

Adaptation Strategy of the Slovak Republic on Adverse Impacts of Climate Change

Overview: Executive Summary

It is the fact, that climate change has caused a wide range of impacts on natural and human systems all over the world¹. In Slovakia, we have observed more frequent physical impacts of climate change such as floods, landslides, long-term droughts and others, which have effects on health, ecosystems, economies, societies, services and infrastructure.

This strategy describes the impacts on natural system (geological environment, water, soil, biosphere and biodiversity) and the following sectors: health, urban environment, agriculture, forestry, transportation, energy, industry and tourism. There is a set of adaptation measures proposed for each of these sectors and impacts in the strategy.

The aim of the strategy is ***to draw attention to the fact that climate change is an urgent issue that requires an integrated and comprehensive approach.***

PRINCIPLES

- *Integrated approach* is important in assessing synergies of mitigation and adaptation measures, as well as assessing the suitability of proposed adaptation measures for individual components of the environment, the economy (infrastructure, physical capital, production and consumption) and social impacts (employment, health, equity of access to resources, reasonable management systems);
- *Mutual coherence* of mitigation and adaptation measures;
- Implementation of *win-win and no-regret measures* is priority;
- Identification and utilization of *opportunities* related to adaptation processes;
- *Avoiding maladaptation*;
- *Knowledge and objective information* for decision-making at all levels should be built.

The strategy was approved by the government and through defined objectives, principles and criteria which prioritise proposed measures creates ***the framework for adaptation processes in Slovakia***. Tasks for ministries and municipalities are imposed by governmental approval of the document to contribute to the objectives of the strategy.

OBJECTIVES

- To provide information about the *current state* of the adaptation processes;
- To describe *adverse impacts* of climate change in the Slovak Republic;
- To analyse the *expected impacts* of climate change on key areas/sectors;
- To propose a set of appropriate *proactive adaptation measures* and mechanism for their implementation;
- To establish procedures for *risks prevention and management* associated with extreme weather events and to minimize the social and economic costs;
- To promote the development and application of methodologies, models and tools for better assessment of *investment risks* associated with the cost of damage and adaptation;
- To adopt recommendations for the development of information technologies

¹ <http://www.ipcc.ch/report/ar5/>

and to create a *knowledge base*;

- To identify *opportunities* associated with the process of adaptation and create conditions for their practical realisation;
- To suggest criteria for selecting and evaluating *investment priorities* within the adaptation measures;
- To design a system for *monitoring, evaluation and review* of adaptation measures;
- Enable *mainstreaming* of proactive adaptation measures to financial resources from Operational programmes for the period 2014 – 2010 and within new financial instrument LIFE;
- To create an infrastructure which would enable efficient and cost-effective adaptation to adverse climate change effects by 2020.

CLIMATE CHANGE AND TRENDS IN SLOVAKIA

Following trends were observed from 1881 to 2010:

- increase of mean annual air temperature by about 1.7 °C;
- decrease of annual precipitation totals by about 0.5 % (mainly in the south of Slovakia - up to 10 %, small increase in precipitation totals is only at the northern border of Slovakia - about 3 %);
- decrease of all snow cover characteristics by altitude 1000 m a. s. l.; increase of snow cover days and depths was recorded only in higher mountains;
- increase of potential evapotranspiration and decrease of soil humidity – southern Slovakia gradually dries out which is visible on the characteristics of evapotranspiration, soil humidity and solar radiation;
- the amount of extreme daily precipitation increased within the last 15 years, this caused the growth of the risk of local floods.

General conclusions to the further climate change in Slovakia:

Air Temperature

- in comparison to the period between 1951 and 1980 the average air temperature may gradually increase by from 2° C to 4° C – the so-far inter-annual and inter-seasonal weather fluctuation may remain;
- the decrease of the average daily air temperature amplitude is caused by the faster growth of the daily minimum air temperature in comparison with daily maximum air temperature;
- the projections do not assume influential change in the annual air temperature cycle; lower air temperature increase may be measured in autumn in comparison with the air temperature increase measured in spring, summer and winter.

