Summary of Climate Change Adaptation Development Plan

Introduction

Pursuant to the competitiveness agenda "Estonia 2020", it is necessary to carry on developing a more resource-efficient economic system than the present one to achieve economic growth. In addition to climate change mitigation (reducing greenhouse gas emissions), adjusting to the impacts of climate changes is also important in transferring to a resource-efficient economy. Adjusting to the impact of climate changes means alleviation of the risks caused by climate changes and the framework of action for increasing the preparedness and resilience of the society as well as the ecosystems to climate changes.

In "The Development Plan for Climate Change Adaptation until 2030" (hereinafter *the Development Plan*), a framework is presented based on which the vulnerability of Estonia to the impact of climate changes can be reduced. The development plan was drawn up based on thorough studies, in the course of which the measures for adaptation to climate change to be implemented in the short-term perspective (up to 2030) as well as in the long-term perspective (up to 2050 and 2100) were determined. Achievement of the goals of the Development Plan is supported by a respective implementation plan.

The Development Plan involves eight prioritised sectors[1]:

1. **Human health and rescue capability**;
2. **Land use and plaaning**, incl. coastal areas, other areas of flooding risk / soil risk, land improvement, irrigation and drainage, urban planning;
3. **Natural environment**, incl. biological diversity, terrestrial ecosystems, freshwater ecosystems and environment, the Baltic Sea and marine environment, ecosystem services;
4. **Bio-economy**, incl. agriculture, forestry, fishery, wild game and hunting, tourism, peat production;
5. **Infrastructure and buildings**, incl. technical support systems, buildings, transport;
6. **Energy** and power supply, incl. energy self-sufficiency, security and safety of supply, energy resources, implementation of energy efficiency, heat generation, electricity generation;
7. **Economy**, incl. insurance, banking and finances, employment, business and entrepreneurship, industry;
8. **Society, awareness and cooperation**, incl. education, awareness and science, communication, society, international relations, and cooperation.

The aim of the Development Plan is to plan and direct the field of adaptation to the impact of climate changes comprehensively through one development plan. This will ensure better coherence of the various sectors related to adaptation to the impacts of climate changes.

As a result of the Development Plan, the preparedness and capability of Estonia to cope with climate changes on the local, regional and national level will improve and the areas of activity most vulnerable to climate change will be determined.

Compilation of the development plan was supported by European Economic Area Grants. The development plan will be implemented in cooperation with other ministries and agencies. The

[1] The sectors were approved at the management committee meeting of 27.05.2014

Ministry of Environment will organize the annual reporting on the implementation of the development plan and coordinate the exchange of information between ministries.

The need for adaptation to climate change in Estonia

Even though the climate changes in Estonia are not as extreme as in many other countries in the world and the European Union (EU), we can also probably expect the following changes:

a) Increase in temperature, which was higher in Estonia in the second half of the 20th century that the global average, resulting in less ice and snow; heat, drought and extreme rain periods in the summer; changes in growth of vegetation; appearance of introduced species, incl. new plant pests and infectious agents; unfrozen and waterlogged forest soil, accompanied by logging restrictions; changes to energy consumption in the winter and summer (levelling of peak consumption – added cooling devices in the summer); increased frequency of public health problems (especially in the case of the elderly); increased volume of the tourism sector services in the summer, etc.;
b) Increased precipitation (especially in winter and thus also higher number of floods, increased need for maintenance/establishing of drainage ditches and systems, increase in the volume of erosion of river banks and thus also the need for securing the banks, pressure to relocate buildings/structures, increased pumping volumes in mines, etc.);
c) Raised sea level resulting in coastal erosion, threat to coastal structures, pressure to relocate buildings/structures, etc.;
d) Increased frequency of storms resulting in requirements to the resilience of buildings, structures, power lines and to the capacity to eliminate storm damage.

In the course of drawing up the Development Plan, the Environmental Agency drew up and the management committee of the project approved the document "Estonian Future Climate Scenarios 2100", which is aiming to provide an overview of the projections and assessments to the future climate in Estonia up to 2100.

A more detailed overview of the presumed impacts of climate changes in Estonia is provided in the "Estonia's Sixth National Communication under the United Nations Framework Convention on Climate Change"[2].

