national projections are not sufficiently detailed.

As a focal point for environmental data collection and reporting (National Environmental Monitoring System), the Executive Environment Agency is expected to play a key role in provision of data on CCA and biodiversity and in introducing ecosystems-based monitoring.

Generating knowledge and information at the local level will require additional data collection and research and longer-term observations. The most important challenge for Bulgaria is seen in the sector report as information exchange and knowledge communication if the required synergy in climate change mitigation and adaptation is to be achieved.

Integration of climate change impacts and adaptation planning into disaster risk management frameworks and vice versa

The activities for population protection in case of emergency or disasters are carried out by the Unified Rescue System according to Disaster Protection Plans. The Unified Rescue System includes ministries and agencies, municipalities, commercial companies and sole entrepreneurs, emergency medical care centers, other medical and health care establishments, nonprofit organizations, including voluntary formations under Article 41 of the Disaster Protection Act, and armed forces. A Disaster Risk Reduction Council was created as a permanent body to

the CoM to ensure coordination and cooperation in the implementation of state policy in the field of disaster protection. The Council performs the functions of a national DRR platform in implementation of the Hyogo Framework for Action 2005–2015 and Sendai Framework for Disaster Risk Reduction 2015–2030.

Overview of institutional arrangements and governance at the sub-national level (where “sub-national” refers to local and regional)

Legal requirements and strategic documents

At the sector level there are, in general, no specific current legal acts in Bulgaria that deal solely with CCA. Instead, aspects of adaptation can be found in a broad range of sector and cross-sector documents including strategies, laws, and guidance documents. A summary of the legal framework for each sector is given in the following paragraphs.

Networks or other collaborations on adaptation across national authorities

Bulgaria adopts its first "Climate Change Adaptation Strategy and Action Plan" at the end of 2019. In view of the time horizon that it covers - until 2030 at the moment, Bulgaria still does not have a network or other collaborations on adaptation across national authorities

Good practice examples of networks or other collaborations on adaptation across local and regional authorities

Bulgaria adopts its first "Climate Change Adaptation Strategy and Action Plan" at the end of 2019. In view of the time horizon that it covers - until 2030 at the moment, Bulgaria still does not have a good practice examples of networks or other collaborations on adaptation across local and regional authorities

Adaptation strategies, policies, plans and goals

Adaptation priorities

Activities which are assessed as priorities to start in the short term will be, in many cases, measures which enable and support following adaptation actions. This means that many of these priority actions across all sectors are soft measures (assessed as no cost or low cost) supporting the strategic and operational objectives related to (a) building institutional capacity (including through addressing knowledge gaps), (b) mainstreaming and integrating CCA into existing national and sectoral plans and programs, and (c) raising awareness. These will provide the foundation for medium- and longer-term practical actions for building climate change

resilience including through the management of infrastructure and assets, and the protection and enhancement of natural capital.

Challenges, gaps and barriers to adaptation

- Awareness-raising and communication. This refers to the need for effective communication of relevant information on CCA
- Institutional capacity. This refers to internal organizational/administrative capacity and expert capacity among organizations responsible for CCA policy and actions. Identified specific gaps and barriers are as follows:
 - o The scope and quality of coordination between institutions related to CCA (ministries, state agencies, and so on).
 - o Insufficient professional training, including specialized occupational training and knowledge-sharing activities related to CCA, as well as dedicated university programs.
 - o The level of awareness among some decision makers and preparedness of staff to integrate this knowledge into the planning and management process.
 - o Data collection and monitoring. This refers to the extent to which relevant information is available and used for informed decision making regarding CCA at all levels.
 - o Monitoring and evaluation (M&E) capacity. Effective implementation of CCA policies requires a process of M&E to be put in place. For example, the health sector is at an early stage of policy development and requires further development of appropriate tools and mechanisms for this.
- Knowledge and data gaps. This includes uncertainties with climate projections and associated risks, costs and benefits of adaptation, vulnerabilities at the local level, and the availability of data for M&E purposes
- Policy and legal framework. This refers in particular to changing or developing regulations, standards, codes, plans, policy or programs to integrate, and risks from climate change, and mainstream CCA responses. Key specific issues are the following:
 - o The need for improved policy coherence and coordination of CCA initiatives across sectors.
 - o The need for implementation arrangements to have clear allocation of responsibilities and mandates to different entities.
 - o A specific gap is the need to simplify and accelerate decision making by implementing to the extent possible a single pool of environmental data for the use of decision makers and developing tools for analyzing tradeoffs in decisions.
- Limitation in financial and human resources. Lack of financial resources for CCA actions is a common theme across sectors. Currently, there is high dependence on EU funding, especially for large investment projects. Key issues are the following:
 - o Competing priorities.
 - o Lack of information on the financial resources necessary for adaptation to climate change, such as in the case of buildings and facilities in the urban environment.

- o Limited CCA dedicated human resources both in number and in expertise in key institutions are identified by a number of sector assessments

Summaries of national strategies, policies, plans and efforts, with a focus on goals and objectives, foreseen actions, budget and timeline

Summaries of national strategies, policies, plans and efforts, with a focus on goals and objectives, foreseen actions, budget and timeline

Agriculture

- Water management and the development of good irrigation practices are recommended for immediate attention. In particular, promotion of sustainable use of natural resources and arable land and reduction of the vulnerability of agricultural crops to climate change impacts that may lead to decrease in crop yields, loss of profits, and loss of competitiveness. Recommendations also include improving soil structure maintenance and restoration and increasing the soil's infiltration capacity to minimize erosion.
- Adjusting livestock breeding to address the adverse effect of climate change on livestock production.
- Investment in CCA measures and risk management tools by the private sector, NGOs, and government and local communities.
- Targeting eco-innovations and the development and introduction of more selective fishing equipment, facilities, and resource-efficient technologies.
- Information dissemination. Develop a database of information and online portal for exchange of information. Availability of innovation research will allow its use by different stakeholders including farmers and public institution.

