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CLIMATE CHANGE AND DEVELOPMENT – Towards Alternatives

Briefing Paper

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INTRODUCTION

Climate change is one of the greatest environmental, social and economic threats for the society, especially in the developing world. Increase in global average temperature is very likely due to the observed increase in anthropogenic greenhouse gas concentrations.

With the implications of climate change including threats to water security, sea-level rise, more intense tropical cyclones and other extreme weather events, it is clear that climate change is of great significance. Communities and natural systems around the world are already experiencing the effects of climate change, and scientists warn that impacts on the developing world will be far more devastating than in industrialised states.

This is because developing countries have economies that are generally more reliant on climate-sensitive natural resources such as agriculture, fisheries and forests; that poor people do not have the resources to mitigate the impacts of climate change; and infrastructure is far less able to cope with the impacts of severe weather events.

This is why many development groups and aid agencies have joined environmental organisations in advocacy of more substantial reduction of greenhouse gas emissions, and more effective help to affected poor countries.

This paper summarises development and humanitarian aspects of climate change. Its focus is on analysis of impact on poor societies in the developing world. We discuss three key implications of climate change on development assistance policy:

- Climate will change, affecting livelihoods of poor people, especially in rural communities. The scale of the change depends on the amount of future greenhouse gas emissions. However, some change is already inevitable. Humanitarian assistance needs to adjust to this new reality, so that it helps the poor farmers and others to adapt to new circumstances, and does not support solutions contributing to climate change.

- The scale of climate change depends on the amount of greenhouse gas pollution – so that ambitious steps to reduce carbon pollution are urgently needed. Governments and industry have to invest in clean, highly effective technologies, support innovations and promote energy modernisation. The responsibility lies mainly in rich world, which has historically produced much more CO_2 per capita than developing countries.

- Priorities of development policy can help to spread low carbon technologies in poor countries, so that their economic growth and higher quality of life do not depend on higher and higher pollution. At the same time, distributed renewable energy technologies will bring electricity and heat supplies to rural communities of the third world without the costly power infrastructure. This will contribute to energy sovereignty as well as prevents further deforestation.

1. PHYSICAL BASIS OF CLIMATE CHANGE

1.1 Global climate

Climate is one of defining aspects of our life. Water supply and agriculture – which provides food for all and livelihoods for rural communities, i.e. for most of the human population – critically depend on it. Our way of life is adjusted to the climate of the part of the Earth which we live in. Our economy is build around the current climate. Extreme weather events, such as floods, hurricanes and storms, radically disrupt lives of affected people and cause enormous damage.

1.1.1 What do we know

One factor which influences global climate is the concentration of so-called greenhouse gases. Concentrations of some greenhouse gases in the atmosphere have increased as a result economic activity. Most importantly, burning of fossil fuels – coal, oil and natural gas – increases the atmospheric level of CO_2. Right now the CO_2 level in the atmosphere is higher than any time in the last 650,000 years.[1] Unless we radically reduce industrial emissions, it will double against the pre-industrial concentration some time in mid-21st century. Now the crucial question is, of course, quantification. How much temperature increase it would lead to – and what would be the impact?

Thanks to advances in climate science over the last several decades, we know something about the extent of climate change. Crucial for this are extremely sophisticated computer models, fed with data on climate variables, which calculate future changes under various pollution scenarios. Current models show that, with 90% probability, the value of climate sensitivity is approximately 2–4.5 °C, with most likely value of about 3 degrees.[2]

1.2 Impacts

1.2.1 Environment

With the same models that calculate climate sensitivity we are able to predict much about climate change impacts.

[1] IPCC 4AR WG1 SPM p. 2
[2] IPCC 4AR WG1 pp. 630, 798-799

- **An increase in global mean temperature by several degrees.** The best estimate is that the global mean temperature will increase by 4 °C during this century (90% probability range is 2.4–6.4 degrees).[3] Slower but persistent increase in emissions[4] would lead to an increase by about 3.4 degrees (2.0–5.4 degrees range for 90% probability).[5]

  Just for illustration: were all CO2 emissions stopped immediately, the best estimate for such a theoretical scenario is 0.6 °C increase in temperature. [6]

- **Precipitation patterns will change, albeit in various ways.** Generally speaking, increases of precipitation are projected, usually with very high confidence, in high latitudes: Arctic, Siberia, Canada, Scandinavia. More moderate increase would happen in tropics.

  However, much more important are negative trends. Most subtropical regions should expect significant decreases of rains. Even in a scenario which assumes that CO_2 emissions continue to increase by 2050 and decline thereafter[7], rains are projected to decrease by more than 20% in Mediterranean, parts of North Africa, South Africa (southern winter) and much of Central Asia (summer).[8]

- **Mountain glaciers will melt and retreat** relatively fast, with radical decreases in volume already in coming decades.[9] This is important especially in India and Latin America. Hundreds of millions of people here depend on rivers flowing from Himalayas and Andes for their water supply.