Estonia has so far mainly been engaged in preparation for emergencies and climate change mitigation, and does not yet have a separate development plan for adaptation to the impacts of climate changes. However, some adaptation measures have been included in sectoral development plans, action plans and laws (e.g., "The Estonian Forestry Development Plan until 2020", "The Nature Conservation Development Plan until 2020", the Water Act, the Emergency Act and the risk analyses of emergencies, "The Action Plan for Climate Change mitigation and Adaptation to the Impact of Climate Changes in the Agricultural Sector", "The Public Health Development Plan for 2009–2020", "The Estonian Rural Development Plan for 2014–2020", "The National Security Concept of Estonia"). The existing development and action plans are mostly drawn up to the year 2020, but the field and the measures related to adaptation must be planned for a longer period in advance, if there is a thorough impact analysis (incl. analysis of potential risks and vulnerability). The development plan was drawn up keeping these impacts in mind.

Several climate projects have been completed or are ongoing, and the impact of climate change has been covered in many academic researches, but the information is fractured between

[2] http://www.envir.ee/sites/default/files/elfinder/article_files/kliimaaruanne_et.pdf

different fields of activity and institutions. For timely implementation of efficient adaptation measures in all sectors and at all levels of administration, a more strategic, nationally coordinated approach is needed in the form of a national development plan for adaptation to the impacts of climate changes, bringing together all goals and activities related to this issue. Keeping in mind that climate changes have an impact on the economy, the environment as well as the whole society, it is important to ensure including all relevant fields and levels of administration in the adaptation measures, and creating a commonly agreed national strategic action framework.

Sectoral impacts

Health and rescue capability

Weather and climate have a vital role in shaping the health condition of a person. The impact of climate changes on human health is multifaceted, and the impacts are often of critical importance from the perspective of the society and the quality of life. Climate changes may influence health directly (e.g., higher mortality due to more frequent heat waves) or indirectly (e.g., higher morbidity due to deterioration of air quality as a result of climate changes). Based on the studies conducted so far, climate changes have already had an impact on human health. This impact will increase in the period from 2030–2050 and increase significantly in the period from 2050–2100, especially sharply, however, in the case of the RCP8.5 climate scenario.

In connection with climate changes, it is necessary to be prepared for accidents or emergencies, which may break out due to more frequent extreme weather conditions, and for the consequences thereof, incl. in places that are difficult to access. The following types of emergencies are related to climate changes: extensive forest or landscape fires, flooding of densely populated areas, storms with serious consequences, epidemics, extensive immigration of climate refugees into the country.

Land use and planning

The impacts of climate changes can be alleviated by applying land use and planning measures, but not eliminated completely. Non-climatological factors will play an important role here, incl. political, economic and social trends, as well as, for example, the geology of the area. The significance of the impacts does not only depend on the extraordinary nature of the impact, but also on how the impact is exhibited and on the vulnerability of the environment. Thereat, natural variability of the climate, anthropogenic changes in the climate and socioeconomic processes must be taken into consideration. The measures for adaptation to the impact of climate changes largely depend on the vulnerability of the observed system – in this case, a town or settlement as a complex system –, incl. the level of awareness of the local municipality officials as well as the population.

Natural environment

The forecasted changes in the climate parameters (e.g., precipitation, air temperature, etc.) impact biodiversity as a whole as well as various ecosystems (terrestrial, freshwater and marine ecosystems), and the benefits and services offered to the society by the latter. Ecosystem services are environmental, social and economic benefits, which support human well-being[3]. Such services include, for example, binding and storage of carbon, protection from storms, floods and soil erosion, which are directly related to climate changes. Thereby, healthy ecosystems capable of regeneration provide important protection against the impact of climate

[3] Millennium Ecosystem Assessment. (2005). Ecosystems and human well-being: synthesis. Washington, DC: Island Press.

changes[4]. Approximately a half of the ecosystem services on Earth either have degraded or are not being used sustainably. Changing climate conditions influence the volume and quality of ecosystem services. The negative impacts of climate changes can be buffered by protection of biodiversity as a whole or at various levels (intra-species, inter-species and variability of ecosystems).

