Innovative Solutions to Global Warming

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Introduction

Nowadays, global warming has been a hot issue. It raised more and more people's attention, especially some scientists. It's listed as one of the six global environmental concerns with population growth, air pollution, and extinction of organism species, land degradation and ecological balance. Most of us are worried about global warming. It's a problem that will change the future of the world we live in and affect generations to come. So I'd like to introduce how global warming occurs, that is to say, explain its mechanism. Afterward, some ecological concepts and principles in it will be mentioned. And every possible consequence brought to people will be listed. At last, I will come up with some effective ways to slow down global warming, including what people have done and some new measures to be take. This paper starts with two aspects below. For one thing is the technology of controlling the emission of carbon dioxide and improving energy use efficiency; on the other hand it is to exploit the technology of sequestrating carbon dioxides.

1 What is global warming?

The earth is wrapped in an atmospheric envelope that makes the biosphere a hospitable place for life as we know it. Clean, dry air at the earth's surface is approximately 78.08% nitrogen, 20.94% oxygen, 0.93%argon, 0.03% carbon dioxide, and less than 0.00005% ozone. Air also contains variable concentrations of water vapor and trace quantities of helium, hydrogen, krypton, methane, and neon.

Carbon dioxide and other gases warm the surface of the planet naturally by trapping solar heat in the atmosphere. This is a good thing because it keeps our planet habitable. However, by burning fossil fuels such as coal, gas and oil and clearing forests we have dramatically increased the amount of carbon dioxide in the Earth's atmosphere and temperatures are rising.

