Normative Principles for Adaptation to Climate Change Policy Design and Governance

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Abstract Recognising climate change as a highly complicated and basically unstructured problem, the purpose of this paper is to suggest a theoretical frame supplemented with practical elements for adaptation to climate change policy design in the context of the requirements of sustainable development normative principles and criteria. The paper attempts to break the *business-as-usual* approach to policy design and decision-making practice concerning complicated and unstructured problems. The first recommendation for achieving that purpose is the application of a systemic and analytical approach to the elaboration process of adaptation policy, required by the United Nations' Framework Convention on Climate Change (UNFCCC), and reflecting the systemic nature of climate systems and climate change. The second recommendation touches on sustainable development principles, as well as appropriate criteria to be taken into account when proceeding from one policy cycle stage to another. Analysis of experiences from international and Latvian climate change and adaptation policy led to the conclusion of the necessity for a more systemic approach to exploring and managing the risks and benefits related to climate change. It also concluded that an adequate database should be established for assessing socio-economic effects and improving the system of forecast models, including systems related to natural ecosystems and human welfare. Addressing adaptation to climate change from the social dimension and emphasising the national (state) level as the foundation for resolving the issue in a systemic way (minimising risks and maximising benefits), the paper

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J. Knieling and W. Leal Filho (eds.), *Climate Change Governance*,
Climate Change Management, DOI: 10.1007/978-3-642-29831-8_4,

suggests a new approach for practical analysis and preparation of a set of policies employing cause and effect cognition.

Keywords Climate change · Sustainability · Adaptation · Policy design · Unstructured problem · Normative principles and criteria · Systemic approach · Latvia

1 Introduction

The paper aims to describe theoretical considerations and practical approaches used in the preparation of Latvian adaptation to climate change policy. The cornerstones of the theoretical framework for policy design encompass a systemic approach to resolving complex unstructured problems and designing appropriate normative criteria based on principles of sustainable development. An enhanced scheme for designing policy development cycles is offered for the practical implementation of the proposed theoretical approach, with particular emphasis on decision-making criteria throughout all stages of the cycle.

The first part of the paper describes the overall context and adaptation to the climate change policy development process in Latvia, pointing out the necessity of defining normative criteria for setting up a structured approach for policy design and governance.

The second part offers a methodological approach for use in designing practical policies, i.e., when preparing Latvian national strategy for adaptation to climate change. Recent advances in overall development policy with a focus on climate change are summarised. Main principles identified as being fundamental in high-level policy documents are also highlighted. Principles of sustainable development are further used to set up a framework for the analysis of major issues raised by climate change in Latvia. Theoretical frameworks and analytical approaches, policy instruments and normative criteria, applicable for decision-making, are proposed for each particular issue.

The third part includes a detailed description of the socio-economic consequences of climate change in Latvia, as well as characterising the capacity of Latvian administrative and research institutions for providing reliable data for policy development.

The fourth part summarises principles in the system of analytical approaches and decision-making criteria to be used in policy cycle. Risk minimisation and polluter (user) pays principles are chosen as being the most fundamental. Further information available on risks caused by climate change is provided, and the costs and benefits arising from climate change impacts and policy response alternatives are considered.

In the final part, practical recommendations for the further development of adaptation to climate change policy are given.

2 Arguments for Normative Principles and Criteria

As indicated in the United Nations' (UN) Framework Convention on Climate Change (UNFCCC 1992),[1] parties should take precautionary measures (according to sustainable development principles) to anticipate, prevent or minimise the causes of climate change and mitigate its adverse effects. The Convention also specifies that the parties should cooperate in preparing for adaptation to the impacts of climate change, develop appropriate and integrated plans for coastal zone management, water resources and the use of agricultural land, and for the protection and rehabilitation of areas affected by drought, as well as floods. Establishment of funding, insurance and transfer of technology are among the issues to be considered.

Similarly, impact assessment, formulated and determined nationally with a view to minimising the potential adverse effects of adaptation projects on the economy, on public health and on the quality of the environment, should be implemented to a feasible extent. At the same time, promotion of new innovative measures and development of technologies (including policy and decision-making technologies), along with the adaptation measures already approved, are prescribed in the UN Decision 1/CP.10 regarding the Buenos Aires programme of work on adaptation and response processes (UNFCCC 2005).

Furthermore, as it was stressed in the 2006 Nairobi UNFCCC conference, climate change is an issue directly related to United Nations' Millennium Development Goals: starting from the eradication of extreme poverty and hunger, ensuring environmental sustainability to the development of a global partnership for development (UNFCCC 2000). As stated by the UN Secretary-General: "We will have time to reach the Millennium Development Goals—worldwide and in most, or even all, individual countries—but only if we break with business-as-usual". Chair of the International Panel on Climate Change (IPCC), Rajendra K. Pachauri,[2] said on 25 March 2010, visiting the European Parliament: "We need policies to promote the development of new technologies or the employment of the existing ones. We (the IPCC–I.B.) have clearly stated in our report that the technologies needed are already available or on the verge of being commercialised. These technologies will only be used if we have the right set of policies."[3]

But breaking with business-as-usual refers to the necessity for a radical new attitude (approach) to designing policy for such complicated and usually unstructured problems like climate change mitigation or adaptation to it; this new

[1] Adopted at the national level as "Law on the framework Convention on Climate Change of the United Nations Organisation", by the national parliament *Saeima* of Latvia on 23 February 1995.

[2] Dr. Rajendra K. Pachauri, (1940) has been elected as Chairman of Intergovernmental Panel on Climate Change (IPCC) from 20 April 2002 onwards. He has been active in several international forums dealing with the subject of climate change and its policy dimensions.

[3] Source: http://www.europarl.europa.eu/news/public/story_page/064-24711-084-03-13-911-20080319STO24704-2008-24-03-2008/default_en.htm.

attitude requires a much more systemic approach if we want to find common points, borders or parts therefore—to take the correct and, even more importantly, effective actions.

One of the key conclusions from the European Union (EU) project "Adaptation and Mitigation Strategies: Supporting European Climate Policy" (ADAM project) stated: "Global climate policy beyond 2012 requires a strong, integrated governance architecture that involves both public and private actors and that provides a regulatory framework on both mitigation and adaptation. Highly fragmented global climate governance is likely to be more costly, less effective in terms of environmental goals, and less equitable regarding smaller countries, particularly in the global South" (Hulme et al. 2009).

The conclusion about fragmented adaptation governance is also recognised in the EU's White Paper on Adaptation: "Adaptation is already taking place but in a piecemeal manner" (Commission 2009: p. 2).

For ensuring successful and systemic adaptation policy design, it is crucial to remember that the climate change issue is part of sustainable development and, as already concluded in the report of the Bellagio project (Hardi and Zdan 1997) regarding the practice of sustainable development, for that the entire process is normative. The same approach is required for solving such a huge and unstructured problem as climate change risks and adaptation to it and, for that purpose, it is required that all relevant principles and criteria in a full policy cycle should be assessed.