Biodiversity and ecosystem services

- Development of guidelines for the integration of environmental policy and climate change policy in the EU Funds programming, on the initiative of the Ministry of Environment and Water for the current programming period 2014–2020.
 - Progress on important environmental data that could be used for sectoral CCA . In particular, European Economic Area Financial Mechanism 2009–2014 programs BG02 integrated management of marine and inland water and biodiversity and ecosystem services have laid the methodological foundation and compiled a mapping and assessment outside NATURA 2000, whereas OP-Environment has planned for performing the mapping and assessment within NATURA.
 - Bulgaria also participates in international activities related to Biodiversity and Ecosystem and exploring the relationship with climate change, such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), International Long-Term Ecosystem Research (ILTER) and Network and the Ecosystem Services Partnership (ESP).
- Energy

Bulgaria is currently not implementing any energy measures/actions explicitly targeted at CCA. However, a number of activities and initiatives in the sector mainly dealing with

mitigation efforts provide synergies with adaptation. These include the following:

- Integrated Plan for Energy and Climate of Republic of Bulgaria 2030
- National Investment Plan 2020 (with a main objective to ensure a sustainable transition to a low-carbon economy)
- Diversification of energy sources (in particular, development of the gas network) and energy efficiency

Forestry

- Program of Measures to Adapt Forests in the Republic of Bulgaria and Mitigate the Negative Impact of Climate Change on them 2012–2020, adopted by the Executive Forest Agency (EFA) under the MAFF (UNECE 2017).
- The Third National Climate Change Action Plan 2013–2020 defines a small number of adaptation measures in the agriculture and forestry sectors.
- National Forest Inventory (NFI). Ongoing implementation of a full NFI is of critical importance to collect reliable data on the status of forest resources.

Human health

Individually, the sector representatives take part in a number of activities at the local, national, and international level, relevant to CCA. This includes participation in the process of policy making, educational activity, research activity, information provision, and public communication.

Tourism

There is very limited current involvement by the tourism sector on CCA activities. The only CCA-related action in which a Bulgarian tourism organization took part that is referred to in the sector assessment report was the 'Climate Change – the Challenges before Bulgarian Nature and Tourism' conference held in December 2015 and co-organized by BAAT.

Transport

Specific climate change-related issues have been identified by stakeholders who have sometimes attempted to resolve them on a case-by-case basis. Examples of CCA actions taken in the various transport subsectors include increased use of polymer modified bitumen, stopping of heavy vehicles during hot weather (by the Traffic Police based on an ordinance issued by the RIA), and revision of the road design norms (commissioned by the MRDPW).

Following EU legislation for the current programming period 2014–2020, all transport infrastructure projects applying for grant financing from the EU Cohesion and Structural Funds shall perform a CCA assessment.

Urban environment

Urban environment-related specific ongoing and foreseen actions are mainly focused on the response of other sectors to the extreme weather events and their consequences. These relate to action for extreme temperatures, floods, landslides, fires, droughts (water resources), and DRM. The most important actions are connected with the monitoring and control of the implementation of the adopted strategic documents and their action plans and programs, with the provision and access to reliable information, knowledge development and communication, capacity building, and awareness raising.

At the municipal level, ongoing actions most directly related to adaptation of the urban

environment are their CCA strategies. All municipal councils have adopted rules and procedures aimed at reducing the risk of natural disasters.

Water

Water utilities are participating in various projects and initiatives, including benchmarking projects. Although CCA is not directly targeted, this is an opportunity for the water utilities to increase their efficiency. This is the way to also increase their resilience, especially in terms of increasing the efficiency of water supply systems, reducing leakages, and unbilled consumption.

Regional feasibility studies are currently being carried out for the designated areas of the biggest 15 operators of water supply and sewerage systems that will assess the risks associated with climate change and will set up measures to adapt to future climate change and mitigate their impact as well for disaster resilience. As a result of the assessment, measures will be proposed to comply with existing national and European legislation related to climate change.

Overview of the content of sub-national strategies, policies, plans and efforts

14. Strategy for adaptation to climate change for Sofia Municipality in line with the requirements of the Compact of Mayors initiative

In the context of the Strategy of Sofia Municipality, several main directions for adaptation can be identified, on the basis of which specific measures for adaptation by sectors are proposed. Develop horizontal policies and strategic planning, including planning to build institutional capacity to deal effectively with climate change. This direction also includes preparation of new and change of existing policies, strategies, legislative framework, standards for adequate adaptation to the changes; preparation of risk management plans for specific climate events; cost-benefit analyzes of the planned measures

Increasing the institutional capacity in the municipality for adaptation to climate change, incl. coordination and cooperation of the municipality with other responsible institutions, not only at regional but also at national level, and active work with stakeholders; Carrying out targeted research and monitoring to increase knowledge and data collection for adequate and effective planning and implementation of adaptation measures; performing targeted analyzes to reduce vulnerability

Conducting information campaigns and increasing the knowledge and commitment of society to climate change

Effective communication of the implementation of the Strategy by holding regular meetings with stakeholders and creating an active dialogue;

Seeking additional benefits and synergies - carrying out proactive activities to prevent risk and reduce vulnerability by turning the challenges of climate change into opportunities for

positive change - improving the quality of life, developing the local economy, implementing effective solutions and good practices.