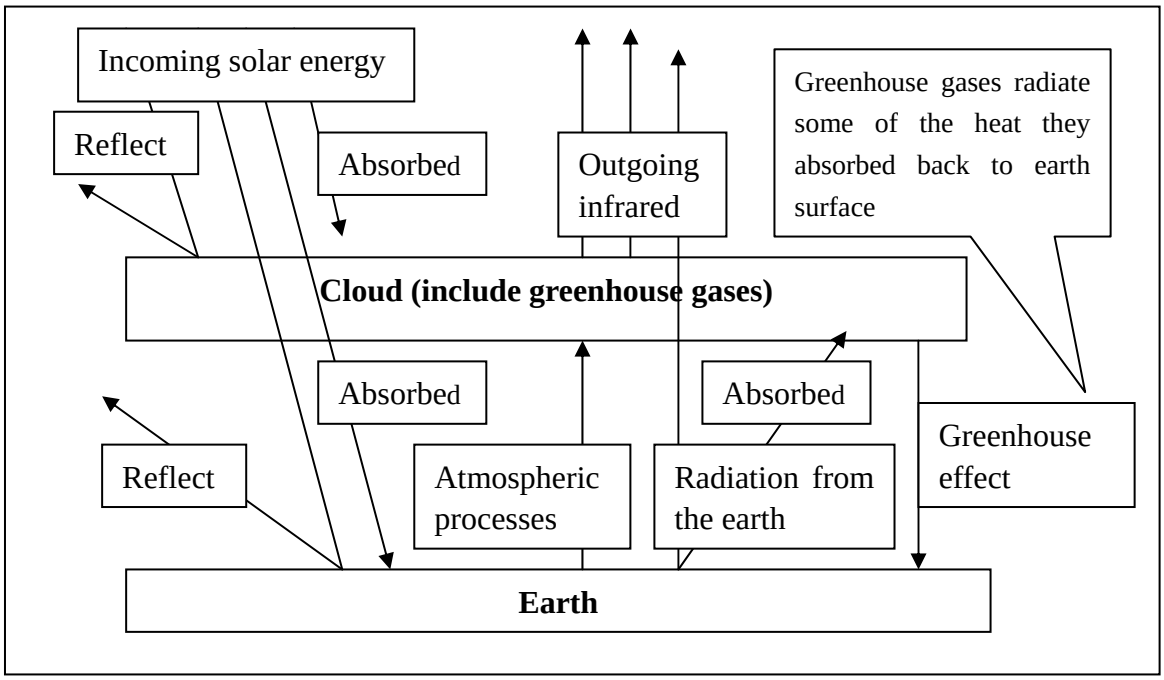


Figure 1：The greenhouse effect: heat trapping by earth's atmosphere

In the figure 1, you can find the process of global warming. I think it was described clearly in the article named the CO_2 problem in 6 easy steps. We all know CO_2 is culprit of global warming. Why increasing CO_2 is a significant problem. The explanation in this article has a number of separate steps. First of all, there is a natural greenhouse effect. And then, trace gases contribute to the natural greenhouse effect. Next, the trace greenhouse gases have increased markedly due to human emissions. Afterwards, radiative forcing is a useful diagnostic and can easily be calculated. After this, Climate sensitivity is around 3ºC for a doubling of CO_2. Finally, Radiative forcing multiplied by climate sensitivity is a significant number.

Global warming is the increase in the average temperature of the Earth's near-surface air and oceans since the mid-20th century and its projected continuation. Global surface temperature increased 0.74 ± 0.18 °C (1.33 ± 0.32 °F) during the last century. The Intergovernmental Panel on Climate Change (IPCC) concludes that increasing greenhouse gas concentrations resulting from human activity such as fossil fuel burning and deforestation are responsible for most of the observed temperature increase since the middle of the 20th century. The IPCC also concludes that natural phenomena such as solar variation and volcanoes produced most of the warming from pre-industrial times to 1950 and had a small cooling effect afterward. These basic conclusions have been endorsed by more than 45 scientific societies and academies of science, including all of the national academies of science of the major industrialized countries.

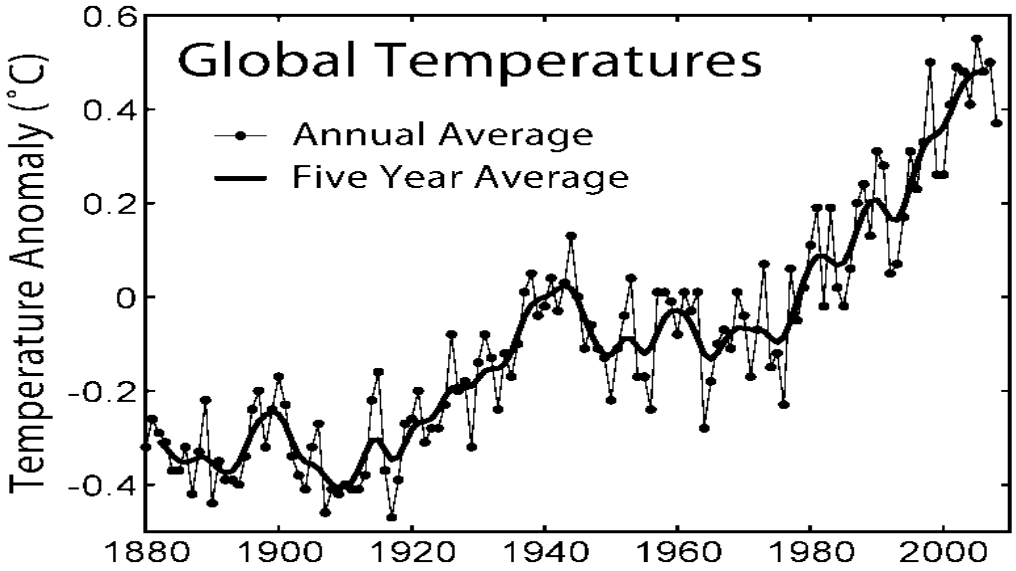


Figure 2：The instrumental temperature record from 1880 to 2000
Source: Wikimedia Commons

The figure 2 shows the instrumental record of global average temperatures. You can see the annual temperature is increased year by year, although the temperatures fluctuate according to the season and some unusual events.

2 Possible consequences of global warming

Climate model projections summarized in the latest IPCC report indicate that the global surface temperature will probably rise a further 1.1 to 6.4 °C (2.0 to 11.5 °F) during the twenty-first century. What dose 1.1 to 6.4 ℃ mean? Does it just mean global warming and we feel hotter than before? The answer is definitely no!