The national/state level (as a basic area for adaptation policy design and governance) is where overall political responsibility is located in all the stages involved in elaborating new policy during the complete policy cycle. At state level, government sets policy planning documents; formulates national positions on EU legislative acts in its drafting stage; fosters national legislation and regulations, many of which directly or indirectly affect the climate change risks the country and sectors are facing, or creates the incentives (or disincentives) for exploring climate change adaptation opportunities and advantages. This is also the main level for coordinating sectoral policies and branches, including many cross-cutting responsibilities and functions (e.g. risk assessment and management; *polluter (user) pays* principle; the security dimension; integrated assessment (welfare, etc.), as well as providing the overall policy guiding framework within which lower levels (sectoral, municipal, communities) operate. The state also manages international (bilateral, multilateral) relations with other countries; cross-border aspects of climate change and international financing and cooperative mechanisms; participation in multilateral environmental agreements such as the UNFCCC, and its Kyoto Protocol, where political *consensus* could be reached only through successful policy dialogues and compromise between policy options.

The strong topic for discussion about normative principles and criteria is the evidence of risks and losses from climate-related natural hazards increasing year

by year (USD 100 billion per annum in the last decade alone[4]). Thereby, climate-change related risk insurance is one of the policy instruments, being a strong complementary aspect of a wider adaptation framework that can, and should, provide financial security against natural disasters, such as floods, droughts, heat waves, forest fires and peat bog fires, windstorms, intense cold, snowstorms, and so on.

At the global level, the Bali Action Plan, adopted by UNFCCC Parties in Bali, Indonesia in December 2007, in this context calls for the "consideration of risk sharing and transfer mechanisms, such as insurance" to address loss and damage. For that, talking about the post-2012 adaptation regime, the potential role of risk-pooling and risk-transfer systems must be firmly established (Bali Action Plan, UNFCCC 2007).

The second extremely important policy planning document in the global context is the Hyogo Framework for Action 2005–2015[5]: "Building the Resilience of Nations and Communities to Disasters" which considers *inter alia* the integration of risk considerations into the sustainable development and the development of institutions, mechanisms and capacities at all levels to systematically build resilience against hazards. The Hyogo Framework specifically identifies the need to "promote the integration of risk reduction associated with existing climate variability and future climate change into strategies for the reduction of disaster risk and adaptation to climate change…" The implementation of the Hyogo Framework therefore provides a powerful tool to support adaptation, through building resilience and reducing vulnerability to climate-related hazards. The Hyogo Framework sets out strategies for reducing disaster risks through the five priorities for action needed: (1) ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation; (2) identify, assess and monitor disaster risks and enhance early warning; (3) use knowledge, innovation and education to build a culture of safety and resilience at all levels; (4) reduce the underlying risk factors; and (5) strengthen disaster preparedness for effective response[6] (UN 2005).

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[4] Source: Munich Climate Insurance Initiative.

[5] Agreed at the World Conference on Disaster Reduction in January 2005, in Kobe, Japan, by 168 governments and endorsed by the United Nations General Assembly, the Hyogo Framework for Action 2005–2015: Building the resilience of nations and communities to disasters, provides the foundation for the global implementation of disaster risk reduction. See: http://www.unisdr.org/eng/hfa/hfa.htm.

[6] Disaster risk reduction strategies and risk management practices: critical elements for adaptation to climate change. Submission to the UNFCCC Ad Hoc working group on long-term cooperative action by the informal task force on climate change of the inter-agency standing committee 1 and the International Strategy for Disaster Reduction (ISDR), 11 November 2008. This paper was prepared as a submission to the UNFCCC parties on the risk-related matters identified in the Bali Action Plan (1/CP.13, paragraph 1. (c)). The paper provides further background in respect to the submission to the AWG-LCA on 29 September 2008 from the ISDR entitled "Proposals for the AWG-LCA chair's assembly document on enhanced action on adaptation", and includes specific information from the humanitarian perspective.

Demonstrators of best practice in the field of climate change risk at an international level (Mills 2007) are the Arkwright Mutual Insurance Company, which examines climate change and trends in flooding (Zeng and Kelly 1997), the Insurance Australia Group[7] which, together with the University of Oklahoma, is working on high-resolution climate modelling, and Willis (a leading broker) collaborating with researchers in the UK and Japan on next-generation climate modelling, with greater resolution for enabling the evaluation of changing typhoon risks and associated insurance implications (McLeod 2007). Swiss Re (2006) and the Association of British Insurers (2005) have also coupled climate models with insurance loss models. Swiss Re projected an average increase in losses from 16 to 68 % from European winter storms (and significantly higher for some individual countries) between 1975 and 2085, excluding the associated effects of storm surge and flooding and socio-economic factors (inflation, insurance penetration, settlement patterns) that would further compound losses (Swiss Re 2006). Munich Re takes the leading role in the insurance of natural catastrophes and, as the world's largest re-insurer, is incorporating the physical effects of climate change into hurricane models (wind and storm surge), and associated economic effects such as the surge in demand (and prices) for construction materials following such events (Höeppe, n.y.). With support from AIG and Lloyds of London, Harvard University and the Insurance Information Institute are collaborating to better integrate climate change factors into insurance loss models.

Adaptation to climate change was put on the EU policy agenda on 29 June 2007 in the EU Green Paper on Adaptation. In response, Latvia has realised separate sectoral adaptation policies (e.g., flood risk prevention with technical solutions, risk management and insurance in agriculture, rural development, coastal zone management, etc.) as well as research on narrow or specific themes of climate change impacts, vulnerability and adaptation possibilities. A coordinated process of elaborating on the adaptation policy in a systemic manner started in 2008 upon the acceptance of the report on adaptation to climate change by the Latvian government.

This report deals with climate change impacts and vulnerabilities in different sectors, and gives an overview of relevant research work at international and national levels. It also presents the most important policy initiatives, both globally and at EU level, in relation to adaptation. The main finding was the identification of the set of risks caused by climate change. The report also describes the situation in Latvia until the beginning of 2008, presenting what has already been done concerning adaptation, and outlines recommendations for future adaptation policies and measures to be taken. It also identifies the need to prepare a national strategy on adaptation with scenarios on development, to be produced within 1 year after the delivery of the white paper on adaptation by European Commission, i.e., by 1 April 2010 (MoE 2008).

[7] http://www.iag.com.au/

3 A Methodological Approach to the Design of Adaptation to Climate Change Policy

Unfortunately, it sometimes seems that we are forgetting about the concept of dematerialisation, which is fundamental for sustainable development, and brings about the de-coupling of economic or welfare development and consumption of natural resources and waste (also greenhouse gas (GHG) emissions) production. It can be resolved only by qualitative progress or development, and clarification of the strength or weakness of our development according to sustainability (sometimes recognisable as ecoefficiency) principles and criteria.

Sustainable development principles such as (i) solidarity and cooperation (intra-generational equity, inter-generational equity, international equity); (ii) dematerialisation; (iii) caution; (iv) sustainable resource use; (v) polluter (user) pays or full-cost recovery; (vi) the triple bottom line (for societal or human plus social capital,[8] nature capital, man-made or economic capital); and (vii) diversity (diversification) should be taken as a basis for adaptation to climate change policy design and implementation with clear conclusions from certain scientific studies, appropriate legislative acts, policy planning documents, public awareness campaigns, technologies, and so on.