Precipitation amount

- annual precipitation stays the same except the southern parts of Slovakia (10 % increase);
- more significant changes are expected in the annual precipitation cycle:

- higher incidence of relatively longer droughts and relatively shorter heavy rain episodes;
- thus the warmer weather, the snow cover under altitude 900 m a. s. l. is expected to be uneven;
- more winter floods due to the unstable snow conditions;
- increase of snow cover days and depths was recorded only in higher mountains (altitude above 1 000 m a. s. l. covers only 5.4 % of Slovak territory).

Other climate elements/indicators and characteristics

- considering the tendency to the stronger storms in the warm period of the year, the higher occurrence of high wind, gale and tornado is expected;
- decrease of soil moisture in Slovak lowlands.

VULNERABILITY ASSESSMENT

The vulnerability of some sectors was also assessed deeply and in wider scale of areas in the *"Climate change impacts and possible adaptation measures in various sectors in Slovakia"*² report prepared by the Slovak Hydrometeorological Institute. This document was one of the basic sources for preparation of the strategy.

This report provides results of an analysis of the trends and impacts of climate change on sectors such as water, agriculture, forests, biodiversity, transport, tourism and human health. In general, Slovakia is not considered to be vulnerable to climate change to a great extent and therefore the topic is not perceived as a priority. Some sectors are considered more vulnerable than others, such as transport, infrastructure or agriculture.

The impacts on GDP (Gross domestic product) and employment for covered sectors or areas were also analysed using the modelling tools (Computable General Equilibrium – CGE) and elaborated approach with given level of aggregation determined by the first use and availability of data. Economic modelling allowing the quantification of the direct social and economic categories for preventive or planned adaptation measures compared to the cost of inaction was developed under the project. Results of first modelling showed the area for further development, namely in the definition of indirect and cumulative sector-related economic effects. Comprehensive economic adaptation measures assessment methodology and methodology for priority setting for selecting adaptation measures is therefore further needed step to be developed in the Slovak Republic.

STRATEGIC DOCUMENTS AND POLICIES

European Commission policy documents (Green paper, White paper, EU Strategy on adaptation to climate change) provided a basis for the formulation of principles of

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<http://www.shmu.sk/File/projekty/Zaverecna%20Sprava%20projektu%20Klim.%20zmena%20a%20Adaptacie%202012.pdf>

proactive adaptation. Other basic documents which were used for preparation of the Strategy are:

- Concept of water management policy of the Slovak Republic 2015;
- Water Plan of the Slovak Republic 2009 – 2015;
- National Biodiversity Strategy of Slovakia;
- National Forest Programme (NFP);
- Action Plan of the NFP;
- Strategy on Forestry in Slovakia;
- Strategy of the International Commission on Protection of the Danube River (2013);
- Environment and Health Action Plan;
- Strategy for Transport Infrastructure Development 2020;
- Tourism Development Strategy to 2020.

RESEARCH

Scientific and research organisations have widely participated in research projects aimed at climate change impacts, economic impact assessment and identification of the adaptation measures, which provided inputs to the strategy.

As mentioned above, the Slovak Hydrometeorological Institute study “Climate change impacts and possible adaptation measures in various sectors in Slovakia” provided valuable inputs to identify the adaptation options. Other R&D agencies, universities, the Slovak Academy of Sciences, and research institutes linked to the ministries have included the adaptation in their research tasks.

Some Slovak institutions are participating in several international research projects, for example Comenius University participates in the CC-TAME Project (Terrestrial Adaptation & Mitigation in Europe). The Slovak Hydrometeorological Institute participates in the project Joint Disaster Management Risk Assessment and Preparedness in the Danube macro-region (SEE Risk) which is focused on risk assessment and its purpose is to foster awareness and effectiveness of the measures in emergency situations caused by climate change.

