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Climate change 2010: A global perspective

Abstract: *The decade of 2000–2010 was the warmest decade in recent history. It was also a decade of climate extremes such as the 2003 heat wave in western Europe and 2010 heat wave in Russia, frequent major floods in Europe, Pakistan in 2010 or Australia in early 2011, devastating cyclones, or major cold snaps and snow blizzards as in the US, UK and China. Despite this reality, there persists a deep gap between the scientific evidence about the changing climate of the Earth, and political awareness about the reasons and consequences of global warming. Such a gap between physical reality and political thinking will be extremely costly. Recent scientific evidence suggests that measures considered to tackle global warming are gravely inadequate. It appears that the average global temperature by 2100 will increase by at least 3°C to 4°C. Such increase will have devastating effects on agricultural production and survival of hundreds of millions people. The purpose of this paper is to improve understanding of climate change science among policy makers and diplomats.*

Unfortunately, to read hard science is much more challenging, than to read tabloids and to think analytically is much more demanding than to believe. Some popular media like to quote various "scientists" expressing their doubts about climate change – it gives them the appearance of "balanced reporting." In the vast majority of cases such media use statements from people, who are not climate specialists, but specialists in something different (meteorologists, geologists in best cases). In, for example, medicine, nobody would dare to take seriously a dermatologist making statements about neurosurgery – but in climate debate similar practices became common practice.

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Data released by the National Air and Space Administration (NASA)[1] and the National Oceanic and Atmospheric Administration (NOAA)[2] put 2010 – together with 2005 – as the Earth's warmest year in over 131 years of systematic measurements. Nine out of ten globally warmest years happened during the 2000 to 2010 decade, which is also the warmest decade on record.[3] Global insurer Munich Re announced there were 950 natural catastrophes recorded in 2010, 90 per cent of which were weather-related events such as storms and floods, making it the year with the second highest number of natural catastrophes since 1980.[4] All this happened during the period, when an11 year long small solar cycle was in its deep minimum.[5]

Despite these solid facts about the Earth's climate over the previous decade, for many opinion makers, common citizen and politicians in Central and Eastern Europe, climate change remains an abstract if not artificial subject, very much imposed on V4 people by "Brussels." In some countries and certain segments of the society some people, including people of power and influence, have doubts about the very existence of climate change. The most extreme expressions of this denial of the reality and the science can be found in statements calling global warming "a new religion."[6]

Many do not deny warming of the climate as such, but have doubts whether it is a man-made or natural process. Yet others are not able to see, whether it is an important topic or not, and whether it is an urgent matter, or something relevant for next generations – and therefore worth ignoring for real life politicians

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1 "NASA Research Finds 2010 Tied for Warmest Year on Record," National Air and Space Administration. Available online: http://www.nasa.gov/topics/earth/features/2010-warmest-year.html (accessed on February 21, 2011).

2 "2010 Tied for Warmest Year on Record," National Oceanic and Atmospheric Administration. Available online: http://www.noaanews.noaa.gov/stories2011/20110112_globalstats.html (accessed on February 21, 2011).

3 "NASA Research Finds 2010 Tied for Warmest Year on Record," NASA. Available online: http://www.nasa.gov/topics/earth/features/2010-warmest-year.html (accessed on February 21, 2011).

4 "Stronger cyclones to menace miners, crops in warmer world," *Reuters*, February 10, 2011. Available online: http://www.reuters.com/article/2011/02/10/us-climate-cyclones-idUSTRE7191Y920110210?pageNumber=1 (accessed on February 21, 2011).

5 "For the past several years the sun has been in its most quiescent state since early in the twentieth century," said University of Colorado Boulder Professor Daniel Baker. "Solar Flare: Space Weather Disrupts Communications, Threatens Other Technologies," *Science Daily*, February 18, 2011. Available online: http://www.sciencedaily.com/releases/2011/02/110218142451.htm (accessed on February 21, 2011).

6 "Klaus: Globálne otepľovanie je nové náboženstvo," *Hospodárske noviny*, December 12, 2009. Available online: http://hnonline.sk/svet/c1-39549360-klaus-global (accessed on February 21, 2011).

with their four year terms and perspective. For some V4 politicians goals such as 20–20–20 (20 per cent higher energy efficiency, 20 per cent renewable energy in the energy mix and 20 per cent reduction in CO_2 emissions by 2020) defined by the European Union, tend to be simply a top-down distraction from "real matters" and "threat" to economic growth, understood as the ultimate objective of governments. Distraction, that one has to obey or fake.

As is well known to all scholars following the climate debate and politics in the United States, such ignorance is hardly the V4 phenomenon. US debate is extremely important not only because of the US being until very recently the largest CO_2 emitter, but also because of ideological influence of American neoconservatives around the world, and in particular in the "New Europe." An extremely serious part of the problem in the USA was the White House's systemic effort to censor and suppress climate science during the G.W. Bush era.[7] An open letter signed by over 250 American top scientists in May 2010 states "We also call for an end to McCarthy–like threats of criminal prosecution against our colleagues based on innuendo and guilt by association, the harassment of scientists by politicians seeking distractions to avoid taking action, and the outright lies being spread about them. Society has two choices: We can ignore the science and hide our heads in the sand and hope we are lucky, or we can act in the public interest to reduce the threat of global climate change quickly and substantively."[8]

Despite the solid facts about the Earth's climate over the previous decade, for many opinion makers, common citizen and politicians in Central and Eastern Europe, climate change remains an abstract if not artificial subject, very much imposed on V4 people by "Brussels."

The gap between physical reality and political thinking will be extremely costly. According to *Economic Review of Climate Change* prepared for the British government by economist Nicolas Stern in 2006, climate change could cost

[7] For details see *Storms of My Grandchildren* by the director of the NASA Goddard Institute for Space Studies Dr. James Hansen or report on climate science censorship published by the Union of Concerned Scientists in 2007; J. Hansen, *Storms of My Grandchildren*, New York: Bloomsbury, 2009, pp. 28–59.

[8] "Climate Change and the Integrity of Science," *Science,* May 7, 2010. Available online: http://www.sciencemag.org/content/328/5979/689.full (accessed on February 21, 20110).

the world at least 5 per cent of GDP each year; if more dramatic predictions come to pass, the cost could be more than 20 per cent of GDP.[9] New findings since 2006 suggest, that even 20 per cent may be a very low estimate.

It is matter of scientifically proven reality, not a religious faith, that global warming is happening, that it is anthropogenic (caused by human action), it is progressing extremely fast and is already having serious impacts on human societies – even if what we see today is but a mild taste of the future. In medicine the common rule applied to a doctor's behavior is "Hope for the best, prepare for the worst." Behavior of the key world politicians, unaware of the facts and confused by ideologists, is fundamentally different. It goes like "Hope for best, prepare for nothing but status quo." Unfortunately, status quo means rapid warming with tremendous consequences. There are only small regional variations to the failure of global politicians, such as "Hope for best, do a little" (old EU), "Hope for best, ignore the rest" (USA and "the new Europe") or "Hope for the best, expect others to do the rest" (China).

Understanding science: The past

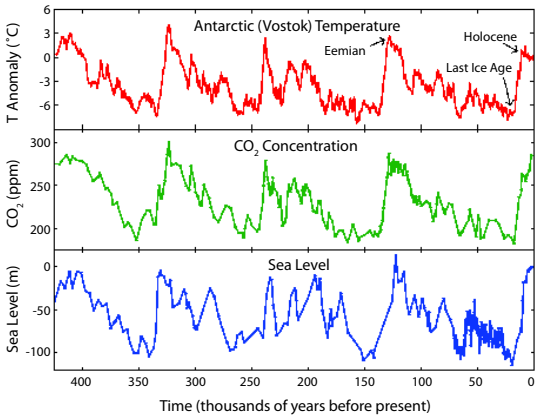
Just twenty thousand years ago – a blink of an eye from geological perspective – the vast part of Europe was covered by a several kilometers thick ice sheet, as was the whole of today's Canada and northern parts of USA.

Analysis of the ice structure from the ice cores drilled from the ice sheets of Antarctica and Greenland, enabled paleoclimatologists to reconstruct changes in the global temperature over the previous hundreds of thousand of years as well as a chemical composition of the air trapped in the ice. A critically important finding is that the differences between the average global temperatures during the ice ages and average interglacial temperatures were only about 6 °C. This seemingly small average temperature difference was sufficient for switching between the ice ages and interglacial periods, with sea levels fluctuating as much as 130 meters, as is shown on Figure 1.

A noticeable detail on the upper temperature curve is, that maximal temperatures during the recent interglacial period known as Holocene were reached approximately 8 to10,000 years ago and then the cooling process appears to start. While transitions from glacial to interglacial periods and

[9] "Stern Review: The Economics of Climate Change. Executive Summary." Available online: http://siteresources.worldbank.org/INTINDONESIA/Resources/226271-1170911056314/3428109-1174614780539/SternReviewEng.pdf (accessed on February 21, 2011).

Figure 1. Temperature change, atmospheric Carbon dioxide amount, and sea level as a function of time for the past 425,000 years



Source: J. Hansen, *Storms of My Grandchildren*, New York: Bloomsbury, 2009, p. 37. Available online: http://www.columbia.edu/~mhs119/Storms/Storms_Fig.03.gif (accessed on February 19, 2011).

melting of ice sheets were happening over very short periods of a few thousand years, the cooling process was mostly slower.

Recent science has a solid understanding of mechanisms involved in switching between the ice ages and interglacial periods. Ice age melting processes were initiated by periodical changes in the Earth's orbit known as Milankovitch cycles. Their periods are 100,000 years, 41,000 years and 23,000 years respectively and these small changes are sufficient to set into motion major changes in the Earth's climate.

There is a straightforward causal relationship between greenhouse gases, of which CO_2 s the main one, and the temperature of the planet. Without greenhouse atmosphere, the average surface temperature of the Earth would be 33°C below the current average temperature.

Understanding science: The present

Global warming is confirmed by direct temperature readings (in many places centuries long, in others shorter) from all across the Earth, including the

surface of oceans and more recently depths of oceans. Direct temperature measurements confirm an average 0.7°C increase in the global temperature over the previous 130 years, with increase more pronounced closer to polar regions and less pronounced near equator. The increase is much faster over the last 40 years.

Over the last approximately 40 years, warming of the Earth's surface and atmosphere is confirmed also by sensors on satellites and data provided by remote sensing. Scientists and interested public can streamline data from satellites documenting, for instance, rapid decrease in ice coverage of the Arctic Ocean on a almost daily base.[10]

Satellites enable scientists to measure not only the overall area covered by the sea ice at any given moment, but also to measure ice thickness and therefore its volume. The volume of Arctic sea ice is disappearing even faster than surface coverage, meaning that the remaining ice is younger and thinner. From a physical perspective it is important to remember, that Earth's ice represents the planet's "cold buffer."[11]

It is important to understand that the seemingly remote Arctic is a "canary in the coalmine" of the climate. Due to the Earth physics, temperature increases faster in the polar regions than closer to the equator. While ice reflects 50 to 70 per cent (fresh snow 95 per cent) of sun radiation back to space, the ocean absorbs around 90 to 95 per cent of the energy. Melting of the sea ice in the Arctic, therefore, further accelerates the warming of the Earth through a positive feedback mechanism. Polar ice's albedo is the second most important mechanism for Earth's temperature regulation after level of greenhouse gases.

Ice melting in the Arctic does not affect only floating sea ice, but also glaciers accumulated on the Arctic islands, the Greenland ice sheet representing by far the largest accumulation of ice in the northern hemisphere. While the melting of the floating sea ice does not significantly influence the sea levels, the melting of Greenland's massive continental ice sheet with its average thickness of 2,300 meters may increase global sea level by 6.5 meters.[12] Melting of both Greenland and Antarctic continental ice sheets could push the ocean level 80 meters above current sea level.

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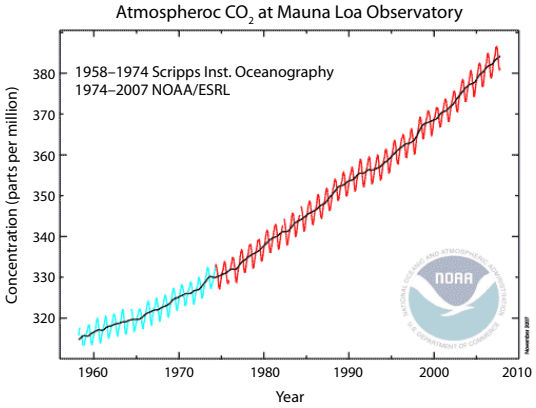
[10] *Arctic Sea Ice News & Analysis*, National Snow and Ice Data Center. Available online: http://nsidc.org/arcticseaicenews/ (accessed on February 27, 2011).

[11] Due to latent heat of melting, the same amount of heat is needed for melting 1 gram 0°C "warm" ice to 0°C cold water, as for warming the same 1 gram of water from 0°C to approximately 80°C. Once the ice is gone, warming continues much faster.

[12] "Sea level and climate," US Geological Survey. Available online: http://pubs.usgs.gov/fs/fs2-00/ (accessed on February 21, 2011).

Figure 2. Carbon dioxide in Earth's atmosphere



Source: "NOAA celebrates 50-year Carbon dioxide record," NOAA, 2007. Available online: http://www.noaanews.noaa.gov/stories2007/20071126_carbonrecord.html (accessed on February 21, 2011). Figure is available online: http://www.esrl.noaa.gov/news/2007/img/co2_data_mlo.2007.m.gif (accessed on February 21, 2011).

Globally, the oceans are now rising at about 3.3 mm per year. While the 3.3 mm appear to be rather small figure, melting acceleration should be of concern. During the last decade, the rate was 1.7 mm per year. If melting accelerates by factor of two every decade, than annual sea level increase in 2020 would reach 0.66 mm, in 2030 1.32 cm/year, in 2040 2.64/year, in 2050 5.28 cm/year and in 2060 10.48 cm per year – a very significant figure for low laying regions of the world. According to the US Geological Survey, 10 m sea level increase would flood around 25 per cent of the US population, figures for Bangladesh, Egypt or northern Europe are much worse. Obviously, it is not guaranteed that melting of the ice sheets will be a smooth linear process and not a process with many abrupt sea level growth events.

The trigger and the key factor in the recent global warming are carbon dioxide and methane emissions from the combustion of fossil fuels and agriculture combined with deforestation. As shown earlier (see Figure 1), pre–industrial levels of CO_2 in the Earth's atmosphere were below 300 parts per million, while CH_4 levels, currently at around 1750 ppb (parts per billion) were below 700 ppb. Fast growth in the atmospheric CO_2 to currently 390 ppm is depicted in Figure 2.

While the Arctic Ocean, Greenland and Antarctica attract a lot of scientists' attention, dramatic changes were happening also in another part of the world.

Another "canary in the coalmine" of the Earth's climate – the Amazon region in South America – experienced a "one-in-100-years" drought event in 2005. 100 years lasted only until 2010, when even more widespread and severe drought hit the Amazon region again. While in a normal year the Amazon forests serve as a carbon sink and absorb around 1.5 billion tons of CO_2, as a result of the 2010 drought more than 5 billion tons of CO_2 may be released from Amazonia's decaying tree mass. For comparison, the United States' CO_2 emissions in 2009 were 5.4 billion tons. Repeated droughts in Amazonia thus may become yet another positive feedback in addition to the rapidly decreasing albedo in the Arctic and a growing amount of CH_4 emanating from the melting permafrost of Siberia and Canada.

"Two unusual and extreme droughts occurring within a decade may largely offset the carbon absorbed by the intact Amazon forests during that time. If events like this happen more often, the Amazon rainforest would reach a point where it shifts from being a valuable carbon sink slowing climate change, to a major source of greenhouse gasses that could speed it up," said Dr. Simon Lewis, researcher from the University of Leeds. "Having two events of this magnitude in such close succession is extremely unusual, but is unfortunately consistent with those climate models that project a grim future for Amazonia."[13]

Understanding science: The future

There are a number of mathematical models trying to predict two fundamental parameters of warming faced by humankind in the future: how quickly will the temperature rise and how high will it go. Given large number of variables affecting climate change, different methods give a range of projections. Several projections are prepared within the work of the International Panel on Climate Change, alongside with the reconstruction of the average temperatures over the previous millennium by different authors.[14]

Given the trends of the last ten years, climate scientists believe that higher warming scenarios are much more likely to happen. This is not only because there are no signs of political determination to reduce emissions in the key polluting countries, but to a great degree due to rapidly strengthening positive

[13] "Two Severe Amazon Droughts in Five Years Alarms Scientists", *Science Daily,* February 3, 2011. Available online: http://www.sciencedaily.com/releases/2011/02/110203141820.htm (accessed on February 21, 2011).

[14] See, for example, D.S. Chapman, M.G. Davis, "Climate Change: Past, Present, and Future," *Eos transactions American geophysical union*, Vol. 91, No. 37, 2010, p. 327.

feedbacks, set in motion by the burning of the fossil fuels by humans over the previous hundred years and completely out of human control. As half time of CO_2 retention in the atmosphere is around 50 years, excessive amount of CO_2 emitted by people in the recent past will remain in the atmosphere for several centuries. During that time the rising global temperatures will be further reinforced by the following mechanisms:

- Decrease in the Earth's surface reflectivity (albedo) caused at the beginning by melting of the summer sea ice in the Arctic and later by melting continental ice sheets of Greenland and Antarctica. Compared to ice and snow, open sea and land reflect much less and absorb much more solar energy, thus accelerating warming of the Earth surface.
- Massive release of methane from the melting permafrost in Siberia and Canada (see Figure 3). The thaw of at least part of permafrost is now irreversible.[15]
- Release of additional methane from methane hydrates frozen and accumulated at the bottom of shelf seas in the Arctic Ocean.[16]
- Decrease in the CO_2 absorption by Amazon forests and eventual release of CO_2 from decaying Amazon trees.[17]

Over the nearest future – upcoming decade – not irrelevant will be also the expected upward trend in the small solar cycle that is due to follow an unusually deep minimum during most of the previous decade.

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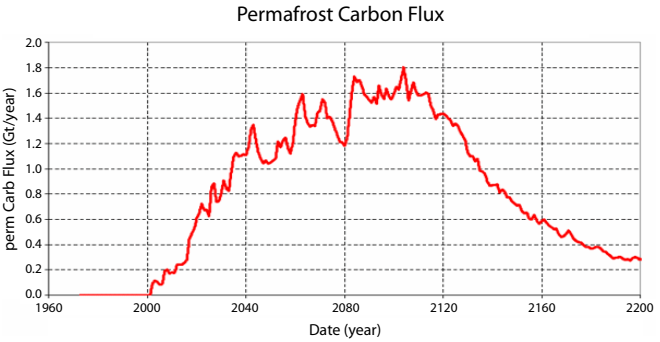
[15] "One – to two – thirds of Earth's permafrost will disappear by 2200, unleashing vast quantities of carbon into the atmosphere," says recent study by researchers at the Cooperative Institute for Research in Environmental Sciences (CIRES) National Snow and Ice Data Center (NSIDC). "The amount of carbon released is equivalent to half the amount of carbon that has been released into the atmosphere since the dawn of the industrial age." Over the 100 years period, methane is approximately 25 times more potent heat trapping gas than CO_2, but it is around 70 times as potent over 20 years time (the difference is result of faster decomposition of methane). "Thawing permafrost will accelerate global warming in decades to come, says new study," National Snow and Ice Data Center, February 16, 2011. Available online: http://nsidc.org/news/press/20110216_permafrost.html (accessed on February 16, 2011).

[16] "Methane releases from Arctic shelf may be much larger and faster than anticipated," National Science Foundation, March 4, 2010. Available online: http://www.nsf.gov/news/news_summ.jsp?cntn_id=116532 (accessed on February 21, 2011).

[17] The UK Met office warns that a 2°C rise above pre-industrial levels would see 20–40 per cent of the Amazon die off, a 3°C rise would see 75 per cent destroyed by drought, while a 4°C (7.2°F) rise would kill 85 per cent. The U.K. Met also warns that, without drastic action, this worst-scenario rise of 7.2°F (4°C) rise will actually be reached by 2070, and possibly as early as 2060. R. Betts, "4°C global warming: regional patterns and timing," Met Office Hadley Centre, 2009. Available online: http://www.eci.ox.ac.uk/4degrees/ppt/1-2betts.pdf (accessed on February 21, 2011).

Figure 3. Amount and timing of permafrost carbon release in response to climate warming



Source: Climate progress. Available online: http://climateprogress.org/2011/02/17/nsidc-thawing-permafrost-will-turn-from-carbon-sink-to-source-in-mid-2020s-releasing-100-billion-tons-of-carbon-by-2100/ (accessed on February 16, 2011).

A major unknown is the influence of atmospheric aerosols on the global temperature. Scientists agree that their prevailing influence is cooling (by reflecting solar energy back to space), but how strong this cooling effect is remains so far a matter of estimates. With the exception of periods of major volcanic eruptions, a major source of atmospheric aerosols is human activity – for instance burning of coal alongside large amounts of CO_2 also produces SO_2 and particles, which, to a degree, compensate for warming caused by the CO_2. The problem however is that the lifetime of aerosols in the atmosphere is much shorter, than that of greenhouse gases. There is a large body of historical evidence proving that large volcanic eruptions have a strong atmospheric cooling effect, many times with disastrous effects on agriculture with famines to follow. Even the cooling effect of the largest documented volcanic eruptions did not last longer than a few years, as was demonstrated for instance by the Mount Pinatubo eruption in 1991.[18]

[18] The Mt. Pinatubo eruption injected into the atmosphere the largest amount of sulfur dioxide since the eruption of Krakatoa in 1883 and rapid increase in atmospheric aerosols led to a 0.5 to 0.6°C reduction in the average global temperature. However this effect was short lived and lasted only two to three years. "Pinatubo Climate Investigation," National Air and Space Administration, January 1997. Available online: http://www.giss.nasa.gov/research/briefs/hansen_02/ (accessed on February 21, 2011).

While volcanic aerosols are outside of human influence, aerosols produced by human economic activity by definition are not. It is therefore reasonable to analyze what would be atmospheric temperature consequences of the fast decline in human economic activity caused, for instance, by a deep and prolonged global economic crises. Recent study published in Geophysical Research Letters[19] suggests, that a sudden loss of cooling from aerosols would cause abrupt warming of as much as 0.9°C above the current temperature.

What science tells us with no mercy of doubt is that when the CO_2 concentrations in the atmosphere were at their current levels of 390 ppm, some 15 million years BP, the sea level was at least 25 meters above the current level. At the peak of the previous interglacial period 130,000 to 114,000 years ago, the sea levels were 5 to 6 meters above the current level, while CO_2 concentrations were deep below today.

What science tells us with no mercy of doubt is that when the CO_2 concentrations in the atmosphere were at their current levels of 390 ppm, some 15 million years BP, the sea level was at least 25 meters above the current level.

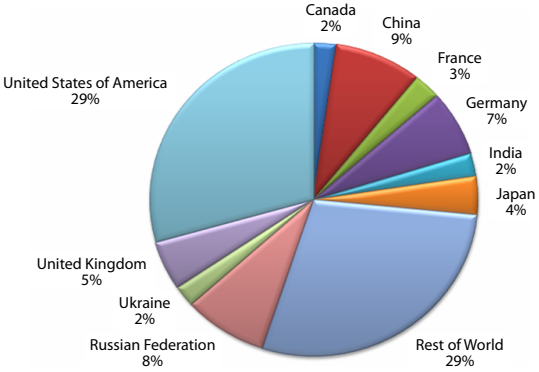
Two last figures worth knowing: At the peak of the last ice age, only 20,000 years ago, the sea levels were 125 meters below the current level and the mammoths were grazing on the bottom of the current North and Baltic Seas. Some 16,000 years BP, the sea levels were rising at the speed of 3 to 5 meters per century, due to the rapid melting of European and North American continental ice shields. This was happening while CO_2 levels were much lower that today.

