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**“If People Don't Care about their Children and Grandchildren, They Don't Need to Do Anything”.** At the beginning of February 2010, 55 countries made a voluntary decision to reduce greenhouse gases in the atmosphere by 2020. Thus the countries met the engagements their leaders took at the Climate Conference in Copenhagen in December 2009. At the same time, there are a lot of people who suggest that global warming is a myth, created by organizations who are interested in governments' billions. **The New Times asked a Nobel Prize laureate in Economics, the Intergovernmental Panel on Climate Change (IPCC) leading author, and Professor Emeritus at Stanford University Kenneth Arrow for comments on this issue**

*Kenneth Arrow – Catherine Verkhunova and Dmitry Krylov*

**Could it be that global warming is only a fiction created by climatologists who are fighting for grants?**

No, it is not a fiction. The issue isn't really whether the Earth is warming up – I think that's unquestionable – the question is: by how much and what is the speed of change? This is where the problems come from for scientists.

**— The mankind is the one in charge —**

**Why did this misfortune happen?**

The source of all energy on the Earth is the Sun. The Sun warms up the surface of the planet. The Earth is suspended in space and space is very cold, essentially, close to absolute zero. So, why does not the energy radiate out like it does on the Moon? It must be because of the atmosphere, which is mainly made up of a mixture of nitrogen (79%) and oxygen (20%). These gases are very important to us to breathe and gain energy, but they have nothing to do with the temperature of the Earth because they are transparent.

Well, it turns out that there is a whole bunch of gases the volume of which is very-very small compared to that of oxygen and nitrogen (1%), but they are the ones that do count. There are about 20 gases which absorb infrared radiation, very low frequency radiation, but do not radiate the energy out. And the leading gases that do this are water vapor, carbon dioxide (CO<sub>2</sub>) and methane. That is how “the greenhouse effect” works.

Because man started to burn much more fuel than he did before the Industrial Revolution in the XVIIIth century CO<sub>2</sub> started to accumulate in the atmosphere. So, the temperature of the Earth started to increase slowly. A great Swedish chemist whose name is Svante Arrhenius (A Nobel Prize laureate in Chemistry 1903 who did a number of calculations arguing that industrialization influenced climate change. – *The New Times*) wrote about this causality in the beginning of the XXth century.

**There are theories that say that the global climate change is a cyclical process, and in this case human influence is negligible.**

It is true that the climate changes overtime: there are warm and cold periods. The thermometer was invented between the XVIth and XVIIth centuries but we have some evidence of weather based on things like records from the English monasteries that grew grapes and made their own wine early Middle Ages. That is why we have information about the climate around the year 1000. There are paintings of the Netherlands, dated 1400 to 1800, and you find they're always skating on the canals. Now the canals in the Netherlands still freeze occasionally... once in every 5 to 7 years. So, we do have evidence of climate variations. But we don't know if it happened to the rest of the world, whether it's global enough – there is no really good evidence. So, these changes could have been caused by the Gulfstream shifting or the terrestrial axis moving. If you go thousands of years back you will find that in Sahara desert around 500 BC there was a lot of rainfall. There is evidence saying there were woods there and so forth. We do have fluctuations which cannot be ascribed to human activity because there were not many humans and they were not doing that much – only burning a few fires, maybe. Nevertheless, we absolutely know that emission of CO2 causes warming, and the reason is man's activity.

### **— The Price of Degree —**

**Why should people spend billions of dollars on mollifying global warming if they don't have insurances that there'll be positive outcome?**

The current level of CO2, according to Sir Nicolas Stern calculations, that I trust, is 430 parts-per-million (The measure used for CO2 emissions. – *The New Times*). Before the Industrial Revolution it was 280 ppm, and if no change is made, it will reach 550 ppm by 2035. And this means that the temperature will increase at least by 2°C. With 50% chance, by the end of the century it'll rise by 5°C. These changes will negatively affect the world economy. The Stern Report predicts a GNP reduction of about 20% by the year 2200. And I am not mentioning social disasters caused by rising sea-level, which will affect, for example, Maldives, some part of Bangladesh or Manhattan.

**What if we take into consideration the present day situation instead of the long-term effects?**

MIT scholars demonstrated that global warming changed temperature of the World Ocean and it raised the number of storms and their power. For many countries, including the USA, it is a serious problem. Because of Katrina hurricane the American insurance companies paid \$50 bln to their clients in 2005. But we can prevent emitting carbon dioxide into the atmosphere. And if the world community solves this problem we can at least lower the speed of the warming.