In the Vision for Development of the Municipality of Burgas in the period 2021-2027 is set the development of a Strategy for adaptation to climate change, which will be implemented and set integrated measures for energy efficiency, tourism, urban environment, water;

Overview of efforts to integrate climate change adaptation into sectoral policies, plans and programs, including disaster risk management strategies and action

Agriculture

- Horizontal adaptation options

Develop climate change training

Develop knowledge dissemination actions

Develop insurance and risk management programs

Develop water management innovations

Improve the CCA legal framework

- Vertical adaptation options

Improve water management practices

Adjust the timing of farm operations

Improve the soil structure maintenance and increase the soil's organic matter reserves and soil cultivation technologies

Eliminate secondary salinization conditions and conditions for anthropogenic soil acidification

Maintain and improve existing aquaculture habitat

Biodiversity and ecosystem services

(a) Develop and adopt the new Biodiversity Strategy and Action Plan and a new Green Infrastructure Strategy with regard to ecosystem-based management, conservation, restoration and CCA

Review and amend legislation and secondary legislation in the environment sector and related sectors to reflect the new Biodiversity Strategy and Green Infrastructure Strategy

(b) Set up interdisciplinary teams and centers of excellence

(c) Operationalize ecosystem-based monitoring and strategic/environment impact assessment

(d) Open data for public use

Establish communication and provide tools for informed prioritization of research and practical action

Enable volunteer sharing

(e) Adjust regional and local adaptation strategies to the amended CCMA and the strategic documents and legislation on BD&ES services

Stimulate local development and equitable access to ecosystems services

(f) Link decision making, resources, and funding to efficient assessment of improved ecosystem

conditions

(g) Identify regional/local 'red lines' to prevent decrease or irreversible loss of ecosystem services vital for CCA

Develop regional/local programs to conserve and restore biodiversity to increase the delivery of ecosystems services

(h) Carry out ecosystems restoration—a long-term business opportunity
Implement new training programs at all educational levels and in informal/non-formal education

(i) Create carbon environmental accounts

Develop cultural ecosystems services for recreation and education

Use genetic resources for resilience

(j) Collection folk customs and traditional knowledge in a targeted manner

Energy

Advance efforts to motivate end users of energy to implement energy-saving measures, especially in households

Review costs and benefits of incorporating climate resilience into the design of new power plants

The MoEW is to ensure that climate resilience is integrated into water resources management and associated decisions affecting the operation of large HPPs

Undertake an inventory of strategies, policies, plans, standards, site selection, energy infrastructure design norms and other, to identify those where climate resilience should be incorporated

When the new Energy Strategy is developed, ensure climate resilience is mainstreamed into it

Forestry

Establish a research and development coordination body

Design and implement a research program

Promote management strategies, which ensure high species and structural diversity and natural regeneration

Execute the NFI

Establish a national system for early warning and awareness at regional and local level

Establish and maintain a national disturbance monitoring system

Develop a wood specifiers guide and promote wood use

Human health

Monitor and collect data; develop warning system about dangerous for health climate change phenomena

Carry out public education and awareness outreach

Work in partnership and cooperation: intra- and intersectoral (local, national, and international)

Carry out research/raise knowledge-base

Tourism

Vertical options

Develop a NAS for CCA in the Tourism Sector

Develop a system of monitoring indicators and indicators monitoring

Raise and develop the tourism industry's adaptive capacity and awareness
Develop four seasons' tourism across the country
Develop and implement new market segmentation and new marketing strategies

Horizontal options

Improve the CCA legal framework
Develop and improve an M&E system
Develop a national database (online portal) containing CCA-specific information
Create cross-sectoral policy frameworks and improve coordination among responsible government and public institution
Introduce subsidies, grants, and other financial programs

Transport

Review the institutional settings
Assign CCA responsibilities in the statute and internal procedures of the relevant stakeholders and train the staff
Introduce and/or improve CCA relevant data collection practices
Update the design norms (with specific focus on road and railway bridges and culverts) and continue the updating of these codes
Develop a common guideline for all beneficiaries to take CCA into consideration and embed it in the project preparation process

Urban environment

Policy - Mainstream CCA into the policy of regional and urban development, including housing and construction; Adaptation option - incorporate CCA into the National Housing Strategy (2017–2030);

Legislation - Revise and amend legislative documents to transpose CCA issues (after RIA when applicable and necessary); Adaptation option - mainstream CCA requirements in all related legislative documents, relevant to regional and spatial/urban planning and environmental protection (Spatial Planning Act, Regional Development Act, Regulations No. 4, 7, and 8, Regulation for Spatial Development Documents for EIA and SEA);

Information - Secure institutionally regulated exchange of information and data according to INSPIRE Directive obligations; Adaptation option - create common standards for the type, structure, scope, and format of metadata and data, harmonized with the EU at the city level;

Research - Provide a common long-term vision and objectives in the urban environment CCA research through amendment of the National Scientific Research Development Strategy 2020;

Adaptation option - identify priority scientific topics, linked with the city, open and green spaces, buildings, infrastructure, construction materials, and human health;

Education - 'Train the trainers' for CCA; Adaptation option - organize appropriate education and training formats for all levels—from politicians to the general public

Finance - Change financial, social, and insurance policy; Adaptation option - revise the existing financial instruments and design new ones for CCA and DRM, including for energy renovation.