2.1 Increasing death rate

When the climate change, and heat waves, floods and forest fires will goes with it. They will destroy people's living place, and we human beings will become homeless. For one thing, we must find a better place for living; for another thing, we have to face some unpredictable thing such as epidemic diseases. So it will be a big test for people lives.

According to the first comprehensive study of the human impact of global warming, global warming is already responsible for 300,000 deaths a year and is affecting 300m people. It projects that increasingly severe heat waves, floods, storms and forest fires will be responsible for as many as 500,000 deaths a year by 2030, making it the greatest humanitarian challenge the world faces.

2.2 Change our environment

As what we concern those years, ice is melting worldwide, especially at the Earth's poles. This includes mountain glaciers, ice sheets covering West Antarctica and Greenland, and Arctic sea ice. Increasing global temperature will cause sea levels to rise and will change the amount and pattern of precipitation, probably including expansion of subtropical deserts. The continuing retreat of glaciers, permafrost and sea ice is expected, with the Arctic region being particularly affected. Other likely effects include shrinkage of the Amazon rainforest and Boreal forests, increases in the intensity of extreme weather events, species extinctions, and changes in agricultural yields.

2.3 Influences of species

Other living things in the earth will not adapt their environment one day as if the temperature continue to rise, not only we human beings. Researcher Bill Fraser has tracked the decline of the Adélie penguins on Antarctica, where their numbers have fallen from 32,000 breeding pairs to 11,000 in 30 years. Some butterflies, foxes, and alpine plants have moved farther north or to higher, cooler areas. There are also some scientists found that Spruce bark beetles have boomed in Alaska thanks to 20 years of warm summers. The insects have chewed up 4 million acres of spruce trees. We have to say, it has to be a bad news to ecology balance.

Some surprising results we can't image are definitely happening quietly. Scientists warned that carbon dioxide in the atmosphere is already above the level which condemns coral reefs to extinction in the future, with catastrophic effects for the oceans and the people who depend upon them. One of global warming's impacts is the fact that with the warming climate, birds in the U.S. are staying farther north during the winter. The new study was carried out by the Audubon Society and focused on all different types of bird species!

Global warming continues to have a major impact on the entire world. Many people estimate it's consequences. But a scientist named Chris Field said future temperatures "will be beyond anything" predicted. Prof Field said the Intergovernmental Panel on Climate Change (IPCC) report had underestimated the rate of change. He said warming is likely to cause more environmental damage than forecast. Speaking at the American Science conference in Chicago, Prof Field said fresh data showed greenhouse gas emissions between 2000 and 2007 increased far more rapidly than expected. "We are basically looking now at a future climate that is beyond anything that we've considered seriously in climate policy," he said. Prof Field said the 2007 report, which predicted temperature rises between 1.1℃ and 6.4℃ over the next century, seriously underestimated the scale of the problem. He said the increases in carbon dioxide have been caused, principally, by the burning of coal for electric power in India and China.

3 Innovative solutions to global warming

3.1 What can international organization do?

The problem of climate change may date back to famous France chemist J.B.J Fourier, he is the first people who came up with the conception of “greenhouse effect” in 1872. From them on, many scientists did a number of experiments consummated Fourier’s idea and thereby raised the first upsurge of global warming. Especially in 1972, UNCHE (United Nation Conference on the Human Environment) was held and encouraged people to do more researches about climate issue and other related problems. The first international conference on global warming was held in Villach, Austria. The conference was a chance to make the situation known all over the world. Then the famous Kyoto Protocol to prevent global warming was adopted on December 11, 1997. It stipulates that the developed country must cut down green house gases by 5.6% from 2008 to 2012. Nowadays, WMO (World Meteorological Organization) and UNEP (United Nations Environment Programme) found IPCC (Intergovernmental Panel on Climate Change) which provides scientific and technological information about climate change to international community and every country’s government.

In those days, nothing is hotter than G8 (Group of Eight). But what we concern is that The Group of Eight industrialised economies, including America, today agreed for the first time that they must limit worldwide temperature rises to no more than 2℃, and people all over the world expect Barack Obama to break a decade long deadlock.