- **Hotter atmosphere will generally lead to more frequent weather extremes.** Projections show that an increased intensity (wind speed, rain intensity) of tropical hurricanes and typhoons is likely to occur with increasing levels of greenhouse gases (66% probability).[10] Total frequency of hurricanes and typhoons is expected to decrease, albeit with lower probability, due to smaller incidence of relatively weak storms.[11] More or less the same pattern (more intense, less frequent) is predicted for storms outside tropics. Extreme precipitation events, leading to floods in Europe, Asian monsoon region and elsewhere, are expected.[12]

  Summer heat waves – similar to the European summer of 2003 – and extremely hot days would become more frequent (90% probability).[13] Also, more droughts should be expected, with “extreme drought increasing from 1%

[3] IPCC 4AR WG1 SPM p. 13
[4] IPCC special report: emission scenarios, SPM p. 8: A2
[5] IPCC 4AR WG1 SPM p. 13
[6] IPCC 4AR WG1 SPM p. 13
[7] IPCC special report: emission scenarios, SPM p. 8: A1B
[8] IPCC 4AR WG1 SPM p. 16
[9] IPCC 4AR WG2 SPM, IPCC 4AR WG1 p. 776
[10] PCC 4AR WG1, p. 788, a IPCC 4AR WG1 SPM p. 16
[11] PCC 4AR WG1, p. 788
[12] PCC 4AR WG1, p. 783
[13] IPCC 4AR WG1 SPM p. 16, IPCC 4AR pp. 785-786

of present-day land area to 30% by the end of the century" in the scenario with sustained increase of CO2 emissions. [14]

1.2.2 Humanity

We have chosen these four domains that are affected by climate change process – health, water, agriculture and migration – because we can demonstrate on them complexity of the problem as these domains are inextricably interlinked and mutually interdependent. We can show it on one example: it is now clear that the Himalayas glacier are retreating what will contribute to low flow of the big Asia's rivers as Ganga or Indus, so that many communities which are dependent on agriculture will suffer from lack of water supplies for irrigation. This will lead to poor crops, higher probability of hunger and of health problems related to malnutrition. And in the end this all is contributing to migration because people want to safe their livelihood.

In addition Czech development aid is focused mainly on the projects related to environmental issues, health service and agriculture. And of course we are not so audacious to describe whole picture of the impacts because they are just emerging and many of them are out of human perception for now.

1.2.2.1 Health

According to the most recent international assessments climate change is unquestionably a serious threat to health, although its impacts depends on where you live, your age, access to health care, and your public health infrastructure.

The UN Intergovernmental Panel on Climate Change in its assessment[15] considered which areas or populations are vulnerable to the health impacts of climate change:

- areas or populations in or bordering on regions with high endemicity of diseases that are sensitive to climate [for example malaria]
- areas with an observed association between epidemic disease and extremes of weather [for example epidemics linked to the El Nino weather pattern]
- areas at risk from severe climate impacts relevant to health [for example stress on food and water supplies, risk of coastal flooding]
- areas at risk from concurrent environmental or socioeconomic stresses and with little capacity to adapt [for example local stresses from practices in the use of land or impoverished or underdeveloped health infrastructure]

For any given vulnerable region, adverse health effects will generally occur in poor populations that have little capacity to adapt, predominantly in the tropics and subtropics.

Heat-strokes, asthma

Geographically expanding or sprawling cities, replacing vegetation with surfaces retaining heat, cities with poor quality housing, and with topography that gives rise to stagnant air masses and air pollution are especially at risk [for example

[14] IPCC 4AR pp. 782
[15] IPCC 4AR WG II SPM p. 7nn.

Santiago or Mexico City]. Since vulnerability to heatwaves is driven by socioeconomic factors, cities in developing countries may be therefore more vulnerable to heat. Elderly people and people with preexisting illnesses are disproportionately affected. Furthermore, temperature and the formation of ozone at ground level [photochemical urban smog] are related, ozone can heighten the sensitivity of people with asthma to allergens and contribute to the development of asthma in children.

Thirst, hunger and malnutrition

Areas currently experiencing food insecurity and risk of drought, together with a lack of resources to import food [southern and eastern Africa, parts of Latin America, and central Asia] are likely to experience further reduction in crop yields caused by mid-continental droughts. Decreased availability of water as a result of climate change could affect populations in the subtropics where water is already scarce. Nearly half the populations of countries in central, southern and eastern Africa are already undernourished and these regions are highly vulnerable.

Water-borne diseases

Climate change may increase the risk of flooding of rivers in regions such as Central America, Europe, South Asia, and China. In Bangladesh, settlement of populations in high risk areas such as floodplains and river deltas increases vulnerability. Heavy rainfall and runoff influences the transport of other microbial and toxic agents from agricultural fields, human septic systems, and toxic dumps. Moreover, rainfall can alter the transport and dissemination of microbial pathogens and temperature may affect their survival and growth which then will lead to spread of diarrhoeal diseases and cholera.

Highland malaria

The way in which climate factors influence the transmission of malaria is more likely to become obvious in environmental fringe areas such as highlands or desert borders. Many of the highland regions in Africa that are surrounded by lowland areas where malaria is endemic are densely populated. Small changes in the distribution of malaria may therefore expose large numbers of people to infection. Some malaria epidemics in the African highlands have been associated with abnormally warm or wet weather conditions.

Overburdened health systems

After a rise in sea level, widespread flooding, intrusion of salt water, and coastal erosion are expected in low lying coastal settlements, low lying deltas or coral atolls. Countries such as Vietnam, Egypt, Bangladesh, and small island nations will be especially vulnerable. Thirteen of the world's 20 current megacities are situated at sea level. Extreme case of a rise of one meter in the sea level can inundate low lying areas, affecting 18.6 million people in China, 13 million in Bangladesh, 3.5 million in Egypt, and 3.3 million in Indonesia.

In sum, the health problems related to climate change in conjunction with problems presented by displaced populations will constitute great burden for health

system together with public budgets of affected countries. So that coastal communities may experience forced migration of populations.

1.2.2.2 Water supplies

More than half of humanity relies on the freshwater that accumulates in mountains and seventy percent of the worlds freshwater is frozen in glaciers. Glacier melt buffers other ecosystems against climate variability. Very often it provides the only source of water for humans and biodiversity during dry seasons. Freshwater is already a limited resource for much of the planet, and in the next three decades, the population growth is likely to far exceed any potential increase in available water.