The essence of these principles has been postulated in the Delhi ministerial declaration on climate change and sustainable development: climate change could endanger future well-being, ecosystems and economic progress in all regions, and that in order to respond to the challenges faced now and in the future, climate change and its adverse effects should be addressed while meeting the requirements of sustainable development. Parties have a right to, and should, promote sustainable development (UNFCCC 2002).

The EU has declared sustainable development as a fundamental objective [see EU Sustainable Development Strategy (SDS)]. In the EU's integrated climate and energy policy, an integrated approach to the sustainable management of natural resources, the protection of biodiversity and ecosystem services and sustainable production and consumption are listed among the drivers for achieving objectives under both this strategy and the Lisbon strategy (Presidency 2007).

In Latvia, a reasonably used and preserved natural environment is listed as one of the preconditions for safe and stable development in the "National Development Plan 2007–2013" (MoRDLG 2006); however, one of the tasks is the promotion of the assessment, reduction and monitoring of natural, including climate change, and industrial risks. Political objectives for reducing the adverse effects of global climate change have been specified in the "Environmental Policy Guidelines for 2009–2015" (MoE 2009).

Preparation of the national strategy for adaptation to climate change has begun and is in line with strategic goals set in the long-term development strategy for

[8] For principles used to introduce notions of three, four or five capitals, see part II "A framework for sustainable capitalism" in (Porritt 2007, pp. 137–212).

Latvia "Sustainable Development Strategy Latvia—2030" (MoRDLG 2010). Experts from the Ministry of the Environment were involved in the preparation of parts of the strategy devoted to the natural capital. Concerning environmental issues, this strategy proposes several goals for Latvia: (1) to become a leading EU Member State in terms of preserving and enlarging the natural capital and using it in a sustainable manner; (2) to retain a leading position in the EU in terms of utilisation of renewable energy resources and to fully evolve the potential of "green economics"; and (3) to make a living and natural environment that is attractive for people, and capable of promoting development in the entire country, as well as strengthening the development of the country and the whole Baltic Sea region. The Strategy proposes several directions for priority actions. Firstly, management of the natural capital, which should include (i) the natural capital approach; (ii) the Green Budget Reform; (iii) the Nature preservation plan; and (iv) the establishment of a Nature Restoration Fund. Secondly, the development of market-based instruments through (i) the assessment of the value of nature capital for land; (ii) the introduction of a tendering process for ecosystem services; (iii) the introduction of fees on natural capital; and (iv) the introduction of the programme of "eco-gifts". Thirdly, capitalisation of environmental activities, which means (i) establishing the Investment Fund for the Green Economy; (ii) creating networks for knowledge transfer; (iii) establishing the "Green innovation programme"; and (iv) developing the programme for "digitalisation of the environment". Fourthly, activities to support sustainable living with (i) environmental education programmes, promoting change; (ii) the introduction of "ecological footprint accounts"; and (iii), the creation of a database for national heritage. A fifth area in which this would be achieved would be through the widescale use of renewable energy resources and innovation, e.g., promoting the use of wind and solar energy, measures to promote energy efficiency, diversification of the rural economy, and the maintenance and promotion of the spatial identity.

The principle of sustainability, which compels ensuring "a qualitative environment, balanced economic development, rational utilisation of natural, human and material resources, development and preservation of the natural and cultural heritage for the present and next generations", as well as the task "of creating preconditions for ensuring environmental quality and rational utilisation of the territory, and the prevention of industrial and environmental risks" is specified in the "Spatial Planning Law" (2002), among other basic principles of sustainable development (MoE 2008).

With respect to practical policy design, the authors wish to clarify the definition and essence of adaptation or what constitutes the subject of policy design. Although numerous definitions and explanatory articles on adaptation to climate change *anatomy* exist in policy design space (UNFCCC 1992; Smit et al. 2000 etc.), authors agree with a point of view that we have to discuss the adaptation issue, which is a problem for us, people, society and mankind. Therefore we, as human beings, are responsible for solving it to ensure our own well-being, and also to maintain the natural balance for the planet as a whole. It is not nature that is the problem, therefore we have to address adaptation to climate change from the

position of the social dimension, fundamental policy options, or a response strategy concerning climate change (Frankhauser 1996; Smith 1996).

For that reason, authors see adaptation to climate change as an issue which requires a logical set of policies and measures, or PAMs, designed in a systemic way that takes into consideration normative principles and appropriate criteria in all stages of the policy cycle, making decisions. At the same time, this well-structured process is expected to be coordinated by state government, which would allow for proper cost-effective and responsible management of social development, consumption of natural resources and use of technology at all levels (state, regional, municipality, enterprise, individual) in order to prevent natural disasters and threats, or to use all opportunities and advantages offered by climate change. In cases where threat or real damage has occurred because of climate change, appropriate technical, financial or other assistance should be available to individuals, particular species or ecosystems, thereby promoting the system's (society's, community's, dwelling's) preservation or minimising unacceptable consequences or, again, taking advantage of climate change impacts.

Unfortunately, to date, too many policy evaluations at basic political strategic levels (both globally and nationally) have often been applied in an *ad hoc* and unsystematic way due to (i) uncertain knowledge; (ii) disagreement about normative elements (e.g., values, norms or objectives); and (iii) disagreement about cognitive elements (e.g., research or information) (Hisschemöller and Hoppe 2001). It has been evident in international negotiations in the attempt to prepare new political agreements during the post-Kyoto period (e.g., on financial architecture for adaptation to climate change, new market-based policy instruments, intellectual property in technology transfer, and so on). Thus, it is an obvious necessity to design adaptation to climate change policy and to ensure solutions according to the full policy cycle (assessing *ex-ante* and *ex-post* phases in it), and every decision made, descending from one policy cycle stage to another, should be based on taking note of the *spectrum* of normative principles and appropriate criteria.

There are three components we should take into account for every decision discussed: (1) criteria—the standards by which decision-makers evaluate alternatives (sometimes referred to as "interests", after Fisher and William 1983); (2) alternatives—specific courses of action or options, being considered as positions; and (3) cause and effect beliefs—cognitions linking specific alternatives to specific criteria (University of Rhode Island 2007). Criteria for choosing policy instruments in the certain policy development cycle stage can be: (i) causal—as answers to the basic question, for example, whether or not the policy instrument addresses the underlying economic failure; (ii) efficiency e.g., economic efficiency criteria include costs and benefits, public opinion, etc.; (iii) equity; (iv) macro-economic; and (v) legal—this criteria concentrates on the issue of subsidiarity, i.e., where policy is located most effectively, (there are three main criteria upon which levels of subsidiarity can be assessed: gains from cooperation, gains from harmonisation, gains from sustainability). Having a clear vision on the policy cycle, the main actors, principles, transparent criteria, and so on, help to resolve the aforementioned difficulties when dealing with the complex unstructured problem.