Water

Adapt the legal framework to make it instrumental for addressing climate change impacts

Establish dynamic publicly available GIS database supporting climate change decision making
Maximize the use of research and education institutions
Operate water infrastructure to increase resilience to climate change for all users and sectors
Strengthen adaptation capacity: CCA awareness raising campaigns, education, and training

Overview of measures in adaptation policy at the national level and good practice examples from the sub-national levels to engage with stakeholders particularly vulnerable to climate change impacts

Bulgaria adopts its first "Climate Change Adaptation Strategy and Action Plan" at the end of 2019. In view of the time horizon that it covers - until 2030 at the moment, Bulgaria still does not have a overview of measures in adaptation policy at the national level and good practice examples from the sub-national levels to engage with stakeholders particularly vulnerable to climate change impacts

Overview of measures in adaptation policy at the national level and good practice examples from the sub-national levels to engage with the private sector

Program of the National Trust Ecofund - Climate Investment Program (IPC) and Climate Microprograms Program (CIM). The IPA finances projects to improve the energy efficiency of state and municipal sites, and the funds are provided by auctioned sales of greenhouse gas emission allowances under the EU Greenhouse Gas Emissions Trading Scheme. So far, measures have been implemented to reduce energy consumption in 103 sites, including schools, kindergartens, hospitals and health services

- Emissions reductions through reducing energy consumption in public buildings
- Better conditions for learning, better working conditions
- Additional employment opportunity for the building sector

Monitoring, reporting and evaluation of adaptation actions and processes

Monitoring, reporting and evaluation (MRE) methodology related to reducing climate impacts, vulnerabilities, risks, and increasing adaptive capacity

Monitoring and Reporting under the National Climate Change Adaptation Strategy 2019-2030 (NAS) and its Action Plan should be a participatory process, which enables capacity building and

understanding, as well as applying lessons learned from the activities' experience. It will be performed in accordance with the recently approved Regulation on the Governance of the Energy Union, which incorporates the respective provisions of the existing Climate Monitoring Mechanism Regulation and harmonizes them with those of the Paris Climate Agreement. The monitoring and reporting process shall serve several purposes, as follows:

- ☐ Facilitating timely identification and resolution of problems;
- ☐ Enhancing the performance of the planned activities;
- ☐ Providing the basis for technical and financial accountability;
- ☐ Building institutional and local capacity to implement and manage the planned actions successfully; and
- ☐ Promoting the identification and dissemination of lessons learned by participants themselves.

Monitoring involves the collection and analysis of data about implemented activities. The data should be easy to understand and will be incorporated in the reports. The monitoring should allow stakeholders to keep track of the activities, to determine whether the objectives are being achieved and to make whatever changes are necessary to improve the performance (an outline of the requirements of performance indicators is given in Section 6.2). Pursuant to the Regulation on the Governance of the Energy Union, reporting on the national adaptation actions will be performed every 2 years, starting in 2021. Progress in implementation of measures envisaged in the Action Plan under the Strategy will be assessed in one mid-term and one final official report, to be drafted and presented to the Council of Ministers respectively in 2025 and in 2031. Implementation of the short-term measures of highest priority, as identified in Chapter 5.3 of this Strategy and highlighted in green in the sectoral Action Plans, will be assessed in the initial report to be developed in 2021. The performance will be strengthened and further refined on the basis of experience gained from implemented activities.

Monitoring and Evaluation (M&E) of the Action Plan requires deciding which information provides the best measure of progress and performance. Guidance on M&E is given in a number of sources including EC (2013b). Arrangements to monitor and evaluate progress can focus on processes and outcomes of implemented actions in meeting objectives and should also be able to capture unintended maladaptive consequences.

Each of the activities listed in the Action Plan includes a proposed indicator or set of indicators for monitoring performance. To the extent possible, current and expected outcomes have been given. Further agreement and development of these indicators will be needed in consultation with implementing institutions.

MRE methodology related to the implementation of adaptation actions

The range of actions for each sector set out in this Action Plan provides a firm basis for implementation of the Climate Change Adaptation Strategy in the period up to 2030. The Action Plan should, however, be treated as an evolving document in that the range and detail of

actions supporting each strategic objective will need to be fine-tuned and improved over time, as envisaged in the Monitoring and Reporting arrangements outlined above. A key role is to be played by the MoEW in leading and coordinating adaptation actions at the national level in cooperation with involved ministries and other institutions in line with this Strategy and Action Plan.

A number of high priority actions have been identified that should be the focus of implementation in the short term, since they provide an essential foundation for enabling other subsequent medium and long-term actions. These priority actions focus, in particular, on soft measures to raise awareness and promote education on climate change adaptation and build adaptation capacity and knowledge. In general, these high priority short-term actions have been assessed as no cost or low cost.

Since mid- and long- term priorities are more investment intensive (for example, related to infrastructure improvement) this will allow time in the shorter term to assess and develop available and potential financial resources to support these actions. This should include exploring climate financing options in the post-2020 Multiannual Financial Framework.

State of play of the implementation of measures planned under 'Strategies and Plans', including an overview of the subnational level and the disbursement of funding to increase climate resilience

With regard to high priorities for increasing resilience to climate change by reducing pollution, disruption and overexploitation by assessing the load capacity of vital ecosystems and their capacity to provide ecosystem services and the use of own monitoring and Environmental impact assessment to monitor exploitation, disturbances of ecosystems and natural capital stocks, Ministry of Environment and Water, including Regional Inspectorate of Environment and Water applies the existing legislation regarding the Environmental impact, Compatibility ratings and procedures, incl. reports a cumulative effect on ecosystems.