Mountain glaciers are shrinking all over the world

Research shows that the glacier cover of mountain regions worldwide has decreased significantly in recent years as a result of warming trends. A recent comparison of historical glacier data with images from the ASTER (Advance Spaceborne Thermal Emission and Reflection Radiometer) instrument on NASA's TERRA satellite by the United States' Geological Survey revealed a significant shrinkage of mountain glaciers in the Andes, the Himalayas, the Alps and the Pyrenees over the past decade.

Decline of freshwater supplies in mountain regions

In the course of the century, water supplies stored in glaciers and snow cover are projected to further decline, reducing water availability in regions supplied by meltwater from major mountain ranges, where more than one-sixth of the world population currently lives.[16] Based upon a number of scientific investigations and the IPCC there are forecasts that up to a quarter of the global mountain glacier mass could disappear by 2050 and up to half could be lost by 2100. Glacial melt will affect freshwater flows with dramatic adverse effects on biodiversity, and people and livelihoods, with a possible long-term implication on regional food security.

Furthermore, settlements in mountain regions are at enhanced risk to glacier lake outburst floods caused by melting glaciers and governmental institutions in some place have begun to respond by building dams and drainage works.[17]

Himalayas' glaciers retreat – threat for Asia's water supplies

The Himalayas have the largest concentration of glaciers outside the polar caps. These Himalayan glaciers feed seven of Asia's great rivers: the Ganga, Indus, Brahmaputra, Salween, Mekong, Yangtze and Huang Ho. It ensures a year round water supply to millions of people.

A significant portion of the low flow contribution of Himalayan rivers during the dry season is from snow and glaciers melt in the Himalayan region. The runoff supplies communities with water for drinking, irrigation and industry, and is also vital for maintaining river and riparian habitat.

[16] IPCC WG2 SPM, p. 7
[17] IPCC WG2 SPM, p. 4

Climate change has already impacted the glacial ecosystem tremendously. Sixty-seven percent of glaciers are retreating at a startling rate in the Himalayas and the major causal factor has been identified as climate change.

For a landlocked country like Nepal, which relies on hydropower generation as a vital source of national income, the prospect of an eventual decrease in the discharge of rivers spells doom.

Reduced irrigation for agriculture will have ramifications on crop production and on basic human needs like available food supplies. In the Ganga, the loss of glacier meltwater would reduce July-September flows by two thirds, causing water shortages for 500 million people and 37 percent of India's irrigated land.

1.2.2.3 Agriculture

Changing temperatures, altered rainfall patterns and increased frequency of severe weather events, such as droughts or floods, will vary from region to region and locality to locality. However, it is likely that climate change – including increased climatic variability in the short term – complicates and will likely worsen the picture of the conditions and events that influence the rate and pattern of growth in many poor countries.

Economies heavily dependent on climate and weather-sensitive sectors for their growth are likely to be most affected. The implications of climate change for agriculture are particularly important, as agriculture's development is recognized as critical to the success of pro-poor economic growth. Indeed - despite rapid urbanization, about three-quarters of the world's absolute poor (those living on less than US$1 per day) continue to live in rural areas, their livelihoods heavily dependent upon agriculture and natural resources.

Lower yields

Global warming over the past quarter century has already led to a fall in the yield of some of the most important food crops in the world, according to one of the first scientific studies of how climate change has affected cereal crops. There was a clear trend, showing the cereal crops were suffering from lower yields during a time when agricultural technology, including the use of chemical fertilisers and pesticides, became more intensive. The study estimates that warming since 1981 has resulted in annual combined losses of wheat, maize and barley crops representing roughly 40 Mt or $5 billion per year, as of 2002. While these impacts are small relative to the technological yield gains over the same period, the results demonstrate already occurring negative impacts of climate trends on crop yields at the global scale.[18]

The IPCC report similarly concluded, that warmer and drier conditions in the Sahelian region of Africa have led to a reduced lenght of growing season with detrimental effects on crops. In southern Africa, longer dry seasons and more uncertain rainfall are prompting adaptation measures. There is high confidence that there has been a trend in many regions towards earlier ‚greening' of vegetation in the spring linked to longer thermal growing seasons due to recent warming.[19]

[18] Lobell, David B., Field, Christopher B.: Global scale climate – crop yield relationships and the impacts of recent warming, Environmental Research Letters Vol. 2, no 1, January-March 2007

[19] IPCC WG2 SPM, p. 3

In the short term, extreme events are more likely to have an adverse effect on agricultural production than climatic trends. Gradual changes in temperature and the timing and levels of rainfall will reduce yields in some areas and enhance yields in others, depending on initial conditions. In the most affected countries, cropping patterns may have to change to respond to changing climatic conditions.

Africa – more hungry and insecure

For many African countries and regions a decrease of agricultural production is projected, including access to food. The area suitable for agriculture, the length of growing seasons and yield potential, particularly around semi-arid and arid areas, are expected to decrease. This would further adversely affect food security and worsen malnutrition in the continent. In some countries, yields from rain-fed agriculture could be reduced by up to 50 % by 2020. Further, local food supplies are expected to be negatively affected by decreasing fisheries resources in large lakes due to rising water temperatures. [20]

Asia – more polarized

Climate change will pose substantial constraints to sustainable development of most developing countries of Asia as it compounds the pressures on natural resources and the environment associated with rapid urbanization, industrialization, and economic development.