4 Consequences of Climate Change Impacts in Latvia and Data Providers

Latvia's territory is 64,589 km^2, with a population of 2.3 million inhabitants. It has a flat surface topography—57 % of Latvia's territory is below 100 m above sea level. The climate is mainly humid (the mean precipitation ranges from 600 to 850 mm per year) and comparatively cold—the mean annual air temperature in Latvia is +5.8 °C (in 2008: +7.6 °C!). Latvia is rich in waters and forest—the mean density of the river network is 588 m per km^2, but forests cover—54 % of the territory (Klavins et al. 2007).

Latvia's coastal zone is sensitive to erosion—approximately 67 % of the 496 km coastline is vulnerable to erosion during storms. Over the last 70 years, Latvia has lost 1,000 hectares in storms with a 50–200 m wide area of the basic coast having been washed away (Eberhards and Lapinskis 2008).

Over the last century, the average air temperature has increased by 0.5 °C in Latvia as a whole, and by 1 °C in the capital Riga. The process of global warming and related changes in atmospheric circulation have led to higher air temperatures and greater cloudiness, leading to less sunshine and greater precipitation (higher values are observed in the western part of Latvia). It has been found that the variability of annual mean temperatures of the Baltic Sea region is about five times larger than the variability of global mean temperatures.

The Climate Change Vulnerability Index for Latvia is determined at 26.0–30.0 on average in a range between 0 and 100. As defined in the Stern Review, "vulnerability to climate change can be classified as *exposure* to changes in the climate, *sensitivity*—the degree to which a system is affected by, or responsive to, climate stimuli, and *adaptive capacity*—the ability to prepare for, respond to and tackle the effects of climate change" (Stern 2007). This index reflects exposure more than vulnerability.[9]

Eastern Europe is highly vulnerable to the risk of flood. In many of the newer EU Member States (Poland, Romania, Bulgaria, Slovakia, Lithuania), annual flood risk has exceeded 1 % of the Gross Domestic Product (GDP). In some events, national authorities have had severe fiscal problems in financing the recovery process (Hulme et al. 2009). Latvia is among those flood-prone countries, and it is at similar risk, both in terms of the great fiscal deficit and options for the realisation of efficient adaptation policy actions.

In the last 20 years, the water discharge from rivers in Central and Eastern Latvia has increased by ~4 % and in the western part of the country by ~6 %. The ice cover period has been decreasing—the reduction of the ice-cover period

[9] Choice of individual indicators included in the CC vulnerability index is determined by: (a) change in population affected by river floods; (b) population in areas below 5 m; (c) potential drought hazard; and (d) vulnerability of fisheries, agriculture and tourism to changes in temperature and precipitation. We have to note, for example, that economic benefits of climate change, ecological effects or effects on health are not included in this indicator.

for the last 30 years is from 2.8 up to 5.1 days every 10 years. The change in the river break-up towards earlier in the year can explain the increase in winter run-off in Latvian rivers (Klavins et al. 2007).

Spring and summer phases in Latvia have occurred, on average, 4 days earlier over the past 50 years; the most recent changes were observed for early spring phases (the most significant shift has happened in the last 15 years). The flowering phase has advanced by 1.6 days per decade for the bird cherry (Padus racemosa) and 0.9 days per decade for the linden (Tilia cordata). The autumn phases in Latvia have started 2.8 days per decade earlier in contrast to Europe where autumn phases have started later. The length of the growing season, determined by the vegetation of birch and maple species, has increased by 9.8 days (3.3 days per decade) for the birch (Betula pendula) and 18.5 days (6.2 days per decade) for the maple (Acer platanoides) (Grisule and Briede 2007).

The scale of economic losses brought about by climate change is illustrated well by compensation for the damages caused by agro-climatic conditions in agriculture, which were EUR 887,687[10] in 2000; compensation for damage caused by natural phenomena and accidents (in storm, flood, fire) to persons engaged in coastal fishing and in internal waters or fish farming were EUR 26,910.74 in 2001; the total compensation for the damage caused by agro-climatic conditions was EUR 312,635 in 2004 and EUR 620,797.32 in 2005 (including compensation for animals which have died from gnat bites—EUR 184,687.94, for covering of material losses caused by floods—EUR 436,109.38).[11]

Due to unfavourable agro-climatic conditions in 2006, more substantial losses were inflicted on agricultural producers. In order to ensure the disbursement of compensation for the losses caused by drought in agriculture and forestry, the Cabinet granted additional financing of EUR 36.35 million to the subsidy programme on the basis of the information notice "On the Emergency Situation in Agriculture", approved on 19 September 2006. The following support costs in relation to the losses caused by the drought were made in 2006: (1) financing of EUR 26.50 million was disbursed in the field of crop farming; (2) EUR 8.11 million in the field of agriculture; and (3) EUR 0.68 million in forestry.[12]

The amount of subsidies in agriculture for risk decrease measurement (including compensation on insurance premiums) has a decreasing trend: in 2007 it was EUR 692,654, in 2008 it amounted to EUR 380,884 and EUR 260,729 in 2008.

Excessive drought and strong winds significantly increase the likelihood of forest combustibility or the outbreak of fire. For example, the largest number of forest fires in the State—1929 (the total calculated losses from forest fires were EUR 2.77 million)—was registered in 2006, which was one of the most critical years in protection against forest fire. Artificially restored forest plantations suffer

[10] LVL 1 = EUR 0.7098.

[11] Source: Rural Support Service, reports from 2000 to 2009.

[12] Publication of the Ministry of Agriculture of the Republic of Latvia (2007) "Agriculture and Fields of Latvia" (in Latvian).

due to extreme natural conditions—fire destroyed 564 hectares of young forest stands in 2006,[13] the spring drought and summer heat of 2006 were the main reasons for the replanting of approximately 25 % of plantations set that year.[14]

The storm of January 2005 affected not only Latvia, but also all of Northern Europe, causing great damage. According to the EU criteria defined in Council Regulation (EC) No. 2012/2002 of 11 November 2002 establishing the European Union Solidarity Fund,[15] or EUSF, the total losses inflicted on Latvia were assessed to be approximately EUR 192 million (the ESF granted EUR 9.487 million), EUR 48 million for Estonia (the ESF granted EUR 1.29 million), and approximately EUR 15 million for Lithuania (the ESF granted EUR 0.379 million). Particularly significant damage was inflicted on Sweden—their evaluation amounted to almost EUR 2.3 billion (the ESF granted EUR 81.725 million).

In the informative report "On Damage Inflicted by Storms According to the Fields in the Public, Local Government and Private Sector on 8–9 January 2005", developed by the Ministry of Finance and approved by the Cabinet of Ministers of Latvia, in 2005 total losses amounted to EUR 217.2 million (MoF 2005). The total damage inflicted by the storm to various interests, including damage to the public sector, was indicated in this report. The costs for liquidation of the consequences of the storm were separated, also indicating the resources for the immediate restoration of the infrastructure and facilities for energy, water supply and sewerage, telecommunications, transport, health care and education. The financing necessary for the provision of shelter to affected residents, provision of activities required by the responsible rescue services, immediate restoration of the protective infrastructure, immediate rescue of cultural heritage and immediate clean-up of the territories polluted by the natural disaster were also clarified.