**So, when can this happen?**

In a century or a half, if 55 countries realize the liabilities they recently announced. Scientists have different calculations regarding the link between CO2 reduction and projected decrease in temperature. Some of them deal with fractions of degree Celsius, others with several degrees. But the most pessimistic predictions can turn out more positive than the reality which the next generations will face. The risks can be much higher!

**How will the situation change if mankind does not fight against the warming?**

Let's consider two options. One – the world community spends money and tries to prevent

global warming. But in 50 years people conclude that they do not have any positive outcome. What would they have, then? New technologies and ecological production. In the second case people do not do anything. And what would we have in the same period? There are no new technologies, environmental pollution at the same level, and risks are higher. How do we want it to be? Of course, if people don't care about their children and grandchildren, they don't need to do anything...

### — Expensive alternative —

#### **What economic tools will be effective in this case from your point of view?**

Economists have a universal receipt: “If you do not like something, tax it”. That is why many governments in the world, like those of the U.S. and France, for example, are going to apply a carbon tax.

Another way is regulation and licensing. The world community fixes a volume of gas emissions and tries to decrease CO<sub>2</sub>. If a country does it quite well it could sell quotas to countries which exceed their limits. Companies could sell or buy quotas in the same way.

The third way is to subsidize development of new technologies which will produce the same amount of energy with lower CO<sub>2</sub> emission. It's lower, for example, with natural gas than with oil, less with oil is than with coal, and nuclear energy has no CO<sub>2</sub> emissions – it has effects of a different kind. But we should think about a nonproliferation problem.

#### **Does it mean that solar batteries, wind energy, and electromobiles are people's future?**

Alternative energy sources cover only 6% of our needs. By the way, any energy transformation is costly. Electromobile works on electricity, but we need to produce electricity for it. The recent calculations I saw show that we don't enjoy any benefits using an electromobile because we need to burn the same volume of natural gas or oil to build and maintain it.

Solar batteries are a great idea but it is very expensive to produce components for batteries (photovoltaic cells) – it is 5 times cheaper to use traditional energy resources (gas or oil). Moreover, we need to store solar energy because we want to use it on rainy days or at night. And this is expensive too. Geothermal recourses and wind energy are limited because of the location.

Nuclear plants produce around 20% of the energy, and countries will use it more and more in future, I think. Yet we need to think of what to do with nuclear wastes.

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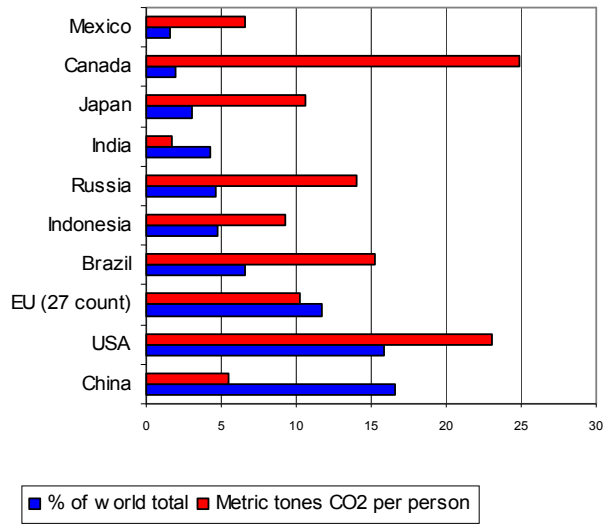
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**Kenneth Arrow** is 88 years old. He is the author of “Arrow's impossibility theorem” which became one of the few axioms in political science. In collaboration with Gerard Debreu, he proved existence of a market clearing equilibrium. Incorporation of the notion of uncertainty into economic theory owes a lot to Arrow's work. In 1972 he was awarded the Nobel Prize in Economics (jointly with John Hicks) for “pioneering contributions to general economic equilibrium theory and welfare theory”. Kenneth Arrow won the John Bates Clark Medal (1967) and the National Medal of Science (1957). He is one of the co-editors of *The Annual Review of Economics*. Arrow's fundamental monograph “Social Choice and Individual Values” was translated into Russian (2004).

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### The Largest Producers of Greenhouse Gases in the World



**Source:** Climate Analysis Indicator Tool, World Resources, 2005