CLIMATE CHANGE IMPACTS AND PROPOSED ADAPTATION MEASURES – examples

Field/Sector	Climate Change Impact	Proposed adaptation measure
Geological environment and soil	<ul style="list-style-type: none"> ▪ landslides, soil erosion ▪ changes in the valley shape as a result of floods and heavy rain ▪ desiccation and salinization of soil 	<ul style="list-style-type: none"> ▪ to protect potentially vulnerable area against landslides – adjust water regime and ensure vegetation cover ▪ increase inundation and retention capacity of the area; to create retention areas in order to collect heavy rain and convert to the space of the original inundation while respecting the geological structure and maintaining the conditions of stability zone ▪ to change the water regime of non-irrigated soils, infiltration belts
Hydrology and water management	<ul style="list-style-type: none"> ▪ decrease in water resources in the south and east of Slovakia ▪ increase in the occurrence of drought and floods ▪ change of hydrologic cycle 	<ul style="list-style-type: none"> ▪ to decelerate water runoff from the river basin (ensure suitable land use in areas threatened by increased risk of erosion and flooding, to apply good agricultural practices etc.) ▪ implementation of measures for the effective use of water resources to ensure sustainability ▪ to minimize the pollution of water resources by discharges of untreated or insufficiently treated municipal waste water
Biodiversity	<ul style="list-style-type: none"> ▪ change of the favourable status of forest habitats, fragmentation of forest, fire, increase of damages, of drought and floods ▪ drought and floods, changes of water regime and of water sources quality; increase of air temperature ▪ increased erosion, change of temperature conditions for plant production and of agro-climate production potential, changes of physical and chemical properties of soil ▪ habitat fragmentation ▪ spread of invasive alien species and pathogens 	<ul style="list-style-type: none"> ▪ strengthening of the natural regeneration of natural forests and their sustainable use ▪ diversification of landscape and landscape structures – ensuring the heterogenic ecosystems, increased diversity of vegetation and of morphology, ensuring the dynamic natural processes; sustainable use of grasslands ▪ increase of the landscape connectivity – building of green infrastructure, support or creation of corridors and stepping stones, elimination of barrier effect of roads and railways, elimination of barrier on water streams ▪ systematic, long-term mapping, monitoring of

		occurrence of populations of invasive alien species
Urban environment	<ul style="list-style-type: none"> ■ overheating of buildings ■ higher demands on water consumption ■ deterioration of traffic safety and flow ■ disruption in supplies of energy, damage of equipment 	<ul style="list-style-type: none"> ■ to define an urban structure of the city in order to allow better air circulation ■ to support and ensure the re-use of rainwater and wastewater ■ to ensure and support adaptation of transport and energy technology, materials and infrastructure to climate change
Health	<ul style="list-style-type: none"> ■ the deterioration of general health, older and lonely people aged over 75, children and disabled will be the most affected ■ increased risk of infectious diseases caused by polluted water and food ■ asthma, allergies, respiratory diseases 	<ul style="list-style-type: none"> ■ to extend the network of monitoring stations to monitor the concentration of biological allergenic particles (pollen grains, spores) in ambient air as a basis for the public information and alerting ■ to create and continuously maintain the public reporting and alerting of extreme weather events (heat waves, frost, floods, drought, allergens in the air, an outbreak of the disease, especially epidemic diseases, etc.)
Agriculture	<ul style="list-style-type: none"> ■ occurrence and spread of pests and diseases on plants, trees and animals ■ areal changes of the precipitation and humidity (decrease of the air humidity under altitude 400 m a. s. l.) ■ extension of the growing period (43 more days in the eastern and 84 more days in the southern Slovakia by 2075) 	<ul style="list-style-type: none"> ■ protection of the biotopes ■ protection of the integrated production and ecological stability ■ use of irrigation with emphasis on irrigation efficiency and water saving ■ to ensure the traditional Slovak species breeding, to support the domestic species and help adapt them to the present-day conditions with the purpose of more stable productivity
Forest management	<ul style="list-style-type: none"> ■ elevation of the production optimum altitude of the forest ■ higher risk of forest fire ■ changes in the population dynamics of the pests 	<ul style="list-style-type: none"> ■ measures supporting biodiversity, ecological stability and community service of the forest ■ improvement of the forest management (objectives, framework, principles) regarding to the adaptation to the climate change (according to the latest research)
Transport	<ul style="list-style-type: none"> ■ damage to road infrastructure ■ longer transport time, vulnerability to accidents 	<ul style="list-style-type: none"> ■ optimize the design of roads with regard to climate change ■ maintain the high frequency weather monitoring and on-time warning in the endangered areas (floods, storm, ground-ice)