Crop yields could increase up to 20 % in East and Southeast Asia while it could decrease up to 30 % in Central and south Asia by the middle of 21st century. Taken together and considering the influence of rapid population growth and urbanization, the risk of hunger is projected to remain very high in several developing countries in Asia.[21]

Latin America – drier and saltier

In drier areas of the continent, climate change is expected to lead to salinisation and desertification of agricultural land. Productivity of some important crops is projected to decrease and livestock productivity to decline, with adverse consequences for food security. However, in temperate zones soybeans yields are projected to increase. Increases in temperature and associated decreases in soil water will lead to gradual replacement of tropical forest by savanna in eastern Amazonia. A risk of significant biodiversity loss threatens many areas of tropical Latin America.[22]

1.2.2.4 Migration

People rarely migrate for environmental reasons alone. A range of factors including economic opportunity, operate together, and represent consequences of the economic and cultural effects of globalization. However, in the case of atoll countries such as Tuvalu or Kiribati, for example, there is widespread agreement that climate

[20] IPCC WG2 SPM, p. 10
[21] IPCC WG2 SPM, p. 11
[22] IPCC WG2 SPM, p. 12

change and associated sea level rise threatens the long-term ability of people to remain living on their islands.

Stretched limits of adaptability

In the first instance it will be climatic extremes and increasing climate variability that will enhance migration as soils are degraded, water supplies are contaminated and depleted, housing, livestock and infrastructure are destroyed, insurance costs rise and lives are lost. While communities generally adapt and are resilient to extreme events, climate change may stretch the limits of adaptability and resilience, making migration an attractive if not the only option to preserve livelihoods and quality of life.

Sea level rise is very likely to induce large scale migration in the longer-term. The flood risk for people living on islands will be 200 times greater than in the situation where there was no global warming[23].

It is likely that existing avenues of migration will be explored first for those social-ecological systems that are highly sensitive to climate change. In developing countries planning for enhanced internal migration and international immigration is required given that most existing migration is within and between developing countries. As we now for some regions is the threat more serious as for others.

Indian subcontinent – potentiality for conflicts

Many of the 5.5 million people living on the Ganges Delta in Bangladesh who will be forced to relocate with a 45 cm rise in sea level may seek to move inland within Bangladesh, but a significant number may seek to move to neighbouring India and Pakistan – and previous migration of this kind has been a factor of violence in the region.

Arctic's coastal erosion – threat of relocation

Climate change is already being particularly intensely experienced in the Arctic. Severe coastal erosion will be a growing problem as rising sea level and a reduction in sea ice allow higher waves and storm surges to reach the shore. Along some arctic coastlines, thawing permafrost weakens coastal lands, adding to their vulnerability. Some communities and industrial facilities in coastal zones are already threatened or being forced to relocate, while others face increasing risks and costs.[24]

Pacific – challenge to immigration policy

The challenges to immigration policy are borne out in the case of the Pacific Islands. It is incumbent on Australia, New Zealand and the United States to prepare for greater numbers of Pacific Island immigrants as these countries are capable of accommodating larger number of people, they already have substantial populations of Pacific Islanders, and they are in no small way responsible for climate change. In June 2000, New Zealand said it would accommodate Tuvalu citizens should they be required to leave their homelands due to climate change.

[23] Barnett, J.: Security and climate change, Global Environmental Change 13, 2003, p. 12
[24] Impacts of a Warming Arctic - Highlights, Cambridge University Press, 2004, p. 8

For those countries already dealing with large influx of migrants, and for those likely to receive increasing numbers of migrants as a consequence of climate change, forward looking assessments and forward planning for climate immigrants should be a policy priority.

1.2.2.5 What to do?

As we can see, the problem of climate change is really too complex and involve community as a whole. In addition in time of globalization, the world is more and more interlinked and problems are perceived as global problems that need to be solve on transnational level.

But if we want to solve something we should have a look at the origin at first. It was scientifically proved that one of the origins of climate change stems from human activity – mainly burning of fossil-fuels.[25] But in the same time this activity is perceived as necessary for "development" that has strong implications on economic and policy system. So that we should focus on thinking over new models of development which would be more climate-friendly.

[25] IPPC WG1 SPM, p. 2

2. CLIMATE CHANGE AND DEVELOPMENT

So far we have sketched out the physical basis of climate change and the implications for environment and humanity. The main aspiration of this paper, however, is the relations between climate change and development, i.e. the responses and alternatives to take for both developed and developing countries in tackling climate change while ensuring the much needed development of the world's poorest.

2.1 Responsibility and Responses

There are **several dimensions** of the climate change and development challenge. The first dimension relates to division of focus on adaptation to the impacts as opposed to mitigation of the roots of climate change, which is of various relevance to work of humanitarian and development NGOs. The second dimension concerns different roles and responsibilities in these efforts of developed and developing countries, including the differing roles and responsibilities of actors within those countries – governments, businesses, civil society and individual consumers.

2.1.1 Responsibility

Let us start with the latter, which is getting to the key question: Who is to pay? Responsibility over causes has a direct relevance for disputes over who shall take a lead and pay for the responses. All of climate adaptation and mitigation measures will require new and additional funds. What more, they will require substantial amount of political will, social capital and economic wisdom.

It is both unrealistic and immoral to expect that poor countries shall cover costs of adaptation to climate change, let alone mitigation. Poor people who are least responsible for climate change are hit by the negative impacts first and worst. This is because the poorest communities:

- live in the most affected tropical and subtropical areas
- are most dependent on climate for their livelihood and survival
- are worst equipped to adapt to changed climate

There is certainly a role the poor as well. However, rich people are responsible for 80 per cent of all carbon dioxide in our atmosphere. Moreover, as the biggest polluters they are at the same time best able to cope with climate change because they are the most developed ones. Therefore the rich must be at the forefront of efforts to combat climate change and commit corresponding share of resources needed.

In addition, economic feedback mechanisms are likely to emphasize and accentuate the **uneven distribution of climate change impacts** across the world, resulting in net gains for developed countries.