These efforts well demonstrated that we have paid much attention on climate change, especially global warming.

3.2 What can we do?

Table 1：Gases relevant to radiative forcing only (per IPCC documentation)

	Concentrations and their changes		Radiative Forcing	
Species	2005	Change since 1998	2005 (Wm^{-2})	1998 (%)
CO_2	379±0.65 ppm	+13 ppm	1.66	+13
CH_4	1,774±1.8 Ppb	+11 ppb	0.48	-
N_2O	319±0.12 ppb	+5 ppb	0.16	+11
CFC-11	251±0.36 ppt	-13	0.063	-5
CFC-12	538±0.18 ppt	+4	0.17	+1
CFC-113	79±0.064 ppt	-4	0.024	-5

HCFC-22	169±1.0 ppt	+38	0.033	+93
HCFC-141b	18±0.068 ppt	+9	0.0025	+93
HCFC-142b	15±0.13 ppt	+6	0.0031	+57
CH3CCl3	19±0.47 ppt	－47	0.0011	－72
CCl4	93±0.17 ppt	－7	0.012	－7
HFC-125	3.7±0.10 ppt	+2.6	0.0009	+234
HFC-134a	35±0.73 ppt	+27	0.0055	+349
HFC-152a	3.9±0.11 ppt	+2.4	0.0004	+151
HFC-23	18±0.12 ppt	+4	0.0033	+29
SF_6	5.6±0.038 ppt	+1.5	0.0029	+36
CH_4(PFC-14)	74±1.6 ppt	－	0.0034	－
C_2F_6(PFC-116)	2.9±0.025 ppt	+0.5	0.0008	+22

Source: in the IPCC Fourth Assessment Report (IPCC,2007).

In the showing table, you can find CO_2 changed a lot in atmosphere since 1998 and the radiative forcing is stronger than others. We have to say, CO_2 has mainly caused an exact percentage of the greenhouse effect and it will rage hotter and hotter. Although carbon dioxide contributes to the greenhouse effect only about 9-26%, the innovative solutions to global warming must aim at CO_2. For one thing is the technology of controlling the emission of carbon dioxide and improving energy use efficiency; on the other hand it is to exploit the technology of sequestrating carbon dioxide.

To some extent, the increasing CO_2 warned us that we have burned too much fossil fuels and deforestation are leading to higher carbon dioxide concentrations. That means on the one hand we must decrease the use of fossil fuels. On the other hand, the highest priority is to exploit new energy alternatives to fossil energy. Out of consideration for cleanliness and renewable energy, more and more people pay attention to solar energy. We can start from every family unit and realize solar electric power generation at last.

China is a large agricultural country. The agriculture in China has a long history and it is a collection of the crystallization of human wisdom. Many rural areas are using the technology of biogas. Biogas is a combustible mixture of gases produced by micro-organisms when livestock manure and other biological wastes are allowed to ferment in the absence of air in closed containers. The major constituents of biogas are methane (CH_4, 60 percent or more by volume) and carbon dioxide (CO_2, about 35 percent); but small amounts of water vapor, hydrogen sulphide (H_2S), carbon monoxide (CO), and nitrogen (N_2) are also present. The composition of biogas varies according to the biological material. The methane content of biogas produced from night soil (human excreta), chicken manure and wastewater from slaughterhouse sometimes could reach 70 percent or more, while that from stalk and straw of crops is about 55 percent. The concentration of H_2S in biogas produced from chicken manure and molasses could be as high as 4 000mg/m^3, and from alcohol wastewater even higher at 10 000 mg/m^3.