Responsibility

Man-made CO_2 emissions are the main factor behind current climate change, followed by methane and nitrous oxide emissions and deforestation. Only 10 countries are responsible for more than 70 per cent of the total CO_2 in the atmosphere between 1900 and 2005 (see Figure 4). The United States alone is responsible for over 29 per cent followed by the European Union (27) at 25

[19] "Climate commitment in an uncertain world," *Science Daily*, January 27, 2011. Available online: http://www.sciencedaily.com/releases/2011/01/110128095044.htm (accessed on February 21, 2011).

Figure 4. Contribution to cumulative CO_2 emissions 1900–2005



Source: "Blog action day 2009: climate factoids," World Resources Institute. Available online: http://earthtrends.wri.org/updates/node/357 (accessed on February 21, 2011).

per cent and China at 9 per cent.[20] This makes very clear the EU's share of the global responsibility and moral obligation of Europeans (and Americans) to reduce the CO_2 emissions much more and sooner, than the others. Unilateral commitments to reduce CO_2 emissions above the levels required from China and other developing countries are fully justifiable. The EU should however also continue its pressure on the US and China, because current EU emissions are much lower than their emissions and even a radical decrease in the EU's emissions would not be sufficient to slow down global warming.

In this light, the European Commission's ambitions – supported by the governments of the UK, Germany and other "old Europe" leaders – to lead the world in climate change policies and to adopt unilateral goals and commitments is an expression of accepting a moral obligation to pay back debts amassed by the Europeans in the past.

Consequences

Living in a technological and largely urban society, it is very easy to forget that whole human civilization is entirely based on the agriculture and its capability to

[20] "Blog action day 2009: climate factoids," World Resources Institute. Available online: http://earthtrends.wri.org/updates/node/357 (accessed on February 21, 2011).

produce enough food at affordable price. Once climate change (and other global factors, such as the availability of cheap oil and fossil fuels) reduces productivity of agriculture, many societies across the world will start to crumble. As someone put it "Each civilization is thick only two weeks of hunger."

The reality above has extremely serious consequences – not only for prosperity or economy, but ultimately for the very survival of our civilization and, in extreme situations, our species. Our agriculture is highly vulnerable to the warming of climate and changes in Earth's water regime, such as increased frequency of droughts or floods.

For instance a Russian heat wave and drought during the summer of 2010 reduced Russian wheat harvest by close to 40 per cent, leading very quickly to a major increase in global food prices to record highs. By February 2011, the FAO Food price index "rose for the seventh consecutive month, averaging 231 points in January 2011, up 3.4 percent from December 2010 and the highest (in both real and nominal terms) since the index has been backtracked in 1990. Prices of all the commodity groups monitored registered strong gains in January compared to December, except for meat."[21]

Russia became the second largest global wheat exporter in 2009, after only the United States, by far the largest grains exporter in the world. The renowned American researcher and author Lester Brown speculates about the possibility of a similar heat wave setting over the USA, "... if the 2010 heat wave centered in Moscow had instead been centered in Chicago, it could easily have reduced the US grain harvest of 400 million tons by 40 percent, or 160 million tons. World carryover stocks of grain for 2011 – the amount remaining in the bin when the new harvest begins – would have dropped to an all-time low of 52 days of consumption, well below the 62 day carryover that set the stage for the tripling of world grain prices in 2007–2008. Brown says, "In short, if the July temperature in Chicago were to average 14 degrees above the norm, as it did in Moscow, there would be chaos in world grain markets." Grain prices would quickly climb off the chart. Food prices would soar worldwide. Many grain–exporting countries, trying to hold down domestic food prices, would restrict or even ban exports, as they did in 2007–2008."[22]

What followed within a short 6 months after the Russian heat wave is major political destabilization of the whole Middle East and North Africa region with

[21] "FAO Food price index," FAO, February 3, 2011. Available online: http://www.fao.org/worldfoodsituation/FoodPricesIndex/en/ (accessed on February 21, 2011).

[22] "When Will the Food Bubble Burst?," Earth Policy Institute, January 12, 2011. Available online: http://www.earth-policy.org/index.php?/press_room/C68/pr_wote/ (accessed on February 21, 2011).

serious political and security consequences. It is obvious that food prices were not the only one causal factor in the "Arab revolt," nevertheless it clearly served as a trigger and tipping point of change. It appears reasonable to anticipate, that "the change" may not end up quite positive from the Western perspective. It is practically certain, that new rulers of individual Arab countries – whoever they end up to be – will not be able to secure enough food at the price affordable to their populations on longer run.

It appears quite clear, that there is no way to prevent consequences of already now record high CO_2 and CH_4 levels in the atmosphere. There is no technology of scale available, which would enable humankind to reduce CO_2 which we already put into the atmosphere by burning fossil fuels. By burning them over a short period of roughly 200 years we emitted carbon accumulated over hundreds of millions of years.

Given the extreme vulnerability of the whole Mediterranean region and the Balkans to droughts, aridization and eventual desertification, to address climate change is – or at least should be – in Europe's very own economic, social and political interest.

We need to be clear, that whether the EU adopts and – more importantly – executes 20–20–20 goals, or 20–20–30, or even 20–20–40 or more, it will not stop global warming. Not only that USA and China, two countries emitting half of the world's greenhouse gas emissions, are for now and foreseeable future clearly determined to continue doing so. Even if all the countries of the world adopt and implement much stricter reduction goals than internationally considered so far, Earth's temperature will continue to grow by sheer momentum of CO_2 and CH_4 that is already in the air, Arctic ice albedo decrease that is already far advanced and growing CH_4 emissions from melting permafrost in Siberia and Canada and Arctic shelf seas.

What is said above does not mean the EU should give up on its climate policies. On the contrary, would the EU leaders fully understand what is at stake – for the Europeans and for the humankind as whole – they would and should adopt much higher greenhouse gas reduction goals and implement them even unilaterally, regardless of competitiveness and similar shallow considerations: It is not at all irrelevant, whether global temperatures will increase, for instance, by 4.5°C by the end of the twenty-first century, or by "only" 4.0°C. That 0.5 degree difference may be, for very many, the difference between food security

or famines, between the survival or extinction. Given the extreme vulnerability of the whole Mediterranean region and Balkans to droughts, aridization and eventual desertification, to address the climate change is – or at least should be – in Europe's very own economic, social and political interest. Within just two decades massive droughts can trigger large scale migrations within the EU itself, while some regions around the Mediterranean Sea may become uninhabitable for large populations. At the same time "Dust bowl" conditions may set up over a large part of the American Midwest and destroy a large part of the US food production and exports.

The Key Geopolitically Relevant Climate Events of 2010

Contrary to what may be a common impression among the political analyst, the key geopolitically relevant "climate" event of 2010 was not the Climate summit in Cancun, but the major climate disturbances that have happened in southern Russia and Pakistan during the summer of 2010 and possibly the drought that started in China towards the end of the year.

Can we attribute these catastrophic events to climate change? NASA Goddard Institute Director James Hansen's answer to this fundamental question is:

> "Finally, a comment on frequently asked questions of the sort: Was global warming the cause of the 2010 heat wave in Moscow, the 2003 heat wave in Europe, the all–time record high temperatures reached in many Asian nations in 2010, the incredible Pakistan flood in 2010? The standard scientist answer is 'you cannot blame a specific weather/climate event on global warming.' That answer, to the public, translates as 'no'. However, if the question were posed as 'would these events have occurred if atmospheric carbon dioxide had remained at its pre–industrial level of 280 ppm?', an appropriate answer in that case is 'almost certainly not.' That answer, to the public, translates as 'yes', i.e., humans probably bear a responsibility for the extreme event."[23]

[23] J. Hansen, "2010 — how warm was this summer?," National Air and Space Administration. Available online: http://data.giss.nasa.gov/gistemp/2010summer/ (accessed on February 21, 2011).

[24] All population data are quoted from *The World Factbook*. Available online: https://www.cia.gov/library/publications/the-world-factbook/index.html (accessed on February 21, 2011).

There is no doubt that both Russia (population 139 million)[24] and Pakistan (population 184 million), being both nuclear powers and major regional powers are globally important players on their own. In that sense whatever affects them, affects the world.

Both events were tragic on their own. "Russia has recently seen the longest unprecedented heat wave for at least one thousand years," said the head of the Russian meteorological center in early August 2010.[25] If the 2003 heat wave in Western Europe (mainly France) killed prematurely over 40,000 people, reported direct life loss due to the 2010 Russian heat wave appears to be 56,000 people. The data published on the Russian statistics office's website show that in August 2010 alone, 191,951 people died across Russia, compared to 150,689 in August 2009 – that means more than 41,000 excess deaths in just one month.[26] However, the life and economic loss in Russia is only a small fracture compared to the global costs of this extreme heat wave.

Pakistan floods killed immediately around 1,800 people, but destroyed 1.2 million houses and crops sustaining millions of people. Indirect loss of life due to hunger, malnutrition and poor housing, especially among children, elderly and the frail, are inevitably much higher, although unaccounted for. British relief and aid agency Oxfam, in January 2011, reported: "Malnutrition levels in the south have soared, and the aid community has only 'scratched the surface of human need.' At least 170,000 people remain in relief camps and swathes of land are still under foul water."[27]

While Russia was seriously affected by a prolonged drought and fires, that affected its population and harvest, Pakistan emerged on an opposite extreme and was hit by the most extreme monsoon rains in over 80 years, leading to devastating floods that directly affected the lives of 14 to 20 million Pakistanis. Pakistan – a nuclear power surrounded by war-torn Afghanistan, theocratic regime in Iran and long term rival and nuclear power in India – was already prior to summer 2010 floods listed in the 2010 Failed States Index as the tenth

[25] "Deadly Russian heat wave gravest over millennium," *Rianovosti*, August 9, 2010. Available online: http://en.rian.ru/russia/20100809/160128496.htm (accessed on February 21, 2011).

[26] "Russia confirms death rate rose by quarter in heatwave," *BBC News Europe*, October 8, 2010. Available online: http://www.bbc.co.uk/news/world-europe-11503550 (accessed on February 21, 2011).

[27] "Pakistan floods crisis is far from over, says Oxfam," *BBC News South Asia*, January 26, 2011. Available online: http://www.bbc.co.uk/news/world-south-asia-12284522 (accessed on February 21, 2011).

most fragile country in the world.[28] Economic and social hardship and internal grievances aggravated by the unprecedented crisis are not likely to ease already an extremely tense and fragile situation in Pakistan.

The third geopolitically highly relevant climate event started in 2010 may become a drought in northern China and risk of consequent crops failure. Drought started in China's wheat growing northern provinces in October 2010 and by February 2011 is being described by Chinese authorities as "the worst drought in decades."[29] As a response, the Chinese government announced emergency measures and released 15 billion USD to ease the farmers' situations and to increase capacity for irrigation from underground water sources. Chinese aquifers, however, are already for many years decreasing at an alarming rate. "Groundwater levels of the arid North China Plain have dropped as fast as 1 meter a year between 1974 and 2000, forcing people to dig hundreds of meters to access fresh water. Water is scarce for two-thirds of China's 660 cities, according to a survey by the Ministry of Water Resources (MOWR)."[30]

2010 may well end up in the history books as the year when the climate returned – in a big style – to geopolitics. In more vulnerable regions, such as Sub-Saharan Africa, climate actually never left it.

Unlike Egypt or Yemen, China (population 1,330 million) has sufficient financial resources to avoid destabilization by massive buying of the grains at the international markets. A major Chinese purchase would inevitably push global prices even higher, further worsening food security in Arab countries, Pakistan, Bangladesh, Africa and some of the Latin American countries. Mexico with its 112 million inhabitants, experiencing rapid fall in oil production and revenues from oil export as well as bad weather threatening

[28] "The failed states index," *Foreign Policy*. Available online: http://www.foreignpolicy.com/articles/2010/06/21/2010_failed_states_index_interactive_map_and_rankings (accessed on February 21, 2011).

[29] "China drought threatens wheat crops," *BBC News Asia-Pacific*, February 17, 2011. Available online: http://www.bbc.co.uk/news/world-asia-pacific-12497459 (accessed on February 21, 2011).

[30] "China faces up to groundwater crisis," *Naturenews*, July 13, 2010. Available online: http://www.nature.com/news/2010/100713/full/466308a.html (accessed on February 21, 2011).

2011 harvest[31] may prove to be extremely vulnerable to social and political destabilization accelerated by raising food prices. The Failed states index 2010 may provide additional indication of which countries may be most likely to face aggravated instability or even collapse as a result of such development.

World Bank Group president Robert Zoellick described the situation in early 2011 with the following words: "Rising food prices have driven an estimated 44 million people into poverty in developing countries since last June."[32]

At the beginning of this large move towards poverty were several climatic events. 2010 may well end up in the history books as the year when the climate returned – in a big style – to geopolitics. In more vulnerable regions, such as Sub-Saharan Africa, climate actually never left it.

Conclusions

There is overwhelming evidence that the climate of the Earth is rapidly warming and that the main cause of this warming are CO2 emissions from burning fossil fuels. Current domestic and international measures to reduce emissions and warming are deeply inadequate. There is therefore a very high probability – practically certainty –, that the warming will by the end of the twenty-first century highly overcome 2°C, deemed as "acceptable" by the world politicians. Very little decision makers do understand the context at which is the warming happening, its unprecedented speed and tremendous consequences for the world population, including for the populations of the rich countries of Europe and North America. There is a large volume of evidence, that even unrealistically low 2°C increase in global temperature would drastically reduce agricultural production in some of the largest food producers such as the USA, the EU and China, leading to steep growth in food prices, making them non affordable to hundreds of millions world poor. Large scale famines caused by such spiraling prices will become a major threat to world security and economic order, as flagrantly illustrates recent development in the Middle East and North Africa

[31] "Cold snap hits Mexico maize crop," *BBC News Latin America & Caribbean*, February 12, 2011. Available online: http://www.bbc.co.uk/news/world-latin-america-12437862 (accessed on February 21, 2011).

[32] "Food price hike drives 44 million people into poverty," The World Bank, February 15, 2011. Available online: http://web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:22833439~pagePK:34370~piPK:34424~theSitePK:4607,00.html (accessed on February 21, 2011).

region. The international policy community can choose to try to understand global warming in its complexity, or become irrelevant observers of very quickly unfolding events and global destabilization.

Milan Lapin

Climate changes in 1881–2100 and the 2010 weather extremes in Central Europe

Abstract: *Climate in Central Europe has changed significantly during the last several decades. Mean annual temperatures increased by about 1.5°C since 1980. Annual precipitation totals changed only slightly – some precipitation increased in the North and decreased in the Southeast. Serious extremes in precipitation, temperature, soil moisture, runoff and snow cover were registered. The three-year period 2007–2009 was the warmest since the beginning of meteorological measurement and 2010 had unbelievable high precipitation totals in Slovakia and neighboring countries, mostly by about 200 mm more than the present record total. The newest climatic General Circulation Models indicate a continuation of an increase in temperature and weather extremes also in the next decades. Some socio-economic sectors and natural ecosystems are vulnerable due to a fast change of climate, so adaptive options need to be designed in the close future to reduce possible negative impacts. Various scenarios show close trends up to 2050.*

High quality meteorological measurements are enabled to calculate air temperature and precipitation trends for all of Slovakia since 1881. Air temperature significantly increased by 1.7°C (according to a representative 3 stations, deviations average from the 1951–1980 normal) and insignificant precipitation totals decreased appr. by 4 mm (0.5 per cent, according to 203 stations) was registered in Slovakia in the 1881–2010 period (Figure 1). On the other hand, annual relative air humidity means decreased in the lowlands by about 5 per cent since 1901 (based only according to data from Hurbanovo, Figure 2). This decrease was the greatest in the spring months and less significant in the mountains (considering a shorter time series of annual relative air humidity measurements since 1951). Water vapor pressure in the atmosphere had

Lapin, M., "Climate changes in 1881–2100 and the 2010 weather extremes in Central Europe," *International Issues & Slovak Foreign Policy Affairs* Vol. XX, No. 1, 2011, pp. 22–31.

an insignificant trend in 1901–2010 year round with some lower values in 1976–1993. These changes influenced the regime of air humidity, potential evapotranspiration, actual evapotranspiration, soil moisture and runoff mainly in southern Slovakia. For example, evapotranspiration increased in Hurbanovo (SW Slovakia, lowlands, 115 m a.s.l.) by 17.5 per cent and in Oravská Lesná (NW Slovakia, mountains, 780 m a.s.l.) by about 10 per cent in 1951–2009. Serious changes of most climatic characteristics were registered mainly since 1990 when remarkable increase of air temperature means occurred in all of Slovakia.[1]

Extreme year of 2010

The Slovak Hydrometeorological Institute (SHMI) web site[2] shows the monthly and annual maps of air temperature deviations from normal and the percentages of precipitation totals of long-term average totals for 1961–1990. Such maps are prepared at the beginning of each month and inform in detail on the previous month's weather in Slovakia.

Serious changes of most climatic characteristics were registered mainly since 1990 when remarkable increase of air temperature means occurred in all of Slovakia.

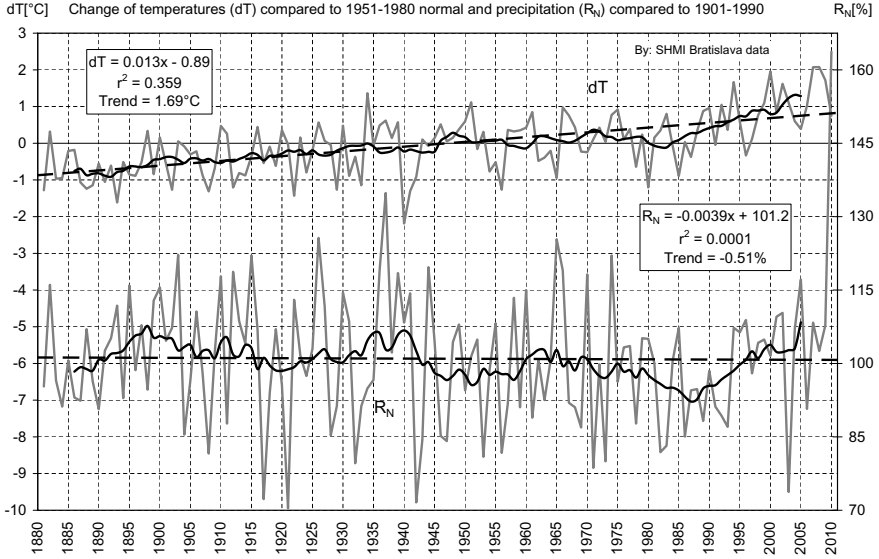
The May and annual climatic values pose well the abnormal weather conditions in 2010. It can be seen there that annual precipitation total in 2010 was much higher than usual (by 65 per cent in whole Slovakia), roughly twice more than normal in the southern regions of Slovakia. The most serious was a flooding situation at the beginning of June when, after a record high monthly total in May (309 per cent of normal in Slovakia on average), 100 to 200 mm of precipitation occurred from June 1–5, 2010 in some regions.[3] Wet and warm weather continued during all of summer in Slovakia, ending in a

[1] M. Lapin, M. Gera, J. Hrvoľ, M. Melo and J. Tomlain, "Possible impacts of climate change on hydrologic cycle in Slovakia and results of observations in 1951–2007," *Biologia* Vol. 64, No. 3, 2009, pp. 454–9.

[2] Slovak Hydrometeorological Institute data and maps are available at http://www.shmu.sk/sk/?page=1607 (in Slovak).

[3] J. Pecho, P. Faško, M. Lapin, P. Kajaba, K. Mikulová, P. Šťastný, "Extrémne atmosferické zrážky na jar a na začiatku leta 2010 na Slovensku," *Meteorologický časopis/Meteorological journal* Vol. 13, 2010, pp. 69–80 (in Slovak).

Figure 1. Deviations of annual mean air temperatures in Slovakia from the 1951 – 1980 normal (average deviation from stations Hurbanovo, Košice and Lipt. Hrádok) and normalized annual precipitation totals in Slovakia (based on 203 stations data) in per cent of the 1901 – 1990 normal, linear trends and 11 – year running means.

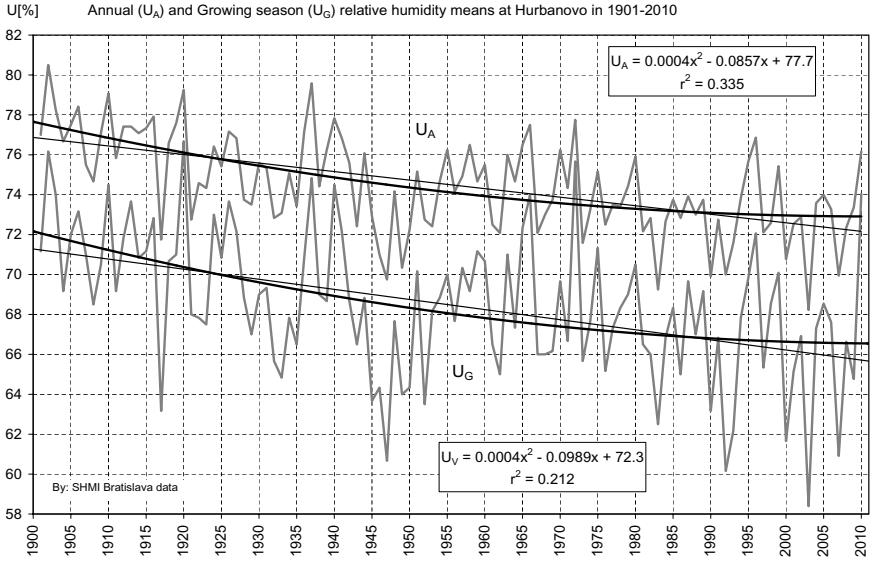


three-month precipitation total (June to August) of 183 mm (71 per cent) above normal and by 1.7 to 2.0°C warmer than normal. It was the first time since the beginning of meteorological measurements when the record rainy summer was also very warm.[4]

Similar rainy weather also happened in Hungary, south Poland, east Czech Republic and western Ukraine. On the other hand, eastern Ukraine and Russia in Europe had a record hot and dry summer with numerous wild fires. In 2010 western and northern Europe had mostly cold weather all year round. The end of 2010 was also extreme, because of alternation of very cold and warm weather spells in Central and Western Europe.

[4] Very detail analysis of climatic changes in Slovakia is presented also in the Division of Meteorology and Climatology web site http://www.dmc.fmph.uniba.sk/public_html/main9.html (accessed on February 27, 2011).

Figure 2. Annual relative air humidity averages and Growing season relative humidity averages (U_G) measured at the Hurbanovo Observatory (SW Slovakia, 115 m a.s.l.) in 1901–2010, linear and power trend lines are included (in 2010 a very high relative humidity average was observed, mainly due to an extremely high precipitation total).



Global scale analyses of mean annual temperature and precipitation totals are prepared by several centers (National Climatic Data Center (NCDC) data are presented in the National Oceanic and Atmospheric Administration (NOAA) web sites, Climatic Research Unit (CRU), National Aeronautics and Space Administration (NASA) as well as the Goddard Institute for Space Studies (GISS). Based on their data, it can be seen there that the annual mean temperatures in 2010 were higher in Central Europe than between 1971–2000 when it was an average of about 0.5°C. Only western and northern Europe had some lower temperatures than normal. On the other hand, Southeastern Europe was by about 3°C warmer than the 1971–2000 average, Canada and some other regions were even 6°C warmer. Annual precipitation totals were higher than the 1961–1990 average in all of Central Europe. It is interesting that in relative cold western and northern Europe the precipitation totals were significantly lower than normal.