Even developing country governments – including those taking ever larger share of greenhouse gas emissions like India and China – cannot be expected to take a lead. While the responsibility is common, it is highly differentiated (as the UN has it) in terms of both adaptation and mitigation. Albeit this unconditional asymmetry in mitigation (as anchored in Kyoto agreement) should change gradually, in particular with big corporate polluters in emerging markets as their share of pollution and economic profits grow. In fact, some sort of corporate taxing or burden-sharing appear to be in the interest of the developing country governments as they are unlikely to receive enough funds for adaptation measures from the rich countries and their taxpayers.

The divergence between the countries most responsible for and most affected by climate change creates a **political tension**. South refuses the imposition of economic costs for the amelioration of environmental problem which they perceive to be North-caused. This tension and imbalance could be seen as a future risk.

Not just historically, the poor countries still have a negligible share of greenhouse gas emissions. Current per capita consumption of all developing countries is well below global average. Most Africans emit less then 0.1 metric tonne of CO2 per year. India stands at 1.2 tonnes and China at 2.7 tonnes as opposed to Europe (17 tonnes) and the United States (24 tonnes). In addition, China has shown a trend towards increasing energy efficiency – it decreased the energy consumption per dollar of GDP compared with 2005.

More importantly, developing countries host the vast majority of world's poorest people. Despite rapid economic growth, India and China still contain the largest portion of people living under one dollar a day, almost half a billion. Although economic growth has not proved very effective in raising people out of poverty and has been damaging for climate, in the short term the rich countries, including Czech Republic, cannot deny developing countries a right to grow their way. It is not just a matter of historical justice and current emissions for:

- there are no immediately and readily available alternatives for developing countries
- the rich countries used the very same model of economic growth to get where we are now

In the long term, however, this would be a futile strategy. Developing countries would be shooting themselves in the foot, including India, China, Brazil or South Africa who are all likely to take severe, although differing hits from changed climate. It is the rich industrial countries who need to start investing to both adaptation and mitigation not only to take over the historical debt and bring relief to most affected poor communities as soon as possible. It may also be the only way to later persuade leading developing countries that they should get onboard, too, in both adaptation and mitigation.

2.1.2 Adaptation

Out of the two major responses to climate change, adaptation is more imminent for the poor communities. Global temperature rose by 0.6 degrees Celsius

over past 50 years. Climate has already changed. The poor people are already feeling its negative impacts and need to began to **adjust immediately**. Longer droughts in East and South Africa, more frequent and severe storms in the Caribbean, disappearing Pacific islands, melting glaciers in the Andes and Himalayas, floods in South Asia - all are increasingly ascribed by experts to climate change. And more global warming is to come.

Some impacts of climate change are new such as melting of glaciers or rise of sea-level. However, most are not. They just multiply negative impacts of age-old well-known natural phenomena. However, it is most clear that both the new and old impacts of climate change **add to other problems** poor communities are already suffering from: malnutrition, ill health, environmental degradation, livelihood insecurity and vulnerability in turn undermining food production, economic performance, conflict resolution, social and political stability. Moreover, poverty further reduces people's ability to adapt to climate change

The range of impacts is **broad**, so too needs to be the range of **coping strategies.** Plus they will need to **differ** from region to region, from ecosystem to ecosystem, from policy to policy, and from development project to development project. In this report we have briefly described impacts on health, agriculture, migration and fresh water supplies. What are the adaptation challenges in these fields? Do the adaptation responses have something in common? Is it possible for people to adapt at all to the full scale of expected climate change?

The **health** experts need inter alia to consider following adaptation measures:

- more intense prevention of climate-sensitive and water-born diseases (malaria)
- climate proof water and sanitation systems
- foster crises health management by flooding and extreme weather events
- urban preparedness for heat waves (especially in higher latitude cities) and atmospheric pollution from forest fires
- rethink urban planning especially in low-lying areas – 13 from 20 current megacities are located at the coast)

The **agriculture** experts need to take into account for instance following measures:

- strengthen local food security
- adjust current agriculture patterns (crops, technologies)
- need to devise new agriculture technologies (soil and water)
- implement innovative water
- prepare for more humanitarian food aid

The people concerned with **migration** shall among others pay attention to:

- adjustment of rich countries immigration policies to allow for influx of climate refugees
- assistance to developing countries to prepare for and manage well both migrants from neighbouring countries (e.g. India, Pakistan from Bangladesh) as well as its own citizens dispersed internally due to climate change impacts (e.g. inside Bangladesh)
- political, legal and financial framework to relocate most threatened communities from local to international level

Systematic, careful and creative **water** management in all its various aspects is one of the common imperatives for responses to climate change, including prevention of mass migration. Neither public health, food production, nor livelihood security are possible without enough quality water. Too much or too little water is a matter of death and life in poor countries. There is not much that can be done about melting mountain glaciers in terms of adaptation. Moreover, most solutions seem to carry much too big financial, or political and social (engineering) costs:

- introduce highly effective and efficient water retention, purifying and desalination, storage and distribution, and water saving technologies
- bring the missing water from elsewhere
- relocate threatened communities

The adaptation measures in all sectors shall include risk and cost assessments, resolute steps and changes in corresponding policies, disaster awareness-raising, building of adaptation and coping capacities of various local actors, and overall adaptation efforts and disaster preparedness. Clearly, the key role here is for governments. In several fields incentives for and transfer of new technologies will be highly desirable (e.g. innovative housing, soil and water technologies), Therefore, governments will need assistance and inputs from businesses and non-government organizations, especially development (e.g. risk and cost assessments, awareness campaigns and coping strategies at community level) and humanitarian (arrangements for climate-related disaster relief) NGOs.