Freshwater sites form a considerable part of the land area of Estonia and any changes in climate parameters may cause significant shifts in these ecosystems. The national goal is to achieve a good status of waterbodies, but climate change may backfire on achievement of this goal, as an increase in water temperature, transport of nutrients and an increase in internal load and an increase in transport of hazardous substances may be forecasted – with the latter potentially deposited in the mud on the bed of the waterbody or in the living aquatic organisms – as well as more frequent toxic algal bloom.

The changes induced by climate change in atmosphere processes are directly manifested in the form of changes in sea water circulation, temperature and salt regime. The changed climate conditions of the Baltic Sea, incl. decreasing of the extent and thickness of sea ice, increase in water temperature, have an impact on all living organisms and their mutual relationships. The regime shifts in the biota make the marine environment unstable and more vulnerable to various pressure factors. Increasing of the sea water temperature facilitates surviving of introduced species in the Baltic Sea, which may thereby completely reorganise the functioning of the local ecosystem.

Bio-economy

Changing climate conditions have an impact on the functioning of the most important branches of bio-economy in Estonia. Estonia is in a climate zone in which forecasted climate changes may bring certain opportunities to the agricultural sector (e.g., prolonging of the growth period), while fluctuating weather conditions may cause significant fluctuations in the yield and the quality of the crop (e.g., extreme weather conditions may damage functioning systems for producing foodstuffs). Climate changes may also significantly influence the capability of the forestry sector and the percentage thereof in economy and employment, e.g., through long-term changes in the composition and production of Estonian forests and in the ecological status of the forests, or due to a potential decline in the quality of wood. The impact on the fish populations in the Baltic Sea and Estonian inland waterways is manifested through long-term one-way changes (increasing of the temperature of waterbodies) as well as through changing of the frequency of random, short-term, extreme weather conditions (e.g., influx of salt water into the Baltic Sea). This, in turn, means new conditions for industrial and hobby fishing.

Climate changes also influence other fields of bio-economy. For example, the traditional tourism destinations in Southern Europe are losing their attraction due to climate warming and decreasing fresh water reserves. Thus, the importance of Northern European destinations will probably increase, especially during the summer months. On the other hand, a decline in the potential of winter tourism can be anticipated. The role of hunting, more specifically wild game economy is very important from the perspective of the natural conditions and the economic situation in Estonia. This is, to a significant extent, also related to the functioning of other economic sectors, e.g., sustainable forest management would be impossible and agricultural production considerably more complicated without ensuring of an optimal numbers of wild

[4] Valge Raamat. (2009). Kliimamuutustega kohanemine: Euroopa tegevusraamistik. Brussels. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0147:FIN:ET:PDF

game. In the period from 1992–2013, the volume of peat extraction has ranged from 0.3–1.5 M t/y. The high fluctuation is mainly related to the weather conditions – primarily to rainfall, as well as to the number of precipitation-free days and air temperature. Climate change-induced increase in the average temperature will presumably result in more intensive mineralisation in the extraction areas and thus more intensive CO_2 emissions.

Economy

The economy sector in Estonia has felt relatively low impact by climate changes so far on the background of other influences factors. As a small country of open economy, Estonia has been impacted more by the impact of climate changes on world economy than by the local climate change-related processes. The global need for technological progress, more sustainable management and environment-friendlier production has placed the issues of climate changes in the area of entrepreneurship opportunities instead of being perceived as a significant threat to the economy. This is based on the success of the sector of technological entrepreneurship, which is showing a rising trend in Estonia, and on our development advantage due to availability of the natural resources enabling sustainable production (wood and other natural materials) and the tradition of using such resources.

Global climate changes have increased the likelihood and extent of extreme weather conditions, and given rise to several novel risks, which could significantly influence the situation of the insurance sector. Even though the insurance sector has indeed become one of the most important sectors of economy in adaptation to climate change worldwide, the volume of the Estonian insurance market is small and the population rather poor, thus, the market is dominated by compulsory and semi-compulsory (motor third party liability insurance, home insurance) types of insurance here. The Estonian insurance sector has practically not been engaged in climate risk spreading so far.

Society, awareness and cooperation

Changing of the climate influences the way of life and welfare as well as the health of the population (physical and mental health risks). Extreme weather conditions (heat waves or cold weather, floods, etc.) impact people more than any other climate changes.

