Things Hidden by the Global Warming

Yoshiaki Fujii[1] and Hideho Abe[2]
[1]Rock Mechanics Laboratory, Hokkaido University, Sapporo, Japan
[2]Komatsu Ltd., Tokyo Japan

Abstract: Problems against the human beings to survive for the coming 100 years were deliberately investigated. It was clarified that most of such problems as exhaustion of resources, food crises etc. could be solved by preventing population increase in less developed countries. A way to ethically do it for more developed countries is to financially help less developed countries industrialized. It was also clarified that efforts to mitigate temperature rise by reduction of anthropogenic CO_2 emission will result in unbearable economic loss or, on the contrary, economic growth, more CO_2 emission and more fossil energy consumption depending on assumptions. The unnecessary efforts, anyway, should be immediately stopped and the efforts for population stabilization and other important issues should be urgently begun.
Keywords: Population increase, Food crisis, Water shortage, Global warming, Population stabilization

Introduction

Some people think that the global warming is the most serious problem for human beings as this issue was the main theme of Hokkaido Toyako Summit, Japan in 2008. However, we have such serious problems as population increase, exhaustion of resources, food crisis etc. to be solved. The objective of this paper is to clarify relationships between those problems and to propose how we should do for human beings. Problems which would arise in 100 years are considered since the authors believe that no one can predict the world after 2100.

Relationship between problems

Fig. 1 shows the result of a questionnaire for approx. 200 students mainly in Faculty of Engineering, Hokkaido University, Japan, asking what the most serious problem for human beings is. Number of students who think that the exhaustion of energy and mineral resources is the most serious problem is the most. Global warming and population increase follow. It should be noticed that not the most students think that the global warming is the most serious problem for human beings. However, we cannot obtain much from such questionnaire.

The problems are very different in nature and they are strongly affecting with each other. A diagram which shows the direct relationships between the problems was therefore drawn for deep considerations (Fig. 2). Population increase accelerates food crisis, water shortage and exhaustion of energy and mineral resources. Global warming is also accelerated by population increase if the main cause of it is anthropogenic CO_2 emission. The question mark is put since the authors are not sure about the cause of global warming.

Water shortage accelerates food crisis but decelerates population increase since some people may die due to water shortage. Note that the authors do not wish people to die. However, possible effects by causes are described here without any ethical considerations to clarify the relationships between problems.

Food crisis also decelerate population increase. Exhaustion of energy resources accelerate food crisis since agriculture requires huge energy resources. The exhaustion decelerates global warming under the above assumption on the cause of the warming.

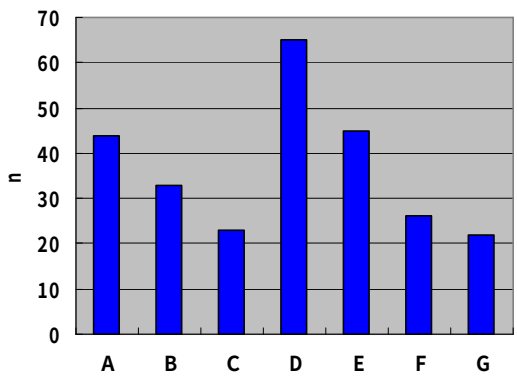


Figure 1. Answer for a questionnaire for approx. 200 mainly students in Faculty of Engineering, Hokkaido University asking what the most serious problem for human beings is. A: population increase, B: food crisis, C: water shortage, D: exhaustion of energy and mineral resources, E: global warming, F: economic crisis, G: others.

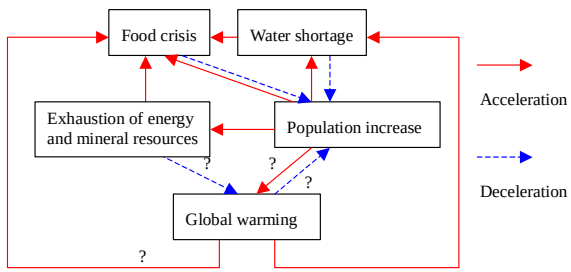


Figure 2. Direct relationships between the problems.