A number of climate-related problems, nonetheless, cannot be fully resolved by adaptation measures. Or these measures seem to reach economic, social and political costs comparable to the costs of mitigation. Although all these costs are close to impossible to measure and compare, the human costs of adaptation (Christian Aid report estimates that 185 million people in sub-Saharan Africa alone could die of disease directly attributable to climate change by the end of century) are undoubtedly much higher than those of mitigation.

2.1.3 Mitigation

If the CO2 and other damaging emissions are to decline to a level compatible with tolerable climate change (below 2 degrees Celsius rise in global temperature), they need to be reduced globally across a critical mass of countries and across key sectors of their economies – both in industrialized countries, but increasingly so also in the so called **emerging markets** and other developing countries.

There is an increasing consensus over on key factor behind the human-caused part of the climate change. The past and current emissions of greenhouse gases are largely due to the **fossil-fuel-based development.** This development model has so far been common to both industrialized as well as developing countries.

It is impossible for this paper to deal with various dimensions of alternative models in depth. Therefore, the emphasis is rather on what may be common to such efforts - the **contours of new model** of development, the common denominators and conditions necessary for alternatives to make headway, and how development and humanitarian NGOs may contribute.

The two **key questions** are thus:

- How can global economy, but especially these development-hungry countries fuel their economic growth in a way that both helps better adapt to upcoming impacts of the climate change as well as does not contribute to further deterioration of greenhouse gas concentrations?
- And how do we ensure that this economic growth based on non-fossil energy sources also at the same time results in reduction of poverty and realisation of the basic human rights of the poorest communities?

The change of current fossil-based development model into a sustainable and pro-poor model of development not only needs to happen on a global scale and in a trans-sectoral manner (from energy, transport to agriculture and manufacturing), it had better happen fast. While there maybe a debate on the scale and acceptability of the human and environmental – or the economical - costs of climate change and poverty, it is beyond doubt that inaction will help reduce these costs over time[26].

In short term, some trade-offs between economic development and climate change mitigation may be unavoidable. But a long term solution must clearly work for both the atmosphere and the poor people.

2.2 Alternatives

In the long term perspective it is not possible to pursue the model of development launched by the countries of the North in the future. There is no time to waste on finger pointing about past responsibility for or future contributions to the problem. It is time to **re-think and re-shape the concept** and pathway to "development". The era of reckless profusion of resources must end.

One of the alternatives (not only) for poor countries wanting to grow out of poverty without harmful impacts on the environment is seen in the concept of "**sustainable development**". What does it mean? Here are some aspects :

- Safeguarding finite natural resources for next generations
- Producing food, goods and services without overusing scarce resources
- Not damaging the land or watercourses or atmosphere with toxic substances
- Changing of behaviour patterns oriented wholly on consumption
- Energy efficiency

Now we will try to introduce here some aspects of this concept and point out some fields which are concerned with it.

2.2.1 Towards Energy Sovereignty

Current model of development based on fossil fuels is damaging climate and is increasingly expensive for developing countries. The most conservative voices in "peak oil" debate say we may still be two to three decades before oil price will need to reflect dramatic drop in supplies as opposed to growing demand for oil. Many say

[26] The Financial Initiative of the United Nation Environment Programme (UNEP) calculated that the economic costs of global warming are doubling every decade. Up in Smoke? p.5

we're past this point and global price for oil and its fossil substitutes will only go up. The need for development model based on small-scale, efficient and renewable (or at least non-fossil) energy is also fostered by security, human rights and indeed basic democratic considerations.

International distribution of oil resources represents a security thread for all countries who excessively rely on oil for their economic growth. Plus it stands for **human rights threat** to poor populations of oil producing countries. Concentration of oil reserves in hands of undemocratic, unpredictable and fundamentalist governments (or unaccountable companies) has several undesirable consequences:

- oil revenues are proved to help finance radical groups prone to terrorism and other forms of violence (Saudi Arabia, Iran)
- oil revenues clearly have a key role in legitimating several governments with a record of human rights abuse (Azerbaijan, Nigeria)
- oligopoly supply and global dependence on oil allow for international price manipulation (OPEC)
- dominant supply and bilateral dependence on oil may lead to abuse of oil exports as a foreign policy instrument (Russia)

It is not only international oil production and trade that is problematic feature of fossil fuel-based development. Distribution of energy produced by large-scale power plants such as those burning fossil fuels can become a threat from the point of view of humane security, economic competition and democracy. While some of these large scale power plant technologies may be friendly vis-a-vis climate change (natural gas, atomic) and may seem to offer certain guarantees against external **energy security** threads (Russian capital gaining larger share of Czech energy market), they all create and require a large and highly concentrated electricity power grid. National distribution monopoly and dependence of firms and consumers on such grids create public or even private utilities that:

- tend to have a control over price (or can negotiate regional cartel agreements) and market conditions
- create huge market asymmetries: profits and survival of small-scale producers are largely dependent on their good will (ČEZ)
- run a risk of large systemic fall-outs and the grid vulnerability represents a national security thread

All of these threads can be managed if these huge players can be kept transparent and under public control both at national and local (municipal) level. In practice, however, this has so far been difficult to ensure since – as with all big economic players - their economic profits translate into large negotiating power and political clout. This **political power** is often used to influence the very process of public control. It undermines internal energy security of sub-regions, municipalities or local communities as well as individual consumers.

Given their enormous importance in the current development model, these companies tend to suffer from a lack of transparency, accountability and indeed demonstrate lack of possibility for **democratic control**, which is otherwise an officially stated (internationally approved) hallmark of development for countries of both North and South. Only well-advanced democratic societies with good governance seem to be capable to cope with such a challenge. But how can this be realistically expected from poor countries with poor governance standards?