Annually in the state budget of the Republic of Bulgaria are planned funds for capital transfers for non-financial enterprises in the railway sector, which are provided for the maintenance, development and construction of the railway infrastructure and for the purchase of new rolling stock. In this regard, we would like to inform you that in 2020 the central budget provided funds for capital transfers to the National Railway Infrastructure Company in the amount of BGN 120 million and to BDZ - Passenger Translations EOOD in the amount of BGN 89 million. BGN

At the national level, changes are being developed in the national legislation in order to comply with the requirements of the legislative acts from the EC package "Clean Energy for All Europeans", subject to transposition. An Act amending and supplementing the Energy Efficiency Act (EEA) has been adopted, and a draft Act on Renewable Energy is under development. In addition to the legislation on the Clean Energy for All Europeans package, Directive (EU) 2019/692 of the European Parliament and of the Council of 17 April 2019 amending Directive 2009/73 / EC concerning common rules for the internal market in natural gas it has also been transposed into Bulgarian legislation by the Law on Amendments to the Energy Act (EA) adopted

in early 2021.

In 2020, the Integrated Plan in the field of energy and climate of the Republic of Bulgaria 2021 - 2030 (IPEC) was presented to the EC. IPEC has been developed in accordance with the European goals and policies in the field of energy and climate, aimed in the long run at achieving ambitious Community goals for transition to a low-carbon economy, taking into account the specifics, experience and traditions in the energy sector of Bulgaria. The trends and policies in the field of energy security, energy efficiency, liberalization of the electricity market and its integration into the Common European Energy Market, development and expansion of the gas market, as well as opportunities for using new high-efficiency energy technologies in the country are defined.

In fulfillment of the commitments of the Republic of Bulgaria for achieving the goals of the European energy policy for the establishment of the Energy Union, the Plan sets the following main priorities:

- Increasing energy security for sustainable energy development; Energy security and sustainable development of the energy of the Republic of Bulgaria for the period 2021 - 2030 will be achieved through: (1) efficient use of local energy resources, in strict compliance with environmental legislation; (2) increasing the interconnection energy connectivity; (3) increasing the flexibility of the national energy system and (4) diversifying the sources and routes for natural gas supply
- Development of an integrated and competitive energy market and consumer protection by ensuring transparent, competitive and non-discriminatory conditions for the use of energy services;

In order to achieve the goals for increasing the interconnection and development of a competitive electricity market, and its integration into the common European energy market, a number of projects with a high level of European added value will be implemented included in the list of priority projects of common European interest. Their implementation will meet the European target of at least 15% interconnection.

- Increasing energy efficiency in the processes from production to final energy consumption;

In line with the EU's priorities for increasing energy efficiency (EE), Bulgaria puts EE in the first place, given its importance for improving the country's energy security by reducing dependence on energy imports, reducing energy costs for businesses and households. , to create more jobs, to improve air quality and to reduce greenhouse gas emissions and improve the quality of life of citizens.

- Use and development of energy from renewable sources, according to the available potential, network capacity and national specifics, as part of the transition to a low-carbon economy

State of play of the implementation of measures planned under 'Strategies and Plans': spending earmarked for climate adaptation including in disaster risk management

Annex I: 4.2a

Within the current programming period in the field of "Climate change mitigation and adaptation" is proposed for development and the conclusion of a contract with National Trust Eco Fund on Predefined project № 3 "Implementation of innovative measures for climate change mitigation and adaptation in municipalities in Bulgaria" "On Result 4:" Increasing the capacity of local municipalities to reduce emissions and adapt to climate change. "The project aims to improve the capacity of local authorities to plan, monitor and implement specific measures to mitigate the impact and adapt to climate change.

The proposed project will launch a process for pilot implementation of some aspects of the National Strategy for Adaptation to Climate Change in the field of urban planning in 8 municipalities in the country - Sofia, Plovdiv, Varna, Burgas, Kardzhali, Ruse, Stara Zagora and Sliven. These are the municipalities that have been identified as places with heat island effects, with the highest risk of natural disasters (floods, landslides, fires) and / or high temperatures, combined with drought, causing water stress.

As a result, it will be possible to apply the latest knowledge, experience and pilot innovative measures for urban planning. Engineering projects for planning and development of infrastructure facilities preventing floods and landslides, green infrastructure in cities, improving the permeability of urban surfaces and / or controlling the risks of floods, etc. will be implemented. The results and good practices will be widely disseminated in Bulgarian municipalities, as well as will be discussed as opportunities for reproduction.

To the extent possible, state of play of the implementation of measures planned under 'Strategies and Plans': the share of spending used to support climate adaptation in each sector

During the one-year period from the adoption of the National Strategy and Action Plan for Adaptation to Climate Change with Decision № 621 of 25.10.2019 of the Council of Ministers, namely in 2020 the Ministry of Health provided and allocated under its budget for capital expenditures Targeted funds of the state medical establishments - commercial companies in the amount of BGN 46,617 thousand, intended for the purchase of medical apparatus and equipment, as well as modernization, adaptation and improvement of the hospital infrastructure (buildings and installations) to provide and respond to the changes and modern requirements and standards for the hospital environment.