Global warming may accelerate water shortage. The authors are not sure its effects on food crisis since some cultivated area will be abandoned but huge area would become suitable for cultivating. Even Ministry of Environment, Government of Japan

which usually emphasize the seriousness of global warming states that rice crop may increase by 20% by adjusting the growing method to global warming [1]. Population increase may be decelerated by global warming if frequency and degree of such weather as typhoon, heavy rain are increased by global warming. However, the question marks are put to the effects of global warming since they are not clarified enough.

The famous "Limits to Growth" [2] was written based on numerical simulation results obtained by formulating the above and other causes and results as well. However, we can easily realize even without such simulation that the population increase is the origin of all the above problems.

Population stabilization

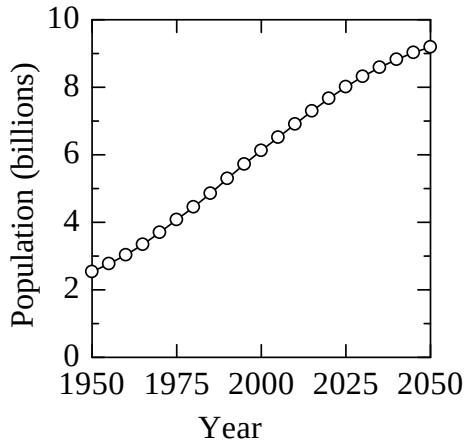
Fig. 3 shows the population of the world and Japan in the past and prediction based on the moderate scenarios. World population is approx. 6.5 billion in 2008 and predicted to increase to approx. 9 billion in 2050. It is apparent that we will be confronted to a catastrophic population decrease regardless if the global warming is a fatal problem or not.

Reason of the population decrease may be food crisis, energy and mineral resources shortage, water shortage and then wars induced by them. A rather stable world will appear after the population decrease. It would be ethically correct to avoid such catastrophic population decrease although the authors have no idea on the quality of the human lives of the world after the population decrease. Apparently, we have to stabilize population first.

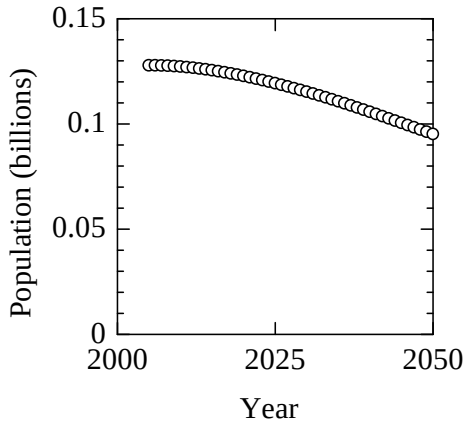
There would be many ways to stabilize population. However, some of the ways would not be ethical and impossible to be carried out in practice. For example, Chinese government policy is criticized from many aspects. Actually, it is very sad that Chinese rather old parents who lost their only one child by the earthquake in Sichuan, China in 2008 are trying to have new babies. Some may worry that population stabilization can lead to eugenics. Careful consideration should be made.

Japanese population as an example of the more developed region is approx. 0.13 billion and decreasing from 2007. The decrease is predicted to continue. Fig. 4 shows the population for the less and more developed regions. The stabilization target is apparently the less developed regions.

Fig. 5 shows crude birth and death rate in Mexico and their prediction. Death rate decreases as average income increases and improvement of medical services. Birth rate is high when a country is poor since people needs a number of children who work and feed parents when they get old. As the country getting developed and pension system becoming better, number of children needed by those parents decreases. Increase of nuclear families and increase of highly educated women who have full-time jobs also accelerate the decrease of birth rate. The increase of death rate after its minimum might be due to lifestyle-related illnesses and the society aging. The birth and death rates are predicted to cross with each other in approx. 2050 for the case of Mexico.