Moreover, how can vibrant local communities and national economies evolve in face of highly concentrated, opaque and unaccountable systems of distribution of the key energy resource people and companies need for their development?

The very basic question for most poor countries is even more prosaic though. Can they at all effort huge **public investments** into building and maintenance of large power grids? And can such investments be realistically expected from, and responsibly left to, private investors given the low purchasing power of poor people and the need to guarantee affordable and fair access? While most poor governments can barely find such finance and even harder ensure their effective and sustainable use, the prevailing experience of public utilities privatization in the developing countries has so far been mixed at best.

Thus, small scale renewable energy is ultimately the most pro-poor approach also because it carries the greatest potential to provide electricity to people without access to grid. Renewable energies are affordable and may eventually provide many more jobs (and growth) in poor countries that large scale fossil fuel models could.

"A shift from the traditional fossil fuel-based economy to carbon-free energy systems would be the cornerstone of an environmentally sustainable economy".[27] There is need to introduce technological innovations which help to bypass the carbon intensive growth and advance cleaner development.

However new technologies represents incremental costs and take time to develop and disseminate. Financing mechanisms for technology transfer from the North to the South therefore would be critical to meeting the rapidly growing energy needs of the developing countries.[28] Again, this is only short-term cost, which will be paid off after couple of years. As the Stern review suggests, it is necessary to **take the emission reduction as an investment** - "a cost incurred now and in the coming few decades to avoid the risks of very severe consequences in the future".[29]

Another matter of consideration is energy efficiency. There is need to search **energy conservation** in some sectors like :

- **Transportation** : imposition of ecological taxes on aviation and maritime transport
- **Building** : there is need to better isolation of buildings, phenomena of energy self-sufficient buildings
- **Households** : change in people's attitudes towards energy consumption
- **Renewables**
- **Analyse the impacts** of political decision on GHG emission

2.2.2 Agriculture

Agriculture is particularly vulnerable to the vagaries of the weather. It is generally predicted that climate change will lower the incomes of vulnerable populations and increase the absolute number of people at risk from hunger. Africa is

[27] Figueres, Ch., Ivanova, M. H. : *Climate change : National interests or a global regime?* In. Esty, D. C., Ivanova M. H. eds. : *Global environmental governance : Options & Oportunities.* Yale School of Forestry and Environmental Studies : 2002. p. 219

[28] Figueres, M. H., p. 220

[29] Stern, N. : *The Economics of Climate Change. Executive Summary.* : 2006, p. 1

expected to experience marked **reductions in yields**, decreases in production and increases in the risk of hunger as a result of climate change.[30]

Potential damages resulting from climate change need to be addressed by new development strategies such as sound agriculture system. What does it mean?

- **Sustainable agriculture** - refers to the ability of a farm to produce food without causing irreversible damage to an ecosystem. It makes farmers in developing countries possible to cope with nowadays and future impacts of climate change and at the same moment doesn't contribute to it.
- **Small-scale farming** - it has proven to produce positive externalities like clean water, preservation of soils with high turnover of crops, rural landscapes. The labour intensive approach of small farming is more environment-friendly than the high input technic and capital intensive approach of the corporate food production. In addition, this model of farming connected with diversification of production and replenishment of soil boosts self-sufficiency of food production of developing states.
- **Fair trade :** Today's local markets are destabilized by the dumped food and price volatility caused by corporations. Therefore, it is necessary to prevent the dumping and to work on stabilizing prices to be able to achieve food security and food sovereignty of developing countries. The developing countries must be able to set up limits to the flow of low price imports which are flooding their markets in order to protect their local production.

The principle of extra-territorial responsibility[31] in multilateral regime, accompanied with an adequate watchdog mechanism, would ensure that domestic support do not harm the food market of others. Moreover, the price of products should reflect the full costs of production, that is to say, taking the costs of social and environmental negative externalities into account.

2.2.3 Economy

As we can see, traditional economic model which aims at creating wealth at first and views environment only as a subset of economy is no longer sustainable. Current economy is shaped by market forces with its imperative of maximazing the profits at minimum costs and based on market signals (f.e. price). But these signals and forces are not reflecting the environmental costs representated by the services provided by ecosystems.[32] Thus **market is not providing reliable information**. The natural resources are not valued so that they seemed to be valueless only as an instrument to reach the profit.

This point of view on the natural resources is really misleading. It supports unlimited extraction and consumption of resources at the price of damaged

[30] Lorimer, J. : *Background research paper on the predicted climate change impacts of greatest relevance to Oxfam.*
[31] Ecofair p 56
[32] BROWN, L. R. : *Eco-economy : building an economy for the earth.* W.W. Norton & Company : New York, 2001, p. 79

environment which at the same time is not incorporated into the real price of products. This model is really not contributing to the balance between ecosystems and economy (f.e. carbon emission – carbon fixation ; soil erosion – soil – formation etc.).[33]

Thus if we want to trigger sustainable way of development we need to "systematically restructure the global economy in order to make it environmentally sustainable".[34] This is again connected with the axis North-South. Like in the case of CO_2 emissions, **resource consumption is unequally distributed** between the citizens of industrialized and developing countries.

The world is then divided into resource producing and resource consuming countries which brings along important economical impacts. For example, the EU is net importer of raw materials (relatively cheap resources from the South) and on the other hand is net exporter of products with added value, which means that the "economic profits from international trade therefore are concentrated in the EU".[35] South is then dependent on resource-related revenues with little added value so that there is a tendency towards bigger extraction of resources which simultaneously leads to bigger environmental damage.