Climatologists and other specialists are trying to find the causes of such extreme weather. Many of them consider low Arctic oscillation as the main reason.[5] The Arctic region had the highest mean temperature since the beginning of regular observations (NASA satellite measurements)[6] and it was by 1.5°C warmer in 2010 than 30 years ago (a linear temperature trend by 1.5°C was found in 1979–2010). This was probably the main reason of extreme weather events occurring not only in Europe, but also elsewhere in the Northern Hemisphere in 2010. The ground for such a high Arctic mean temperature in 2010 is probably connected with the continuous increase of an atmospheric greenhouse effect.

Climate change scenarios up to 2100

Climate has changed since 1750. Regionally as well as globally. The mean global air temperature increased by about 0.8°C. More rapidly since 1975. The temperature increase in Central Europe was even greater – mostly by about 2.0°C. The change of global precipitation totals was less significant, but increase in polar regions, in some colder mild regions and monsoon areas was well pronounced.

The atmospheric greenhouse effect changes can be described by several methods.[7] Because of about a 55 per cent share of the CO_2 of the total radiative forcing an increase due to the greenhouse effect enhancement, the CO_2 global emissions and rise of its concentration in the atmosphere can be considered a good measure for global warming evaluation. Generally the global atmospheric greenhouse effect consists of the radiative forcing of several main gasses: water vapor contributes 36 to 72 per cent (upper limit represents the influence of gas alone in the atmosphere and the lower one accounts for overlaps with the other gases), for CO_2 the limits are 9 to 26 per cent, for methane 4 to 9 per cent and for ozone 3 to 7 per cent. During the 1750–2010 period the CO_2 concentration increased in the atmosphere by 38.5 per cent and at methane by

[5] For more see NOAA Arctic Oscillation data. "Arctic oscillation," NOAA National Weather Service Climate Prediction Center. Available online: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/ao.shtml (accessed on February 27, 2011)

[6] NASA mean monthly air temperature deviations from the 1979–1998 average. Presented by UAH (University of Alabama in Huntsville). Available online: http://vortex.nsstc.uah.edu/data/msu/t2lt/uahncdc.lt (accessed on February 1, 2011).

[7] "IPCC Fourth assessment report: Climate change 2007 (AR4)," Intergovernmental Panel on Climate Change, 2007. Available online: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1 (accessed on February 27, 2011)

about 150 per cent. Water vapor changes are determined only by temperature, so the 0.8°C warming caused about a 4 per cent water vapor increase in the global atmosphere. In the last years about 10 Gt carbon is emitted annually into the atmosphere due to anthropogenic activities (fossil carbon burning, cement production, tropical forests reduction). This results in about a 0.5 per cent CO_2 concentration increase annually.

The Intergovernmental panel on climate change (IPCC) and many climate change scientists suppose another significant increase in air temperature and changes in the precipitation regime if the emission of greenhouse gases into the atmosphere continue. Several emission scenarios were prepared in 1999.[8] These scenarios are included in the General Circulation Models (GCMs) for calculation of future regional and global climatic variables. Let us select SRES (Special Report on Emission Scenarios) A2 scenario as a pessimistic one (emission of 28.9 Gt of fossil carbon in 2100, 1773 Gt cumulative in 1990–2100) and SRES B1 as an optimistic one (emission of 5.2 Gt of fossil carbon in 2100, 989 Gt cumulative in 1990–2100).[9]

Climate has changed since 1750. The mean global air temperature increased by about 0.8°C. More rapidly since 1975. The temperature increase in Central Europe was even greater – mostly by about 2.0°C.

The GCMs calculations (outputs) are provided by several centers. Climatologists in Slovakia use the CGCM3.1 (Canada)[10] and ECHAM5 (Germany) as well as from several European Regional Circulation Models outputs. Results are very close on nearly all models up to the year 2050.

In Figure 3 only an example of air temperature means of growing period (April to September) for the Hurbanovo Observatory (SW Slovakia, 115 m a.s.l.) is presented. Comparisons with measured data in 1961–2010 show that the model does not calculate weather predictions (values in selected years are different), all GCMs calculate climatic scenarios (values represent climate conditions in any 30-year or longer period).

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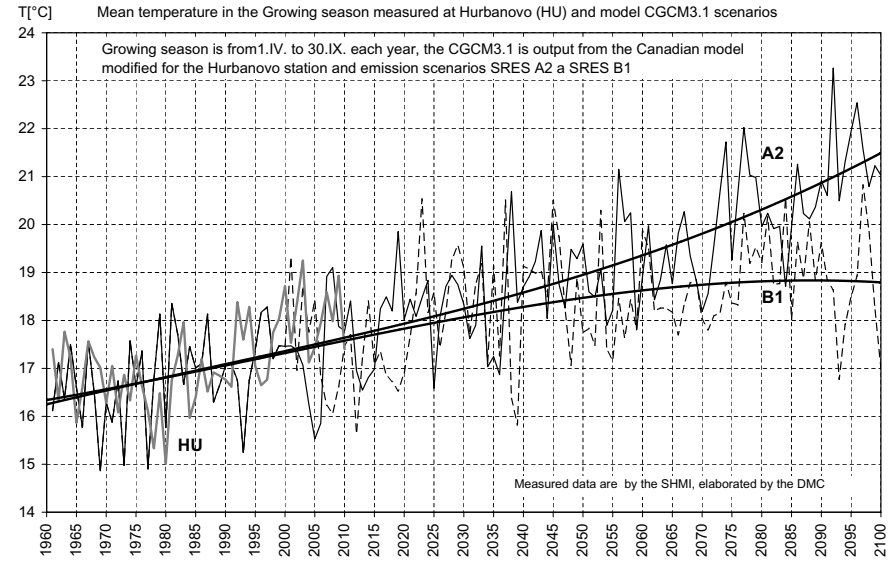
[8] Ibid; N. Nakicenovic and R. Swart, eds, *IPCC Special report emission scenarios. Summary for policy makers*, Cambridge: Cambridge University Press, 2000.

[9] M. Lapin, M. Melo, "Methods of climate change scenarios projection in Slovakia and selected results," *Journal of Hydrology and Hydromechanics* Vol. 52, No. 4, 2004, pp. 224–38.

[10] G.J. Boer, G. Flato and D. Ramsden, "A transient climate change simulation with greenhouse gas and aerosol forcing: Projected climate to the twenty-first century," *Climate Dynamics* Vol. 16, No. 6, 2000, pp. 427–50.

Figure 3. Mean air temperature in growing season (April to September) in Hurbanovo, measurements (HU, bold line) and modified CGCM3.1 outputs (A2 and B1), power trend lines are included.



The GCMs outputs offer temperature, humidity, precipitation, solar radiation, wind and other elements scenarios in grid points with resolution by about 200 km in Central Europe, regional climatic models mostly with a resolution of 25 km. The results show that an increase in temperature will be probably comparable in all year round (in the South some higher increase in summer and in the North in winter is supposed). Precipitation totals scenarios suppose no significant change in annual values, but a different annual course in the South and the North. Generally some greater increase in precipitation totals is designed by all scenarios for the cold-half year months, in northern Central Europe up to 30 per cent compared to the 1961 – 1990 average. On the other side the summer precipitation totals will probably change insignificantly, some decrease is more probable in the South. Most GCMs scenarios suppose change in the precipitation totals temporal distribution (regime). Longer periods with low precipitation and several short periods with very high precipitation totals are expected in some part of central Europe each year. These precipitation extremes will be more pronounced than in the past. Higher temperatures and therefore more water vapor in the atmosphere during cyclonic weather events (by 6 per cent at 1°C

warming) are considered a main cause for such development. On the other hand during dry anticyclonic weather events, the potential evaporation will increase by 6 per cent at 1 °C warming and no change in relative humidity.[11] This will cause an increase in drought risk mainly in lowlands and southern parts of Central Europe.

What to do?

Each of the Central European countries should have its strategy prepared to reduce the possible negative impacts of climate change being enhanced by the increasing greenhouse effect. Such strategies should be divided into the part of mitigation options i.e. the reduction of greenhouse gas emissions into the atmosphere and the part of adaptive measures in all socio-economic sectors. Slovakia prepared her *5th National Communication on Climate Change* in 2009.[12]

Slovakia, as a member state of the EU (the EU-15 commitment was adopted in the form of a so–called burden sharing agreement) has committed itself to an 8 per cent reduction of GHGs emissions compared to the base year 1990. According to the emissions inventory updated in April 15, 2009, Slovakia has achieved a reduction of total anthropogenic emissions of GHGs, stated as CO_2 equivalent, of approximately 36 per cent compared to the base year 1990 without emissions from Land Use, Land Use Change and Forestry (LULUCF). Total GHG emissions in Slovakia are stable or slightly increasing due to recovery of economic activities (rise of GHGs emissions is higher in the transport category) in spite of a high annual increase of GDP in the last years.

Chapter 6 of the Fifth national communication on climate change[13] deals with the evaluation of research results on climate change and variability in Slovakia; preparation of regional scenarios of climate change till 2100; estimates of vulnerability of selected social and economic sectors and proposal of adaptation measures to mitigate negative impacts and utilization of positive consequences of climate change in Slovakia. The data used comes from the Slovak national climate program, research projects results, the reports of the IPCC and other

[11] M. Lapin, M. Gera, J. Hrvoľ, M. Melo and J. Tomlain, op. cit.

[12] The short review is to be found in M. Lapin, J. Szemešová, "Review of climate change and GHGs inventory in Slovakia," *Meteorologický časopis/Meteorological journal* Vol. 12, 2009, pp- 151–5.

[13] "The Fifth Slovak national communication on climate change," Ministry of the Environment of the Slovak Republic, Slovak Hydrometeorological Institute, 2009. Available online: http://unfccc.int/resource/docs/natc/svk_nc5.pdf (accessed on February 27, 2011).

relevant sources. Analysis of all documents confirms that climate change and variability might result mostly in negative impacts.

Assessment of vulnerability to climate change and projection of adapting options was prepared for socio–economic sectors: water management, water resources and hydrological cycle, agriculture and field ecosystems, forestry economy and forest ecosystems (some other sectors have been contacted). Based on climate change scenarios and vulnerability assessment models there were selected serious negative impacts connected mainly with the decrease of water availability during the growing period and due to the occurrence of harmful weather events (drought, heavy rains, floods, wild fires, heat waves, wind storms...). Introduction of new pests, invasive insects, diseases, and weeds will also play an important role in the management ecosystems. The most negative climate change impacts in Slovakia are connected with long drought periods and shorter flash flood events.

A 2 to 4°C mean temperature increase is expected by the year 2100. This will result in a prolongation of a growing period by more than 30 days, so the start of vegetation will shift to the beginning of March with a significant increase of frost risk compared to the beginning of April.

The following are the several examples of the most negative impacts and needed adaptation measures:

1. A 2 to 4°C mean temperature increase is expected by the year 2100. This will result in a prolongation of a growing period by more than 30 days, so the start of vegetation will shift to the beginning of March with a significant increase of frost risk compared to the beginning of April. Other negative impacts are connected with change in winter conditions. Milder winters improve living conditions for many pests and diseases with a possible shift into higher altitudes. Growing conditions for many traditional plants and forest species will surely worsen significantly due to competition with new invasive species expanding from the South, due to higher drought risk, pest and disease occurrence. Adapting for such conditions must be done well in advance, mainly because of the long lifetime of most forest trees and slow adapting processes in natural ecosystems. Adapting in agricultural crop production needs a shorter time, but it is very costly.
2. Higher temperatures by 2 to 4°C will result in 20 to 40 per cent higher extreme precipitation totals during cyclonic summer weather situations (central cyclones and strong thunderstorms). An example of such events

occurred in 2002 (Czech Republic) and 2010 (Slovakia). Flood warnings and prevention systems must be projected and prepared also well in advance. The cost of such anti flood systems is about 2 billion euro only in Slovakia. On the other hand, higher temperatures will result in the case of anticyclonic and low precipitation episodes in an increase of potential evaporation with significant rise of drought and wild fires risks. Such situations occurred in Central Europe during several years in the last two decades (mainly in 1993, 2000, 2003, 2007). Adapting options are very costly also in this case, water resources management needs more than 1 bill. euros investments only in Slovakia.

3. The third group of the most serious negative impacts is connected with dwelling conditions, transport, public health and foodstuffs management in a warmer climate. Construction of air-conditioning in new and older buildings and traffic means represents only a small part needed from adapting measures.

Instead of Conclusions

At the present, several research projects on vulnerability to climate change and on possible impacts due to climate change are solved by various institutions in Slovakia. The goal is to prepare completely new scientific results and groundwork for the Sixth national communication on climate change under the Ministry of Environment coordination. In spite of a long tradition of such research and good outcomes in the last two decades, recently we have been facing in Slovakia several serious problems. The state funding of education, science and research is still lower than in any EU country, and more over it is decreasing since 2009. The number of skilled specialists and research workers is decreasing because of young people moving abroad and numerous retirees.

Alexander Ač

Climate change in the face of peak oil: An unconventional view

Abstract: *Global warming and climate change pose an increasing risk to human society through disrupting long-term weather patterns. Mitigation strategies through deploying low-carbon technology generally assume a functioning global economy and continuous economic growth. However, there is growing evidence that people are entering a declining phase of global oil production. Business-as-usual (i.e. growth-based) policies will be increasingly difficult to implement and sustain, since economic growth is increasingly difficult to achieve and sustain with peaking or declining oil production. With peak oil it is impossible to solve climate change with highly complex and expensive technology (such as nuclear power) and, conversely, it is impossible to solve peak oil with implementing high carbon emissions intensive alternatives to oil (such as unconventional oil). Peak oil will mean a significant challenge for global food, energy, and geopolitical security.*

The beginning of 2011 has been characterized by record floods in the Australian states of Queensland and Victoria. On top of that, in February, Queensland has been hit by a category five tropical cyclone, Yasi: one of the strongest tropical cyclones in history. Brazil and Sri Lanka experienced record floods, and South Africa and the Philippines experienced heavy rains. Scientists investigating the links between extreme weather events and global warming are convinced that emissions of greenhouse gases are contributing to more extreme weather. According to some climatologists, such as James Hansen[1] from NASA, if the concentration of carbon dioxide (CO_2) was at the

[1] J. Hansen, "How warm was this summer?," 2010. Available online: http://www.columbia.edu/~jeh1/mailings/2010/20101001_SummerTemperatures.pdf (accessed on January 10, 2011).

Ač, A., "Climate change in the face of peak oil: An unconventional view," *International Issues & Slovak Foreign Policy Affairs* Vol. XX, No. 1, 2011, pp. 32–48.

level it was before the Industrial Revolution started, some of the events would "almost certainly" have not occurred. In any case, even if we are able to stop all greenhouse gasses tomorrow, we are already committed to several hundreds of years of warming and increasing sea level rise.[2]

While the mainstream International Panel on Climate Change[3] (IPCC) emission scenarios are quite "optimistic" considering the amount of fossil fuels in the ground and thus implies the need for some kind of CO_2 regulation, there is a growing group of scientists claiming that there is a far smaller amount of economically extractable fossil fuels, at least regarding the — crude oil. This might force us to decrease CO_2 emissions much more and much faster than most people realize.

Peak oil comes to the "rescue"

Peak oil is the moment, when rate of the crude oil production will reach its maximum. After that, irrespective of technology or oil price the production declines. James Schlesinger, the Secretary of Energy for the US Government said in 2007, in Ireland, at the peak oil conference that:

> "The peakists have won ... to the peakists I say, you can declare victory. You are no longer the beleaguered small minority of voices crying in the wilderness. You are now mainstream. You must learn to take yes for an answer and be gracious in victory."[4]

The very first pioneer in the research of peak oil was American geologist Marion King Hubbert. Therefore the peak in oil production is sometimes referred to as the "Hubbert peak." In 1956 Hubbert has shown in his breakthrough article,[5] based on the accessible geological data that sometime during the end

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[2] V. Ramanathan, Y. Feng, "On avoiding dangerous anthropogenic interference with the climate system: Formidable challenges ahead," *PNAS* Vol. 105, No. 38, 2008, pp. 14245–50. Available online: http://www.pnas.org/content/early/2008/09/16/0803838105.full.pdf+html (accessed on January 10, 2010).

[3] More information see at official web site of the International Panel on Climate Change www.ipcc.ch.

[4] Cited in: Ch. Vernon, "UK industry taskforce sounds alarm on peak oil," *TheOilDrum*, November 6, 2008. Available online: http://europe.theoildrum.com/node/4724 (assessed on February 15, 2011).

[5] M.K. Hubbert, "Nuclear energy and the fossil fuels," Presented before the spring meeting of the Southern District Division of Production, American Petroleum Institute, San Antonio, March 7–9, 1956. Available online: http://www.hubbertpeak.com/hubbert/1956/1956.pdf (accessed on February 11, 2011).

of the 1960s and the beginning of the 1970s the USA would reach the peak in oil production. Only few people took him seriously and mostly people in the oil industry found it ridiculous and ignored it. However, peak oil in the USA was reached in 1970[6], and even a dramatic increase in oil drilling using the best technologies did not help to reverse the decline. Since 1970 the US oil production decreases and new oil discoveries and production capacities in Alaska only slowed down the decline for a few years.[7] In 2010 the oil production was raised a bit thanks to an underwater oil field. Despite the advances in technology the amount of produced oil is at the level of only 60 per cent compared to the maximum 40 years ago, but oil consumption did not decrease. Therefore the USA needs to import[8] an increasing demand of oil. But since 1956 King Hubbert has been long forgotten.

Even if we are able to stop all greenhouse gasses tomorrow, we are already committed to several hundreds of years of warming and increasing sea level rise.

The term "peak oil" was for the first time introduced to the broader, especially American, public by two prominent oil geologists Colin Campbell and Jean Laherrére in the popular scientific magazine *Scientific American* in 1998, in the article End of cheap oil.[9] Many Americans have in the vivid memory the oil shocks in 1973 and 1979[10] (which were also the years with the highest global per capita oil production[11]), which had shown the Western world the importance of oil for the economy. The reality is enormous and increasing dependency on the production and consumption of the most precious fossil

[6] C.A.S Hall and J.W. Day, "Revisiting the limits to growth after peak oil," *American Scientist* Vol. 97, No. 3, 2009, pp. 230–7.

[7] "Table 5.1 in petroleum overview, 1949–2007," *Annual energy review 2007*. Energy Information Administration, 2008. Available online: http://www.eia.doe.gov/emeu/aer/txt/ptb0501.html (accessed on January 25, 2011).

[8] For more detailed information see the Energy Information Agency web site. Data is available online at http://www.eia.doe.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mbbl_a.htm (assessed on February 5, 2011).

[9] C.J. Campbell and J.H. Laherrére, "The end of cheap oil," *Scientific American* Vol. 278, No. 3, 1998, pp. 60–5.

[10] R.B. Barsky and L. Kilian, "Oil and the macroeconomy since the 1970s," *Journal of Economic Perspectives* Vol. 18, No. 4, 2004, pp. 115 –34.

[11] Author's calculation based on EIA data of crude oil production available online at http://www.eia.doe.gov/emeu/aer/txt/ptb1105.html as well as the U.S. Census Bureau data available online at http;//www.census.gov/compendia/statab/2011/tables/11s/1328.xls (accessed on March 5, 2011).

fuel, being also referred to as, and not by accidence, "black gold." Campbell and Laherrére showed that global oil production will start to decline before the year 2010, based on the accessible information about the existing, as well as suggested oil fields, which are left to be discovered.[12] And this will be decline that is irreversible. At that time only a few people noticed their "catastrophic" scenario. According to their vision, in 2030 the world could have only so much oil, as it did in 1970.

International energy agencies, i.e. European International Energy Agency (IEA) and American Energy Information Administration (EIA), which were established as a response of governments to the oil shocks and which projections serve as a basis for formulating the energy policy of national governments, consistently projected low oil prices and a steady rise of oil production in the coming decades.[13] Thus, the scenario of Campbell and Laherrére were in very strong disagreement with these official scenarios.

In March 1999 the popular magazine *The Economist* published the article "Drowning in oil."[14] The article expressed the fear over low oil prices, which would lead to lower revenues from oil production and thus would contribute to poverty and corruption. However, only a few years later the event gathered the opposite direction.

The price of crude oil never decreased below 5 dollars per barrel, as the authors feared in *The Economist*.[15] At the beginning of the millennium the oil price gradually increased which turned into a very rapid rise a few years later. The rise was so rapid that between 2004 and 2008 oil prices increased more than three-fold from 40 dollars per barrel to historically unprecedented prices of 147 dollars per barrel in July 2008. Despite this dramatic rise in price, the maximum rate of average crude oil production from 2005 was not surpassed to date. Given the recession and fall of oil prices, which cut investments in future oil production capacity, the increasing rate of depletion on existing oil fields and lack of new discoveries, many argue that we are at a plateau of global oil production.

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[12] C.J. Campbell and J.H. Laherrére, op. cit.

[13] For more see the International Energy Agency's "World energy outlook 2000," 2000. Available online: www.iea.org/textbase/nppdf/free/2000/weo2000.pdf (accessed on January 13, 2011).

[14] "Drowning in oil," *The Economist*, March 4, 1999. Available online: http://www.economist.com/node/188131 (accessed on January 13, 2011).

[15] "The next shock?," *The Economist*, March 4, 1999. Available online: http://www.economist.com/node/188181 (accessed on January 13, 2011).

The general argument against the peak oil problem is that "there is at least a 40 year oil supply at the current rate of consumption."[16] The world, however, does not work at current the rate of consumption, but at an exponentially growing rate of consumption. Exponential growth happens always when we have growth in x per cent over a given time. For instance when we have 10 per cent GDP growth per year, GDP will double each seven years, at two per cent growth per year the doubling time is 35 years, etc. During the years 1965 and 1974 oil consumption grew at 7.3 per cent per year and after the oil shocks in the 1970s, oil consumption grew at 1.6 per cent per year.[17] Therefore, it is not important to know, how much oil we have "at the current rate of consumption," but when we reach the peak, or the maximum in oil consumption. This is the moment when the current world economic model will start to have problems. One has to also keep in mind that peak oil does not mean the end of oil, rather the end of cheap oil, as Campbell and Laherrére explained. The world is arguably at this point right now. In fact, IEA announced in its last World Energy Outlook, that peak in crude oil production reached in 2006 will never be exceeded,[18] significantly deviating from its previous projections.[19]

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It is obvious that people can only extract oil which has been discovered. Globally, oil discoveries peaked by 1970 and were declining since then.[20] Currently, people consume four–five barrels of oil per one barrel of oil discovered and most of the

[16] J. Browne, "Environmental policy – a progress report," Melchett Lecture at Wenlock Road for the Institute of Energy, 2001. Available online: http://bp.com/genericarticle.do?categoryId=98&contentId=2000285 (accessed on March 4, 2011).

[17] "Historical data of oil consumption 1965-2009," British Petroleum, 2009. Available online: http://bp.com/sectiongenericarticle.do?categoryId=9023770&contentId=7044467 (accessed on March 4, 2011).

[18] "World energy outlook 2010 – Executive summary," International Energy Agency, 2010. Available online: http://www.worldenergyoutlook.org/docs/weo2010/WEO2010_ES_English.pdf (accessed on February 10, 2011).

[19] "World energy outlook 2000," op. cit.