(a) World [3]



(b) Japan [4-5]

Figure 3. Population in the past and prediction (moderate scenario)

Fig. 6 shows crude birth and death rate in Japan and their prediction. It is incredible that the shapes of those rates are almost the same for the two countries which are very different in many aspects. The birth and death rates already crossed in 2007 in Japan and population decrease is predicted to continue.

The feature of birth and death rates are almost the same also for BRICs although that for Russia is slightly different from those for the other countries. It is estimated that there would not be a significant difference for the other countries in the world. An

ethical way to stabilize population therefore would be that the well developed countries financially help less developed countries to accelerate the decrease of birth rate. The effects of this countermeasure can be illustrated in Fig. 7. Thick lines denote birth and death rates with the early crossing and the less maximum population.

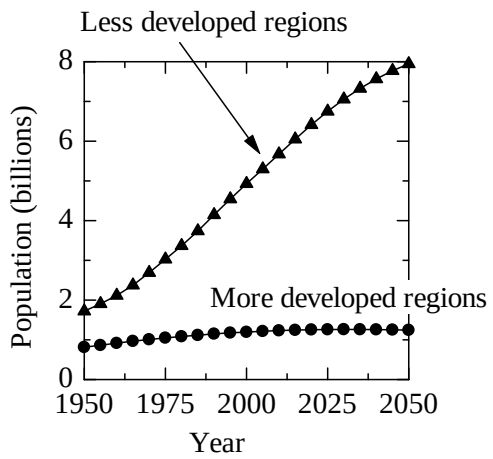


Figure 4. Population of the less and more developed regions [3].

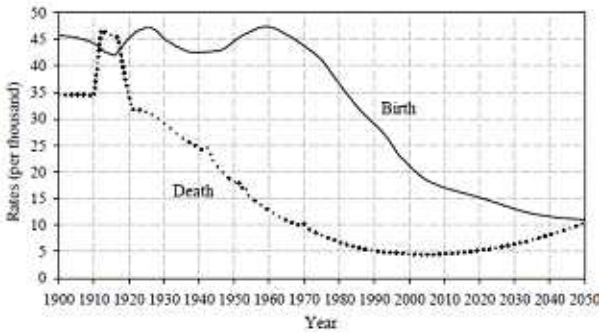


Figure 5. Crude birth and death rate in Mexico and their prediction [6].

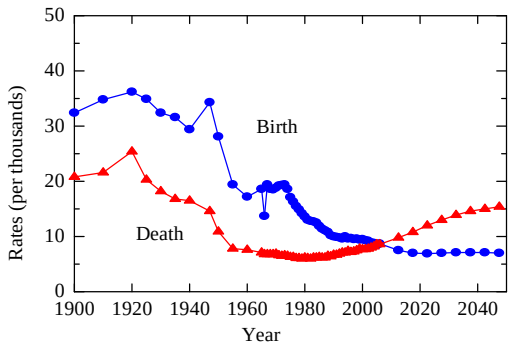


Figure 6. Crude birth and death rate in Japan and prediction [4-5].

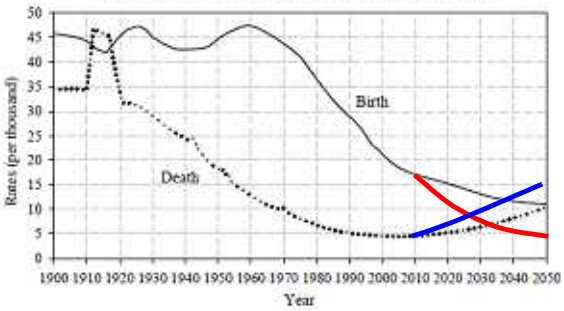


Figure 7. An image of population stabilization by financial aids.

Other problems

The other problems are considered in this chapter under the assumption that the population will soon be stabilized. Otherwise, all problems would be accelerated by population increase and can be fatal. Also remember that the discussion is limited for the coming 100 years. No one knows how the 22nd century's world is.

Table 1 shows R/P (reserves to production ratio) of energy resources. Crude oil can be exhausted first. R/P of uranium also would not be enough if number of nuclear power plants significantly increased for reduction of anthropogenic CO_2 emission. However, it can be realized that basically we have no energy exhaustion in the coming approx. 50 years.

