

Interview with Prof. Zbigniew Kundzewicz and Prof. Eugeniusz Mokrzycki

Climate Facts and Possibilities



Vattenfall

Germany's Schwarze Pumpe, the world's first and so far only zero-emission power plant using carbon capture and storage (CCS) technology

Academia: Is the climate definitely getting warmer? Recently there has been talk of climate cooling.

Zbigniew Kundzewicz: I cannot agree with the notion that world temperatures have dropped. Everything depends on how one compares data. If we look at January 2008 against January 2007, as global warming skeptics do, there is indeed a considerable drop globally, although not in Poland. Yet the overall trend points to a constant warming. 1998 was the warmest year, but all the years from 2001 to 2008 were among the top nine warmest since recordkeeping began in 1850. And so if we compare the very warm 1998 to 2008, we

see no warming. But if instead of the calendar-year perspective we consider each period of 12 successive months, the record for Poland, for Europe, and for the whole northern hemisphere came in the period from July 2006 to June 2007. Those 12 successive months were clearly the warmest in the history of recordkeeping. The Met Office in the UK is forecasting that at least half of the calendar years 2009-15, which means at least four of the seven, will break the temperature record set in 1998.

Is warming definitely the work of mankind? The reliability of the models used has been challenged.

Z.K.: The models do have many weak points, but we have nothing better. Although shoddy, the models nevertheless enable us to identify the global temperature in rough terms. Many different climate models that take account of natural factors alone - chiefly the intensity of solar radiation and volcanic eruptions - have been tested against the global temperature changes seen over the past century. It turns out that if the anthropogenic factor is not provided for the rising concentration of greenhouse gases in the atmosphere, then atmospheric warming has no justification, just the Sun and volcanoes alone cannot account for it. Nothing aside from the intensification

of the greenhouse effect can explain it. The skeptics say: the planet was once much warmer. But the current conditions are unique. The deepest ice-drills indicate that never in the past 650,000 years has there been as much atmospheric CO₂ as there is now. The models still cannot cope with many aspects, but they are improving.

Haven't warming forecasts been getting milder?

Z.K.: The discrepancies are not essential. The IPCC report sums up existing research – it does not generate new information, but looks synthetically at what has been published and tries to identify some deeper sense in it. The models are getting better, our confidence in them is growing. If the forecast range of changes is becoming somewhat narrower, I would see that as a positive thing. I am by no means a panic-monger: for Poland these problems are still very far-off, and some warming will not be all that bad for us. The European Union has settled on a certain simplification – as politics of course prefers simple situations. It announced that if we try very hard we can limit global warming to 2°C above pre-industrial levels, but if we do nothing the rise will be 4°. Those are very simplified, straightforward figures that one might not lend credence to. They are more like symbols. If you forced a specialist to cough up precise figures rather than ranges, those are probably the numbers she or he will give. 2° will result in consequences that can still be coped with.

Can climate change be halted?

Z.K.: There is a chance, but the climate machine has a lot of inertia to it. And we cannot control the Sun – although some have gone so far as to suggest a planetary experiment, releasing a huge quantity of particles into space to reduce solar radiation, with even a Nobel Prize laureate in chemistry endorsing the notion. We also cannot control

volcanoes. There are only two factors we have a considerable influence over. One, the makeup of the atmosphere, i.e. its greenhouse gas content, and two, land-surface properties, like permeability or the albedo, or how much solar radiation gets reflected from or absorbed by the Earth's surface. Snow reflects it, bare ground absorbs it.

Are we up to fighting climate change?

Z.K.: A report by British economist Lord Nicholas Stern estimates that climate change will cause a 5% drop in world GDP, as a conservative guess. If we take other factors into account, it could drop as much as 20%. In Stern's view, protecting the world's climate against the worst consequences would require spending around 1% of the GDP. Many people protest that this is an oversimplification, but if true it is not so bad and globally we would be able to afford such a price. However, each country is a separate story. Denmark, for example, has lowered

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its energy consumption and CO₂ emissions tremendously, while at the same time significantly boosting its GDP – it is proud to have the best technology, to be able to earn money and show the world the way forward. They are where everyone would like to be, and that is possible.

Even for Poland?

Z.K.: More than 90% of Poland's energy sector is based on coal. We have some potential for biomass. Wind power is a mixed bag: some windmills have been erected here and there, but they are not spinning since the wind does not always blow. The story is similar with solar cells, although there are places where they

are being installed on a large scale on apartment buildings and single-family homes, with residents expecting them to pay for themselves in eight years. But all of these things depend on how the economic parameters are set. Everything will look different when we really have to cut emissions and foot the bill that entails. Then the calculations will be completely different.

Shouldn't we invest in adaptation?

Z.K.: Wealthy countries are of course able to take preventive measures. We can imagine the Netherlands building even higher dykes against the sea and large rivers, because it can afford to. But how pleasant will it be to live behind such high dykes? If we fail to counteract climate change, such adaptation will become very difficult and costly, or even impossible.

Will we have to completely abandon traditional fossil-fuel based sources of energy?

Eugeniusz Mokrzycki: I don't think so, because renewable energy sources can now only satisfy part of the demand. Practically speaking, our energy will have to continue to come from fossil fuels whether we like it or not. Aside from that, all forecasts for the consumption of primary energy carriers worldwide predict further increases, especially consumption of coal, which is still available in sizeable quantities. Fossil fuels will therefore continue to be harnessed, although we are all aware that they are the "dirtiest" in terms of CO₂ emissions. However, low-emission coal-combustion technologies are now being introduced, and I suppose they will already be in broad use in 2020.