[20] C.J. Campbell, "The end of the first half of the age of oil," IV international workshop on oil and gas depletion. Geophysics Centre, University of Evora, 2005 . Available online: http://www.cge.uevora.pt/aspo2005/abstracts.php (accessed on January 10, 2010).

current consumption comes from oil fields discovered before 1980.[21] Some of the official projections suggesting no immediate peak in oil production[22] are using United States Geological Survey (USGS) expected discovery data. However, new oil discoveries from 1995 to 2025 are 100 billion barrels found and 100 billions barrels expected to be found (which is equivalent to only eight years of global consumption), while the USGS average prediction for the same period is 649 billion barrels.[23] Moreover, in the past few years all drilling globally did not find enough oil even to pay for the drilling,[24] which means that drilling for oil as an energy source makes no economic sense. Oil discoveries in the USA peaked around 1940 and oil production peaked about 30 years later.[25] Currently the world is 40 years behind the peak in oil discoveries and application of the Hubbert model indicates that oil production peaked in 2005.[26,27]

Another fact that needs attention is that once the oil exporting country reaches its own peak in oil production the subsequent decline in oil exports is significantly faster since the country primarily secured oil for the (mostly growing) domestic population. This is well described in the so-called Export Land Model (ELM).[28] The ELM model projections are especially suitable for relatively poorer and developing countries, such as Indonesia, Egypt, Malaysia, or Mexico. These countries generally have a high population of growth and high food and energy subsidies, thus gasoline prices are very low, encouraging consumption. For instance Indonesia exported more than one million barrels per day (mbpd) in 1976 (year of peak oil) and the consumption was less than 0.5 mbpd, while since 2004 Indonesia increasingly imports oil and now consumes almost 1.5 mbpd.[29] The ELM model is less valid for developed countries, such as the United

[21] J.W. Day, C.A.S. Hall, et al. "Ecology in times of scarcity," *Bioscience* Vol, 59, No. 4, 2009, pp. 321–31.

[22] "Appendix G: projections of petroleum and other liquids production in five cases," *International energy outlook 2008*, Energy Information Administration, 2008. Available online: http://www.eia.doe.gov/oiaf/ieo/pdf/ieopol.pdf (accessed on 15 January 2011).

[23] K. Aleklett, "Global Energy Resources – The Peak Oil View," Presented at University of Aberdeen, March 5, 2009. Available online: http://www4.tsl.uu.se/~aleklett/ppt/20090305_aleklett_aberdeen.pdf (accessed on January 30, 2011).

[24] J.W. Day, C.A.S. Hall, et al., op.cit.

[25] Ibid.

[26] R. Bentley and G. Boyle, "Global oil production: forecasts and methodologies," *Environment and planning B: planning and design* Vol. 35, No. 4, 2008, pp. 609–26.

[27] K. Deffeyes, *Beyond oil: the view from Hubbert's peak*, New York: Hill and Wang, 2005.

[28] L.M. De Sousa, "World oil exports," VII International conference on oil and gas depletion, October 21, 2008. Available online: http://www.aspo-spain.org/aspo7/presentations/deSousa-Exports-ASPO7.pdf (accessed on January 9, 2011).

[29] Data from Mazama Science: "Energy export databrowser," Available online: http://mazamascience.com/OilExport/ (accessed on January 12, 2011). Mazama Science uses the BP Statistical Review of World Energy data.

Kingdom or Norway, where the oil consumption is relatively stable. In summary three main characteristics of net export declines are that net export decline rates tend to:

- exceed the production decline rate;
- accelerate with time; and
- bulk of the net exports is shipped early in the decline phase.[30]

But even if the ELM model is not taken into account, depletion rates of oil fields may be extremely fast. For instance oil production in the North Sea (i.e. combined production from United Kingdom Offshore, Norway, Denmark, Netherlands Offshore, and Germany Offshore) declined during the last two to three years by about 1 mbpd,[31] which is more than the amount of energy currently supplied by world wind energy.[32]

According to the author of the ELM model, petroleum geologist Jeffrey Brown, while the amount of exported oil in 2005 was 40.8 mbpd, in 2015 the amount of exported oil could decrease by almost 30 per cent to 29.5 mbpd (excluding China and India).[33] That essentially means that many of the developed oil importing countries are soon on their way to becoming independent of the imported oil, "just not in the way that many people anticipated," according to Jeffrey Brown.

Oil, declining EROEI and the problem with alternatives

The very important parameter of any energy source is the so-called EROI – Energy return on energy investment. It is a very simple concept introduced by ecologist Charles Hall, which defines the amount of energy gained as compared to amount of energy invested. According to Professor Hall, "EROI will be one of the most important defining issues of the future."[34]

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[30] J.J. Brown, S. Foucher and J. Silveus, "Peak oil versus peak net exports – which should we be more concerned about?," International ASPO-USA peak oil conference, July 7, 2010. Available online: http://www.aspousa.org/2010presentationfiles/10-7-2010_aspousa_TrackBNetExports_Brown_J.pdf (accessed on January 12, 2011)

[31] Information from the Energy information administration. Available online: http://www.eia.gov/countries/ (accessed on February 5, 2011).

[32] Information from the World wind energy association. Available online: http://www.wwindea.org/home/index.php (accessed on February 6, 2011).

[33] J.J. Brown, S. Foucher and J. Silveus, op.cit.

[34] C.A.S. Hall and C.J. Cleveland, "EROI: definition, history and future implications," ASPO-USA conference, November 10, 2005. Available online: http://www.esf.edu/efb/hall/talks/EROI6a.ppt (accessed on January 7, 2011).

The higher the ratio, the cheaper and more abundant the energy source is and the more it is accessible for mass utilization. Conventional petroleum, i.e. fuel derived from geologic deposits using drill bit technology that move to the surface because of their own pressure or with pumping or additional pressure supplied by injecting natural gas, water or other substances.[35] Unconventional sources of oil, often cited as a solution to peak oil, are mostly shale oil and tar sands usually mined as solids.

The greatest advantages of conventional oil are extremely high EROI, energy density, and transportability. When oil extraction started in the USA in the nineteenth century, its EROI has been about 100:1, which means that we got about 100 units of energy per one unit of energy invested. 40 years later in 1970 EROI of the domestic production of oil in the USA decreased to 1:30.[36]

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But the EROI is not declining only in the USA. Recent global analysis of EROI by Gagnon[37] showed that EROI for oil was 26:1 in 1992, increased to 35:1 in 1999 and then decreased to 18:1 in 2006. The reason behind declining EROI is very simple. We first extract the easiest and most accessible resource. This "best first" principle applies to all kinds of resources – from iron ore mining to fish catching.[38]

Despite the fact that the global data are quite scarce and these are only preliminary results, the declining trend in EROI has a very significant implication.

[35] C.A.S. Hall, R. Powers and W. Schoenberg, "Peak oil, EROI, investments and the economy in an uncertain future," in D. Pimentel, eds, *Biofuels, solar and wind as renewable energy systems*, Dodrecht: Springer, 2008.

[36] Ibid.

[37] N. Gagnon, C.A.S. Hall and L. Brinker, "A preliminary investigation of energy return on energy investment for global oil and gas production," *Energies* Vol. 2, No. 3, 2009, pp. 490–503.

[38] H.T. Ruth, S. Brockington, M.C. Roberts, "The effects of 118 years of industrial fishing on UK bottom trawl fisheries," Nature Communications, doi: 10.1038/ncomms1013, May 4, 2010. Available online: www.vliz.be/imisdocs/publications/214382.pdf (accessed on February 7, 2011). According to this study about 17-times more energy is needed to catch the same amount of fish as needed in 1880s in the UK.

We simply need to invest more and more energy in order to get the same amount of energy and in most cases with far lower quality. Vaclav Smil, the world renowned energy analyst, describes facts on why it is not possible to replace fossil fuels at the current scale of use.[39] The first problem is the required scale of the replacement. When the fossil fuel consumption started to rise it took several decades to provide 50 per cent of energy compared to biomass, at an amount of 0.7 TW. In order to achieve the same target today, we need to convert 6 TW of energy, almost 10-times more. Another problem is energy density. In order to replace one kg of oil, we would need three kg of biofuel, while biofuels sometimes may have negative EROI.[40] Power density expressed in watts per square meter (W/m^2) is another problem. Fossil fuels were formed in the Earth's crust for many millennia and their power density is extremely high with a value of 10^2–10^3 W/m^2, thus we need only small areas in order to produce a lot of energy. Biomass power density is much lower than 1 W/m^2,[41] wind and water have a density of electricity production below 10 W/m^2, and modern concentrated solar power plants in deserts can on average deliver about 15 W/m^2.[42] Current factories, buildings, and whole (mega)cities with suburbs are constructed in such way that they require orders of a magnitude of higher power density than currently provided by alternative energy sources. For instance, an average supermarket would require the area of a photovoltaic panel ten times larger than the roof in order to replace electricity consumption and a high-rise building would require a 1,000 times larger area.[43] We would need to cover all of Africa with energy crops in order to replace 1/3 of oil production.[44] The next problem is the intermittency of supply of most energy alternatives. Current society is not able to properly function without a smooth input of energy flow and this base-load power, i.e. minimum required energy, has been rising. Easily storable high energy density fuels have high load factors (more than 75 per cent for coal power plants and more than 90 per cent for nuclear power plants). Highly unpredictable and currently impossible to store cheaply, wind and solar power have much lower load factors of about 25 per

[39] V. Smil, "21st century energy: Some sobering thoughts," *OECD Observer* No. 258/259, 2006, pp. 22–3.

[40] See also D. Pimentel, A. Marklein et al., "Biofuel impacts on world food supply: use of fossil fuel, land and water resources," *Energies* Vol. 1, No. 2, 2008, pp. 41–78. Available online: www.mdpi.org/energies/papers/en1020041.pdf (accessed on January 13, 2011).

[41] D.J.C. Mackay, *Sustainable energy – without the hot air*, London: Cambridge University Press, 2009. Available online: http://www.withouthotair.com (accessed on February 9, 2011).

[42] Ibid.

[43] V. Smil, op. cit.

[44] D.J.C. Mackay, op. cit.

cent. Moreover, large-scale deployment of wind or solar power is not a solution to the intermittency problem.[45] And since there are no currently existing energy sources without oil subsidy, the price of every energy alternative will rise together with the price of oil. Consider for instance that we will build large-scale off-shore wind farms which are dependent on inputs of cheap oil for building and maintenance. How will they be sustained with increasingly scarce oil?

Also most of the unconventional alternatives to crude oil, such as tar sands in Canada, are very problematic. They have a very high CO_2 footprint per unit of generated energy, they are very water and energy intensive with low EROI, they have very low flow rates and are difficult to rump-up significantly.[46] According to IEA, current recession decreased the outlook for tar sands growth by as much as 40 per cent.[47]

Oil and the economic growth

Assumption of an infinite economic growth is expressed by famous quote of Kenneth E. Boulding, "Anyone who believes exponential growth can go on forever in a finite world is either a madman or an economist."[48] There exists tight relation between the global growth of GDP and global oil consumption.[49] When the oil consumption increases, the GDP increases as well, and vice versa. Several scientific studies show that there is no causal relation between these two variables, according to others there does exist one.[50,51] The most probable

[45] Ibid.

[46] S. Staniford, "Tar sands production graph," 2010. Available online: http://earlywarn.blogspot.com/2010/01/tar-sands-production-graph.html (accessed on January 11, 2011).

[47] "Medium-term oil market report," International Energy Agency, 2009. Available online: www.iea.org/papers/2009/mtomr2009.pdf (accessed on January 16, 2011).

[48] K.E. Boulding, *Ecodynamics: A new theory of societal evolution*, Beverly Hills: Sage Publications, 1978.

[49] E. Lopez, "Oil market report – securing oil demand in unstable world," India-IEA Seminar: *Global Oil Market and Stability*, October, 2009.

[50] R. Jimenéz-Rodriguez and M. Sánchez, "Oil price shocks and real GDP growth – empirical evidence for some OECD countries," *European Central Banks Working Paper Series* No. 362, May 2004. Available online: www.ecb.eu/pub/pdf/scpwps/ecbwp362.pdf (accessed on February 20, 2011).

[51] K. Fatai, L. Oxley, F. Scrimgeour, "Modelling the causal relationship between energy consumption and GDP in New Zealand, Australia, India, Indonesia, the Philippines and Thailand," *Mathematics and Computers in Simulation* Vol. 64, No. 3–4, pp. 431–45, 2004. Available online: www.mssanz.org.au/MODSIM01/Vol%203/fatai2.pdf. (accessed on February 17, 2011).

explanation is that the causality holds true in both ways and that there is also a feedback mechanism at work. If the price of oil (or energy in general) is low, it encourages consumption and enables further investment into future production and further growth in GDP. On the other hand when the oil price rises too high, it puts constraints on demand (so called demand destruction) and consumption, GDP decreases, aggregate amounts of investment into future production decreases, which put further pressure on the GDP decrease.

According to Stephen Kopits, energy business analyst and director of Douglas Westwood, the US economy falls into recession whenever the ratio of oil expenditures relative to GDP crosses the 4 per cent threshold.[52] Four out of five US recessions, including the current one, were related to increased energy expenditures. USA was characterized by building of spatially widely distributed suburbs, which are habitable only with a car. They were built at a time when the oil price was much lower than today. Thus, these suburbs are only sustainable at oil prices several times lower than current prices, or using cars with alternative fuel, which are however, more expensive. Public train transportation is very scarce since it could not compete with fossil based transport in the past.

Today we obtain less than 6 per cent of the world's primary energy from nuclear power plants and this fraction is in decline for several years, while a peak in nuclear power was reached in 2006.

According to the Hirsch report[53] ordered by the US Department of Energy published in 2005, we need optimally 20 years of a crash program ahead of peak oil, to avoid serious economic problems associated with liquid fuels scarcity. Changes in energy systems and infrastructure need a very long time to make a significant dent in the global energy production, as documented in the many books of Vaclav Smil. Energy infrastructure inertia has been quantified by Davis[54] who calculated that global CO_2 emissions from existing infrastructure would be

[52] S. Kopits, S., "Oil: What price can America afford?," Research note, Douglas-Westwood, Energy business analyst, 2009. Available online: www.dw-1.com%2Ffiles%2Ffiles%2F438-06-09_-_Research_Note_-_Oil_-_What_Price_can_America_Afford_-_DWL_website_version.pdf (accessed on February 17, 2011).

[53] L.R. Hirsch, R. Bezdek, R. Wendling, "Peaking of world oil production: Impacts, mitigation, & risk management," 2005. Available online: http://www.netl.doe.gov/publications/others/pdf/Oil_Peaking_NETL.pdf (accessed on February 17, 2011).

[54] J.S. Davies, K. Caldeira, D.H. Matthews, "Future CO_2 emissions and climate change from existing infrastructure," *Science* Vol. 329, No. 5997, 2010, pp. 1330–33.

about 500 gigatonnes during the next 50 years and CO_2 would rise to about 430 parts per million (ppm). That would be in the case that no new fossil fuelled car or factory would be built. Large-scale and politically acceptable energy transition to low carbon economy is further complicated by the fact that the last significant base-load and concentrated source of energy was discovered 60 years ago in the form of nuclear power. Today we obtain less than 6 per cent of the world's primary energy from nuclear power plants and this fraction is in decline for several years, while a peak in nuclear power was reached in 2006.[55]

Research of atmospheric physicist Timothy Garrett from University of Utah has shown that one can define a so-called "energy constant" in relation to the amount of money in circulation. Garrett found out that there is 9.7 ±0.3 milliwatts of energy per dollar adjusted for inflation.[56] Or, in CO_2 terms, an average of about 8 000 kilojoules of energy must be extracted from the Earth and is turned into a half kilogram of CO_2.[57] Furthermore, there is strong correlation between per capita GDP and per capita electricity and energy consumption.[58] Garrett and many others[59,60] claim that increasing the energy efficiency per se, one of the most often proposed ways of reducing CO_2 emission, leads to the increase of total energy consumption. This rule is well known as the so-called "Jevons paradox"[60] and it was noticed as early as in 1865 by the mathematician and economist William Stanley Jevons. Jevons observed that energy savings gained by increased efficiency are outperformed by increased number of consumers and increased consumption since the energy becomes cheaper. In other words, "savings" are used to fuel further growth in consumption. Another energy analyst, Steve Sorrel from Sussex Energy Group concludes that although it is extremely difficult to test Jevons paradox empirically, "economy-wide rebound effects are larger than is conventionally assumed and that energy plays a more important role in driving productivity improvements and economic growth than

[55] "Statistical review of world energy, 2010," British Petroleum, 2010. Available online: bp.com/statisticalreview (accessed on March 1, 2011).

[56] T.J. Garrett, "Are there basic physical constraints on future anthropogenic emissions of carbon dioxide?," *Climatic Change* Vol. 104, No. 3–4, 2009, pp. 437–55.

[57] C.A.S. Hall, R. Powers and W. Schoenberg, "Peak oil, EROI, investments and the economy in an uncertain future," in D. Pimentel, op. cit.

[58] From www.gapminder.org; the relationship between income per person and energy use per person can be found at www.bit.ly/fl6lbm and the relationship between income per person and electricity use per person can be found at www.bit.ly/hjn1bm (accessed on January 18, 2011).

[59] See e.g. M. Bertoli, "Efficiency and resilience: after Jevons paradox, the piggy principle," *The Oil Drum*, February 26, 2010. Available online: http://www.theoildrum.com/node/6245 (accessed on January 18, 2011).

[60] B. Alcott, "Jevons' paradox," *Ecological Economics* Vol. 54, No. 1, 2005, pp. 9–21.

is conventionally assumed."[61] However, Sorrel acknowledges that despite the historical evidence of connections between energy efficiency, economic output, factor productivity and total energy consumption, there is not sufficient evidence for Jevons paradox, since the "causal links between this trend remains unclear." But it is more than clear that Jevons paradox cannot be ignored at any serious long-term energy policy planning.

Oil, climate and food security

Oil is used not only to power our cars, ships and planes, but also it is used to grow our food. Professor of economy Lester Brown recognizes the important role of oil for the food industry, "... In short, with higher energy prices and a limited supply of fossil fuels, the modern food system that evolved when oil was cheap will not survive as it is now structured."[62]

Currently, even if the oil price is lower than in 2008, food prices in December 2010 have already surpassed values from previous food crises and are still rising.

In 2011 the global population will exceed seven billion people, which is a seven-fold increase compared to the year 1800. Since the end of the Black Death the total number of people continuously increased. Positively, the peak growth rate of 2.2 per cent per year in 1963 slowed down to 1.1 per cent per year in 2009. Still, current projections of population growth expect the number of people to be anywhere between 7.4 and 10.5 billion in 2050.[63] As of 2011, population growth followed higher estimates of the United Nations.

Increasing world population requires increasing the amount of food and increasing land area, while per capita crop yields peaked in 1985[64] and per capita

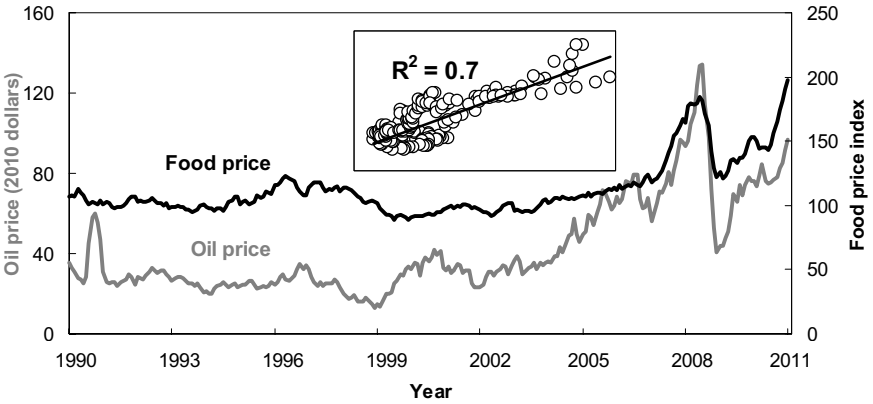
[61] S. Sorrell, "Jevons' paradox revisited: The evidence for backfire from improved energy efficiency," Energy Policy Vol. 37, No. 4, 2009, pp. 1456-69.

[62] R.L. Brown, *Plan B 3.0: Mobilizing to Save Civilization*, New York and London: W.W. Norton & Company, 2008. Available online: http://www.earth-policy.org/index.php?/books/pb3 (accessed on February 8, 2011).

[63] "World population to 2300," United Nations, 2004. Available online: http://www.un.org/esa/population/publications/longrange2/WorldPop2300final.pdf (accessed on February 9, 2011).

[64] J. Laherrére, "Present and future energy problems," HEC MBA Sustainable development seminar, September 8, 2004. Available online: www.oilcrisis.com/LaHerrere/HEC-long.pdf (accessed on February 9, 2011).

Figure 1. Time course of monthly averages of food (black line) and oil BRENT (grey) prices between January 1990 and January 2011.



Source: Real food prices are from Food and Agriculture Organization, available online: http://www.fao.org/worldfoodsituation/FoodPricesIndex/en/ (accessed on February, 19, 2011) and nominal oil prices from Energy Information Administration, available online: http://www.eia.doe.gov/dnav/pet/pet_pri_spt_s1_d.htm (accessed on February 19, 2011). Nominal oil prices were corrected for inflation using CPI Inflation Calculator. Available online: http://146.142.4.24/cgi-bin/cpicalc.pl (accessed on February 19, 2011).

of irrigated land peaked in 1978.[65] Moreover, people in developing countries eat more meat, which requires much more land and energy to produce compared to a vegetarian diet. The increase in agricultural yield is achieved principally through the greater use of fossil fuel for cultivation, fertilizers, pesticides, drying etc. so that it takes some 10 calories of petroleum to generate each calorie of food so that about 20 per cent of fossil fuel consumed in the USA goes to the food system.[66]

As documented in Figure 1, there is a statistically significant relation between the oil price and the food price. (The inner graph shows a linear relation between oil and food prices with the coefficient of determination (R^2) of 0.7). A record run-up in the oil price in 2008 was accompanied by the highest food prices in at least 20 years, since FAO tracks global food prices. High food prices were

[65] Data provided by the Earth Policy Institute, 2010. Available online: http://www.earth-policy.org/data_center/C26 (accessed on February 10, 2011).
[66] C.A.S Hall and J.W. Day, op.cit.

associated with the food protests and riots in many poor countries.[67] Currently, even if the oil price is lower than in 2008, food prices in December 2010 have already surpassed values from previous food crises and are still rising.

Egypt, where President Mubarak was forced to leave the government by civil protests, might serve as a model example of what will happen when the combination of oil production declining, population growth, rising food and energy prices and authoritative regime occurs. Oil production in Egypt peaked in 1995–1996 and declined since then while consumption increased at around three per cent per year together with population. Egypt is a classical example of ELM when the oil exports declined after the peak much more rapidly (nine per cent per year) as compared to oil production decline (three per cent per year). In 1995 oil exports were above 400 kbpd and in 2005 Egypt turned into a net oil importer.[68] The government had also heavily subsidized food and energy where the gasoline prices were very close to the price of oil at the world markets.[69] It will be difficult to raise the gasoline prices in line with market prices.

In Yemen, another country experiencing unrest, oil production peaked in 2001 and oil exports are now at half of what they were at a peak and Tunisia has also turned from oil exporter to oil importer in 2000.[70] It will be very important for future global oil markets for the Middle East and North Africa, namely Algeria, Libya, Yemen, Syria and Iran to be developed. Total oil exports of these countries peaked in 2005 and during the last three years declined by 1.2 mbpd, and if social disruptions in these countries were to occur, it would have a significant impact on already high world oil prices.

Since the oil boom in the 1970s, millions of Egyptians, Syrians, Jordanians and Lebanese have adopted car centered lifestyles enabled by cheap oil. Such a lifestyle is probably nearing its end. The situation is further complicated by food prices which are, according to The Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), affected by strong consumption growth in emerging markets, rising global population, changing

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[67] "Global Food Insecurity and Price Increase," *Situation Report* No.1, United States Agency for International Development 2009. Available online: http://www.usaid.gov/our_work/humanitarian_assistance/foodcrisis/documents/052209_foodcrisis_sr1.pdf (accessed on February 10, 2011).