It can also be said that we do not expect exhaustion of energy resources if extraction methods are improved or developed for such resources as oil sand, oil shale and methane hydrate. Uranium can last for much more than 100 years if such new technology as Fast Breeder Reactor is developed and commercially available. The technology, which uses MOX fuel (Mixed Oxide Fuel, mixture of uranium 238 and plutonium) and is being introduced in Japan, however, can't contribute to reduce uranium consumption since it reduces just approx. 20% nuclear fuel.

R/Ps of some mineral resources are very short (Table 2) and will be exhausted before 100 years. However, due to rise of price, R/P can increase before exhaustion, recycling will become feasible and substitutes will be developed. Exhaustion of mineral resources therefore will not be a very serious problem as long as technology development continues.

Water is already short and the shortage might be accelerated by the global warming. Sooner population stabilization is required. Food also is already short in some country. The shortage would be accelerated by the accelerated water shortage. Sooner population stabilization is strongly required again. However, food crisis at present is mainly occurring in those countries which are having political problems, or a war with other countries or

within the country. This research, unfortunately, can't provide solutions for the problem.

Table 1. R/P of energy resources [7, 8].

Resources	R/P (years)
Crude oil	41
Coal	147
Natural gas	63
Uranium	85
Oil sand*	60
Oil shale*	100
Methane hydrate*	100

*Extraction methods should be improved or developed.

Table 2. R/P of some mineral resources [9].

Element	R/P (year)	Elements	R/P (year)
Al	156	Ni	46
As	23	Pb	24
Au	17	Sb	13
Be	95	Sn	26
Bi	30	Sr	19
Cd	32	In	8
Cr	123	Tl	25
Cu	35	Ti	96
Mn	40	Zn	23

Global warming

Fig. 8 shows a result of a questionnaire at a banquet after a committee which consists of public employees, engineers of construction consultants and university professors who are related to management of national road in Japan. It should be realized that there are many people who don't think that CO_2 should be reduced. An engineer at the banquet working at Japan Weather Association seemed to prefer "climate change" than "global warming".

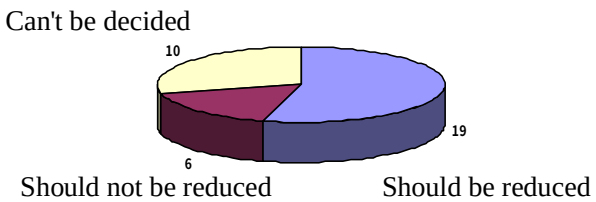


Figure 8. Result of a questionnaire asking on reduction of CO_2 emission.

Anyway, let's investigate first whether the earth is warming or not. Scientists will not doubt that the earth was burning when it was born and has been cooled radiating heat to the space. The earth experienced "snow ball earth" several times [10].

Using a 100,000,000 years scale, we are graciologically in a glacial age as shown in Figure 9. It was approx. 24°C warmer than present approx. 300,000,000 years ago. It is under discussion whether the number of genera is the most at present or not [11]. However, it should be realized that warm climate is very good for prosper of huge creatures. For example, metasequoia grew thick and then withered in Carboniferous and now we can use it as coal for the comfortable civilized life. In the following Permian, Triassic, Jurassic and Cretaceous is of course known as the age of dinosaurs.

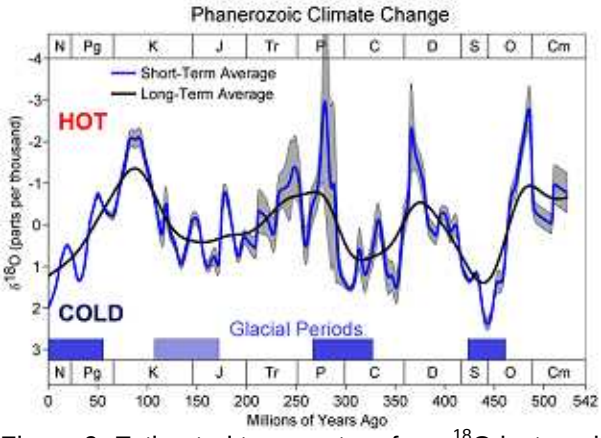


Figure 9. Estimated temperature from ^{18}O isotope in fossils. Multiplying the numerals on *Y*-axis by 4.8 gives approx. air temperature difference from present [12].