- Within the above funds are also allocated by Decree of the Council of Ministers № 216 / 14.08.2020 additional costs under the budget of the Ministry of Health for the needs of University multidisciplinary hospital for active treatment Burgas AD for implementation of, Activities related to energy efficiency efficiency and thermal insulation of the building and wards in the medical institution

- Stage II in the amount of 5,790 thousand BGN. The implementation of energy efficiency measures will lead to achieving the required temperature in the premises, will reduce fuel

consumption and savings on heating, will reduce harmful emissions into the atmosphere, improve the usability of the infrastructure, increasing the safety of the hospital environment, which is also related to climate change.

In the form of capital transfers for non-financial enterprises in 2020, the central budget provided funds for the implementation of programs for elimination of the damages caused to the environment, caused by past actions or inactions, during privatization, in the amount of BGN 2.3 million.

Public awareness - The Climate Small Grant Scheme №4 aims to increase the number of schools carrying out awareness / education activities on climate change. The draft proposals for conducting educational and awareness-raising campaigns will start after the completion of their evaluation and are expected to be completed by the end of 2023.

Regarding the buildings, a project is being implemented for replacement of inefficient wood and coal heating appliances in six municipalities - Sofia, Burgas, Ruse, Stara Zagora, Veliko Tarnovo and Montana. The project budget amounts to BGN 32.6 million, and the funds are provided under the Life + program. Additional funds for Sofia, Burgas and Montana will be provided by the Operational Program "Environment" (OPE). The funds for it are more and in addition to gasification and heating of pellets can be invested in connection to district heating and heating with electricity.

In order to minimize the adverse effects of international civil aviation on the global climate, the International Civil Aviation Organization (ICAO) formulates policies, develops and updates standards and recommended practices (SARPs) on aircraft emissions and conducts information activities. Bulgaria, as a member of ICAO, takes an active part in the ongoing international forums and seminars, which trains the General Directorate "Civil aviation" expert staff on action management issues, according to their competencies, which reduce the potential impact of future climate change.

Progress towards reducing climate impacts, vulnerabilities and risks

The open call № 3 "Increasing the capacity of local communities to reduce greenhouse gas emissions and adapt to changing climate" aims to launch a process of increasing the capacity of local municipalities to evaluate their strategic plans and programs in relation to planned and actions taken as a result of reducing greenhouse gas emissions and adapting to the expected adverse effects of climate change. As a result, it will be easier to plan and implement new strategic steps to introduce good practices to prevent or minimize the damage they can cause.

Draft proposals (under evaluation) have been registered, including for implementation measures from the Action Plan to the National Strategy for Adaptation to Climate Change, related to the establishment of regional climate monitoring systems and air quality, construction of green areas in urban parks. , assessment of the adaptive capacity of the water infrastructure on the territory of certain municipalities, etc.

In the implementation of each of these projects it is set to improve the competence of municipal officials to plan, develop and implement measures to mitigate and adapt to climate

change in the field of transport, urban planning and information campaigns and increase public knowledge and commitment to climate change and seeking additional benefits and synergies by taking proactive activities to prevent risk and reduce vulnerability. The activities are expected to be completed by the end of 2023.

Investments in the development of forest areas and improving the viability of forests - there are approved projects for introduction and improvement of preventive activities to reduce the risk of forest fires in 4 Regional Forest Directorates. Within the framework of projects with external financing, systems for early warning of the danger of fires have been built on the territory of the nature parks "Vratsa Balkan", "Belasitsa" and "Rusenski Lom".

System for long-term monitoring of natural disturbances was started by developing a module "Information system for examinations and forest pathological monitoring" (Lesopathological inspection) in the information system of Executive Forest Agency, which registers the damage from biotic and abiotic factors and the planned follow-up actions.

Progress towards increasing adaptive capacity

The fulfillment of the national target of 27.09% share of energy from renewable sources in the gross final energy consumption by 2030 will be achieved by creating a favorable regulatory and regulatory framework and by increasing the use of energy from renewable sources in the electricity, heat and energy sectors. and energy for cooling and transport. In the transport sector, the entry of new generation biofuels and renewable electricity supplied to the road and rail transport sector. The consumption of these fuels and energy should contribute to achieving the policy objectives of energy diversification and decarbonisation of the transport sector.

Implementation of innovative technologies for sustainable energy development Innovations in the energy sector contribute both to the achievement of overall reduction of energy costs and to the imposition of new standards for energy efficiency and the transition to lower and more sustainable energy consumption.

Water - Within 2020, the project "Update of networks and programs for monitoring the amount of surface and groundwater" was finalized and adopted with assignor MOEW. Within the framework of the Agreement between NIMH and the Ministry of Environment and Water under the Water Act, financed from the state budget, funds are allocated for maintenance and we are technologically updating the monitoring hydrological networks. In 2020, a total of 54 repair and restoration activities were performed at hydrometric stations and hydrogeological stations of the national monitoring hydrological network. In addition, 10 stations with automatic telemetry devices for real-time information transmission were automated during the year.

For Modernization of the National Institute of Meteorology and Hydrology (NIMH) precipitation network, in 2020 5 automatic precipitation meters were installed. as the goal is to gradually modernize and expand the entire NIMH precipitation network.

In 2020, the National Roadmap for Scientific Infrastructure of the Republic of Bulgaria (2020-2027) included ..Distributed Scientific Infrastructure, Bulgarian Network for Long-Term Ecosystem Research "(LTER-BG). The consortium includes IBEI-BAS (coordinator). Institute of

Oceanology - BAS. Forestry University. Forest Institute - BAS and Geopolymorphic EOOD. The mission of LTER-BG is to provide appropriate scientific information for conservation and sustainable management of the unique biological diversity in the Republic of Bulgaria, ecosystems and their services for the benefit of society. The data collected in LTER-BG are already used to implement policies, e.g. Bulgaria's commitments under the Ramsar Convention, Marine Strategy Framework Directive, Water Framework Directive, Directive (EU) 2016/2284 on the reduction of national emissions. They can also be used for the purposes of future European ecosystem legislation, the implementation of the European Green Pact, as well as by local communities and businesses in the implementation of regional policies for sustainable development and adaptation to climate change.