[68] Data from Energy information administration, 2011. Available online: http://www.eia.gov/countries/country-data.cfm?fips=EG#data (accessed on February 20, 2011).

[69] A. Wagner, "International fuel prices 2010/11," Deutsche Gesellschaft für Internationale Zusammenarbeit, 2011. Available online: http://www.gtz.de/de/dokumente/giz2011-international-fuel-prices-2010-2011-data-preview.pdf (accessed on February 21, 2011).

[70] Data from Energy information administration, 2011. Available online: http://www.eia.gov/countries/country-data.cfm?fips=TS#data (accessed on February 19, 2011).

diets from carbohydrates to meat and processed foods, increasing urbanization and rural to urban migration and also supply side disruption caused by climate change: i.e. floods, droughts, diseases and other unusual weather events.[71] At the same time Egypt is the largest importer of wheat in the world. Report of The Association for Strengthening Agricultural Research in Eastern and Central Africa from 2008 further states:

> "But perhaps the most important drivers of price gains over the past year are developments in world energy markets. High oil prices have encouraged a policy focus on biofuels, including significant subsidies for the development of the biofuels industry in industrialised economies such as the US and the EU."

Another country likely to soon follow a similar fate to that of Egypt and other Middle East countries is Mexico, where oil production peaked in 2004 and oil exports are about half the amount from its peak of about 2 mbpd.[72] The Mexican government gets about 40 per cent of its revenues from oil, and if the trend continues, this will drop to zero within a few years. Globally increasing food and fuel prices (Figure 1) in combination with decreasing government subsidies will contribute to achieving the critical mass of population, just as it happened in Egypt.

Conclusions

Climate change is continuing at an increasing pace and might already be affecting food security in some countries. In the climate system there exists many irreversible tipping points and we are already committed to significant warming, but we have no exact knowledge of the critical thresholds of these tipping points. There exists significant sentiment that CO_2 emissions could be significantly reduced in a relatively short time (e.g. decades), while continuing as business as usual, economic growth and climate change could be solved without much "pain." However, this scenario requires a functioning global economy and strong political leadership, both of which are questionable. Increasing debt of governments and individuals is unsustainable and if the financial crisis will worsen in the near future, many projections of investments into low-carbon

[71] "Increasing food prices: a call for policy change," ASARECA *Electronic Newsletter* Vol. 11, No. 5, 2008. Available online: www.aaae-africa.org/adverts/PAAPNewsletter-11-5.pdf (accessed on February 9, 2011).

[72] Data from Mazama Science: "Energy export databrowser," op. cit.

technologies might turn out to be overly optimistic. If the increasing social unrest in the Middle East countries, but also in many European countries, is indeed the first sign of peak oil and declining energy availability, then we should expect more of the unrest in the near future. An increasingly volatile and unsecure world is not the optimal prerequisite for solving the climate change where people are collectively interested on immediate and much shorter-term problems than climate change. Furthermore, there is no known energy mix[73] that would substitute for fossil fuels at the current level of consumption, nor is it desirable given the high CO_2 footprint of most of the unconventional sources of energy. Finally, there is no known alternative energy source that would not require a large energy input from fossil fuels, thus alternative energy today serves only as a supplementary resource.[74] In the past people always experienced the energy transitions from lower quality sources to a higher quality source as well as a transition from a more expensive and scarce energy source to a cheaper and abundant energy source. Now, for the first time in modern history, people will need to adapt to more expensive energy sources with lower quality. This challenge can be successfully managed only if people understand the whole range of implications and adjust their lifestyles accordingly. Attempts to implement alternatives to increasingly expensive oil will be unsuccessful, if these attempts assume a business-as-usual scenario.

[73] R. Heinberg, "Searching for a miracle 'net energy' limits & the fate of industrial society," Project of the International Forum on Globalization and the Post Carbon Institute Report, 2009. Available online: http://www.postcarbon.org/report/44377-searching-for-a-miracle (accessed on February 13, 2011).

[74] D. Fridley, "Nine Challenges of Alternative Energy," in R. Heinberg and D. Lerch, eds, *The Post carbon reader: Managing the 21st century's sustainability crises*, Healdsburg, CA: Watershed Media, 2010.

Zbigniew M. Karaczun

Poland and climate change: Analysis of Polish climate policy 1988–2010

Abstract: *The analysis discusses the history of environmental policy in Poland from 1988–2010. Primary emphasis is placed on climate policy and the obstacles to formulating a unified National Climate Policy. The main problem of concern is the lack of political will towards such policies dealing with energy and its effect on climate change. The author takes a chronological approach, discussing the uses of hydrocarbon fuels throughout the communist regime, through the fall of communism to the present. The author cites the precedence of economic development as a major hurdle in devising practical environmental protection policy. The author closes by discussing Poland's need to reduce its emissions in response to growing pressure from the European Union.*

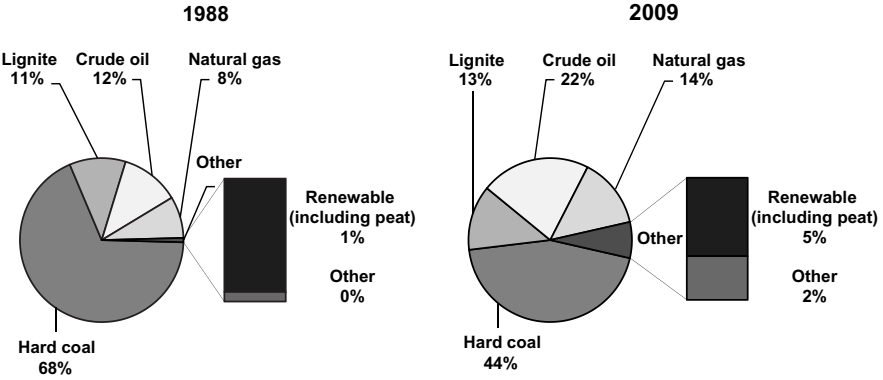
The Polish government's official position on climate protection is determined by the country's dependence on hydrocarbon fuels, mostly coal. Although its importance has decreased significantly over the last two decades (see Figure 1), Poland remains dependent on coal, as this raw material maintains its leading position among energy carriers used in Poland.

However, the data presented in Figure 1 do not give the full picture. This dependence becomes even more evident when we look at final energy – around 93 per cent of electricity is generated from coal, while this energy carrier's share in heat production is only slightly lower, amounting to as much as 80 per cent.

Such strong dependence on coal has derived from political as well as social and economic reasons. After World War II, when Poland became part of the communist bloc, the country's regime insisted on the development of an industrial working class. This prioritized centralized coal-based energy

Karaczun, Z., "Poland and climate change: Analysis of Polish climate policy 1988–2010," *International Issues & Slovak Foreign Policy Affairs* Vol. XX, No. 1, 2011, pp. 49–69.

Figure 1. Share of primary energy commodities in Poland 1988–2009



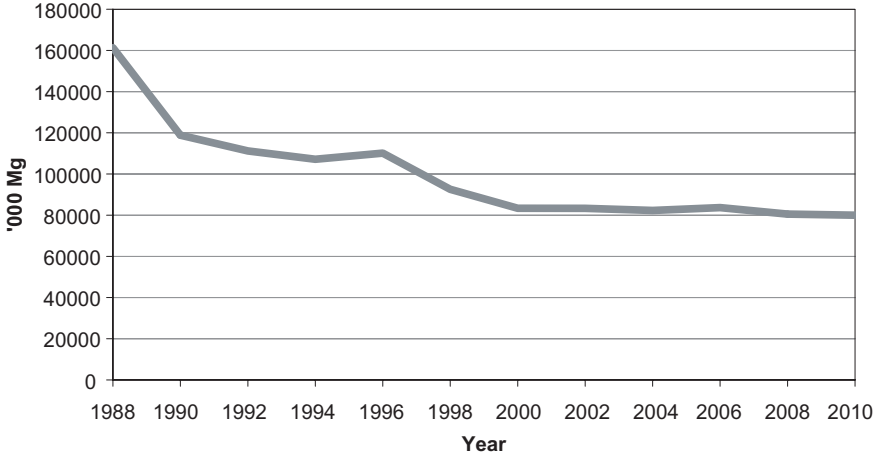
Source: Author's calculations based on statistical data.

generation. Moreover, the communist authorities understood the country's energy security as its self-sufficiency in the supply of energy carriers.[1] Instead of constructing interconnectors and linking the Polish energy grid with the grids of neighboring countries, thus increasing energy supply security, the communist authorities invested in developing coal extraction capacity and new energy generation units, so that domestic resources could satisfy 100 per cent of the country's needs. This plan was to a large extent successfully implemented and in the 1980s Poland not only mined coal for its own needs but also exported large quantities of this energy carrier. The Polish authorities of that time wanted to increase coal export at all costs, regardless of whether it was actually profitable. Unsurprisingly, when Poland made the transition into a market economy, coal extraction decreased sharply. Currently, coal output from Polish mines is twice lower than 20 years ago (Figure 2). Nevertheless, its consumption has increased, as in recent years Poland has shifted from coal export to its import.

The transformation that commenced in 1989 covered many sectors of the economy and mostly the state-owned companies. Regrettably, its impact on the energy sector was small – energy was still necessary and it could be sold regardless of whether its production was efficient or not. Although energy

[1] Ideology was, however, more important – after World War II, Poland closed around 6,000 small, private water power stations. In accordance with the ideology of that time, energy generation was a strategic sector and was totally dominated by the state.

Figure 2. Hard coal production in Poland 1988–2010



Source: Author's calculations based on statistical data available on www.stat.gov.pl.

demand decreased, the Polish government did not dare to close any large utility power or thermal power plant. One of the reasons behind this attitude were the forecasts[2] developed by institutions related to the coal lobby, which showed that, following a period of crisis, economic development would eventually entail a sharp increase in energy demand. In consequence, although maintenance of all the existing coal-based power plants only decreased production efficiency[3], they were kept open so that the system was ready for the expected growth in energy demand. Although these forecasts were not fulfilled, the government did not adjust its plans accordingly.

The economic transformation of 1989 proved very strenuous for Polish society. The collapse of state owned enterprises, before sufficient development of the private sector, resulted in a sharp GDP slump and a significant increase in the unemployment rate. Social discontent was so high that the government feared riots. This was not a favorable context for making tough decisions in the coal sector. Therefore, instead of reforming the Polish energy sector and

[2] "Założenia polityki energetycznej Polski do 2010 roku," Adopted by the Council of Ministers, October 17, 1995.

[3] Sz. Kuczyński, "Raport: Energia w Polsce. Jako stoimy energetycznie? .... Leżymy...," *Ecoeurope.eu*. Available online: http://ekoenergia.pl/index.php?id_akt=621&plik=Raport:_Energia_w_Polsce.html (accessed on February 20, 2011).

shifting it towards low emission sources, the Polish government supported the coal sector, its mines as well as power plants, by means of public subsidies, tax exemptions and long term contracts.[4] In 2003, prior to the EU accession, Polish authorities remitted PLN 17 billion,[5] i.e. over EUR 4 billion, that the coal industry should have paid to the state budget, which reflects the scale of these subsidies. As billions of euros had been pumped into coal energy, willingness to introduce changes decreased considerably. It was difficult to close a power plant that had just been supported with millions of public funds. When the government realized the need for more far-reaching changes in the energy sector, it was already too late to implement them without major problems.

The social and economic reasons behind the unwillingness towards changes in the energy sector stem partially from political reasons. Due to the subsidies, energy from coal is cheaper than energy from other sources.

The social and economic reasons behind the unwillingness towards changes in the energy sector stem partially from political reasons. Due to the abovementioned subsidies, energy from coal is cheaper than energy from other sources. This is favorable for the economy, as production costs are lower. There is no incentive to increase the efficiency of production, as energy costs can be largely disregarded in product prices. Moreover, Poland has a high level of fuel poverty – energy bills account on average for around 10 per cent of a household's budget, i.e. three times more than the average for the EU-15 countries.[6] The implementation of a wide modernization program in the energy sector would significantly increase the share of energy costs in household budgets, which could lead to social discontent. And that is not in the interest of any government.

[4] "Kontrakty długoterminowe (KDT)," *cire.pl*. Available online: http://www.cire.pl/ryneken-ergii/kdt.php?smid=199 (accessed on February 20, 2011).

[5] *Alternatywna Polityka Energetyczna Polski do 2030 roku. Raport techniczno-metodologiczny*, Warsaw: Institute for Sustainable Development, 2009. Available online: http://www.ine-isd.org.pl/lang/pl/page/broszury/id/18/file/27/option/save/ (accessed on February 20, 2011).

[6] Ibid.

The situation of the Polish energy sector

The truth is that the situation of the Polish energy sector is difficult. Having been protected by the state, it did not undergo necessary modernization, expecting that, in the event of a crisis, it would be supported by the government. Although this strategy worked for the last two decades, the current situation is so serious that decisions cannot be postponed any longer. The most serious problems for the Polish energy sector are presented below.[7]

1. In electricity generation there is a surplus in operating installed capacity – 34 GW compared with 25 GW of necessary peak load capacity. At the same time, a large part of this surplus is approaching the end of its technological lifespan – around 40 per cent of electricity units are over 40 years old.
2. All types of electricity grids are in a very poor state. The north-eastern and north-western loops of the 400 kV transmission grid lack closures. Medium voltage grids – 110 kV – lack an emergency measurement system on flows between energy enterprises. Over 80 per cent of the 200 kV grid is more than 30 years old. Around 40 per cent of grid transformers are of a similar age. The low voltage distribution networks (15 and 3 kV) are, however, in the worst condition – they lack closures. In consequence, power supply to rural areas is very weak: voltage is unstable, there are large voltage drops, even to 170 V, and frequent breaks in supply. Over 57 per cent of the distribution networks is over 500 m long, out of this as much as 12.6 per cent is over 1 km long.
3. Energy generation and transmission has very low efficiency: in Polish power plants it amounts to 36.5 per cent (compared with the average for EU-15 of 46.5 per cent). In heat power plants efficiency is higher and amounts to 50–93 per cent (in the EU – 75–93 per cent). Average losses in electricity transmission equal around 10 per cent, but in certain cases they amount to even 20 per cent. The heat distribution network is not insulated properly – only 20 per cent consists of pipelines with proper thermal pre-insulation. Flow speeds differ considerably from designed values, which leads to heat losses. There are also water losses due to lack of tightness.

Additionally the Polish economy is highly energy intensive. Energy consumption per GDP unit in Poland (383.5 koe/EUR 1,000) is over 2.5 times higher than in the EU-15 (150 koe/EUR 1,000).[8] In consequence, energy demand in Poland is relatively higher than in the "old" EU member states.

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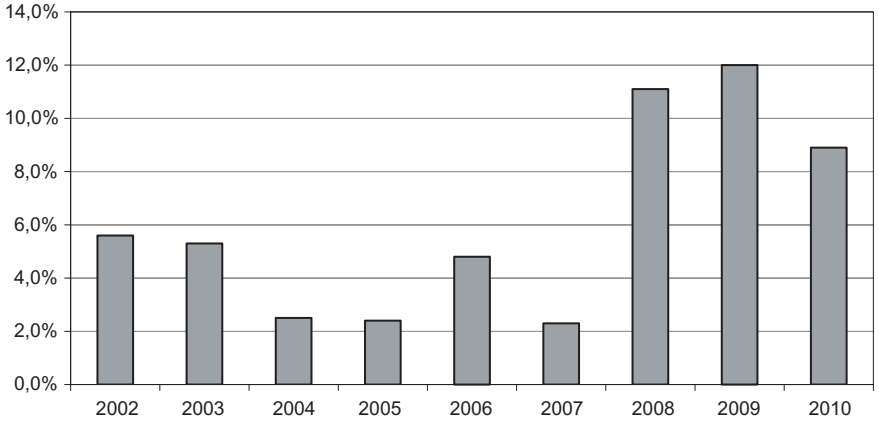
[7] Ibid; "Klimat i energia. Konieczność teraźniejszości, a wyzwanie przyszłości," Ministry of Foreign Affairs of Poland, 2010.

[8] "Energy intensity of the economy," *Eurostat*. Available online: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_ind_332a&lang=en (accessed on February 20, 2011).

Figure 3. Relative growth of electricity prices for households in the period 2002–2010 (Previous year = 100 per cent)



Source: K. Berbeka, *Konsekwencje wprowadzenia białych certyfikatów jako instrumentu poprawy efektywności energetycznej*, Warsaw: Polish Ecological Club, 2010.

As a result, it is necessary to implement a comprehensive program of infrastructure modernization and replacement in the Polish energy sector, which will entail high costs. These costs do not result, however, from the need to adjust to climate protection requirements but from the necessity of replacing degraded energy generation capacities and transmission grids. This process has already been initiated, as energy companies, concerned about the future, are implementing replacement investments. Although the scope of these activities is rather limited, they have already led to a significant increase in energy costs for final consumers (Figure 3). It may be, therefore, concluded that energy consumers are going to face further rises in energy prices, regardless of whether Poland implements an emission reduction program in the interests of climate protection or not.

Nevertheless, the necessity to reduce greenhouse gas (GHG) emissions constitutes a considerable challenge for Poland. As energy generation in Poland is based to a large extent on coal, it has very high emission intensity – for electricity it amounts to 1.06 kg CO_2/kWh of energy and for heat to 0.477 kg CO_2/kWh (these values already account for transmission losses).[9] Reduction of these

[9] F. Jackl, Z.M. Karaczun, A. Kassenberg, S. Keller, P. Manczarski, O. Mikucki, *Raport z obliczenia emisji gazów cieplarnianych z Banku Ochrony Środowiska S.A.*, Warsaw: Institute for Sustainable Development, 2008.

indices, due to adoption of a more stringent climate policy and expected new international emission reduction commitments, should be treated as a priority.

Regrettably, the Polish government has been largely ignoring this need. Although the National Energy Policy,[10] adopted in 2009, includes the objective of zero emission economic growth, in real terms this document is much less ambitious. Among other things it proposes that:

- by 2030 Poland will have reduced its energy intensity merely to the level achieved by the EU-15 in 2005;
- by 2020 the share of renewable energy sources (RES) in final energy consumption will have increased from the current 6 per cent to 15 per cent (this means that Poland is not going to exceed the EU objective). After 2020 RES development is going to progress at an even slower pace – it is planned that only 16 per cent of final energy will come from RES in 2030.

In consequence, CO_2 emissions in Poland will increase in 2020-30 by 8.5 per cent.

According to the National Energy Policy, strong support should be provided for nuclear energy. By 2030, Poland should have built two or three nuclear power plants, with a total capacity of at least 6,000 MW.

Although the government is consistently implementing a program for the construction of nuclear power plants[11] (it has prepared the National Nuclear Energy Development Program, initiated legislative changes and allocated PLN 40 million for promotion of this form of energy), it is far from being sufficiently active in RES development and energy efficiency improvement. The Polish government is ignoring the country's significant potential in renewable energy – estimated at 46 per cent of primary energy.[12] Poland utilizes only 17 per cent of this potential (Table 1) and hardly initiates any action to increase this share. The country's legislation does not contain any act supporting RES, while the programs that theoretically should provide assistance for the development of this energy type have a form that discourages potentially interested parties.[13]

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[10] "Polityka energetyczna Polski do roku 2030," Ministry of Economy of Poland, 2009. Available online: http://www.mg.gov.pl/files/upload/8134/Polityka%20energetyczna%20ost.pdf (accessed on February 19, 2011).

[11] Z.M. Karaczun, "Polsko – Jaderné plány," in K. Polanecky, J. Haverkamp, eds, *Energie budoucnosti? Jaderná energetika ve Střední Evropě*, Prague: Heinrich Boll Stiftung, 2010, pp. 20–4.

[12] "Możliwości wykorzystania odnawialnych źródeł energii w Polsce do roku 2020," Report for the Ministry of Economy prepared by the Institute for Renewable Energy in cooperation with the Institute for Sustainable Development, typescript, Warsaw, 2007.

[13] The support program for solar energy constitutes an example. Beneficiaries have to pay a 20 per cent tax on obtained subsidies and are required to take a commercial bank loan to cover their own contribution. In consequence, interest in this form of support is much lower than initially expected.

Table 1. RES economic potential in Poland and its utilization in 2006

RES type	Realistic economic potential – final energy	Utilization of the economic potential in 2006	
	(in TJ)	(in TJ)	(in %)
Solar energy	83,312.2	149.8	0.18
Geothermal energy	12,367.0	1,535.0	12.4
Biomass	600,167.8	192,097.0	32.0
Hydro energy	17,974.4	7,351.2	40.90
Wind energy	444,647.6	921.6	0.21
Total	**1,158,469.0**	**202,055.0**	**17.4**

Source: "Możliwości wykorzystania odnawialnych źródeł energii w Polsce do roku 2020", Report for the Ministry of Economy prepared by the Institute for Renewable Energy in cooperation with the Institute for Sustainable Development, typescript, Warsaw, 2007.

This lack of political support for RES is also reflected in the consultations and provisions of the National Renewable Energy Action Plan, which implements the requirements of Directive 2009/28/EC.[14] The Climate Coalition[15] was very critical of the Plan, arguing that the proposed RES development target was too low compared with Poland's potential in this respect and that the government had not proposed any new instruments that would ensure fast RES development, maintaining the unjustified and bizarre solution of co-combustion[16] as a method for fulfilling the EU target of RES share in final energy. Although various associations active in RES development supported this critical position, the Plan was submitted to the European Commission (EC) with hardly any changes. In consequence, future support for RES development in Poland will be very weak.

Energy efficiency improvement is also being hindered by various barriers and governmental inaction,[17] despite the fact that Polish potential in this area

[14] "Krajowy plan działania w zakresie energii ze źródeł odnawialnych," Ministry of Economy of Poland, 2010. Available online: http://bip.mg.gov.pl/files/upload/12111/Krajowy%20plan%20dzialania%20projekt%20z%20dnia%2026.11.2010%20r..pdf (accessed on February 4, 2011).

[15] "Opinia Koalicji Klimatycznej na temat projektu Krajowego planu działania w zakresie energii ze źródeł odnawialnych," Climate Coalition, 2010. Available online: http://www.koalicjaklimatyczna.org/lang/pl/page/stanowiska_koalicji/id/7/ (accessed on February 19, 2011).

[16] Co-combustion allows large, utility power plants to combust hardwood with coal and classify energy from hardwood combustion as energy from renewable sources. This reinforces the coal-based structure of the Polish energy sector instead of developing decentralized RES.

[17] "Opinia Koalicji Klimatycznej na temat projektu Krajowego planu działania w zakresie energii ze źródeł odnawialnych," op. cit.

Table 2. Energy efficiency potential in Poland until 2020

No.	Areas for energy efficiency improvement	Potential (in TWh a year)[19]	Share (in %)
1.	Electricity generation	40.0	18.8
2.	Domestic appliances and apartment lighting	9.7	4.6
3.	Residential and public buildings, small and medium enterprises, local heat production	142.5	67.0
4.	Drives	12.4	5.8
5.	Modernization of heat transmission and distribution networks	3.1	1.5
6.	Modernization of electricity transmission and distribution grids	3.5	1.6
7.	Street and square lighting	1.3	0.6
8.	Industrial plant lighting	0.3	0.1
	Total	**212.8**	**100.0**

Source: "Raport. Potencjał efektywności energetycznej i redukcji emisji w wybranych grupach użytkowania energii. Droga naprzód do realizacji pakietu klimatyczno-energetycznego", Polish Ecological Club – Upper Silesian Branch, Polish Foundation for Energy Efficiency, International Network for Sustainable Energy, European Climate Foundation, 2009.

is huge (Table 2) – it is estimated at around 50 per cent of the current energy consumption.[18] Currently, it would be economically justified to implement investments allowing for a 25 per cent reduction in energy demand.