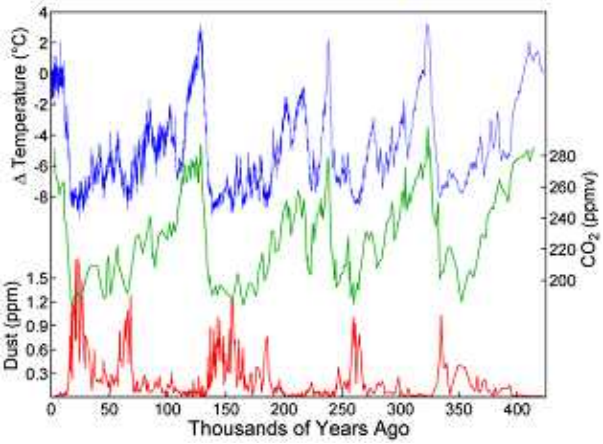


Figure 10. Variations in temperature, CO_2 and dust from the Vostok ice core over the last 400,000 years [13].

Using a 10,000 year scale, glacials (colder period) and interglacials (warmer period) have been iterated at about 100,000 year period in this 500,000 years (Fig. 10). This variation is mainly due to Milankovitch cycle. The temperature amplitude is approx. 10°C. The last glacial maximum was about 20,000 years ago. We seem to be in the hottest peak. It is predicted that it would take at least 50,000 years before the air temperature fall to reach the next glacial maximum [14].

Using a 1,000 year scale, it is estimated that the average world temperature was 0.5-2°C warmer than present approx. 6000 years ago (Fig. 11). This is called Holocene climate optimum. Temperature and sea level were 1-2°C and 3-5 m higher than the present in that period in Japan, known as Jomon

period.

Using a 100 year scale, air temperature was rather high in approx. AD1000. It fell and showed the minimum in approx. AD1600 and has been rising after that to the present (Fig. 12).

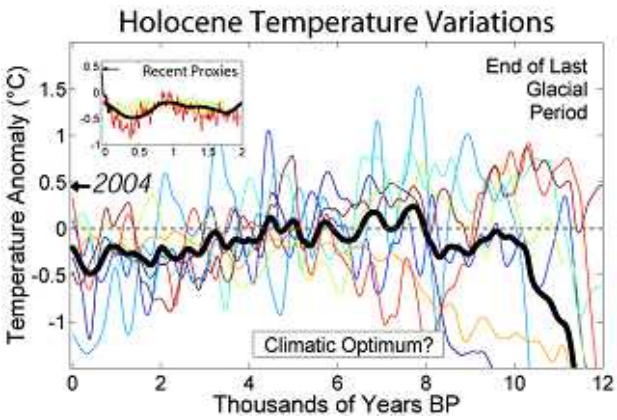


Figure 11. Variations in temperature in this 10,000 years [15].

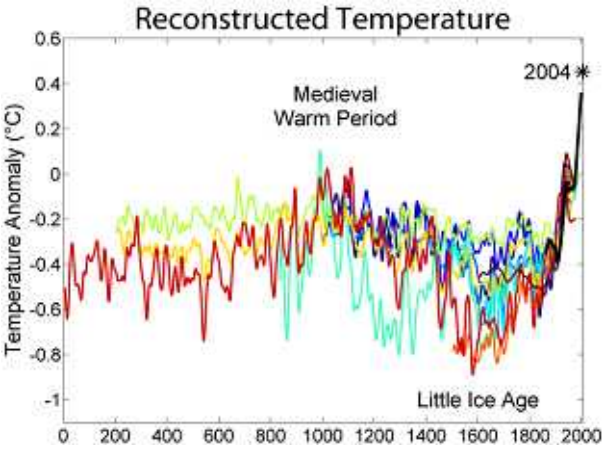


Figure 12. Variation of air temperature AD [16].