Energy	<ul style="list-style-type: none"> ▪ affecting power plants by more adverse weather phenomena, tornado, strong thunderstorm ▪ higher demand for energy in summer season 	<ul style="list-style-type: none"> ▪ increase of power plants safety
Tourism	<ul style="list-style-type: none"> ▪ less snow and irregular occurrence of snow cover in lower localities ▪ winter season shortening in lower localities 	<ul style="list-style-type: none"> ▪ transfer of skiing activity to higher altitude centres ▪ reorientation of threatened winter centres to other activities
Disaster risk management		<p>Proposed measures in fields:</p> <ul style="list-style-type: none"> ▪ threats and risks monitoring ▪ critical infrastructure protection ▪ civil protection ▪ crisis management system

CROSS-CUTTING ASPECTS AND PRIORITIZATION

The adaptation strategies and decision-making process have to take into account potential positive or negative impacts of adaptation measures on different sectors but no methodologies for assessment of potential adaptation benefits and costs are available and therefore it is dependent only on expert judgment and qualitative assessment³, which is useful tool for the evaluation and selection of priority measures. Adaptation measures with positive impacts on public health are considered to be the top priority.

Determining criteria for selection of priority measures are:

- the urgency of the problem;
- the complexity of the solution (positive contributions to the widest range of areas);
- feasibility measures;
- identified additional opportunities.

FINANCIAL FRAMEWORK

Adaptation measures should be primarily financed through their integration into sectoral politics, cross-sectoral synergies should be identified and financial resources should be pooled. There are also some programmes and mechanisms which can be used for financing the adaptation measures: European Economic Area (EEA) Financial Mechanism and Norwegian financial mechanism, Program LIFE, LIFE+ and EU Funds - operational programmes.

Under Regulation EU⁴, the preparation of the Strategy has become ex ante conditionality for Operational Programme Quality of the Environment 2014 – 2020, TO5: Promoting climate change adaptation, risk prevention and management. During the process of preparation of the strategy there has been a lot of effort for mainstreaming of proposed adaptation measures into the relevant Operational Programmes for period 2014 – 2020.

IMPLEMENTATION AND RESPONSIBILITIES

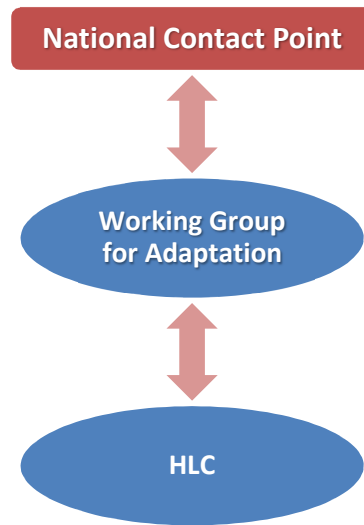
Coordination of activities (information transfer, adaptation measures monitoring etc.) should be organised as follows:

- the National Contact Point (the Ministry of Environment) provides communication with international organizations and coordinates national activities in cooperation with the Working Group for adaptation;
- the Working Group for Adaptation provides the adaptation activities in the area of its competence, cooperates with professional institutions and other relevant organizations, is responsible for preparation of the documents for the Co-ordination Committee for Climate Change Policy and for decision-making;
- the High Level Committee for the Coordination of Climate Change Policy (HLC) defines the main tasks and gives overall lines for further policy-making processes on adaptation.

³ <http://www.shmu.sk/File/projekty/Zhrnutie%20projektu%20Klim.%20zmena%20a%20Adaptacie%202012.pdf>

⁴ COM (2011) 615

Fig. 1 Coordination Framework



MONITORING AND EVALUATION

Currently, there is no available methodology for monitoring and evaluation of the effect of adaptation measures and it is hard to choose indicators for monitoring the progress and effects of adaptation measures, but the preparation of a specific set of such indicators and methodology is planned for the near future.

For now, only costs of adaptation measures that will be implemented within the selected operational programmes for the period 2014 to 2020 will be monitored. Slovakia will use the list of indicators for project evaluation in relation with program LIFE - Climate Action as a starting base for monitoring.

CONCLUSION

The Adaptation Strategy of the Slovak Republic on Adverse Impacts of Climate Change is a framework document for adaptation processes in Slovakia, which will need to be updated based on experience and new scientific knowledge every 5-10 years - also regarding to the conclusions of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. The Government will be provided with information on the progress and accomplishment of the objectives of the strategy in May 2016.