On 11 April 2007, the Cabinet adopted the "Information Notice on Granting Resources from the State Budget to Local Governments for Liquidation of Consequences of the Storm of 14 and 15 January 2007 at Schools and Kindergartens, as well as Local Government Objects, which are Necessary for Provision of Execution of Significant Functions of Municipalities", developed by the Ministry of Regional Development and Local Government. It is mentioned therein that documents confirmed the damage that had been incurred by local government in 69 objects of infrastructure totalled EUR 1.178 million (EUR 444,232.2 were granted), which was received from municipalities by 16 March 2007 (MoRDLG 2007).

In order to reduce scientific uncertainties regarding the effects of climate change and to find specific solutions for adaptation policy, several important international projects have taken, or are taking, place in the Baltic Sea Region: the project "Sea Level Change Affecting the Spatial Development in the Baltic Sea Region" (SEAREG, 2002–2005; Baltic Sea Region INTERREG IIIB programme; 2000–2006); "Project of the Baltic Sea Region" (2005–2007), in which Finland,

[13] Source: State Forestry Service.

[14] Source: JSC "Latvia's State Forests".

[15] OJ C 283, 20 November 2002.

Germany, Estonia, Lithuania, Poland, Sweden and Latvia participated, "Developing Policies and Adaptation Strategies to Climate Change in the Baltic Sea Region" (ASTRA)—the ASTRA project was a follow-up to the INTERREG IIIB project SEAREG (Sea Level Change Affecting the Spatial Development of the Baltic Sea Region); an international project "Climate Impact Research Co-ordination for a Larger Europe" (CIRCLE ERA-NET) within the framework of the Sixth Framework Programme for Research and Technological Development of the European Commission; the new one—"Climate Change: Impacts, Costs and Adaptation in the Baltic sea region"(BaltCICA 2009–2012) is now running, involving Finland, Estonia, Lithuania, Germany, Denmark, Norway, Sweden and Latvia. Sea level changes and coastal vulnerability for Latvia are modelled and being calculated by the Potsdam Institute for Climate Impact Research as part of the ASTRA project; but monthly average temperature changes up to 2100 are being calculated within the Swedish Regional Climate Modelling Programme (SWECLIM).

Latvia is participating as an observer in the EU project CIRCLE ERA-NET, in EPA IG on adaptation, as well as in the work of the European Environment Information Observation Network (EIONET) expert group regarding climate change vulnerability and adaptation. Latvia had also prepared information (submissions) on national adaptation policies and measures to the Nairobi Work Programme on socio-economic aspects of impact vulnerability assessments, and adaptive capacity (2007) and to the Nairobi Work Programme on impacts, vulnerability and adaptation to climate change (2009).

The main scientific authorities researching climate change impacts and consequences in Latvia are: the researchers of the Faculty of Geography and Earth Sciences of the University of Latvia (research on climate change impacts), the Faculty of Biology of the University of Latvia,[16] the Institute of Biology of the University of Latvia,[17] the Latvian State Forest Research Institute "Silava",[18] the Physical Energetic Institute (research on renewable energy or RES resources), the Institute of Solid State Physics (hydrogen technologies), Riga Technical Institute (climate change technologies) and the Agricultural University of Latvia.

In close cooperation with scientists and other stakeholders, the National Research Programme "Impact of Climate Change on the Water Environment of Latvia" (KALME 2006–2009) is being undertaken to assist in the development of

[16] Examples of research projects are "Biological Diversity of Swamp Woods under the Impact of Climate Changes" (2006) and "Changes in the Growing of Trees under the Impact of Climate and Environmental Changes and Connection Thereof with Indicators of Biological Diversity" (2007).

[17] Examples of research projects are "Variability of Global Climate and Actions for Reduction of Impact thereof in Latvia" (2005) and "National Adaptation Strategy for the Management of the Risk Caused by Variability of Climate: Extreme Climatic Phenomena and Effects Thereof" (2006).

[18] An example of a research project is "Impact Assessment of Extreme Wind Velocity on the Stability of Forest Stand, Development of System for Support of Decision-making" (2006).

the adaptation policy. The general goal of this program is to assess the short-, medium- and long-term impacts of climate change on the environment and the ecosystems of the inland waters of Latvia and the Baltic Sea, and to create a scientific basis for the adaptation of the environmental and sectoral policies of Latvia to climate change. Specific goals are to (i) create several mutually non-controversial scenarios of regime-determining parameters; (ii) assess possible climate change impacts on the quality of inland waters of Latvia, their availability, flood and drought risk, to facilitate adaptation of drainage basin management and secure the protection and sustainable use of water resources; and (iii) forecast possible climate change impacts on the physical regime coastal dynamics, biogeochemical regime, and ecosystems of the Baltic Sea, as well as to facilitate the protection of the quality of the marine environment, biological diversity and the sustainable use of its resources and services.

Many institutions and informative modes provide network systems for producing and distributing climate information and monitoring, covering all Latvian territories, including big cities, located on the coastal zone area and near river estuaries, e.g. Riga (722,485 inhabitants in 2007), Liepaja (85,477 inhabitants in 2007), Ventspils (43,544 inhabitants in 2007), Jurmala (55,408 inhabitants in 2007) or Daugavpils city (108,091 inhabitants in 2007),[19] by the river Daugava.

Primary data on the direct impact of climate change (air temperatures, precipitation, changes in river discharge, ice regime, wind regime, etc.) as well on GHG emissions are gathered and distributed by the Latvian Environmental, Geological and Meteorological Agency (LEGMA); data on public and environmental health by the Public Health Agency; data on forests, including CO_2 removals, by the "Silava" scientific research institute; monitoring of the geological processes of the sea coast by the University of Latvia, Faculty of Geography and Earth Science; geographic information systems or GIS maps of the surface of the territory of the State across different scales for modelling flood and other risks by Latvian Geospatial Information Agency.

Responsibility for resolving the problem of common financing and institutional responsibility using well-structured mechanisms and observing political requirements is stated in "Environmental Protection Law" (2007) and in Regulations of the Cabinet of Ministers of Latvia "On the Programme for Environmental Monitoring 2009–2012" (2009). The aim of the Monitoring Programme is to ensure complete data and information has been obtained in order to assess trends and perspectives, develop new environmental policy measures and evaluate the effectiveness of already existing measures (in policy cycle *ex-post* stage). Cooperation criteria are taken into account in the financing mechanism for this environmental monitoring: financing from the State budget (including the Latvian Environmental Protection Fund (LEPF), which is a separate state financial programme) *plus* financing from the European Reconstruction and Development Fund, or ERDF. For example, in 2009 the applicable financing is estimated at EUR

[19] Source: Central Statistical Bureau of Latvia.