Fig. 13 shows the air temperature at the cities in Hokkaido Prefecture, Japan. Sapporo is the biggest city in Hokkaido and the heat island phenomenon can be clearly seen. People may feel that weather is getting warmer by years and years mainly due to the heat island phenomenon. It is also well known that temperature in winter is rising but that in summer is almost constant in Sapporo. Very small temperature rise can be seen for other small cities. It is realized that the temperature variations are rather discontinuous than smooth. This may be explained by the climate jump. There are some observation points which show temperature fall in the world. Detail of them should be investigated in future.

Next, let's consider whether the air temperature continues to rise or not. This also depends on the time scale. By using a billion year scale, the earth is undoubtedly cooling to its death. By using a million year scale, the air temperature may show variation which amplitude is as large as 30°C. By using a 10,000 year scale, the amplitude would be approx. 10°C and we have at least 50,000 years before the next glacial maximum.

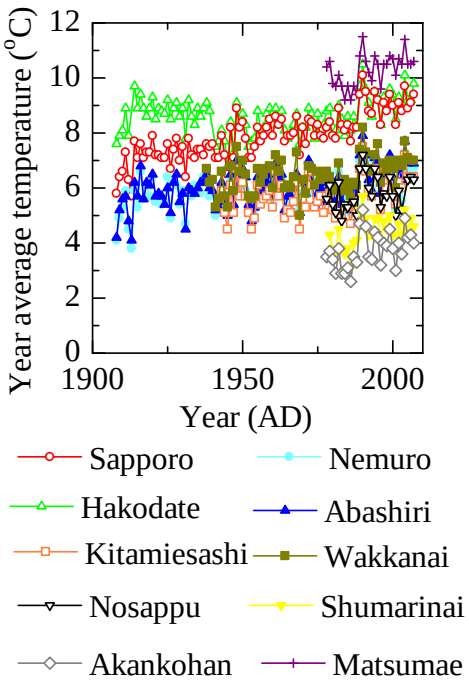


Figure 13. Year average temperature in cities in Hokkaido based on data by Japan Meteorological Agency.

Considering air temperature in the coming 100 years, the average of the prediction by IPCC is approx. 3°C rise [17]. However, the accuracy of the prediction is criticized by many scientists. For example, Maruyama pointed that the prediction method did not include the effects of cloud [18]. Maruyama even stated that the temperature will fall immediately after 2008.

IPCC's logic is that the numerical method can predict the temperature variation for the coming 100 years since it can predict the temperature variation for the past 100 years. However, it should be noted that being able to predict the past temperature variation is just a necessary condition but not a sufficient condition. Everyone who ever tried computer simulation knows that the numerical solution strongly depends on the model and parameters. It is very difficult to clarify the accuracy of numerical predictions.

From the above reasons, the authors strongly think that the future temperature variation in the coming 100 years can't be predicted with enough accuracy. CO_2 reduction is totally useless since the authors don't believe that the anthropogenic CO_2 emission is the main cause of the slight temperature rise around the ground surface. However, the authors' opinion may very different from most readers. Global warming will be, therefore, considered further below assuming that IPCC's prediction is correct.

Relationship between average value of IPCC's prediction on CO_2 emission increase and the temperature rise between 2000 and 2050 is shown in Fig. 14. Temperature rise would be 2.3°C if we continue to emit CO_2 as we did in 2000. This would be reduced to 1.7°C if we reduce CO_2 emission by 50% as stated in Cool Earth 50 by Abe, the former Prime Minister of Japan.