Despite the clear budgetary benefits that could result from energy efficiency improvements,[20] the government does not provide support for such activities. The governmental draft Act on energy efficiency was submitted to parliament after three years[21] only after, due to pressure from the Ministry of Finance, the government had deleted the provisions on the state's exemplary role in energy efficiency promotion and the commitment that energy efficiency in

[18] "Raport. Potencjał efektywności energetycznej i redukcji emisji w wybranych grupach użytkowania energii. Droga naprzód do realizacji pakietu klimatyczno-energetycznego," Polish Ecological Club – Upper Silesian Branch, Polish Foundation for Energy Efficiency, International Network for Sustainable Energy, European Climate Foundation, 2009.

[19] Reduction in heat consumption has been recalculated from PJ to TWh.

[20] K. Berbeka, op. cit.

[21] This was the eighteenth (sic!) version of the draft act.

the public sector would improve by 1 per cent each year. Although the draft act submitted to parliament already lacked most of the provisions that would enable decisive action for energy efficiency improvement, it was further watered down in parliament. MPs from the governing coalition and the opposition were exceptionally unanimous regarding this piece of legislation. In consequence, the new provisions will remain defunct and will not have any impact on energy efficiency of the Polish economy.

All this justifies the opinion that Polish energy policy only takes into consideration to a small extent the challenges resulting from climate protection needs. This is corroborated by an analysis of Polish climate policy over the last two decades.

Development of Polish climate policy in 1988–2003[22]

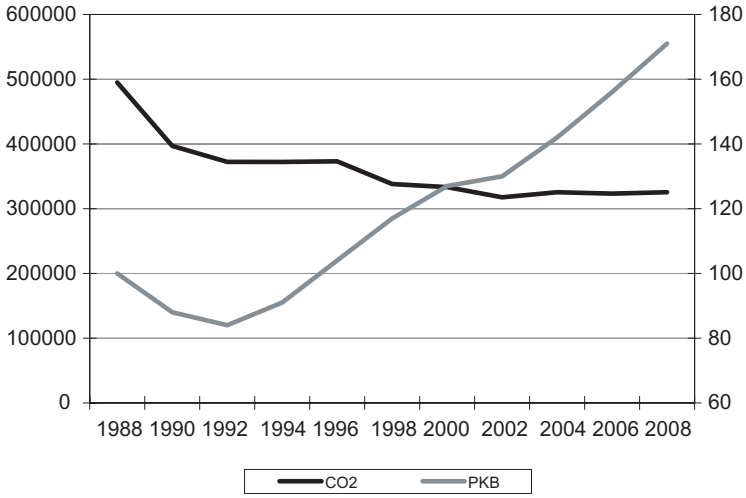
Polish climate policy dates back to 1991. The National Environmental Policy of that time[23] included a climate protection target – reduction of GHG emissions to the level required by international agreements. This target was adopted prior to signing the United Nations Framework Convention on Climate Change (UNFCCC), which allowed Poland to actively participate in the negotiations of the Climate Convention, sign it during the Earth Summit in Rio de Janeiro and ratify it relatively quickly. By signing the Convention, Poland took advantage of the opportunity to choose a different base year than 1990 (the Convention provided this possibility for former socialist states, so called "countries in transition") and changed it into 1988. This was the last year prior to the economic crisis and the emissions were around 20 per cent (see Figure 4) higher than in the year of signing the UNFCCC.

The end of the 1980s and the beginning of the 1990s marked a period of "environmental enthusiasm", which was connected with wider social and economic changes. As the communist regime insisted on industrialization and ever larger production, signs of an environmental disaster were more and more conspicuous at the end of the 1980s. The authorities designated 27 areas of environmental danger, covering 11 per cent of the country's

[22] When writing this section the author used: Z.M. Karaczun, A. Kassenberg, M. Sobolewski, *Polityka klimatyczna Polski – wyzwaniem XXI wieku*, Warsaw: Polish Ecological Club – Mazovian Branch, 2009 as well as Z. Karaczun, "Evolution of Polish Climate Policy in 1988–2008," in L. Karski, I, Grochowska, eds, *Climate Change and Society*, Warsaw: CH. Beck, 2010.

[23] "I Polityka Ekologiczna Państwa," Ministry of Environmental Protection and Natural Resources of Poland, 1991.

Figure 4. Changes in CO_2 emissions (in million tones/year) and GDP (in per cent, 1989 = 100 per cent) in 1988–2008



Source: Author's calculations based on statistical data available on: www.stat.gov.pl.

surface,[24] where environmental norms were exceeded to the extent that jeopardized the health of people living there. Environmental threat reduction became one of the objectives supported by environmental NGOs, which remained in opposition to the communist regime. At the beginning of the 1990s, some leaders of these organizations became members of governmental structures and supported adoption of ambitious environmental objectives.

This was also the period of the largest decrease in emissions, not only CO_2 but also other pollutants discharged into the air or water. This reduction did not result, however, from implementation of environmental policy measures. It was an aftermath of the economic transformation – the collapse of large, state-owned heavy industry enterprises and economic adjustment to the free market rules. In consequence, CO_2 emissions fell by over 100 million tones just in the period 1988–1991 (Figure 4).

[24] "Narodowa strategia ochrony środowiska przyrodniczego Polski do 2010," Ministry of Environment Protection and Forestry of Poland, 1988. See also: A. Kassenberg, M. Marek, *Ekologiczne aspekty p-rzestrzennego zagospodarowania kraju*. Warsaw: PWN, 1986.

The country paid a high price for these changes. Its economy sank into a deep recession and the collapse of large industrial plants led to massive unemployment. Although the economy managed to recover relatively swiftly, unemployment remained high until the end of the 1990s. This was the price that Polish society paid for GHG emission reduction.[25]

Due to the increasing economic crisis and social problems, environmental protection issues lost their appeal. Economic growth gained priority among politicians and they started to perceive environmental protection needs as a barrier to this growth. At that time the energy lobby started to promote the claim that economic development always entails higher energy demand, i.e. also higher GHG emissions.[26] Although the data did not corroborate this claim (Figure 4), as since 1992 emissions have not increased along with the GDP growth, this thesis has dominated the debate on Polish climate policy largely to this date.

This revised attitude towards environmental and climate issues also had practical consequences. In Kyoto, during negotiations over future reduction levels, Poland committed itself to decreasing its GHG emissions in 2008–2012 by only 6 per cent compared to the base year (1988).

Nevertheless, the second half of the 1990s saw institutional strengthening in the field of climate change. The Polish authorities established the Climate Protection Center, later transformed into the Climate Convention Executive Office, and the National Emission Center, created in response to Poland's obligation to provide annual emission reports to the UNFCCC Secretariat. This larger interest in climate protection issues resulted also from Jan Szyszko's, then Minister of Environment, presidency of the fifth Conference of the Parties to the UNFCCC. Regrettably, the structures developed during this presidency proved impermanent and were not maintained.

At the end of the 1990s, the Polish authorities started to amend the state's environmental policy, adopting the Second National Environmental Policy[27] in June 2000. The new policy contained several direct references to global climate change and the need to initiate GHG emission reduction activities. It provided for Poland's active participation in tackling global environmental problems (including initiatives within the Climate Convention). Ratification of the Kyoto Protocol constituted one of its short-term objectives. Other goals included: implementation

[25] See data at the Polish Statistical Office web site. Available online: http://www.stat.gov.pl/gus/5840_677_PLK_HTML.htm (accessed on February 19, 2011).

[26] "Założenia polityki energetycznej Polski do 2010 roku," Adopted by the Council of Ministers, October 17, 1995.

[27] "II Polityka Ekologiczna Państwa," Ministry of Environment of Poland, 2002.

of the requirements under the Kyoto Protocol, a twofold decrease in the energy intensity of national income, wide promotion of the best available techniques in energy efficiency and RES and development of a national strategy for GHG emission reduction and energy efficiency improvement. In regard to the last of the above objectives, the Ministry of the Environment initiated activities in order to fulfill Poland's commitments defined in Article 4(2) of the UNFCCC and at the beginning of 2003 presented a draft of the National Climate Policy.[28] The strategic objective of this document was to:

> "...ensure Poland's active participation in international efforts for protection of the global climate through implementation of sustainable development principles, in particular by improving energy efficiency, expanding national forest and soil resources, rationalizing waste management, utilization of raw materials and industrial products so that it is possible to achieve maximum, long-term economic, social and political benefits..."[29]

As the authors of this document believed that it was possible to reduce GHG emissions by 30 per cent (compared with the 1988 base year) without any additional climate protection measures, the Policy provided for a 40 per cent reduction by 2020.

Adoption of the National Climate Policy proved the most significant, albeit short-lived, success achieved by the Ministry of the Environment in the field of climate protection. It soon became evident that the decision makers lacked the political will to implement all the objectives and priorities spelled out in this document, especially the 40 per cent emission reduction target. Although some of the measures provided for in the Policy were put into operation, their aim was not to promote GHG emission reduction but rather to tackle general environmental protection problems (e.g. fees for CO_2 emissions).

In practical terms, the National Climate Policy has been a defunct document since the very beginning and has had no impact on other strategies and programs developed in Poland. Its objectives were not even transposed into subsequent environmental policies. Neither did it influence the direction of economic development in Poland. Although its adoption was important for psychological reasons, its sole purpose was to formally fulfill the UNFCCC requirements.

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[28] "Polityka klimatyczna Polski. Strategie redukcji emisji gazów cieplarnianych w Polsce do 2020 roku," Ministry of Environment of Poland, 2003. Document adopted by the Council of Minister, October 4, 2003.

[29] Ibid

Polish climate policy after 2004[30]

Poland's accession to the EU had the largest impact on the country's current position regarding climate protection needs. On the one hand, numerous mistakes were committed during the negotiation process, and their negative consequences are still visible. On the other, EU policy has the strongest influence on Poland's position.

In practical terms, the National Climate Policy has been a defunct document since the very beginning and has had no impact on other strategies and programs developed in Poland.

The accession negotiations began at the end of the 1990s. Poland believed that it should tackle its environmental protection problems together with the EU.[31] The European Commission, however, held a different opinion and expected that the accession countries would transpose the EU legislation and implement its provisions in their own. As a result, the accession countries repeated many mistakes made earlier by the western European countries.[32] Moreover, the costs of this adjustment to the new legal requirements were very high. Concerns appeared that the new member states, which in the upcoming years would have to considerably increase their environmental expenditures, would hinder development of a progressive EU environmental policy after their accession to the EU.[33] It was expected that they would not be willing to take on new commitments, as they already had to implement numerous costly environmental

[30] When writing this section the author used: Z.M. Karaczun, A. Kassenberg, M. Sobolewski, M., op. cit. as well as Z. Karaczun, Z., "Evolution of Polish Climate Policy in 1988–2008," in L. Karski, I. Grochowska, eds, op. cit.

[31] Author's own assessment. In years 1999–2002 Author worked as adviser to the Polish Minister of Environment on EU integration agenda and participated in preparation of Polish positions in the field "Environment" as well as participated in the negotiations process.

[32] Had a different negotiation approach been adopted, involving the EC in problem solving, it would have been possible to implement environmental protection investments in the energy sector. Instead, large amounts of money were spent to adjust Polish power plants to the EU requirements (e.g. construction of installations for flue-gas desulphurization in order to fulfill the requirements of the Directives 2001/80/EC and 96/61/EC). These investments further petrified the existing coal-based structure of the Polish energy sector and made it less willing to introduce changes in future.

[33] Z.M. Karaczun, "Preparing for EU environmental policy in Poland: the case of the nitrates directive," *Land Use Policy*, No 22, 2005, pp. 245–53.

protection programs. These concerns proved justified – Polish politicians started to publicly question EU legislation on environmental protection and nature conservation, arguing that the old member states could develop prior to their adoption and that more stringent environmental legislation was directed against the new member states. Subsequent EU decisions, which ignored the special situation of the new member states, amplified this unwillingness towards a more ambitious EU climate policy.

Initially, climate protection issues did not appear to constitute a conflict area. On the one hand, the screening conducted prior to the negations[34] showed that the EU legislation was not so developed in the field of climate protection. On the other, emission levels in the new member states were much lower than in the base year. This was, however, soon to change.

Implementation of the Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading created the first problems. Within the First National Allocation Plan (NAP I),[35] prepared for the purposes of emission allowance trading, Poland demanded 286.2 million tons of allowances annually between 2005 and 2007.[36] The EC, however, did not agree to this and reduced the number of allowances for Poland by nearly 50 million tons. As the NAP I was prepared in haste and without an in-depth analysis, the emission trading scheme (ETS) commenced in Poland with a considerable delay, on June 30, 2006. When the Plan was changed to incorporate the new recommendations, the EC allowed Poland to put the ETS into operation. Due to this delay, Polish companies were deprived of the opportunity to sell allowances when their market prices were high, as they entered the market only when these prices had fallen significantly.

The problems with adoption of the NAP I did not, unfortunately, teach Polish authorities any lessons – the NAP II for 2008–2012 was prepared in a similar manner.[37] In this document the government demanded as much as 284 million tons of emission allowances. Such a large volume did not have any justification (emissions from Polish installations covered by the ETS in 2005 were estimated at 205 million tons of CO_2). The EC did not accept this proposal and in March 2007 decided to lower Poland's allocation by around 27 per cent. Instead of negotiating

[34] G. Niesyto, "Wprowadzenie do problematyki polskiego prawa ochrony środowiska w kontekście integracji z Unią Europejską," 1999.

[35] "I Krajowy Plan Rozdziału Uprawnień do Emisji", Ministry of Environment of Poland, 2004.

[36] One allowance stands for emitting one ton of CO_2.

[37] "II Krajowy Plan Rozdziału Uprawnień do Emisji CO_2 na okres rozliczeniowy 2008–2012," Ministry of Environment of Poland, 2006. Document adopted by the European Committee of the Council of Ministers on June 23, 2006.

a higher number of allowances with the EC, Poland decided to file a complaint against the Commission's decision to the Court of Justice of the European Union. Although Poland won the case[38] (due to formal mistakes committed by the EC during NAP II approval), the government did not change the Plan.

Even though Polish enterprises sustained considerable losses due to the conflicts around NAP I and II (they were not able to sell their surplus emission reduction), the negative changes in the attitudes of Polish political elites towards climate protection issues appear to be even more significant for the future of climate policy in Poland. Politicians started to perceive the EU climate policy as a strategy against Poland, aimed at reducing the Polish economy's competitiveness on the European market and limiting the country's possibilities for economic and social development.

Concerns appeared that the new member states, which in the upcoming years would have to considerably increase their environmental expenditures, would hinder development of a progressive EU environmental policy after their accession to the EU.

Adoption of the EU Energy and Climate Package unleashed a real war against EU policy in this area. The package was signed in March 2007 by then President Lech Kaczyński on behalf of Poland. It did not provoke much interest – there were only several press releases on this subject and there was no public or political debate. Similarly, the reaction of business circles was very limited. Only at the break of February and March 2008 did representatives of different economic sectors start to express strong concerns that the Package could jeopardize the development of the Polish economy.[39] In March 2008, Poland started real negotiations.

[38] "EU greenlights Polish CO_2 emissions allocation plan," *EU business*, April 19, 2010. Available online: *http://www.eubusiness.com/news-eu/poland-emissions/* (accessed on January 12, 2011).

[39] See for example "Pakiet klimatyczny UE to katastrofalne skutki dla Polski," *Wirtualna Polska*, July 11, 2008, Available online: http://finanse.wp.pl/kat,7060,title,Pakiet-klimatyczny-UE-ma-katastrofalne-skutki-dla-Polski,wid,10146259,wiadomosc.html?ticaid=1bebf (accessed on July 11, 2008); "Pakiet klimatyczny, pakiet demoniczny," *Polskatimes.pl*, October 18, 2008. Available online: http://www.polskatimes.pl/opinie/forumautorow/53954,pakiet-klimatyczny-pakiet-demoniczny,id,t.html?cookie=1 (accessed on October 18, 2008); "Rząd walczy w UE, by nie zadusić polskiej gospodarki," *Gazeta Wyborcza*, March 18, 2008.

The Polish negotiation position was based on the *2030 Report*, i.e. a document commissioned by the Polish Electricity Association.[40] The document announced a disaster that was going to follow the Package's implementation – 100 per cent increase in energy prices, falling GDP levels and increasing unemployment. Despite the fact that the Gdańsk Institute for Market Economics pointed out many inconsistencies and simplifications in this publication,[41] the *2030 Report* became the most important document prepared in Poland and served as a point of reference for politicians and negotiators as well as energy and industrial lobbyists.

At the same time the energy sector initiated an aggressive lobbying campaign and convinced politicians that the Package did not contain anything positive. Quite the opposite, it posed serious threats to the Polish economy. For the purposes of this campaign, the largest energy concerns: Polska Grupa Energetyczna S.A., Tauron Polska Energia S.A., Enea S.A., Energa S.A. and two structures gathering thirteen trade industrial organizations established in July 2008 the Green Effort Group. This Group managed to influence politicians and officials and convinced them to oppose the Package's decisions.[42] This lobbying proved successful and Polish negotiators and politicians consistently insisted

Available online: http://wyborcza.biz/biznes/1,101562,5036612.html (accessed on March 18, 2008); "Polski pakiet klimatyczny," *Wprost*, November 3, 2008. Available online: http://www.wprost.pl/ar/143419/Polski-pakiet-klimatyczny/ (accessed November 3, 2008).

[40] B. Jankowski, Z. Parczewski, M. Niemyski, A. Umer, S. Senczek, I. Tatarewicz, K. Dreszer, M. Ściążko, L. Zapart, T. Chmielniak, J. Zuwała, A. Kądzielawa, *Wpływ proponowanych regulacji unijnych w zakresie wprowadzenia europejskiej strategii rozwoju energetyki wolnej od emisji CO_2 na bezpieczeństwo energetyczne Polski, a w szczególności możliwości odbudowy mocy wytwórczych wykorzystujących paliwa kopalne oraz poziom cen energii elektrycznej*, Warsaw: EnergSys Sp. z o.o., 2008.

[41] *Ewaluacja RAPORTU 2030. Wpływ proponowanych regulacji unijnych w zakresie wprowadzania europejskich strategii rozwoju energetyki wolnej od emisji CO_2 na bezpieczeństwo energetyczne Polski, a w szczególności możliwości odbudowy mocy wytwórczych wykorzystujących paliwa kopalne oraz poziom cen energii elektrycznej*, Warsaw: The Gdańsk Institute for Market Economics, 2008.

[42] The scale of lobbying initiatives performed by the Green Effort Group is reflected in the Group's report from its activities. The report states that: "representatives of the Green Effort Group have conducted a number of initiatives aimed at gaining wide support for their proposals. They informed the EU authorities, academic circles and media about the threats identified by Polish energy and industrial experts with regard to the new EU-ETS Directive. (...) The Group promoted the position of Polish energy sector and industry...," "Substantive Report", Green Effort Group, 2009. Available online (accessed on March 10, 2011): http://www.proinwestycje.pl/ets/Raport_merytoryczny%20Green%20Effort%20Group.pdf.

on changing the provisions proposed by the EC. They managed to weaken the Package enough to make it acceptable for the Polish government.[43]

In the shadow of this conflict Poland prepared and organized the Fourteenth Conference of the Parties to the UNFCCC (COP 14) in December 2008. Prior to the conference, the Minister of the Environment, Maciej Nowicki, had been abandoned by the rest of the government. Even though organization of a good COP should have constituted a priority for all Polish authorities, only the Ministry of the Environment was involved in the preparation of this event. As the Prime Minister did not provide any support for the Minister of the Environment, Poland did not present any ambitious proposals, which made its presidency a passive one.

In 2009 and 2010 Poland further toughened its position, ignoring the necessity of climate protection activities.

Nevertheless, the COP 14 in Poznan had some significance. It was an organizational success, proving that Poland was able to prepare a large, international event. More importantly, it considerably stimulated media interest in climate protection issues and climate policy. Although this interest soon abated, information about climate change, climate protection needs and climate policy still appears in the Polish media.

In 2009 and 2010 Poland further toughened its position, ignoring the necessity of climate protection activities. The position has been dominated by the following two trends:

- Polish politicians' unwillingness to take active measures aimed at phasing out fossil fuels, developing a low carbon economy and promoting climate protection;
- attempts to blame EU climate policy for the lack of modernization in the energy sector and growing energy prices.

Since 2008 Poland has been an active player within the EU debate on climate protection, trying to prevent the adoption of more stringent EU emission reduction targets (30 per cent instead of the current 20). It has created a coalition of new member states to gain support for its views and has tried to block any higher EU commitments towards developing countries or to hinder development of restrictions in Assigned Amount Unit (AAU) trading.

[43] One of the main demands made by Poland assumed that until 2012 Polish power plants would not have to purchase emission allowances at auctions but would continue to obtain them for free.

Even though some points in the Polish position are justified (e.g. the fact that basing payments to the fast track fund for developing countries solely on emission levels violates the EU solidarity principle), Polish negotiators are usually unable to support it with sensible argumentation. They have not developed any proposal that would account for the special situation of the new member states and allow for a progressive EU climate policy. All this reinforces the opinion that Poland is hindering the development of EU climate policy.

The political consensus towards climate policy issues constitutes the main reason for the above situation. Although fierce arguments and hostility usually dominate Polish national politics, the governing parties and the opposition agree that climate protection and emission reduction are not in Poland's interest. The Parliamentary Commission of Environmental Protection is dominated by people sceptical about climate protection. During its meetings one may hear that: "[...] faith in global warming has become a new religion, and people who call for emission reduction are its followers [...]" [44] – an opinion presented by an MP from the governing party. MPs from the opposition have presented similar views: " [...] climate protection may be compared to protection of day against night, of winter against autumn and human impact on this type of change is comparable [...]" [45], "...I've heard that...human impact on global warming is negligible [...] there's "climategate" and this whole fraud has been revealed. We certainly have to reduce pollution at its source, but my question is at what cost. I think that the price we will have to pay is too high [...]."[46]

Moreover, a lot of the journalists working in the main media share these opinions[47], believing that climate protection initiatives are unnecessary. In consequence, Polish public opinion receives strongly biased information.

Environmental NGOs gathered in the Climate Coalition – a voluntary agreement of twenty organizations promoting implementation of an ambitious climate policy in Poland – constitute the only group that criticizes the government. For several years now the Coalition has led education activities, media campaigns and political lobbying and is the only partner in the public debate on the climate emphasizing the necessity of further GHG emission reduction. Regrettably,

[44] Opinion of Antoni Mężydło, an MP from the Civic Platform. Session on June 26, 2008.

[45] Opinion of Grzegorz Pisalski, an MP from the Democratic Left Alliance. Session on March 2, 2010.

[46] Opinion of Grażyna Ciemniak, an MP from the Social Democratic Party of Poland. Session on March 2, 2010.

[47] For example see "Bronisław Wildstein przedstawia," TVP. Broadcasted on January 21, 2009; A. Łakoma, "Ochrona klimatu to koszty dla Polski," *Rzeczpospolita*, February 25, 2011; M. Rafałowicz, "Człowiek nie ma nic do klimatu," *Rezczpospolita* December 9, 2008.

although the Coalition has gained significance during recent years, its impact on political decisions remains negligible.

Conclusions

The consequences of the abovementioned lack of political will for implementation of a more active climate policy in Poland will most probably be significant. GHG emission reduction requirements will become more demanding, following the progressing climate change and technological advancement. The EU will not give up its ambitious emission reduction targets. The trend of developing a low-carbon and low-emission economy is gaining popularity within the EU.