There are some possibilities[36] to trigger positive changes leading to an environmentally sustainable and climate change sensitive economy :

- **Debt cancellation** – this enable poorest countries to focus on more important things than paying back the credits
- **Introduction of world-wide taxes** (f.e. ecological tax, Tobin tax etc.) which will create funds for the implementation of sustainable development options for South
- **Introduction of tariffs** on energy-intensive products that originate in states that have not jointed the Kyoto protocol

To be able to reach these goals there should be much more political willingness to cooperate between particular states.

2.2.4 Policy Mainstreaming

It should be paid more attention to the "mainstreaming" of climate change issue into the area of international aid, development policies of developed countries and economic policies of particular developing states. It means especially considering the implications of climate change on variety of development activities such as poverty reduction, rural development etc.

In the decision-making level it could be useful to take into account long-term perspective of sustainable development means involving considerations of a wide range of development activities, from heat-resistant crop selection to the design of highways and utilities routinely.

There are some opportunities[37] how to connect development activities with climate change issue:

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[33] Ibid., p. 78

[34] Ibid., p. 81

[35] *Europe's global responsibility : environmental space, international trade and factor X.* SERI, Friend of the earth., p. 6. http://www.foeeurope.org/publications/2006/SERI_FoEE_EN.pdf

[36] Ibid., p. 9-10

[37] OECD : Putting Climate Change Adaptation in the Development Mainstream. Policy Brief, March 2006

- **Better information** in case of awareness of decision-makers about climate change issue
- **It is required to find out the key areas of development activities** in which should be incorporated the mainstreaming of climate change mitigation and adaptation mechanisms at first (f.e. land use planning, infrastructure design…)
- **Institutional links** between activities initiated to achieve development objectives and efforts coping with climate change agenda need to be set up
- **Transnational cooperation** in promoting shared tools, experience and best practices among national governments and development agencies
- **Regulation and standards**
- **Voluntary agreements between industry and governments**

CONCLUSION

Thanks to the IPCC's releases we have now almost certainty about people are one of the causes of the climate change. Human activity is responsible for higher concentration of the greenhouse gases emission in the atmosphere. Most importantly, burning of fossil fuels – coal, oil and natural gas – increases the atmospheric level of CO2. Just high GHG emissions bring along many climate changes such as:

- Global warming
- Extreme weather events
- Glacier retreating and melting
- Changes in precipitation patterns

Climate change is fundamentally concerned in humanity too. As people live in dialectical relationship with their environment then, logically, environment's changes have profound impacts on them. In this case are the changes of negative character and pose a big threat towards (not only) human beings. Some of them are:

Health problems – spread of climate-sensitive diseases such as malaria, diarrhoea, heatstroke related to heat wave

- Droughts
- Flooding
- Migration
- Agriculture – lower yields, risk of hunger in developing countries
- Insufficiency of water resources

We can conclude further that this situation, critical to humanity, stems from nowadays model of development which is based mainly on fossil-fuels use. It would be said this model is really unsustainable as it bears along irreversible impacts on environment. So that there is need to avoid the old mistakes and introduce new points of view on the concept of "development" alternative to the fossil-fuels based one. These alternative models are commonly called as "sustainable development". It is believed that this model can reduce vulnerability to climate change.
We have divided the alternatives into four main sectors :

- Energy – carbon-free energy systems (introducing of renewable energy sources), energy conservation in transportation, buildings and lifestyle
- Economy – reflection of environmental costs by market, world-wide taxation system, debt cancellation
- Agriculture – small-scale farming, sustainable agriculture, fair trade
- Policy mainstreaming – introducing of transnational cooperation, regulatory system, sharing of best practices

Bibliography :

IPCC : *Climate Change 2001.* Third Assessment Report.
http://www.grida.no/climate/ipcc_tar/

IPCC : *Climate Change 2007 : The Physical Science Basis.* Summary for Policymakers. Working Group I Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report.
http://ipcc-wg1.ucar.edu/wg1/wg1-report.html

IPCC : *Climate Change 2007 : Climate Change Impacts, Adaptation and Vulnerability.* Summary for Policymakers. Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report. http://www.ipcc.ch/SPM13apr07.pdf

UN : *Report of the United Nations Conference on environment and development*. 1992 : Rio de Janiero
http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm

The Climate of poverty : facts, fears and hope. A Christian Aid Report : 2006.
http://www.christian-aid.org.uk/indepth/605caweek/caw06final.pdf

OECD : *Putting Climate Change Adaptation in the Development Mainstream*. Policy Brief, March 2006. http://www.oecd.org/dataoecd/57/55/36324726.pdf

Impacts of a Warming Arctic - Highlights, Cambridge University Press, 2004.
http://www.amap.no/acia/

Europe's global responsibility : environmental space, international trade and factor X. SERI, Friend of the earth., p. 6. http://www.foeeurope.org/publications/2006/SERI_FoEE_EN.pdf

BARNETT, J.: *Security and climate change*. Global Environmental Change 13, 2003

BROWN, L. R. : *Eco-economy : building an economy for the earth.* W.W. Norton & Company : New York, 2001

ESTY, D. C., IVANOVA, M. H. eds. : *Global environmental governance : Options & Oportunities.* Yale School of Forestry and Environmental Studies : 2002

LOBELL, D. B., FIELD, Ch. B.: *Global scale climate – crop yield relationships and the impacts of recent warming*. Environmental Research Letters Vol. 2, No 1, January-March 2007

LORIMER, J. : *Background research paper on the predicted climate change impacts of greatest relevance to Oxfam.*
http://www.oxfam.org.uk/what_we_do/issues/climate_change/downloads/drjlorimer_ogb_summary_climate_change_impacts.rtf

STERN, N. : *The Economics of Climate Change. Executive Summary.* : 2006
http://www.hm-treasury.gov.uk/media/8AC/F7/Executive_Summary.pdf