The hazards accompanying extreme weather conditions do not influence all groups of the society equally – the impacts vary locally (e.g., floods in coastal or lowland areas) and by specific members of the society (e.g., the elderly are more vulnerable to extreme cold and heat). Least privileged people are endangered most by climate change – the people in a poorer socioeconomic status and those with less social capital. Health implications primarily affect children, the elderly and chronically ill people or those simultaneously suffering from several health problems. Thus, extreme weather conditions may deepen the inequality in the society further.

Even though all societies have continuously had to adjust to the changing climate throughout the history of humankind, active implementation of adaptation measures may come in conflict with restrictions arising from the processes and patterns of the society. For example, information about the impacts may be too discouraging for people; there may be too much (saturation) or too little (unawareness) information available. In general, there are more important problems than climate change in people's lives for the improvement of which they reshape their life practices. The focal task is translation of the issue of climate change, which has remained very abstract so far, into as tangible solutions as possible.

The efficiency of adaptation to climate changes in a society depends, on the one hand, on the actions of the political establishment, the fragmentation of the decision-making structures, and the political-administrative culture, on the other hand, however, on the actions of non-governmental stakeholders, incl. the academic circles, the pressure of the public and independent associations and the interests of commercial undertakings. The role of the state and agencies is to create favourable social structures for groups and individuals: legal frameworks, information and mentorship, technical support. The vulnerability of the society and its adaptation to climate changes are also significantly impacted by the level of science and education in the country, which determine the preparedness for climate changes and the ability to accurately estimate the factors accompanying the changes.

Successful adjustment calls for sector-wide cooperation on the national, regional as well as local level, but also between communities. It must be taken into consideration that even if a person is concerned and feels personally responsible, this may not influence his or her behaviour if there are no favourable structural opportunities created.

In Estonia, the awareness of the residents of Estonia of climate change and the issues accompanying climate change are currently rather low as even experts (officials, scientists) have not been able to distribute this information to the public. Climate issues are also not of particularly high priority in the daily lives of people.

As the climate in Estonia is forecasted to change relatively slowly compared to the changes in the society in the future, there is no reason to think that the Estonian society will come face to face with great challenges. Estonia has risk analyses for dealing with emergencies resulting from extreme weather conditions and the national action plans for dealing with such situation. Both the education and research system includes almost everything urgently required for dealing with climate changes. Education and research are much more impacted by the low numbers of children and financing related-issues than by climate changes. The behaviour of an individual is above all influenced by the community that he or she belongs to, the socioeconomic structure surrounding the person, and the person's own social relationships and economic situation. Increasing frequency of extreme weather conditions increases the need for the assistance of social workers, especially in serving vulnerable groups who are threatened by social isolation. The need for cooperation between rescue service authorities, organisations and individuals also increases. Warming of the climate can be expected to be accompanied by a decrease in the housing costs of people, more frequent extreme weather conditions, however, may increase the amount of unforeseeable material damages.

In international communication, Estonia is, above all, influenced by the climate policy of the European Union. Estonia is also a party of the most important international agreements and participates in the development cooperation directed to third countries as a member of the European Union and OECD. Globally, Estonia is mainly the party providing assistance, and thus both global agreements and the agreements within the European Union in the area of adaptation to the climate primarily influence Estonian development cooperation policy.

Infrastructure and energy sector

In the area of infrastructure and energy sector, technical support systems, including roads, ports and bridges, water supply and sewerage and line facilities for TV, radio and communications transmissions; buildings; transportation; energy self-sufficiency, security and safety of supply; energy resources; implementation of energy efficiency; heat generation and cooling and energy

generation are considered in the context of adaptation to climate impacts and climate change based on the economic and administrate structure (both separately and partly together) settled in the Republic of Estonia.

Daily consideration of the negative impacts arising from climate factors and handling of the consequences of such impacts are regulated by the Emergency Act in the Republic of Estonia today. The Emergency Act establishes the legal grounds for crisis regulation, including preparing for emergencies and dealing with emergencies, and ensuing of the functioning of vital services. The Act also mentions natural disasters, which may and mostly do arise due to extreme climate events, as the reason for arising of special and emergency situations. The Emergency Act specifies the vital services that must be ensured by the state and the local municipality and which mostly require operability of the infrastructure servicing these services in emergencies. A national development plan will help to make the topic of adaptation to climate change sector- and industry-wide.