3,958,200 (*inter alia* EUR 425,900 from the LEPF, EUR 315,000 from other state budget funds, and EUR 1,785,200 from the ERDF).[20] The State Forest Monitoring Programme is exploring the impact of climate changes upon forest ecosystems, forest biodiversity status and also changes to forest soils. Responsible institutions for this Programme are the Ministry of Agriculture, the State Forest Service and the Latvian State Forestry Research Institute "Silava".

The State Regional Development Agency of Latvia, among other functions, performs the assessment and analysis of regional development, including the preparation and publication of analytical materials. One of the most recent studies was devoted to socio-economic development tendencies in Latvian towns, including the ecological footprint in the context of land use and land use change as a sink of CO_2 and energy consumption.

Latvia has good experience in the development of a sustainable development indicators system and the assessment of economy-wide natural resources flow, showing an accounting scheme for natural material flows (direct and indirect flows, material accumulation, recycling, emissions, domestic extraction, exports, etc., LEA 2004), reflecting the sustainable development dematerialisation principle. For example, the Latvian report "Report on environmental indicators in Latvia 2002" (LEA 2002) was drawn up according to the causal chain principle, i.e., by grouping the data into five (Driving force—Pressure—State—Impact—Response) logical phases. In fact, all three sustainable development capitals were identified there, and indicators were connected in a unified cause-response chain, showing: (a) what causes the environmental problem; (b) why it originated; (c) what effect it caused; and (d) how, or with what instruments (tools, options), a solution can be found. In this way, normative principles and criteria in full policy cycle were taken into consideration.

The next step in mainstreaming development, not only essential for the State, but also for adapting and elaborating a new methodological approach for sustainable development evaluation in Latvia, was the "Latvian sustainable development indicators report 2003" in which an eco-efficiency indicator, amongst others, acted as a central axis measuring de-coupling and this level of dematerialisation (LEA 2003).

The project "Detection of Building and Coastal Erosion in the Protective Zone of the Coastal Dunes of the Baltic Sea and the Gulf of Riga, Recording it in Orthophoto Maps," implemented by the survey and spatial planning company "Metrum" (with the support of the LEPF) will facilitate planning, detecting the main zones at risk of erosion, as well as problematic areas for building. The data obtained will be usable in the development of spatial plans and monitoring of implementation thereof; in specifying protective zones and property boundaries, in managing specially protected nature areas, in planning port developments, for

[20] Regulations of the Cabinet of Ministers of Latvia No. 187 (11 March 2009) "On the Programme for Environmental Monitoring 2009–2012"include a wide spectrum of indicators reflecting climate change impacts (air temperature, precipitation, wind strength, etc.)

further monitoring of building changes, and so on. Significant support in the formation of risk zoning could also be provided by the Latvian Geospatial Information Agency in developing a digital model of the surface of State territory for modelling flood and other risks.

5 Risk Minimisation and *Polluter Pays* Principles as a Basis for Decision-Making Criteria

Designing systems with analytical approaches and decision-making criteria, to be used in the policy cycle, risk minimisation—i.e., assessment and management and polluter (user) pays principles—have been identified as being fundamental. For this reason, risks had been identified in the Report on Adaptation in Latvia before starting to work on the development of the adaptation policy system, as well as considering the costs and benefits arising from climate change impacts and policy response alternatives.

1. For the damages and losses caused by negative impacts of climate change, the State may be forced to pay high levels of compensation to both individual sectors (particularly in agriculture and forestry) and to residents for the damage caused by natural phenomena to their property, health or even life. From the socio-economic perspective, such risks may distort natural competition in the market economy and pose serious threats to individual sectors of the national economy or sub-sectors thereof (agriculture, forestry, fisheries, sea port sector).

At the same time, the potential benefits to the energy sector (in relation to the installed generating powers), which would be initiated by such direct manifestations of climate change, such as the rise in air temperature, the increase in the average flow rate of water due to increased rainfall, should also be noted. It would bring a reduction in the consumption of energy resources for heating (in the context of energy efficiency measures). Increasing hydropower potential in rivers would ensure a higher generation of electricity and reduce dependence on imported energy resources.

Criteria for biofuel sustainability have been determined in the Directive on renewable energy sources (meaning that these criteria have to be implemented): (a) GHG saving at a minimum of 35 %; (b) no raw material from undisturbed forests, biodiverse grassland, nature protection areas (unless taken harmlessly); (c) no conversion of wetlands and continuously forested areas for biofuel production; and (d) all EU biofuels must meet "cross compliance" environmental rules. In order to provide through monitoring and reporting requirements every two years, EU Member States (including Latvia) will have to analyse land use changes, commodity price changes and the availability of foodstuffs, a cost-benefit analysis of different biofuels and import policy, and an analysis of sustainable development issues.

Positive effects from climate change impacts are also related to temperature changes and effects thereof on the biosphere: the increase in temperature will

firstly affect the reduction of frost probability and cause a significant increase in the length of the growing season. In addition, mortality of people from cold will decrease in temperate degrees of latitude due to a milder climate during winter months (Klavins et al. 2008).

In Latvia, the first attempt to develop policy in the direction of climate change risk insurance was for agriculture. The first step was to adopt the Cabinet of Ministers of Latvia's "Conception on Risk Management Policy in Agriculture" (MoA 2007) with appropriate Regulations, which foresees the administration and supervision of an agricultural risk fund, dealing with the compensation mechanism for damage inflicted by natural factors to producers (MoA 2008), thereby reducing direct State payments and involving farmers themselves in risk insurance and covering of losses.

2. Climate change may affect the distribution of invasive species and the migration of agricultural crop pests. In the field of public and environmental health, such changes may call forth the occurrence of diseases that are not typical to the region, for example, malaria, as well as a possible increase in the frequency and spread of diseases carried by ticks. The number of cases of health disorders related to the impact of excessive summer "heat waves" may rise, including serious illness from cardiovascular diseases and chronic respiratory diseases, particularly amongst vulnerable groups of the population (chronic patients, children and elderly people who are frequently also amongst the poorest group), and the mortality rate may also increase due to these factors.

A warmer climate will strengthen the eutrophication processes of waters not only in the Baltic Sea, but also in inland waters (one of the most negative forms is the "blossoming" of *cyanobacteria*), deteriorating the recreation potential of such waters (at first in relation to bathing waters). It is very hazardous for Latvia's inland waters—one of the most sensitive ecosystems.

3. Climate change has many impacts on biological diversity, which is very rich in Latvia. One example of evidence of this is in "A Climatic Atlas of European Breeding Birds" regarding the forecast reduction of bird diversity in Latvia in the 21st century (Huntley et al. 2007). Many special protected natural territories are directly exposed to sea storm overflowing and wash-off and erosion processes. A huge diversity of species and natural biotypes is characteristic of the Baltic Sea coast (dunes, bluffs, coastal pools, etc.). Approximately 90 % of this coastal zone comprises natural biotypes. Sandy beaches (Latvia also has gravel and pebble beaches, high boulder beaches, etc.) are the most typical beaches in Latvia. Their length is approximately 240 km (of 496.5 in total sea coast in Latvia).