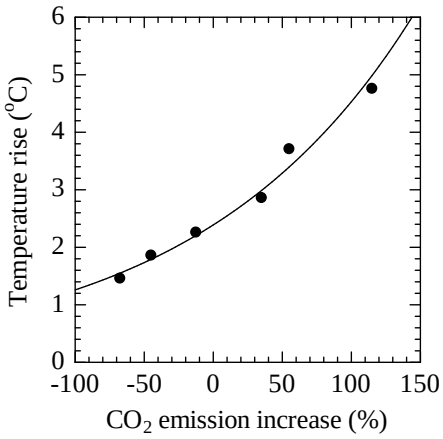


Figure 14. Relationship between average value of IPCC's prediction on CO_2 emission increase and the temperature rise between 2000 and 2050 [17].

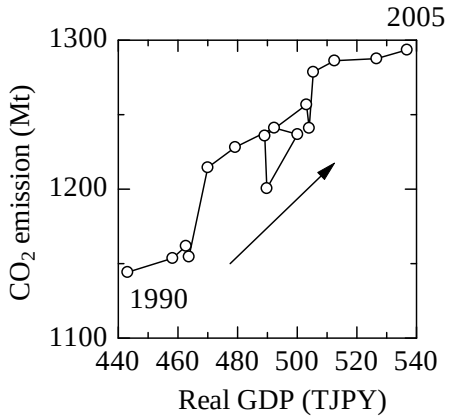


Figure 15. Relationship between real GDP and CO_2 emission in Japan.

Apparently, it is not reasonable to think that human future will drastically change by mitigating the temperature rise of 2.3°C to 1.7°C. It is therefore concluded that reduction of CO_2 is not effective to mitigate temperature rise even believing IPCC's prediction. Moreover, human should do various efforts to achieve this very little 0.6°C mitigation. It would be much more important to prepare such adaptation measures as introduction of siesta, prevention of heat island free-cities etc. if the 2.3°C temperature rise near the ground surface becomes a real serious problem. The latter efforts, in particular, would be very effective for the large number of people living in big cities.

Moreover, according to IPCC's prediction, the efforts to mitigate CO_2 emission by 50% till 2050 causes more than 5.5% of economic loss. Lehman shock caused approx. 1.5% world GDP loss in 2008. 5.5% loss is totally unbearable.

On the other hand, according to the authors' idea, most of the efforts will bring more or less cost increase if subsidies are correctly counted. Subsidies are from the tax we pay and increase GDP as the usual costs. The cost increase will bring economic growth or GDP increase. As an example of Japan shown in Fig. 15, CO_2 emission and GDP has a positive correlation. More CO_2 emission means, of course, more fossil energy consumption. It is therefore concluded that either present or planned efforts to reduce CO_2 emission will result in economic growth, more fossil energy consumption and more CO_2 emission.

The authors welcome economic growth, don't care more CO_2 emission but do care more fossil energy consumption. Moreover, some CO_2 reduction efforts directly result in energy crisis. Increasing nuclear power plants will significantly lower R/P of uranium as stated above. Another example is the efforts to reduce CO_2 emission from coal power plants. Oxy-Fuel Combustion System removes nitrogen and other gases from the intake air and supplies only oxygen to the boiler so that CO_2 can be easily collected from the exhaust gas and then sequestrated also reducing nitrogen oxides and other harmful gasses.

However, efficiency of the system is not better than the conventional high-efficiency coal power plants. It is predicted that R/P of coal decreases to 86 years if the system is widely used in the world [19]. Coal is used almost solely as reducing agent to make pig iron. It is also a very good energy resources, of course, since it's much cheaper and it's supply is much more stable than crude oil and natural gas. Any technique which accelerate the exhaustion of valuable coal should be avoided.

Let us summarize this rather lengthy chapter. The air temperature near the ground surface is significantly rising in big cities due to the heat island phenomenon and slightly rising in most of other areas in the 400 years. There is no widely accepted and proven prediction on temperature variation for the coming 100 years. Reduction of CO_2 has very little effect to mitigate temperature rise and causes unbearable economic loss believing IPCC's prediction. On the other hand, based on the authors' idea, either present or planned efforts to reduce CO_2 will result in economic growth, more CO_2 emission and more fossil energy consumption.

What Japan should do

What the well developed countries should do is to help less developed countries and the less developed countries have to stabilize population. From this viewpoint, Japan should help less developed countries.