The Estonian infrastructure and energy sector have been built taking into consideration all climate conditions in our geographical area. The energy generation and infrastructure in Estonia function on a daily basis in weather conditions, which fluctuate seasonally as well as over 24 hours, thereat in a relatively extensive range. The infrastructure is reliable and consumers are supplied electricity in Estonia without interruptions when it is +35 degrees or -40 degrees outside, as well as in draught or heavy rain conditions. The infrastructure is also functioning at wind speed from 0 to the 45 meters per second, which is the record wind speed measured in Estonia to this date. Some vital, infrastructure-related services can only be disturbed or interrupted for a shorter or longer period of time in the case of extreme weather conditions or several extreme weather phenomena (precipitation over 30 mm per hour or storm gales over 25 m/s). The power distribution network is influenced most by weather conditions, especially strong storm gales, as most of the power lines are on open countryside, running through forested areas, which is why falling of trees on the lines is a frequent reason for breaking of power lines and short-circuits.
Power cuts have a significant impact on the availability of all vital services. On the other hand, power network enterprises have implemented the most measures to alleviate the risks arising from climate factors and to eliminate damages and power cuts, and undisturbed and uninterrupted power supply is regulated the most in Estonia.

Taking into consideration the great seasonal changes in the values of climate factors usual in our region, the forecasted changes are of marginal importance both from the perspective of aspects of positive and negative impact. The impacts are only visible in the end of the observed period, up to 2030, the impact of climate changes on the infrastructure and energy sector is almost non-existent.
Both the sectors of transportation and communications infrastructures and energy and power supply are very tightly connected. For example, the overview and trends concerning energy resources provide an input for the issues of heat generation and cooling. Heat generation and cooling are, in turn, through cogeneration plants, electrical heating and cooling equipment very tightly connected to energy generation. Through energy efficiency, these sectors are also related to the sector of buildings. Preferring domestic energy resources has a positive effect on energy self-sufficiency, security and safety of supply.

The goals and measures

The general aim of the Estonian national development plan for adaptation to climate change is **preparedness and capability to deal with the impact of climate changes.** Based on the division of prioritised sectors, the development plan has eight sub-goals, the achievement of which are supported by the measures for adaptation to the impact of climate changes provided in the implementation plan of the draft.

Health and rescue capability

General aim 1. Improved rescue capability and ability of the people to protect their health and property will reduce the negative impact of climate changes to health and the living environment.

Measures:

1. Development of information, monitoring and support systems, and drawing up action plans for improvement of management of the health risks arising from climate changes and alleviation of the risks.
2. Increasing the rescue capability.

Resources from the Internal Security Development Plan 2020 are counted on for implementation of the measures and, according to estimations, funding in the amount of 5,650,000 euros is needed in the period from 2017–2030.

Land use and planning

General aim 2. The risk of storms, floods and erosion has been alleviated, the heat-island effect has been alleviated, and the climate-resistance of populated areas has been increased by selecting the best solutions in land use and planning.

Measures:

1. Increasing awareness of the impacts of climate changes and the risks in land use, urban organisation and planning, development of the methods for planning risk areas and adjustment of the legal framework. Increasing rescue capability.
2. Alleviation of flood risks, and development of green zones and urban green spaces to alleviate climate risks.

Resources from the Internal Security Development Plan 2020 and Estonian Rural Development Plan for 2014–2020 are counted on for implementation of the measures and, according to estimations, funding in the amount of 6,585,000 euros is needed in the period from 2017–2030.

Natural environment

General aim 3. The diversity of species, habitats and landscapes, and a good status and integrity of terrestrial and aquatic ecosystems, and provision of important ecosystem services from the socioeconomic perspective at a sufficient volume and quality are ensured in the changing climate.

Measures:

1. Preservation of biodiversity in changing weather conditions.
2. Prevention of invasive introduced species finding their way into the nature and controlling of such species in the changing climate.
3. Ensuring a good status of biological communities and diversity of landscapes, and organisation of nature conservation in the changing climate.
4. Ensuring the stability, good status, functions, resources, and diversity of terrestrial ecosystems and habitats in the changing climate.