Progress towards meeting adaptation priorities

Environment Executive Agency - Regarding the exchange of information and data under the INSPIRE obligations - Metadata and services for viewing and downloading 29 sets of spatial data related to reports under the Water Framework Directive have been published on the European Commission's Geoportal, The Urban Waste Water Treatment Directive, the Marine Strategy Framework Directive and the Nitrates Pollution Directive. These datasets are of priority importance under environmental legislation to which access is provided through the INSPIRE infrastructure.

Energy saving measures (households and industry)

- Financing of projects for introduction of energy saving technologies and energy from renewable sources under the Operational Program "Innovation and Competitiveness" 2014-2020;
- Mandatory management of energy efficiency (EE) in enterprises and industrial systems, according to art. 63 of the Energy Efficiency Act (EEA);
- Energy audits and management systems - The realized savings in 2019 from the implementation of the measure amount to 201.4 GWh / y in enterprises and industrial systems and 57.1 GWh / y - from inspection and certification of buildings;
- Check for energy efficiency of heating systems with hot water boilers and air conditioning systems in buildings - Realized energy savings amount to 19.8 GWh / g

As a result of mandatory preparation of programs for increasing the energy efficiency by the state authorities and the local self-government and mandatory management of the energy efficiency in public buildings - The realized savings amount to 83.8 GWh. Raising the awareness of energy traders regarding their obligations under the Energy Efficiency Act and the possibilities for their implementation "- In 2019, within the ENSMOV project, implemented by AUER, a Report with stakeholder needs assessments for the implementation of Art. . 7 of Directive 2012/27 / EU on energy efficiency.

- The Agency for Sustainable Energy Development regularly conducts ongoing information campaigns, meetings with stakeholders, consultations of obligated persons, etc. in respect of their obligations under the EEA.

Work with water sector stakeholders to explore the links between water efficiency (ie system losses) and energy efficiency ":

Water companies in the country also implement a number of EE measures. The most commonly implemented measures are:

- replacement of pumping units for transportation of drinking water and drainage of wastewater;
- introduction of autonomous automated control in water supply systems;
- improving the condition of the building stock.

- Improved resilience to climate change of future transport projects - In accordance with the subject of activity State Enterprise Port Infrastructure develops an investment program including sites for repair, rehabilitation and reconstruction of port infrastructure in public transport ports for 2021.

Agriculture - The draft Strategic Plan for the Common Agricultural Policy (CAP) for the new programming period proposed a measure "Agri-environment and climate", with activity "Promoting the use of crops and varieties suitable for growing in specific climatic conditions". The aim is to support the cultivation of special crops and varieties that have the potential to adapt to climate change.

The strategic document, setting the framework of the development policy for the agricultural sector for the period 2021-2030, is prepared and approved in 2020. National Development Program: Bulgaria 2030 (NDP Bulgaria 2030)

At the same time, the Strategic Plan for Development of Agriculture and Rural Areas is under development.

Progress towards addressing barriers to adaptation

With regard to high priorities for improving knowledge management, education and communication for adaptation, which include the implementation of the interoperability of ecosystem data between competent authorities and other actors, the promotion of science with wide participation - through interdisciplinary research competitions, targeted collection of folk customs and traditional knowledge, facilitating the voluntary exchange of data and information, and implementing new training programs at all educational levels:

The implementation of public procurements within the Natura 2000 Knowledge project has started, which includes planning and conducting three annual international forums on current topics related to Natura 2000, activities for unification of initial awareness, awareness raising and provision of up-to-date information and stakeholder expert information on the Natura 2000 network and others. Activities are currently suspended due to the clauses in the contracts for "Force Majeure" arising from the extraordinary epidemic situation in the country, which does not allow the full implementation of the planned meetings and events on the contracts. It is envisaged that they will be resumed after the cancellation of the epidemic situation by the relevant order of the Minister of Health.

The main challenge in the climate transition will be the successful implementation of reforms in

regions with a carbon-intensive energy sector. In Bulgaria, coal is the leading conventional source of energy and in this regard in the "Integrated Plan in the field of energy and climate" is set to use the existing potential of local coal in the country, in compliance with environmental requirements.

Territorial plans for a fair transition for the three coal regions approved by the EC for financing under the Fair Transition Fund (Stara Zagora, Kyustendil and Pernik) are being developed. At the national level, eight more have been identified as potentially affected by the climate transition, in terms of energy intensity and related industries - Haskovo, Sliven, Yambol, Varna, Burgas, Lovech, Gabrovo and Targovishte.

As a border country, providing 46% of its energy from base coal capacity (up to 60% in the winter months), a key moment for Bulgaria is to prevent carbon leakage and relocate the activities of economic operators to countries with more liberal environmental regimes and economic conditions.

The implementation of infrastructure projects for electricity and gas is key to achieving the goal of improving energy interconnections between EU Member States and neighboring countries, as well as ensuring adequate balancing of renewable energy capacities due to their growing share. by 2030 and with a horizon of 2050. In this regard, and in order to ensure the energy security of the country, by accelerating the diversification of sources and routes of energy resources, our efforts are focused on building the missing infrastructure to ensure security of energy supply .