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Jocelyn Augustino/FEMA

The aftermath of Hurricane Katrina made the world more aware of the potential cost of failing to counteract global warming

Great hopes are especially being pinned on carbon capture and storage (CCS) technology. Is it already in use?

E.M.: Right now only in Germany, which has a pilot facility that pumps CO₂ underground. But we should recognize that CCS is not the only option. For instance, we can strive to reinforce ecosystems, since CO₂ is absorbed by plants. Another method involves storage in the oceans, and a third is mineral sequestration, which traps CO₂ inside rocks.

How safe is it to pump CO₂ underground?

E.M.: CO₂ can be stored in old oil fields, natural gas wells, or deep aquifers. The potential for storing CO₂ in deep, unminable coal seams is also being studied. While the latter methods are in their

infancy, the technology for oil well storage has already been in use for some time. The industry now very widely uses the method of pumping carbon dioxide into an oil reservoir in order to push more petroleum out. The same thing can be done with natural gas fields. In my view this technique is safe: if nothing went wrong when natural gas was mined from such a field and the gas did not leak out to the surface on its own, the carbon dioxide pumped in to such reservoirs will also not leak out. The only problem might be sealing off the drill holes. Storage within deep geological structures is very complex, because the rocks should have the right properties to be able to absorb the carbon dioxide. Secondly, there has been a lot of talk about capturing and storing CO₂, but very little discussion about its transport, which according to the EU Directive is to be handled by the

country in question. That entails quite large costs. The state will have to build pipelines running from CO₂ producers to storage sites. They could be dangerously at risk of acts of sabotage.

And what are the costs of implementing CCS?

E.M.: According to a report by EnerSys, if we assume that generating 1 MWh now costs 140 PLN, implementing CCS will raise that cost by 90–100 PLN, up to 230–240 PLN per MWh. Those are preliminary estimates. In my view the real costs will be somewhat higher, because various things crop up during implementation. In a nutshell, CCS will practically double energy production costs.

You mentioned the possibility of storing CO₂ in mineral form, a method that

has not attracted much discussion. Is it sensible?

E.M.: Mineral sequestration is based on having CO₂ react with naturally occurring minerals, to transform silicate minerals into carbonate minerals. One ton of serpentine can store around half a ton of CO₂, while one ton of olivine can sequester around two-thirds a ton of CO₂. Waste products can also be used here, especially fly ash from coal-fired plants. Such material is then deposited into cavities left behind by coal mining. The problem is that a power station generating 500 MW, let's say, will produce around 10,000 tons of CO₂ per day and will therefore require around 30,000 tons of silicates. That is a colossal amount of raw material, posing problems of how to mine and transport it. However, the method does have considerable advantages. The CO₂ is locked away for good.

Deposits of fossil fuels are limited, so we will ultimately have to find another solution. Wouldn't it be better to do so now?

E.M.: We have to develop in many directions. As long as we have fossil fuels we should use them, while developing other sources of power generation in parallel. Please remember that there are countries and regions where electricity consumption is still very low, but the people there have aspirations and their consumption will increase. In parallel we need to develop both renewable energy sources and nuclear energy. We will not be able to sustain power production on current levels if we move away from conventional energy sources now – partly because renewable sources are very costly. Although natural energy sources are described as just waiting there for the taking, who will use such energy if we cannot afford it? In my opinion, renewable energy sources will only be of local significance in Poland. We should not delude ourselves that they will be able to meet most of our

country's energy demand, but they should be supported where the right conditions are in place. The state has the right instruments to do so. But it is not true, as some people claim, that Poland is just sitting on heaps of renewable energy.

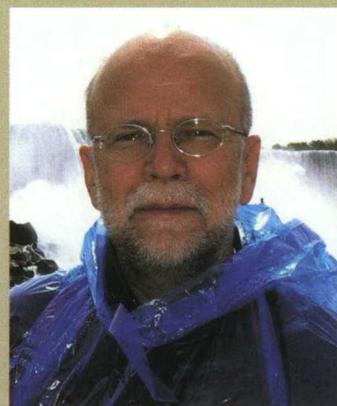
What about geothermal energy? Some say Poland has large resources.

E.M.: We do indeed have extensive geothermal waters, but most of those resources are characterized by relatively low temperature and high mineralization. As a result, using them is difficult. In my opinion, persuading society that geothermal energy will one day be one of the main renewable energy sources is misleading. However, many locations do have local conditions conducive to exploiting such energy. Even small amounts of geothermal energy can be exploited using heat pumps. Geothermal energy can also be easily coupled with natural gas energy. Old or abandoned holes drilled for prospecting or extraction of natural gas and oil, which Poland has large numbers of, can be utilized in geothermal installations. Those are arguments in favor, but there are also obstacles. The main one is the lack of coherent state policy in this regard. The existing regulations are insufficient. Geothermal installations face significant taxation and fees, while the installations themselves are very expensive.

But they would be cheaper if existing drill holes are used?

E.M.: Yes, because in order to access waters at temperatures above 200°, one has to drill down 3 km or more. That costs an awful lot. If such energy can be used to heat a city, such as Zakopane, Łódź, or Mszczonów, then it will make sense.

Interviewed by
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Prof. Eugeniusz Mokrzycki, director of the Kraków-based Mineral and Energy Economy Research Institute, Polish Academy of Sciences, is interested in the political and economic aspects of energy sources utilization and in the global fuel and energy economy. He has authored and co-authored dozens of research articles and over a dozen monographs.