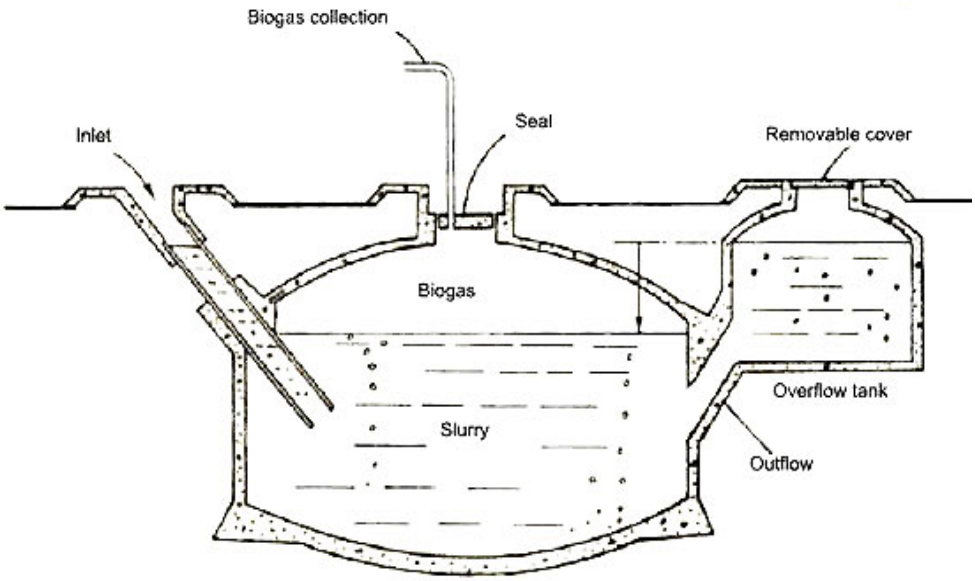


Figure 3: China dome digester
Source: Institute of Science in Society, science society sustainability, Biogas China

Biogas is mainly used as fuel, like natural gas, while the digested mixture of liquids and solids 'bio-slurry' and 'bio-sludge' are mainly used as organic fertilizer for crops. But there are numerous other uses for biogas, bio-slurry and bio-sludge in China.

You can have a clearly understanding of this kind of technology from the below pictures. The left one shows a door of a biogas digester which is fulfilled by livestock manure and other biological wastes. And the right one is an example to the use of biogas. Not only does it can be applied to do some cooking, but also for lighting.

Figure 4: Marsh gas tank and use of methane in Shandong province

Now I will introduce a notable example of biogas use in China: "Four in One". Since Beijing is located in the temperate zone, where the fruits and vegetables are difficult to be planted in the outdoors during winter time, 'Four in One' peach

production system (FIOPPS) composing of a solar greenhouse, a piggery, a lavatory and a biogas digester as a whole has been widely utilized in recent years. Using biogas as linkage, piggery is built in the solar greenhouse, under which hydraulic biogas digester is constructed. The slurry after anaerobic fermentation is provided for irrigating plants in the solar greenhouse, and the biogas produced from the biogas digester supplies cooking energy for the farmers who manage the solar greenhouse. The rest of the biogas is burned to produce CO_2 as gas fertilizer for the solar greenhouse. Thus, a material and energy recycle is formed in the whole production system, in which zero waste emission is realized. In the FIOPPS, the fertilizer is produced from the human and livestock manure by anaerobic fermentation, and the biogas is utilized as energy for living and production. Combining planting and livestock breeding together, FIOPPS decreases the use of chemical fertilizer and pesticide, reduces the environment pollution, and finally, achieves the aim of energy conservation and efficiency promotion.