Polish politicians ignore these needs and reassure each other that Poland's coal resources can turn the country into an energy power. They overlook alarm signals, e.g. the fact that large international energy concerns – RWE and Vattenfall – are giving up their plans to construct new power plants. They do not recognize the need for modernizing the energy sector, despite the threat of blackouts, ignoring the warnings voiced by an increasing number of experts that inaction will inevitably lead to an energy crisis already within three to four years. Despite its declarations of support for RES development and energy efficiency improvement, the government has not proposed any new initiatives that would foster investments in these areas.

Implementation of an ambitious climate policy will be costly. Nevertheless, the political and economic costs of inaction will most probably be even higher.

All this proves that Poland may be lacking internal forces that would change the country's attitude towards international and European climate policy. Therefore, only external forces may induce such a change. EU climate policy may and should constitute such a force. Consistent monitoring of implementation of the EU objective in generation of energy from renewable sources and introduction of obligatory energy efficiency objectives (following the European Parliament's proposal) should significantly change Polish energy policy.

Rules for utilization of EU funds for financing development in Poland will also constitute an important factor. To date, financial support from the European Union has had negative consequences for climate protection. In the strategy outlining EU funds allocations for 2007–2013 the Ministry of Regional Development estimated that planned activities and investments would lead to

a 30 per cent increase in GHG emissions.[48] The analysis of EU fund spending shows that this estimate is highly probable.[49] Nevertheless, the European Commission did not react, claiming that it was not authorized to influence the directions of allocations from EU funds in the member states. If the EC does not change its approach in the next budgetary period and if the rules for EU support remain the same, GHG emissions in new member states will not decrease – actually, it is very probable that they will grow.

Implementation of an ambitious climate policy will be costly. Nevertheless, the political and economic costs of inaction will most probably be even higher. The sooner Poland adopts an active approach towards climate protection, the lower the costs will be.

[48] "Narodowe Strategiczne Ramy Odniesienia na lata 2007–2013," Ministry of Regional Development of Poland, 2007. Available online: http://www.mrr.gov.pl (accessed on February 12, 2011).

[49] Z.M. Karaczun, A. Kassenberg, M. Sobolewski, *Fundusze Unii Europejskiej na lata 2007 - 2013 a ochrona środowiska*, Warsaw: Institute for Sustainable Development, 2008, p. 96.

Urban Rusnák

Turkey as the key element to the EU's southern energy corridor

Abstract: *This article discusses the role of Turkey in the EU's reliance on the import of foreign natural gas and oil. The author shows the importance of Turkey's geographical placement between Middle Eastern suppliers of oil and gas and the European Union. Additionally, all export of Soviet/Russian oil from the Black Sea oil terminals to world markets goes through the Turkish straights of the Bosporus and the Dardanelles. The author demonstrates how Turkey has become a key player in energy negotiations between the EU, Russia and the Middle East, namely using the Sothern Corridor as an example. Turkey is crucial in the realization of the Southern Corridor, which could diversify sources and corridors of natural gas for Central Europe and the Slovak Republic. Turkey will surely progress in a pragmatic way and support the initiatives of the EU in the Southern Corridor, as well as use their geo-political position as leverage in EU accession talks. The author concludes by discussing Slovakia's stance, and what it can benefit from Turkey's role in energy transit.*

"Safe, secure, sustainable and affordable energy contributing to Europe's competitiveness remains a priority for Europe,"[1] is one of the foremost conclusions made by the European Council, which was historically first aimed mainly at energy and innovation. This is not surprising, especially taking into

[1] "European council conclusions," EUCO 2/1/11 REV 1, European Council, February 4, 2011, p. 1. Available online: http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/119175.pdf (accessed on February 15, 2011).

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consideration that the EU as a whole is dependent on importing natural gas and oil. On the contrary, one might be dazed that the highest politics have not given more attention to energy matters in the past. The concentration of high politics on energy at the beginning of 2011 is the result of several mutually influencing factors. Along with the specific interests of the Hungarian Presidency of the European Council and the implementation of the complex "Third energy package" legislature, the external political development added its own impact. Traditionally, most imported energy resources – natural gas and oil to a lesser extent – flows into the EU through three corridors: from the East (Russian Federation, Central Asia), from the North (Norway), and from the West (North Africa). After the EU enlargement of the Central and Southeast European countries in the first decade of the twenty-first century, an objective necessity for geographical and political diversification of the energy flows in this part of Europe emerged. In a reflection to this need it was suggested that the Southern Energy Corridor[2] connect the EU through the Black Sea with the Caspian region and in a larger perspective with the Middle East. The EU together with representatives of Turkmenistan, Uzbekistan, Kazakhstan, Azerbaijan, Georgia, Iraq, Egypt and Turkey agreed on practical cooperation in an attempt to prepare a new direction for energy flow into the EU. All participating partners are important oil and gas production countries, crucial transitors, or both. This concept also anticipates the continuing integration of the Western Balkans and would allow carrying natural gas into Central Europe from new sources and by a diversified route. Its success would lower the full energy dependence of Slovakia and other European nations from their current, often monopoly supplier. One of the key elements of the concept's success is Turkey, a candidate country to the EU with unclear perspectives of full membership. Readers are provided with information on the energy position of Turkey, its influence on security of energy

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[2] "Prague summit Southern energy corridor," May 8, 2009. Available online: http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/misc/107598.pdf (accessed on February 15, 2011).

supplies to the eastern part of the EU and possible scenarios of development including the (non)integration of Turkey into the EU.

Energy balance of Turkey

Turkey is one of the fastest growing economies of the OECD, which has to permanently face their deficiency of domestic energy sources. In 2009 only 24 per cent of Turkey's primary energy demands were covered by domestic fossil fuels. Not even the world energy crisis stopped Turkey's growing energy needs. From 2006 to 2010 Turkey's energy consumption increased from 92 mtoe (million tons of oil equivalent) to 126 mtoe, and according to the energy strategy of Turkey[3] (January 2009) the expected consumption in 2020 is 222 mtoe. In terms of primary energy mix,[4] Turkey obtained, in 2007, "domestic" energy from brown coal (26 per cent) and around 12 per cent from renewable sources – mostly large hydro. High proportions of imported natural gas at 27 per cent and oil at 35 per cent in the energy mix signify great dependence of Turkey's energy security on import. Energy security is therefore a long-term priority of Turkey's foreign policies. The country reached a high level of diversification in importing natural gas by pipelines (from Russia, Azerbaijan, Iran) and by LNG vessels (from Arab countries) as well as importing oil from Iraq by pipeline and other Gulf producers by sea tankers. Turkey is currently an importer of electric energy as well. In the future Ankara counts on the development of renewable sources of energy as well as on nuclear energy. The Russian company Atomstroyxport began preparations to build a large nuclear power plant 4x1200 MW in Akkuyu at the east Turkish Mediterranean coastline near the city of Mersin. In 2010 a Japan–Turkish agreement in principle was signed on the building of a second nuclear power plant in Sinop on the Black Sea coastline. By 2030 Turkey expects to have 10 per cent of nuclear energy in its energy mix, further diversifying its sources and strengthening its energy security.[5]

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[3] "Turkey's energy strategy," Ministry of Foreign Affairs of Turkey, January 2009. Available online: http://www.mfa.gov.tr/data/DISPOLITIKA/EnerjiPolitikasi/Turkey's%20Energy%20Strategy%20(Ocak%202009).pdf (accessed on February 1, 2011).

[4] "Share of total energy consumption by fuel in 2007," European Environment Agency. Available online: http://www.eea.europa.eu/data-and-maps/figures/share-of-total-energy-consumption (accessed on February 10, 2011).

[5] Y. Yazar, "The growing role of Turkey in the EU´s security of energy supply," *European Energy Review*, January 6, 2011. Available online: http://www.europeanenergyreview.eu/index.php?id=2643 (accessed on February 1, 2011).

Turkey uses her unique geographic location between 72 per cent of the world's oil and natural gas reserves (Middle East, Russia and Caspian Sea region) and one of the largest energy consumer markets, the EU, for transit of energy resources. All export of Soviet/Russian oil from the Black Sea oil terminals to world markets goes through the Turkish straights of the Bosporus and the Dardanelles. The Iraqi pipeline from Kirkuk to the Turkish Mediterranean terminal of Ceyhan has been in operation since 1976. The end of the Cold War and the break-up of the Soviet Union created an important window of opportunity for Turkish energy diplomacy. In 1996 a gas pipeline from Iran was opened to Eastern Turkey. Even against the will of Moscow, with US support Turkey was able to build the Baku–Tbilisi–Ceyhan (BTC) pipeline, which has been in commission from 2006. Since 2008 Kazakhstan joined Azerbaijan in exporting oil via BTC.[6] Russo–Turkish tension caused by the aforementioned pipeline did not stop common interests in the building of the gas pipeline Blue Stream, which since 2003 has connected both shores of the Black Sea. Due to pricing issues this pipeline started commercial supplying in 2005 only.

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Despite the political ploys between the two, Turkey introduced practical steps to be integrated into the EU. From September 18, 2010 the Turkish electricity grid has been synchronized with the European Network of Transmission System Operators for Electricity (ENTSO-E).[7] After a year in a parallel trial period, Ankara plans to request membership in the ENTSO-E, this would mean formalization of physical integration of electricity infrastructure with the EU. Turkey is cooperative in terms of other mutually beneficial projects with the EU, as the creation of the South Energy Corridor, yet assertively pursuing maximization of profits. Turkey signed an intergovernmental agreement on the building and operation of the Nabucco pipeline. The Turkish national pipeline company BOTAŞ is a member of the international consortium. But in the hierarchy of Turkey's interests, Nabucco is only one of many different current projects. An example of the political inaction of the EU towards Turkey is that

[6] "Turkey's energy strategy," op. cit.
[7] Y. Yazar, op. cit.

Ankara must appeal to Brussels to ensure the most favorable commercial conditions of the transit. At the same time, Turkey discusses with Russia the possibility of laying the South Stream pipeline westward through the Turkish economic zone in the Black Sea. Besides this, Turkey is negotiating with Iran for increasing the gas supplies and discussing with Syria and Egypt a possible extension of the Arab pipeline from Egypt to southeast Turkey.

In terms of EU energy *aquis* harmonization, Turkey is much more reserved. In the Energy Community,[8] Turkey has the status of an observer and points out that until the EU accession negotiations will be reopened (especially the Energy Chapter), Turkey will not actively alter its own legislation to the law of the EU. The Energy Chapter is blocked by Cyprus, which has a bilateral energy problem with Turkey about exploring for possible oil and gas deposits off shore in the East Mediterranean.[9]

Regional energy connections and relations with neighboring countries

Azerbaijan is from its creation for language, ethnic and religious closeness considered by Ankara as a key regional partner. Azeri energy potential played an important role in the development of bilateral relations. Because the border between both states is limited to a few kilometers wide section with the Nakhichevan enclave only, a trilateral partnership with Georgia was imperative for further successful energy cooperation. Creation of an energy transport corridor from the Caspian region by-passing both Russia and Iran was in the geopolitical interests of the USA. The building and commissioning of the BTC pipeline with the capacity of 50 million tons of oil per year[10] decreased dependence of Caspian producers on Russia's exporting routes. South-Caucasus

[8] Energy Community provides to the South East European region a framework in which it can cooperate on: 1. rebuilding its energy networks; 2. ensure the stability vital for investment; and 3. create the conditions in which its economies can be rebuilt effectively. Ultimately it will also support the integration of the region into the internal energy market of the EU. For more, see the Energy Community web site http://www.energy-community.org (accessed on February 1, 2011).

[9] O.F. Sayan, "Turkey's energy policy between East and West," in K. Linke and M. Vietor, eds, *Beyond Turkey*, Berlin: Friedrich Ebert Foundation, 2010. Available online: http://library.fes.de/pdf-files/id/07553.pdf pg 10 (accessed on February 1, 2011).

[10] For comparison, the annual transportation capacity of Druzhba pipeline in Slovakia is 20 mil. ton. "Ropovodná sieť v SR," Transpetrol. Available online: http://www.transpetrol.sk/ropny-priemysel/ropovodna-siet-v-sr/ ([accessed on February 1, 2011).

gas pipeline Baku-Tbilisi-Erzurum with annual capacity of 8.8 billion m^3 was built parallel to the BTC. The increase of its capacity up to 20 billion m^3 of natural gas per year is planned after 2012, so it could provide a necessary connection source for projects of the Southern Corridor. The largest natural gas source in Azerbaijan is Shah Deniz. All its natural gas from phase I (around 9 billion m^3 per year, production began in 2006) is already contracted until 2031. Hope for rapid increase in production of natural gas is connected with Shah Deniz, phase II (up to 18 billion m^3 per year). This investment was, however, already several times delayed and the current European gas glut does not provide earlier perspectives for commissioning of the source until 2017. The EU-Azerbaijan Joint Declaration on the Southern Corridor[11] signed on January 13, 2011 provides without specific volumes, dates or other actions the political framework only.

Creation of an energy transport corridor from the Caspian region by-passing both Russia and Iran was in the geopolitical interests of the USA.

The relationship of Azerbaijan and Turkey were disrupted in 2009–2010 by Ankara's attempts of rapprochement with Yerevan. Ongoing negotiations over the price and other conditions of natural gas imports from Azerbaijan were negatively influenced as well. Tension was eased only after the failure of Turco–Armenian reconciliatory efforts. In summer of 2010 Turkey opened its gas market to direct access by the Azerbaijan State Oil Company SOCAR in exchange for setting the price mechanism for the domestic market and transit into the EU.[12] The signing of the agreement between Baku and Ankara on the creation of a High Level Strategic Cooperation Council on September 15, 2010 symbolically ended the period of tensions in mutual relations.

Turkmenistan, even though it does not directly border Turkey, in terms of its gas potential has a crucial importance to the future success of the EU Southern Energy Corridor. Gas resources located in the recently found deposits on shore in the West of the country and off-shore in the Caspian Sea could be considered for future export into the EU. Gas fields in exploitation at the East of Turkmenistan are already aimed to export to Russian Federation and China.

[11] "Joint declaration on the Southern gas corridor," European Commission. Available online: http://ec.europa.eu/energy/infrastructure/strategy/doc/2011_01_13_joint_declaration_southern_corridor.pdf (accessed on February 1, 2011).

[12] O.F. Sayan, "Turkey's energy policy between East and West," in K. Linke and M. Vietor, eds, op. cit.

Building an internal East–West pipeline will increase flexibility of Turkmenistan's future possible exports. The main natural (as well as political) obstacle for possible trade with EU via Turkey is the Caspian Sea/Lake itself. The unresolved legal status of the Caspian basin implies disputes on the sea border between Turkmenistan and Azerbaijan and there are objections from remaining littoral states as well. On-shore exporting connection through Iran due to the pending issues with Teheran's nuclear program provides theoretical option only. Turkey is actively moderating relations between Turkmenistan and Azerbaijan. In October of 2008 two trilateral committees were created (for energy and political issues), however, no concrete results stemmed from these committees to date.

Iran is a historical rival and a partner to Turkey in the region. From 2006 they are interconnected with a pipeline of annual capacity of 10 billion m^3 of natural gas. Despite the signed framework agreement, the import of natural gas should provide Turkey with up to 9.6 billion m^3 per year, imports were not higher than 5.2–5.6 billion m^3 per year in reality during previous years. Iran's domestic increase in consumption of natural gas during the winter is assumed as reason for inability to supply Turkey with the expected amount. Bilateral cooperation in the energy sphere of both countries is developing cautiously because of international sanctions imposed on Iran. There are plans (in 2007 corresponding memoranda were signed) for building two new gas pipelines (a direct transit pipeline from Turkmenistan and interconnection from an Iranian South Pars field) with the total annual capacity of 40 billion m^3 of natural gas. Turkish state company TPAO has shown interest in taking part in developing gas in the South Pars field, although realization of existing plans is deadlocked. On the other hand, Iranian companies are taking part in the exploration consortiums in the Caspian Sea as well as participating in the construction of the Baku–Tbilisi–Erzurum pipeline.[13]

Energy relations with Iraq have a long history. Iraqi north export pipeline through the territory of Turkey was built in the year of 1976. The pipeline was reopened after the Gulf war, its capacity was increased up to 70 million tons of oil per year and a related bilateral agreement was prolonged for the next 15 years on September 19, 2010 in Bagdad.[14] On the other hand Turkey supplied Iraq with 50 per cent of its demands in oil products (2005). The High Level Strategic Cooperation Council between Ankara and Baghdad is, similarly to

[13] "Baku-Tbilisi-Erzurum pipeline," Heydar Aliyev's Heritage research center. Available online: http://library.aliyev-heritage.org/en/6223906.html (accessed on February 1, 2011).

[14] "Turkey to Renew Pipeline Agreement with Iraq," *iraq-business news*, September 7, 2010. Available online: http://www.iraq-businessnews.com/2010/09/07/turkey-to-renew-pipeline-agreement-with-iraq/ (accessed on February 1, 2011).

Azerbaijan, an important tool of the bilateral cooperation. Presence in Iraq is very important to many Turkish companies. They are proposing to build a gas pipeline connecting Iraq with Turkey parallel to the existing oil pipeline. Turkey principally stands for the territorial integrity of Iraq and at the same time has a separate relationship with the leaders of the Kurdish autonomy movement in the north of Iraq. Absence of a clear agreement upon the division of profits between Bagdad and Kurdish Regional Administration in Erbil is one of the limiting factors in the exporting of hydrocarbons from the north of Iraq.[15]

The construction of the continuation of the Arab gas pipeline depends on the Egyptian decision to export natural gas through LNG terminals or pipelines. With respect to recent social tensions and unrest in Egypt, the decision cannot be predicted.

Russian–Turkish relations are dominated by ambiguity and pragmatism. On one hand some counteracting geopolitical interest and rivalry over influence in Turkish speaking CIS countries is obvious. On the other hand both sides showed the ability to agree upon mutually beneficial economic, strategic and energy projects. The Russian Federation is the largest supplier of natural gas to Turkey, around 20 billion of m3 of natural gas per year is supplied through two gas pipelines in the West and in the North–East of Turkey. Gazprom was able to substitute the Iranian natural gas failures to meet the agreement in 2007 and 2008, thus Ankara views Russia as a reliable partner.[16] The massive order of Atomstroyxport to build a nuclear power plant in Akkuyu along with the Samsun-Ceyhan crude oil pipeline are other unquestionable evidences showing the strategic energy cooperation between the two nations.[17]

In terms of natural gas import Qatar and Algeria are amongst relevant Arabian nations, from where most of the LNG is imported to the gas terminal on the Marmara Sea. Total import of LNG is up to 5 billion m^3 per year. From the

[15] O.F. Sayan, "Turkey's energy policy between East and West," in K. Linke and M. Vietor, eds, op. cit.

[16] According to the Gazprom data (http://www.gazprom.ru/marketing/europe/ (accessed on February 1, 2011)) amounts of Russian gas exports to Turkey were as follows: 18 bcm (2005), 19.9 bcm (2006), 23.4 bcm (2007), 23.8 bcm (2008), 20 bcm (2009).

[17] Based on the press release from Joint Economic Commission between Turkey and Russia from March 4, 2011 available at the Ministry of Energy and Natural Resources of Turkey web site (http://www.enerji.gov.tr/BysWEB/faces/genel/icerik/belgeveResminiGoster.jsp?file=128517 (accessed on March 5, 2011)).

perspective of gas pipeline projects, in the year 2004 a framework agreement was signed between Egypt and Turkey about the supply and transit of natural gas. The Arabian gas pipeline from Egypt northward has only been constructed to Syria. The mentioned agreement assumes supplies of 2–4 billions m^3 of natural gas per year for Turkey and 2–6 billions m^3 of natural gas per year for the EU.[18] The construction of the continuation of the Arab gas pipeline depends on the Egyptian decision to export natural gas through LNG terminals or pipelines. With respect to recent social tensions and unrest in Egypt, the decision cannot be predicted.

Ankara's perspective on the Southern energy corridor

That Turkey has the participation of the EU Southern energy corridor has a three-pronged importance. Besides expecting profits and economic advantages from expanding domestic gas transportation capacities of the East-West pipeline axis, important for the nation's energy security; it provides significant political leverage vis-à-vis to the EU, to the partners in the region involved in the project and in Turkey´s relations with Russia. To simplify it, for Ankara it is not important in which direction resources will continue travel after passing through the border of EU/Turkey. Routes of all three European projects proposed in the framework of Southern Energy Corridor are identical on 80 per cent of the territory of Turkey. In the scope of their realization due to limited accessible sources of natural gas, an intra-European rivalry could naturally occur. In setting out the project, politics will not play a vital role, but participating companies with own direct access to natural gas will play the decisive role. From this perspective, the most viable project is TAP (Trans-Adriatic Pipeline). Norway's Statoil has shares in both consortia developing Azerbaijani gas field Shah Deniz and construction and operation of TAP. From European companies connected with Nabucco, German RWE has important influence in Turkmenistan. OMV and MOL entered into gas exploration projects in northern Iraq. However, natural gas from these sources is due to the political and technical difficulties in a disadvantageous position in comparison with resources from Shah Deniz.[19]

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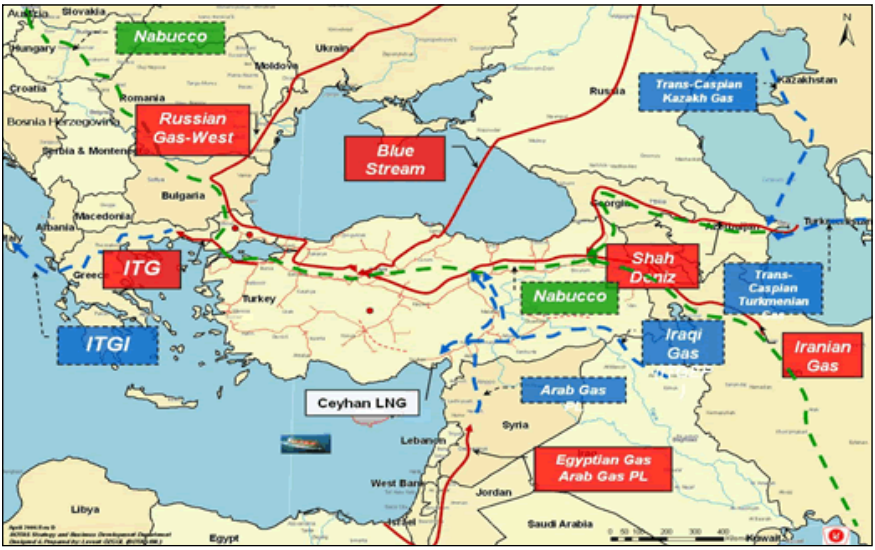
[18] "Egypt–Turkey natural gas pipeline project," Botaș. Available online: http://www.BOTAȘ.gov.tr/icerik/eng/projeler/yurtdisi.asp#03 (accessed on February 1, 2011).

[19] In the Press release to the joint declaration signed on January 13, 2011 in Baku by EC President J. Barroso and President of Azerbaidjan I. Aliev, there is a clear notion that "In the next months, Azerbaijan will make a further decision on which of these pipelines to prioritize." See "Joint declaration on Southern gas corridor," European Commission, January 13, 2001. Available online: http://ec.europa.eu/energy/infrastructure/strategy/doc/2011_01_133 (accessed on February 1, 2011).

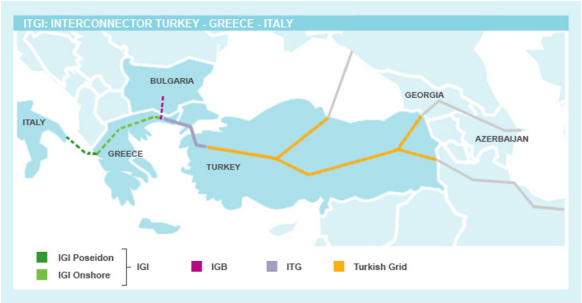
Figure 1. BOTAŞ projects: Turkey as an East–West energy corridor, East–West energy terminal



Source: BOTAŞ Petroleum Pipeline Corporation web site. http://www.botas.gov.tr/images/icerik/harita/BOTAŞProjeE.jpg (accessed February 1, 2010).