5. Monitoring the status of bodies of surface water, structure of the biota communities, external and internal loads of substances arising from changes in temperature and the hydrological regime, and minimising climate risks.
6. Minimising the negative impact of climate changes on achievement of a good quality of the status of the marine environment and preservation of biological diversity.
7. Ensuring the availability of the ecosystem services significant from the socioeconomic perspective in a sufficient extent and with sufficient quality taking into consideration the climate risks.

Resources from the Nature Conservation Development Plan 2020, Forestry Development Plan 2020, the Programme of Measures for the Estonian Marine Strategy, and the Estonian Rural Development Plan for 2014–2020 are counted on for implementation of the measures and, according to estimations, funding in the amount of 6,000,000 euros is needed in the period from 2017–2030.

Bio-economy

General aim 4. The sustainability of the bio-economy sectors important to Estonia will be ensured by climate-conscious planning of the agricultural industry, forestry, water management, fishery, and holiday management and peat extraction.

Measures:

1. Ensuring sufficient food supplies in the changing climate by development of land improvement systems, increasing the competitiveness of agriculture, and by creation and transfer of knowledge.
2. Ensuring the productivity and vitality of forests, and the diverse and efficient use thereof in the changing climate.
3. Ensuring sustainability of fish resources and the welfare (income) of the people making their living from fishery in the changing climate.
4. Diversification of tourism and increasing visitor satisfaction.
5. Optimising peat extraction in the changing climate.

Resources from the European Maritime and Fisheries Fund for 2014–2020 and the Estonian Rural Development Plan for 2014–2020 are counted on for implementation of the measures and, according to estimations, funding in the amount of 17,945,000 euros is needed in the period from 2017–2030.

Economy

General aim 5. Economic operators take advantage of the opportunities accompanying climate changes in the best possible manner and manage the accompanying risks.

Measures:

1. Alleviation of the risks to domestic households resulting from climate changes.
2. Promotion of the business taking into consideration the impacts of climate changes.

According to estimations, funding in the amount of 1,025,000 euros is needed in the period from 2017–2030 for implementation of the measures.

Society, awareness and cooperation

General aim 6. The residents understand the threats and opportunities accompanying climate changes.

Measures:

1. Improvement of risk management and ensuring of the capability of the employees of governmental and local municipality authorities to alleviate the risks accompanying climate changes.
2. Supporting pre-school educational institutions, general education and hobby schools, environmental education centres and vocational educational institutions in adapting to the impact of climate changes.
3. Ensuring availability of modern and thorough information on climate changes, incl. the transferred impact of global climate changes on Estonia.
4. Participation in international cooperation for climate change mitigation and adaptation to the impact of climate changes, and participation in the development of a strong international climate policy.

Resources form the Internal Security Development Plan for 2015–2020, the budget of the Ministry of the Environment, and the EU Structural Funds 2014–2020 are counted on for implementation of the measures, and, according to estimations, funding in the amount of 7,140,000 euros is needed in the period from 2017–2030.

Infrastructure and buildings

General aim 7. The impact of climate changes will not reduce the availability of vital services or energy-efficiency of buildings.

Measures:

1. Ensuring safe traveling, transportation of goods, and access to vital services in the changing weather conditions.
2. Ensuring the durability and energy-efficiency of buildings, and indoor climate comfortable for people in the changing weather conditions.

Resources from the Transport Development Plan for 2014–2020 and the Estonian National Development Plan of the Energy Sector Until 2030 are counted on for implementation of the measures, and, according to estimations, funding in the amount of 320,000 euros is needed in the period from 2017–2030.

Energy and energy supply

General aim 8. Climate changes will not decrease the energy self-sufficiency, safety and security of supply or the use of renewable energy resources or increase the volume of end consumption of primary energy.

Measures:

1. Ensuring the usability of renewable energy resources and supply of energy and heat to consumers in the changing weather conditions.

Resources from the Estonian National Development Plan of the Energy Sector Until 2030 and the Cohesion Policy Funds Implementation Plan for 2014–2020 are counted on for implementation of the measures, and, according to estimations, funding in the amount of 230,000 euros is needed in the period from 2017–2030.