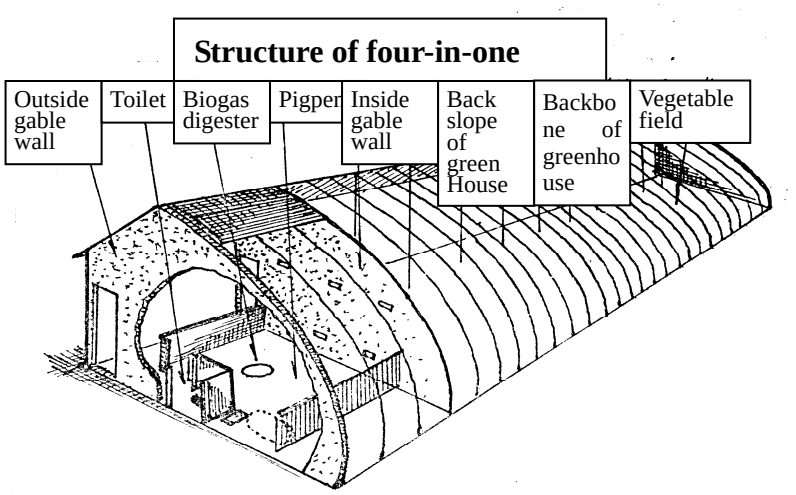
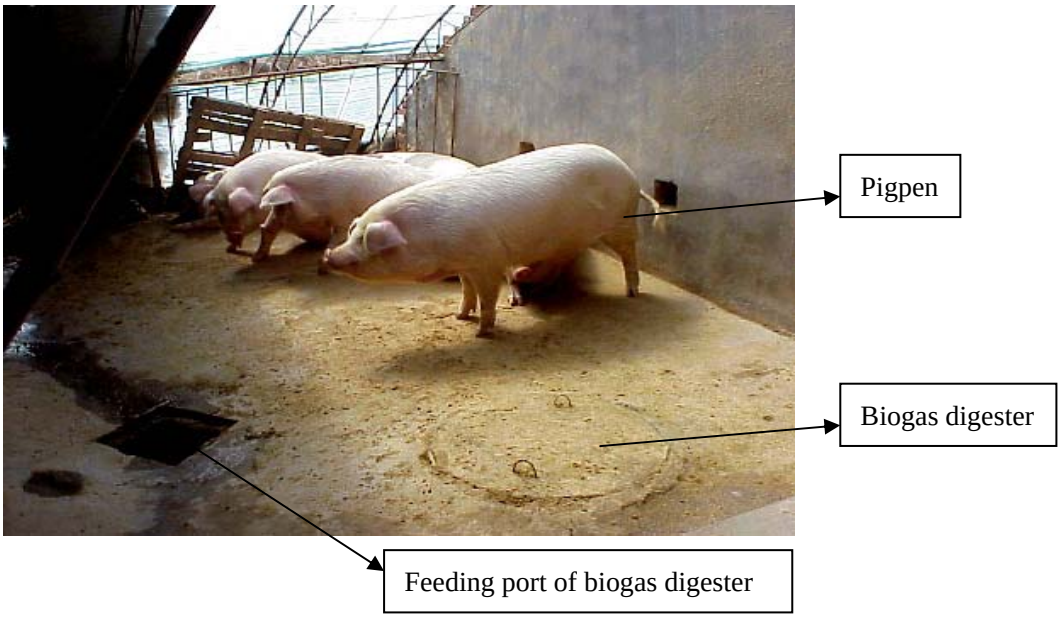


Figure 5: Structure of four-in-one system.
Source: "4-in-1"Biogas system in south China



Only to exploit now energy is not nearly enough. Because our energy is mainly yet provided by fossil fuels, so the most important thing is to improve energy use efficiency. Cascaded technology is now commonly adopted to make use of city's waste heat. It solve the problem of municipal refuse, and use waste heat effectively at the same time.

Another way is to develop technology of sequestrating carbon dioxide. This kind of technology is very easy and just looks at the question from following sides: physical, chemical and biological. They will be listed in the table below.

Table 2: Technology of sequestrating carbon dioxide

	Method	Main Technology
technology of sequestrating carbon dioxide	**Physical Method**	**Reserve CO_2 by separation and recycling them back to the seas.**
	Chemical Method	**Put the CO_2 and H2 together to make new energy and build energy base.**
	Biological Method	**Develop technology of biological reactor.**
	intensive afforestation	**Cultivate drought enduring plants, vegetation cover cosmically and artificial rainfall.**

4 Conclusion

In this paper, some possible consequences and many effective solutions of global warming are mentioned. But we also need to rethink the way we talk about climate change. It is insulting to assume that people can only be energised with the pint-sized options. We need to present all lifestyle changes as part of a radical vision for a smart, healthy and just 21st century. And let's be clear that voluntary action will never be enough - we will need radical political, economic and social change. So let's start by doing away with that wretched phrase "you can save the planet"

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