An intergovernmental agreement on the gas pipeline Nabucco was signed on July 13, 2009 in Ankara and the Turkish Pipeline Company BOTAŞ owns 16.67 per cent shares in the consortium. The weak point of Nabucco is, is that most of the shareholders of the project are, with the exception of RWE, medium size energy companies. On one hand they are not involved in gas production in the Caspian Sea area and on the other hand they aren't able to guarantee an additional gas market for 10–15 bcm annually in their home countries. Local gas markets in Central and Southeastern Europe are saturated with Russian-imported resources, or under developed. Political assistance from the EU, including symbolical financial aid and support for creation of commercial mechanisms of CDC (Caspian Development Corporation) has not brought the desired effect yet. During different discussions about gas transit for the Southern Corridor, Turkey was allegedly proposing a model similar to the Russian one, where Turkey would not provide transportation services only, but would like to act as a middleman, therefore acquiring more profit.

Figure 2. ITGI Interconnector Turkey – Greece – Italy



Source: "ITGI: Turkey – Greece – Italy gas pipeline", Edison. Available online: http://www.edison.it/en/company/gas-infrastructures/itgi.shtml (accessed on February 10, 2011).

TAP or the Trans Adriatic pipeline is a Balkan project, which will connect with the Turkish transit axis Erzurum–Ankara–Istanbul. The project, created by the Swiss company EGL (owns 42.5 per cent) and German E.ON Ruhrgas (owns 15 per cent), counts on the building of a gas pipeline through Greece, Albania to Italy with the capacity of 10 to 20 billion m^3 of natural gas per year. In terms of costs and active participation of Statoil, this project is considered to be one of the favorites for the Southern Corridor.[20]

TGI or the Turkey–Greece Interconnector and ITGI or the Italy–Turkey–Greece Interconnector are from a Turkish perspective overlaid projects. A linear part of TGI with the length of 296 km was put into commission in 2007. In October of 2009 was a common declaration signed between Turkey and Italy about the lengthening of this gas pipeline. The project still needs to finish building the inter-Turkish connection from Erzurum to the west of the country and increase the output of compressor stations and finish building connection through Greece under the Ionian Sea to Italy. According to expectations the total capacity of ITGI should reach 8–12 billion m^3 of natural gas per year. The Italian company Edison, Turkish BOTAŞ and Greek DEPA are all taking part in this project.[21]

[20] For more see the Trans Adriatic pipeline web site http://www.trans-adriatic-pipeline.com/ (accessed on February 2011).

[21] ITGI: Turkey–Greece–Italy gas pipeline Memorandum of Understanding was signed on October 22, 2010. See http://www.edison.it/en/company/gas-infrastructures/itgi.shtml (accessed on February 10, 2011).

EU–Turkey, what next?

Turkey is a key element in the realization of the Southern Corridor, which could diversify sources and corridors of natural gas for Central Europe and the Slovak Republic. In the situation when membership negotiations and specifically the Energy Chapter are blocked, it would be difficult to count upon Ankara's cooperation and generosity in European energy security matters. Turkey will surely progress in a pragmatic way and support the initiatives of the EU in the Southern Corridor. The economic advantage rather than purely political priorities of the EU, including the gas pipeline Nabucco, Energy Community or approximation of the legislature, will be in its focus.

Strengthening the EU's external energy policy with key production, transit and consumer countries of energy resources announced by the European Council on February 4, 2011[22] establishes a framework for more consistent implementation of the coordination of European external policy and its full enforcement in the European Neighborhood Policy. In terms of relations with Turkey as a candidate country, is however a priority to negotiate the terms of accession into the EU. In implementing the third energy package, and particularly its impact on actors outside the EU, the European Commission approach to Turkey becomes largely similar to the EU position towards Russia. The Russian Federation, due to its own indifference to European integration processes, has no positive motivation to the goals of this energy legislature and defends itself against external effects of its implementation. Similarly, Turkey currently has no political motivation on its acceptance.

Unblocking Turkey's accession into the EU is in the interest of long term energy security of Slovakia, as it will cause a positive political incentive for Ankara to build the Nabucco pipeline. Slovakia would then gain access to an alternative supply of natural gas, which would be crucial if Gazprom decides to dramatically reduce or shut down gas transit through Ukraine or for any future price negotiations. Announced construction of the South Stream pipeline[23] will without any compensation reduce an important part of Russian gas transit through

[22] Conclusions of the European Council, 4th of February 2011, EUCO 2/11, European Council, Brussels, 2011, point 1.12. http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/119175.pdf (accessed on February 15, 2011).

[23] Gazprom in cooperation with Italian ENI is preparing South Stream pipeline project with capacity up to 63 bcm/y. Off shore part of the pipeline which should connect Russian and Bulgarian shores of Black Sea and onshore pipeline should transit and supply gas for Bulgaria, Greece, Serbia, Hungary, Slovenia, Austria and Italy. For more, see http://www.gazprom.com/production/projects/pipelines/south-stream/ (accessed on February 15, 2011).

Slovakia into the EU. The planned Slovak–Hungarian gas interconnection Veľké Zlievce–Vecsés is in terms of Slovak participation at the Southern Corridor an imperative project to be constructed. The expected time frame on "our end" of the Corridor gives us hope that we could be on time with its commission. Without positive decisions made at "the entrance" ensuring cooperation with the production nations, necessary volumes of gas and a cooperative attitude of transit nations along the route, the Southern Corridor concept risks to be only partly created or to remain forever on paper only.

Storms of My Grandchildren.

By James Hansen. New York: Bloomsbury, 2009. 304 pp. ISBN 978-1-60819-200-7.

> "When the history of the climate crisis is written, Hansen will be seen as the scientist with the most powerful and consistent voice calling for intelligent action to preserve our planet's environment."
>
> *Al Gore*

"Global warming is here," James Hansen famously declared in the congressional hearing in 1988. Much earlier, in 1981, after studding evidence, he made a number of predictions for what a warmer world would look like in the beginning of the twenty-first century. Hansen said that the Arctic ice would be retreating dramatically and the fabled "North-West Passage" would open up, making it possible to sail through the Arctic. And it has happened as we have all seen it. Since 1988 an incredible wealth of scientific data on global warming has been collected. The history of the Earth's climate has been investigated by drilling into the Greenland and Antarctic ice sheets. Remarkable advances in computer modeling of our climate have been made. Each year, over 10,000 peer-reviewed scientific papers are published concerning world climate exploration.

The majority of these studies has pointed to one consistent conclusion: the planet is warming more and more rapidly, the frequency, intensity, and scale of natural disasters brought on by global warming is continuing to increase; many regions of our Earth are experiencing prolonged droughts, with subsequent shortages of drinking water and the destruction of entire crop harvests; in other parts of the world, typhoons and hurricanes are causing massive flooding and inflicting immeasurable suffering – a lot of evidence indicates that mankind with its enormous greenhouse gas emissions is to be blamed for these harmful global trends. Within the context of rapidly changing climate and other planetary geo-systems, particularly the unstable ice sheets, Hansen once said:

"Drawing on deep pools of scientific evidence – that the burning of oil and coal is emitting so many warming gasses into the atmosphere that we are now very close to triggering a series of catastrophes we won't be able to stop. The most striking to me, as I looked out over one of the world's greatest ice sheets, is the danger of their disintegration – triggering a massive sea level rise. It used to be agreed that it would take millennia for ice sheets to go, but the evidence now shows this is wrong."

James Hansen, one of the world's best known and most internationally renowned climate scientists, has written, at the age of 68, his first and probably also the last book containing the full truth about the upcoming threat posed by climate change. As a director of NASA's Goddard Institute for Space Studies in New York and a professor at Columbia University's Department of Earth and Environmental Sciences, Hansen has, in recent years, become better known for his climate activism than his scientific research. His book, *Storms of my grandchildren: The truth about the coming climate catastrophe and our last chance to save humanity,* has an impressive sounding title. It refers to the ferocity of extreme weather events that will meet the next generation, if the use of fossil fuels continues unmitigated. Hansen's message is very clear: "the global climate is near tipping points and that the consequences would be irreversible – if we do not promptly slow fossil fuel emissions during the next few decades." Hansen insists very urgently and claims: the Kyoto protocol is not enough, cap and trade will not work, the upper long-term carbon dioxide (CO_2) limit has to be 350 ppm, not higher as has been previously assumed, and all coal burning plants should be shut down. Using numerous charts and graphs alongside accessible explanations, Hansen presents many climate data for a broad audience. After discussing the recent history of global warming science, from the Climate task force of 2000 to his up-to-the-minute CO_2 limit of 350 ppm, Hansen provides recommendations for achieving greenhouse gas reduction, as well as strategies for reducing or eliminating fossil fuel use: "For the sake of our children and grandchildren, we cannot allow our government to continue to connive with the coal industry in subterfuges that allow dirty-coal use to continue." The most significant step, Hansen says, would be creating a cost structure that escalates cost as carbon emissions increase. The only solution, Hansen says, is to "phase out fossil fuels." And the best way to do that, the author contends, is through a carbon tax – or, as Hansen puts it, "a rising price on carbon emissions."

Hansen is a pioneer in modern climate science. His whole-life journey to the unexplored corners of climate change science began in Iowa in with a family of a farmer who left school in the eighth grade. After studying the then-unknown atmosphere of Venus for a decade, Hansen started to study the earth's atmosphere. Shortly after receiving his doctoral degree in 1967, Hansen moved to the NASA Goddard Institute for Space Studies, where he spent his entire career. His expertise in radiative transfer (of energy in the atmosphere) enabled him to develop some of the first computer models of the earth's climate. Studying the changes of atmospheric chemical composition he realized that the radiative effect of the growing amount of warming greenhouse gasses could be dangerous. Hansen claims that if we burn all the world's remaining fossil fuels, there is only one precedent in the climate record for the warming that will occur. It happened at the end of the Permian period 251 million years ago, when the world warmed by 6°C. The consequences

of this exceptionally rapid change were devastating. Almost everything on Earth died at that time (more than 90 percent of terrestrial and marine species were exterminated). Hansen claims that not only CO_2 emissions but also the potential release of another greenhouse gas, methane (CH_4), has played the crucial role in this climate catastrophe in the "end-Permian" event. Hansen discusses the hypothesis that CH_4 clathrates accumulated in the arctic tundra beneath sediment on the seafloor of the oceans (particularly in the Arctic) has been unleashed in enormous amounts into the atmosphere due to warmer temperature and lower pressure of the sea water. These unstable conditions have led to a release of CH_4 (which is 25-times more powerful than CO_2 over the period of 100 years) in gaseous form that triggered stronger warming. Additional warming caused by methane emissions has allowed a chain of positive feedbacks when more methane and more rapid warming could have destabilized even more methane clathrates. Hansen believes this could probably happen again if the increase of CO_2 concentration continues at its current pace. Hansen raises the possibility that methane clathrates may also have played a role in a smaller mass extinction during the Paleocene –Eocene thermal maximum (PETM), which occurred fifty-five million years ago. Hansen warns that humanity is putting CO_2 into the atmosphere today at a rate that is ten thousand times higher than the rate during PETM. Hansen escalates his worst fears about future in the chapter, The Venus syndrome, positing a possible future Earth, in which a "runaway greenhouse effect" takes over. The human race with a population now reaching almost seven billion could have to face an even bigger threat than during the last ice ages if this runaway situation happens. The anthropogenic global warming from greenhouse gasses causes increased water vapor in the atmosphere, which in turn causes further warming. This warming pattern is characteristic for Venus, the planet most similar to Earth, where a very strong greenhouse effect, much stronger than earth's, exists. The conditions on Venus push the surface temperature to the observed temperature of 464°C (867°F), creating a planetary surface hot enough to melt lead. Runaway greenhouse effect could eliminate all life on Earth.

Of course this is a speculation, but Hansen thinks that we are not far from the point when the current unprecedented warming could initiate a loop of very strong and fast positive feedbacks leading to irreversible changes. Although his opponents dubbed him an "alarmist" with an aggressive public posture promoted by himself even when the evidence for modern anthropogenic global warming was not as clear-cut as it is today, Hansen's bold predictions have proven true in the light of up-to-date climate change knowledge. The scientific consensus, and there for more-less conservative, is periodically summarized in the statements of the Intergovernmental panel on climate change (IPCC, the Panel does not make its own research, but only reviews published scientific literature). New findings compressed not only in the last IPCC report from 2007 confirms Hansen's views. The area of Arctic ice is rapidly

decreasing – the melting of sea ice has recently opened up the fabled Northwest Passage – for the first time it was recorded in 2007, much earlier than Hansen envisioned in 1981. The Greenland ice sheet is melting as well, losing more than one hundred cubic kilometers of ice every year. A similar situation is observed in Western Antarctica, which is also losing a significant volume of ice each year. Finally, glaciers are retreating almost everywhere. It is difficult to predict the rate at which the polar ice sheets will melt in the future, but it is clear that when it happens it will be very serious in terms of rising sea level, in particular. If sea level continues to rise at the present rate (3.4 mm/year), it will rise 34 cm in one century. But according to some new studies it could rise faster than the present rate as it has in the past, considering the accelerating melting of monumental ice sheets in Greenland and Western Antarctica. At the end of the last ice age, the sea level globally rose at the rate of 3 to 5 meters per century for several centuries. If sea level rises 5 meters it would submerge most of Florida, Bangladesh, and the European lowlands. In the case that all the ice on the Earth melted, the sea level would rise about 75 meters. It would have serious consequences for all coastal places and cities in the world.

His foray into the ancient climate has led him to change his initial assumption that humanity could make do with a greenhouse gas concentration of 450 parts per million (ppm) in the atmosphere. Hansen believes now that even this would be dangerous. Hansen insists: "It's crucial that we immediately recognize the need to reduce atmospheric carbon dioxide to at most 350 ppm in order to avoid disasters for coming generations." Hansen says that keeping the atmospheric concentration of greenhouse gases (measured in CO_2 equivalent emissions) below 350 ppm should prevent an average temperature from rising more than 1°C above recent levels, which is where the author thinks we need to stay in the long term. That corresponds to 1.7°C above the average pre-industrial temperature, somewhat lower than the 2°C target officially recognized as the cut-off point for avoiding dangerous climate change. In its 2007 report, the Intergovernmental Panel on Climate Change concluded that keeping warming to 2–2.4 °C would mean stabilizing at about 450 ppm. The 2010 level was 390 ppm.

To stop harmful global emissions of CO_2, Hansen recommends four achievable approaches: 1. a "fee and dividend" plan (or carbon tax, which rises every year); 2. a resulting rapid phase-out of coal; 3. reforestation; and 4. rapid development of alternative energy sources, including nuclear reactors of the fourth generation. Hansen recommends to stop the burning of coal by 2030, globally. For instance, China is now building about one coal-fired power plant per week. Hansen assumes that, if coal is phased out over a couple of decades, the world can avoid a catastrophic global warming. To achieve this, Hansen recommends a carbon tax, with the proceeds rebated to the population. The author either urges rejection of the Kyoto treaty and rejection of "cap and trade," which Hansen thinks is a shell game and we

can see it is an inefficient tool to effectively reduce carbon emissions. But from this point of view, the most frequently asked questions are: "How can we do the rapid phase-out of coal? Do we have any replacement for fossil fuels anyway?" Hansen thinks that renewable energy and improved energy efficiency will not be enough. The author also widely recommends fourth generation nuclear power, although it is still at the experimental stage, to take the place of coal. Hansen considers a "fast reactor," which can burn up nuclear waste while generating power. Quite different from existing nuclear power plants, the fast reactor, whose neutrons have a much higher energy than those in a conventional, water-cooled reactor, relies on liquid sodium instead of water as a coolant. Hansen's conclusions in terms of limits of renewable energy and improved energy efficiency have been supported by David MacKay, professor of physics at Cambridge University. In 2009 McKay wrote the outstanding book, *Renewable energy without the hot air*, in which the author concludes that, unless sustainable energy sources cover a large area, their contribution to the national energy supply will be very small and symbolic. MacKay considers five possible energy plans for Great Britain. Each of the plans includes renewable sources of energy: hydro, solar, wind, tide and wave. MacKay assumes that substantial improvements in energy efficiency can be achieved. But every one of the energy plans uses either one of the following: nuclear power, or imported energy from other countries. MacKay is concerned with whether or not it is physically possible to convert from fossil fuels to sustainable energy. His answer is yes, but it will take an all-out effort and include nuclear power.

Notwithstanding the gravity of the present situation, Hansen believes that hope for a "brighter future" has not yet been entirely stifled. Transitioning from the current atmospheric carbon concentration of 390 ppm to the "appropriate initial target" Hansen finds in 350 ppm is in his view still practically achievable, though "just barely." Though initially skeptical about the place that geo-engineering schemes should have in the struggle against climate change, Hansen does conclude that such options may become necessary if business-as-usual is continued for the foreseeable future. Hansen eschews the hegemonically favored "cap and trade" approach for what is referred to as "fee and dividend," a framework whereby fees are collected at the mine or port of entry of a given fossil fuel and then divided equally among legal adult residents of the public. Hansen envisions these fees as rising over time. Many of Hansen's practical recommendations for stepping away from the climatic abyss surely merit attention and implementation, as do some of the perspectives advanced in the fictional future-historical account with which he closes the work's final chapter.

Only some crucial moments arising from the message given by James Hansen have been mentioned in this review. In this well written and well presented book the author gives us a message that is much more severe than what we usually hear.

These conclusions will be indeed unwelcome by many people, but the book deserves to be widely read, because the climate change is a problem for all of us, as Hansen highlighted in this quote: "It is crucial for all of us, especially young people, to get involved" in what "will be the most urgent fight of our lives. It is our last chance."

Jozef Pecho
Institute of Atmospheric Physics,
Academy of Sciences
of the Czech Republic

Contributors

Alexander Ač studied environmental ecology at the Pavol Jozef Šafárik University in Košice and gained his PhD at the University of South Bohemia in the field of applied ecology. He currently works in Brno at the Global Change Research Center of Academy of Sciences of the Czech Republic, where he focuses on ecological physiology of plants. The other main scientific interests are climate change and its impacts on natural ecosystems and human societies, peak oil and its implications on economic growth, energy and social security. He runs a popular blog dealing with climate change, peak oil and financial crisis.

Zbigniew Michal Karaczun is an associate professor at Warsaw Agricultural University. During 1993–1997 he was a director of the Climate Action Network Central and Eastern Europe. Between 1999–2002 he was an EU integration adviser to the Polish Minister of Environment. In 2002 he was on a team to prepare *ex ante* assessment of the *National development plan* as well as the Strategic environmental assessment to this plan for which in 2003 he was awarded a prize of Minister of Environment. From October 2003 to June 2004 he was on the Steering Committee for the transportation part of the Cohesion Fund. He is a member of the Polish Ecological Club. He also works as an expert and adviser to the Polish ENGO Climate Coalition. His research is focused on ecological and climate protection policy issues and the integration of the climate protection objectives into agricultural policy.

Milan Lapin studied physics at Comenius University in Bratislava. In 1982, he got his PhD in meteorology and climatology. In 2005 he became a professor of physics. In 1971–1996, he worked at the Slovak hydrometeorological institute. Since 1996, he has been working at the Faculty of mathematics, physics and informatics of the Comenius University. He is also one of the initiators of the National Climate Program of Czechoslovakia established in 1991. Between 1999–2007, he reviewed, on behalf of Slovakia, the Intergovernmental panel on climate change reports. He was a member of several international committees and working groups. He has been the member of the editorial boards of several journals and a member of five scientific

boards. He spent several research stays abroad. He has been promoting issues of meteorology and climatology in various electronic and printed media. His web portal on Climatic change is one of the most visited in Slovakia and abroad.

Juraj Mesík graduated from the Faculty of Medicine of Comenius University, Bratislava and started his career in biomedical research. In 1989 he was appointed Member of Parliament in the Czechoslovak Federal Assembly and elected founding chairman of the Green Party. He later served as a department director at the Federal Ministry for Environment in Prague and advisor to the minister. After the split of Czechoslovakia he worked as director of the Ekopolis Foundation. He also served on a large number of non-profit boards at home and internationally. In 2003–2008 he worked as senior specialist at the World Bank in Washington D.C. working in many countries around the world – most actively in Moldova, Kenya, Nigeria, Tanzania and Thailand. In 2004, he initiated the Global fund for community foundations. He was awarded the Eisenhower exchange fellowship in Philadelphia, the Salzburg seminar fellowship and Synergos senior fellowship in global philanthropy. He continues to work as a World Bank consultant and teaches about global challenges at universities in Olomouc and Bratislava. He is the author of numerous commentaries and analytical articles.

Urban Rusnák graduated from the Moscow Oil and Gas University, Faculty of Geology, Geophysics and Geochemistry in 1990. He has served in various positions in Czechoslovakia, and later in the Slovak foreign service since 1992. In 1994–1998 he worked as a Deputy Head of Mission at the Slovak Embassy in Ankara where he also gained his PhD at Ankara University on Public Administration and Foreign Relations in 1998. During 1999–2000 he was the Director of the Slovak Institute for International Studies. In 2000–2003 he served as the first Executive Director of the International Visegrad Fund in Bratislava. During 2003–2005 he worked as a Deputy Head of Analyses and Policy Planning Department at the Foreign Ministry. In 2005–2009 he was the Slovak Ambassador to Ukraine. Since May 2009, he has been responsible for the External Energy Security project at the Slovak Foreign Ministry.

Guidelines for Contributors

Although many articles are commissioned, unsolicited articles are welcomed. Authors may expect to hear a decision within two months of acknowledgement. International Issues & Slovak Foreign Policy is a refereed journal.

Articles should be original and deliver the data that are accurate, meaningful and timely. It should not be under consideration elsewhere. The text should be submitted to editors in the simple Word document format with and abstract summarizing the main points. The length of contributions should not exceed 6,000 words.

Quotation should be clearly gathered in a manageable proportion as footnotes. Footnotes should be presented as follows:

Books

P.J. Katzenstein, *Tamed Power Germany in Europe*, London: Cornell University Press, 1997, pp. 195–6.

Articles in journals

I. Samson, "The Visegrad Four: from Loose Geographic Group to Security Internationalization?", *International Issues & Slovak Foreign Policy Affairs* Vol. XVIII, No. 4, 2009, pp. 57–73.

Articles in Volumes

Z.M. Karaczun, "Polsko – Jederné plány", in K. Polanecky, J. Haverkamp, eds, *Energie budoucnosti? Jaderná energetika ve Střední Evropě*, Prague: Heinrich Boll Stiftung, 2010, pp. 20–4.

Articles in newspapers:

"Črtá sa podoba novej Európskej komisie", *Sme Daily*, January 7, 2009.

Articles available online:

"Ivan Korčok: Východná Európa žiada férové zastúpenie v Európskej zahraničnej službe", *EurActiv.sk*, March 25, 2010. Available online: http://www.euractiv.sk/obrana-a-bezpecnost/interview/vychodna-europa-ziada–ferove-zastupenie-v-europskej-zahranicnej-sluzbe-014799 (accessed on March 12, 2011).

Documents

"Eastern Partnership. Communication from the Commission to the European Parliament and the Council. Commission of the European Communities", COM(2008) 823 final, {SEC(2008) 2974}, European Commission, December 3, 2008. Available online: http://eeas.europa.eu/eastern/docs/com08_823_en.pdf (accessed on March 11, 2011).

Editor reserves the right to structure the text by adding sub-headings, unless this is already done by the author. Articles should be written in English. Authors will be sent the edited and proofread articles for checking on the understanding. Contributors of accepted articles will be asked to assign copyright to the publisher.

We also welcome reviews of new books (1,500 words).

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