Steps taken to review and update vulnerability and risk assessments

Bulgaria adopts its first "Climate Change Adaptation Strategy and Action Plan" at the end of 2019. In view of the time horizon that it covers - until 2030 at the moment, Bulgaria still does not have a review and update of the measures taken under the strategy for vulnerability and risk assessments.

Steps taken to review and update national adaptation policies, strategies, plans, and measures

Biodiversity - A procedure for coordination of a draft Biodiversity Strategy in the Republic of Bulgaria until 2030 is underway, which after reflecting the comments and suggestions provided by stakeholders will be considered by the Council of Ministers, which is expected to take place in February 2021. Following its adoption, a National Plan for Conservation and Sustainable Use of Biodiversity and Genetic Resources 2021-2025 is to be developed.

Agriculture - In connection with the implementation of the action plan - Agriculture Sector, strategic goal 4 "Strengthening the political and legal framework for adaptation in the agricultural sector", in 2020 a National Program for Protection, Sustainable Use and Restoration of Soil Functions (2020-2030) was adopted.), including an action plan with specific measures, the implementation of which should support the implementation of the above - mentioned objective.

Healthcare - During the one-year period from the adoption of the National Strategy and Action Plan for Adaptation to Climate Change with Decision № 621 of 25.10.2019 of the Council of Ministers, namely in 2020 the Ministry of Health provided and allocated for its budget for capital expenditures of targeted funds of state medical institutions - commercial companies in the amount of BGN 46,617 thousand, intended for the purchase of medical apparatus and equipment, as well as modernization, adaptation and improvement of the hospital infrastructure (buildings and installations) to provide and respond of changes and modern requirements and standards for hospital environment.

- Within the above funds are also granted by Decree of the Council of Ministers № 216 / 14.08.2020 additional costs under the budget of M3 for the needs of UMBAL Burgas AD for the implementation of, Activities related to improving energy efficiency and thermal insulation of the building and departments in the medical institution

- Stage II "in the amount of BGN 5,790 thousand. The implementation of energy efficiency measures will lead to achieving the required temperature in the premises, will reduce fuel consumption and savings on heating, and will reduce harmful emissions into the atmosphere, improving the usability of infrastructure, increasing the safety of the hospital environment, which is also related to climate change.

Energy - In 2020 the following drafts of updated plans have been prepared:

- Preventive action plan to ensure security of natural gas supply;
- Contingency plan for ensuring the security of natural gas supplies to the Republic of Bulgaria.

Transport - Aviation State Enterprise "Air Traffic Management" (State Enterprise Air Traffic Control)

- Within the aeronautical meteorological service provided by the State Enterprise ATM, meteorological databases have been created for the five international airports of the Republic of Bulgaria, which could be used for specialized studies concerning adaptation to climate change.

Overview of good practice with regard to steps taken to review and update subnational adaptation plans, policies, strategies and measures

The Ministry of Environment and Water is the national coordinator of the European Commission's European Mobility Week campaign, which is held annually from 16 to 22 September.

The campaign seeks to encourage the participation of municipalities, schools, non-governmental and business organizations, as well as to involve citizens themselves in initiatives related to sustainable urban mobility, leading to the reduction of air pollution, noise pollution, congestion, road accidents and health problems. problems, reducing environmental pressures and taking into account climate change.

The aim is to increase the knowledge and interest of citizens in alternative ways to move in cities. The campaign calls for a change in behavior and aims to make progress in developing more sustainable transport strategies and better air quality in cities, limiting the effects of heavy

traffic and concomitant climate change.

The MoEW, through its regional offices throughout the country, traditionally participates in the celebrations of the European Mobility Week by conducting various thematic initiatives involving hundreds of children and young people, helping municipalities to promote the campaign and build an environmentally responsible society.

In 2020, the Zero emission mobility for all campaign was launched, encouraging citizens to choose environmentally friendly ways to move around in their daily lives - on foot, by bicycle, by public transport or by combining these options, replacing traveling by car .

Cooperation, good practices, synergies, experience and lessons learned in the field of adaptation

Synergies of adaptation actions with other international frameworks and/or conventions

Bulgaria adopts its first "Climate Change Adaptation Strategy and Action Plan" at the end of 2019. In view of the time horizon that it covers - until 2030 at the moment, Bulgaria still does not have a synergies of adaptation actions with other international frameworks and/or conventions

Cooperation with Union Member States, international cooperation, and with regional and international organisations to share information and to strengthen science, institutions and adaptation knowledge

Bulgaria adopts its first "Climate Change Adaptation Strategy and Action Plan" at the end of 2019. In view of the time horizon that it covers - until 2030 at the moment, Bulgaria still does not have an information to report under the cooperation with Union Member States, international cooperation, and with regional and international organisations to share information and to strengthen science, institutions and adaptation knowledge

Cooperation with Union Member States, international cooperation, and with regional and international organisations to enhance adaptation action at the sub-national, national, macro-regional and international level

Bulgaria adopts its first "Climate Change Adaptation Strategy and Action Plan" at the end of 2019. In view of the time horizon that it covers - until 2030 at the moment, Bulgaria still does not have an information to report under the Cooperation with Union Member States, international cooperation, and with regional and international organisations to enhance adaptation action at the sub-national, national, macro-regional and international level

Any other information related to climate change impacts and adaptation

Key contact details of national coordinator and organisation (1)

Organisation

Annex I: 6.1

Ministry of Environment and Water

Department within the organisation

Climate Change policy

Role of the organisation

Coordinating adaptation policies and responsible for reporting

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