The aim of the "Protection Zone Law" has hitherto been "to decrease or eliminate the effects of the anthropogenic negative impact on the objects for which the protection zones have been determined." At present, an intermediate solution for reduction of the effects of climate change is being introduced in relation to the protective zone of the Baltic Sea and the Gulf of Riga.

4. More frequent natural disasters (storms, floods) may cause industrial accidents, for example, the discharge of dangerous chemical substances, which may cause public health and environment threats. Prevention of the risks caused by

climate change is particularly urgent in the River Daugava because the Daugava hydropower plants or HPPs cascade (Plavinas HPP, Kegums HPP and Riga HPP), are recognised as being a Flood Risk Territory of National Significance. Thus an important factor of flood risk prevention is the proper monitoring of hydrotechnical structures and technical maintenance, as well as strict observation of its exploitation of resources.

According to the Latvian "Law on Environmental Impact Assessment" (it also includes a Strategic Environmental Impact Assessment procedure), all risks should be forecast and assessed. An incompleteness is the fact that these procedures (according to appropriate EU Directives) do not require natural disaster assessment (including climate change impacts). The positive trend is that in several cases in Latvia (in development programmes and plans) these risks already have been assessed.

"The Latvian Rural Development National Strategy Plan for 2007–2013" (2006) foresees risk management, including risks caused by climate change (flooding, draught and killing frost) (MoA 2009).

The National Programme for Acquisition of the European Regional Development Fund in the activity of the Reduction of Environmental Risk for the financial planning period 2007–2013 of the EU provides EUR 15 million financing for measures to improve existing infrastructure and to establish new infrastructure for the prevention of flooding in increased flood risk territories of national significance.

Regarding specific flood risk management, the approach in relation to the water environment is integrated, adopting Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risk, which determines that the component of flood should be included in intended plans for the management of river basins provided for in Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000, establishing a framework for Community action in the field of water policy (requirements thereof at a national level are included in the Water Management Law). The new Directive provides for the performance of the initial risk assessment of flood throughout the State territory, specifying on the basis thereof the territories endangered by flooding, and for the preparation of a flood risk management plan for each river basin region.

According to these new requirements, all flood risk territories and criteria for them at national level are defined in the "National Flood Risk Assessment and Management Program for 2008–2015" (2007), based on two research studies. The Program deals with risk management, the establishment of priority risk territories, for prevention—real-time schedule and financing, flood risk impact assessment (*ex post*), elaboration of maps for risk territories, plans' elaboration of plans for risk territories, including CC risk management incorporation into already existing protection plans for individual territories, etc. The Program also categorises three scenarios (with appropriate criteria and financing): (1) areas with a low likelihood of flooding; (2) medium-risk flood areas (possible recurrence period: 100 years or more); and (3) areas with a high likelihood of flooding.

5. Conflicts regarding non-renewable resources will intensify under the general impact of climate change, particularly in locations where access to such resources is related to State policy. Great changes in global land territory may take place this century, thus possibly causing more disputes regarding land and sea borders and other rights to territory.

"Conception on the coastal zone of the Baltic Sea and the Gulf of Riga registration in the Land Register on the name of State" (2008) foresees coastal zone systemic legal protection and management, avoiding ineffective management in a piecemeal manner (zoning of territories according to risk level criteria).

6. As adaptation to climate change is closely related to development and the welfare of society (inter alia, energy security and independence), adaptation should be based on the security concept and risk management related to climate change. These socio-economic problems, which may be caused by the migration of residents from climatically unfavourable world regions (which are usually the poorest regions) to regions where the manifestations of climate change will not be so sudden or unfavourable, may arise.

The "National Security Concept" is a policy planning document developed on the basis of the analysis of danger to the State, which determines the basic strategic principles, priorities and measures for the prevention of danger (including climate change risks) to the State. The concept of National Security, besides other threats (e.g., military), predicts responses required to react to environmental risks, including those caused by climate change, and asks for appropriate policy-making and development of tools to enable these responses to be possible. The goal of the Concept is to take into account not only risks caused by anthropogenic actions, but also (at the same level) natural disasters, and to predict those risks and be able to adapt to them. National Civil Protection is a well-functioning sub-system, which aims to include measures and responsible institutions, and to provide preventative, readiness and response measures intended for states of emergency, and measures for the elimination of consequences of such situations, and determines the actions of the civil protection system also in the case of damage and risks caused by climate change (MoD 2007).

Natural disasters, according to the risk level criteria and likelihood of damage criteria and actions, as well as the functions of institutions involved in the management of such disasters. are described (defined) most completely in "Civil Protection Law" (2006) and the "National Civil Protection Plan" (2007). All cities in Latvia have their own civil protection plans, where natural disasters and action plans, as well as the functions of institutions concerning climate change risks and its management, are defined. Pursuant to the requirements of the "Law on State Material Reserves" (2007), there is a duty to form and store State material reserves within the framework of the system of civil protection in order to use them in the case of national threat.[21] It is important that the planning of material reserves falls

[21] State material reserves are understood to be the aggregate of material and financial resources formed in accordance with the procedures specified in this Law, which is used by the institutions

under the jurisdiction of ministries (involving institutions subordinate thereto), local government institutions and merchants.

The polluter (user) pays principle (or full cost recovery principle) at national level is transposed in the "Law on Pollution", which determines how to prevent or reduce harm caused to human health, property or to the environment due to pollution. This law lays down conditions for GHG emissions, taking into account cost-effectiveness, and to ensure participation in the EU emission quota trading system. The overall conditions of the EU ETS[22] have been incorporated into the Law, particularly, the rights and responsibilities of State authorities and operators, the issuing of GHG emissions permits, the preparation of annual reports, procedures for the preparation and approval of a national allocation plan, the principles of allowance allocation, conditions for the creation and maintenance of a register of GHG emission units and operations with allowances as well as conditions for the creation of an installations pool. The law lists those polluting activities for which a GHG emissions permit is necessary, and thus are obliged to participate in the EU ETS. The law also prescribes the procedure for community involvement in decision-making based on an allowance allocation and the issuing of GHG emissions permits.

A new financial mechanism, also based on the *polluter pays* principle, has been developed in Latvia with regard to flexible mechanisms under Article 17 of the Kyoto Protocol. The Cabinet of Ministers made a decision on 12 April 2006 on participation in International Emission Trading (IET) under Article 17 of the Kyoto Protocol. It provided the possibility of earmarking 40 million of Assigned Amount Units (AAUs) to be made potentially available during the first commitment period 2008–2012. The Mandate to the Ministry of the Environment to design the legal, institutional system of IET was given in November 2007. The Green Investment Options study completed the Financial Implementation of the Kyoto Protocol by Latvia. "The Law on Latvia's Participation in the Kyoto Protocol Flexible Mechanisms" (2007) foresees the development of the Climate Change Financial Instrument, and strictly defines that every AAU sold will be used for *greening* purposes, including adaptation policy and measures.

The Latvian government is responsible for ensuring that all revenues are being earmarked for "greening" purposes which means: (a) climate change mitigation and adaptation measures; (b) promotion of low-carbon economic development by application of innovative environmental technologies; (c) increase of renewable energy use and improvement of energy efficiency; and (d) capacity building for climate change policy design and implementation.