Also, Japan has such specific problems as the very low self-sufficiency ratio of 40% for food and 4% for energy resources. Japan should make efforts to increase the self-sufficiency ratio for food. Efforts for stable supply of energy resources are also strongly required.

Japan should not try to increase population. Aging of Japanese society will be accelerated and it leads the society to a significantly aged one. Countermeasures for the coming aged society should be urgently and deliberately considered.

Concluding remarks

Problems against the human beings to happily survive for around 100 years were deliberately investigated. It was clarified that most of such problems as exhaustion of resources, food crises etc. could be solved by preventing population increase in less developed countries. A way to ethically do it for more developed countries is to financially help less developed countries industrialized. It was also clarified that either present or planed efforts to mitigate temperature rise by reduction of anthropogenic CO_2 emission can not significantly mitigate temperature rise but will result in unbearable economic loss or economic growth, more CO_2 emission and more fossil energy consumption. It should be stressed that this conclusion is valid regardless if the global warming continues or not and if the main cause of global warming is anthropogenic CO_2 emission or not. The unnecessary efforts to reduce CO_2 should be immediately stopped and the efforts for population stabilization and other important issues should be urgently begun. If the temperature rise become far beyond IPCC's prediction, adaptation efforts should be taken and also new mitigation methods, which are totally different from anthropogenic CO_2 reduction and do not induce any fossil energy exhaustion should be developed.

References

[1] Website of Ministry of Environment, Government of Japan (in Japanese), http://www.env.go.jp /earth/ondanka/ effect_mats / full.pdf

[2] Meadows, D., Randers, J. and Meadows, D. (2004), Limits to Growth: the 30 years Update, Chelsea Green Publishing Company

[3] Website of UN：Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2006 Revision and World Urbanization Prospects: The 2005 Revision、http://esa.un.org/unpp

[4] Website of National Institute of Population and Social Security Research (in Japanese), http://www.ipss.go.jp/syoushika/tohkei/suikei07/houkoku/kekka-1/10-1.xls

[5] Website of Winet (in Japanese), http://winet.nwec.jp/toukei/save/ xls/ L100110.xls

[6] Partida-Bush, V. (2005)：Demographic Transition, Demographic Bonus And Ageing in Mexico, Proc. United Nations Expert Group Meeting on Social and Economic Implications of Changing Population Age Structures

[7] BP (2008), Statistical Review of World Energy, http://www.bp.com/productlanding.do?categoryId=6929&contentId=7044622

[8] OECD・NEA-IAEA(2006)：URANIUM 2005: Resources, Production and Demand

[9] Web site of Eco-material Research Institute (in Japanese)

[10] Walker, G. (2003), Snowball Earth: The Story of the Great Catastrophe that Spawned Life as We Know It, Crown Publishers, London

[11] Alroy, J. et al. (2001), Effects of Sampling Standardization on Estimates of Phanerozoic Marine Diversification, PNAS, Proc. National Academy of Science US, Vol. 98, No. 11, pp. 6261-6266, http://www.pnas.org/content/98/11/ 6261.full.pdf+html

[12] Wikipedia (Japanese version), "Ice Age"

[13] Wikipedia, "Ice Age"

[14] Berger, A. and Loutre, M. F. (2002), An Exceptionally Long Interglacial Ahead?, Science, Vol. 297, No. 5585, pp. 1287-1288, http:// www. sciencemag.org /cgi/ content/ full/ 297 / 5585/1287

[15] Wikimedia, http://upload.wikimedia.org/ wikipedia/commons/c/c1/2000_Year_Temperature_Comparison.png

[16] Wikipedia (in Japanese), "Global warming"

[17] IPCC (2007), Fourth Assessment Report, IPCC

[18] Maruyama, S. (2008 in Japanese), 90% Scientists Know that "CO_2 Induced Global Warming Theory" is a Lie, Takarajimasha

[19] Okada, Y. (2008 in Japanese), Costs of Thermal Power Plants, JCOAL Journal, Vol. 10, pp. 1-5.