(Footnote 21 continued)
involved in the management of disasters; the resources at their disposal are insufficient for the implementation of measures.

[22] Conditions of the EU ETS are described in the Directive 2004/101/EC of European Parliament and Council of 27 October 2004 amending the Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms.

Latvia is positioned to be a fast-track provider of AAUs with green credentials and low risk and low transaction costs. Latvia's market position could be characterised by such comparative strengths: low risk of non-delivery of AAUs, robust surplus estimates, advanced in compliance with Kyoto eligibility criteria, low reputational risk, solid legal background and strong political commitment to an efficient, transparent and accountable Green Investment Scheme, efficient public and private sector institutions, and terms tailored to buyer expectations. Comparative weaknesses of Latvia should also be specified: relatively small size of tradeable headroom and limited opportunities for greening with direct reductions of GHG (Latvian Green Investment Scheme may need to include the relatively high share of the greening measures that do not generate an immediate and easily measurable reduction in GHGs[23]).

Key elements of the "Law on Latvia's Participation in the Kyoto Protocol Flexible Mechanisms" are postulated as: (1) ownership of AAUs; (2) authority of the Cabinet of Ministers to make decisions on each sale of AAUs, including the price and specific conditions; (3) authority of the Ministry of Environment and Ministry of Finance to prepare and sign the sale of AAUs; (4) principles for using the revenues from the sale of AAUs, including a clear provision stating that all income from the sale of AAUs shall be earmarked for "greening" projects; (5) special budgetary arrangement defining that money from the sale of AAUs is transferred to a special account in State Treasury, with disbursements being organised under the budget programme "Climate change financial instrument" from a special account in the State Treasury, in the annual budget, the financing for the Climate Change financial instrument is ensured in the amount of received and unused proceeds from AAU sales in previous years; (6) principles for environmental and financial monitoring, verification and reporting.

Latvia proposes a programmatic model for the Green Investment Scheme in which most programmes now consist of a large number of small projects related to energy-efficiency savings in public buildings. Therefore Latvia would propose to buyers "wholesale" greening programmes backed by a credible and accountable national mechanism to "retail" AAU revenues to multiple project owners. Latvia can offer a robust Green Investment Scheme implemented by competent national institutions that require only minor and targeted institutional strengthening.

The Latvian government allocated around 40 million AAUs for a GIS, out of which 18.5 million AAUs have already been sold to Austria, the Netherlands, Spain, Japan, Portugal and a Japanese private buyer (Tuerk et al. 2010).

The dematerialisation principle of sustainable development underpins the Natural Resources Tax (NRT) (in our specific case—carbon tax as a component of the NRT system) which is aimed at reducing the ineffective use of natural resources and pollution of the environment; reducing the manufacture and sale of environment-polluting substances (including GHGs), at the same time promoting

[23] ECSSD Sustainable Development Department and ENVCF Carbon Finance Unit (2007). "Latvia's Participation in International Emissions Trading". Options Study, p. 136.

the implementation of new and improved technology with less pollution load and increasing energy efficiency and the share of renewable and local energy sources (wood, straw and peat), thus reducing air pollution. The "Law on Natural Resource Tax" states that (from 1 July 2005) a fee of EUR 0.14 for each emitted tonne of CO_2 shall be paid by all combustion installations, except those using peat or renewable energy sources and those that are involved in the EU ETS. Carbon tax increased to EUR 0.42 per tonne CO_2 after 1 July 2008. However, this tax rate is low and extremely ineffective, and should be revised.

In Latvia, the Excise Tax, besides other product categories, is applied to oil products that are imported, exported, produced, processed, stored, sold, received or sent. A feed-in tariff support has been provided for electricity production from renewable energy resources (energy from small HPPs, biogas production and wind power). However, the conditions for receiving the support have changed frequently and do not correspond with sustainable development criteria.

6 Recommendations

The attitude and methodological approach applied to policy design for climate change adaptation should be perceived as being equal in importance to the policy for mitigation of climate change. It is not an issue (problem) where attitude and methodology should be considered separately, but should be solved as an integral part of sustainable development according to all principles and criteria upon which sustainable development is based. Thus it should be included in policy planning documents and sectoral policies with innovative approaches to the formulation and implementation of such policies, involving all kinds of partners at national and global level, as well as at EU level.

The national state level is the basic one upon which adaptation to climate change (e.g., establishment of funding, insurance and transfer of technology) should be designed as part of the full policy cycle and in every decision-making process.

As risk minimisation and polluter (user) pays principles are amongst the most important ones, serving as a basis for the decision-making criteria of sustainable development, in order to ensure the prevention and reduction of the potential risks to the business and national economy at large and to adapt rational economic activities, it is required that the private sector also develops strategies for the prevention or reduction of such risks in cooperation with specialists of state administrative institutions, local governments and foreign specialists, adapting technologies and anticipating the potential risks related to climate change. Although such management of risks will initially require certain investments, it will reduce the damages inflicted to undertakings or the national economy and welfare at large, in the long term. It is intended to develop the potential forms of cooperation and development in the work groups referred to in the Protocol decision. Much attention should be paid to educating and informing the public regarding climate change, the threats it presents, as well as the readiness to act in a situation of disaster or crises.

The roles of regional and local level government should be emphasised in relation to adaptation to climate change because they will have the most accurate information regarding the local environment and the living conditions of residents, as well as regarding conditions hindering or promoting environmental changes. This makes it easier to produce a detailed assessment of the consequences caused by climate change and the foreseeable consequences. This, in turn, presents an opportunity for developing plans of measures on a local scale and spatial plans, which would ensure adaptation of the particular territories to climate change, as well as preparing for risks caused by climate change expected in the future. Spatial planning (including spatial plans of local governments), which determines the establishment of population structure, has a significant role, thus it is essential to take into account the foreseeable effects and the potential risks of climate change to infrastructure and built-up areas in the process of spatial planning.

Exploration and management of the risks related to climate change, concurrently establishing or improving the necessary databases, ensuring that adequate monitoring systems are in place, regularly renewing maps of risk objects and assessing the socio-economic effects from the point of view of cost-benefit analysis, would facilitate the process of the identification and evaluation (including financial) of risks. It would also improve the establishment of a system of different forecast and development models, including such systems which are related to the assessment of the effects of climate change on different natural ecosystems and biological diversity, human health and welfare at large.

It is important that the measures implemented for the reduction of the impacts of climate change (flood control, changes in agriculture or output of energy resources), at the same time would not harm ecosystems and biological diversity. It should be taken into account that natural biotopes (particularly forests and bogs) serve as carbon dioxide sinks. If such biotopes are significantly disturbed (even if it is done for the purpose of mitigation of climate change), the total benefit may not counterbalance the loss of the biotope as a carbon dioxide sinks. The usefulness of biofuel and the impact of production thereof on ecosystems should be carefully balanced. It is necessary to organise scientific research and monitoring in order to trace the changes of biological diversity caused by climate change.

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