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## Kyoto, its Successors, and their Effect on World Energy Usage

In the last few decades, the global emissions of greenhouse gasses have increased alarmingly. Since 1751 around 283 billion tons of carbon dioxide(CO<sub>2</sub>) have been released into the atmosphere, and half of those emissions have occurred since the mid 1970's. ("Global") Pre-industrial (before the mid 1800's) atmospheric concentration of CO<sub>2</sub> was .0280%, it has since increased to .0367%. ("Historical", "Atmospheric") This may seem small, but it means that the amount of CO<sub>2</sub> in the atmosphere has increased by about 30%. The Kyoto Protocol was the first united effort by a large part of the world community to respond to fears that these increases are harming the world climate. It aimed to lower world emission of these gasses in an attempt to stop this potentially harmful climate change. However, due to flaws in implementation and a lack of cooperation by some of the biggest culprits in greenhouse gas emissions, Kyoto is not likely to succeed.

One alternative suggested is a plan called Contraction and Convergence, which, unlike Kyoto would involve all countries in the world equally, and would seek to lower global emissions over time while allowing individual countries the flexibility of trading emissions credits. Whatever the method, reducing global greenhouse gas emissions will likely have a substantial effect on world energy usage. The magnitude of necessary changes in energy usage, and the economic consequences they will bring may determine the ultimate success any plan to reduce emissions.

*[A nice introduction to the paper]*

The Kyoto protocol originated in the United Nations Framework Convention on Climate Change. The convention recognized human's role in climate change, and the necessity to control emissions in order to prevent climate change from reaching dangerous proportions. It also recognized that developed nations would have to shoulder the majority of the work of controlling emissions, as developing countries would suffer economically if they had to contribute their full share toward reducing emissions. The convention was ratified almost unanimously by the UN, with only Somalia, Andorra, and Iraq dissenting. ("Status") In 1997, in a session in Kyoto Japan the convention adopted the Kyoto Protocol as the means of realizing these goals.

The Kyoto Protocol is the first of a multistage plan to reduce world greenhouse gas emissions. In this first stage, only developed countries [Annex 1] are required to reduce their emissions. The goal is for these countries to collectively reduce their emissions to 5% below 1990 levels between 2008 and 2012. ("Kyoto") To facilitate this process, countries are allowed to trade "emissions credits". These credits can be gained by keeping emissions under quota, or by investing in projects abroad that reduce CO<sub>2</sub>, such as renewable energy sources in developing countries. Credits can also be gained through the preservation of so-called carbon sinks—or qualifying forests and green spaces that are assumed to absorb a certain amount of CO<sub>2</sub> emissions.

Specifically, Annex 1 consists of the majority of Europe, the United States, Canada, Japan, Russia, and Australia. This leaves out all of Africa and South and Central America, Mexico, and China, India, and the rest of southwest Asia and Indonesia. For the purposes of a rough comparison, in 1999 non-Annex 1 countries emitted approximately 2689 million metric tons of CO<sub>2</sub>, whereas Annex 1 countries emitted 3769 million metric tons of CO<sub>2</sub> in the same time period. ("Kyoto-Related")

The Kyoto Protocol will not actually take effect until the Annex 1 countries who ratify it have total emissions of at least 55% of the greenhouse gas emissions of all Annex 1 countries. (“Kyoto”) Currently, 120 countries have ratified or otherwise agreed to the Kyoto Protocol. However, the Annex 1 countries who have ratified the Kyoto protocol account for only 41.2% of Annex 1 emissions, which falls short of the total needed for Kyoto’s implementation. (“Kyoto... Status”) The refusal of the United States, Australia, and potentially Russia to ratify Kyoto may keep it from ever going into effect. What went wrong?

Countries like the US cited the fact that developing countries were not included in the initial reduction goals as one reason for refusing to ratify Kyoto. Not only does their exclusion hurt the world effort to decrease emissions, as increases in these countries emissions serve to offset hard-won decreases in developing countries, but these countries also have an economic edge over countries forced to reduce their emissions.

*[Why the U.S. withdrew, in a nutshell]*

Countries such as Russia also feel that the reduction goals of the Kyoto Protocol are incompatible with their own goals for economic growth. Russia’s President Putin has stated that he plans to double their GDP in the next decade, a goal which under the restrictions of the Kyoto protocol almost certainly would not be met. (“Kyoto Mechanisms”) The use of 1990 levels as a goal for scaling back emissions also leads to more inequities. The reunification of Germany led to the shut down of much of East Germany’s heavily polluting industry in the 1990’s. Also, during the 1990’s the UK discovered a large natural gas reserve and began to phase out the coal industry. (“Problems”) These circumstances make it easier for these countries to make their quotas than for other European nations.

The Kyoto Protocol then, has its problems. However, it is not all bad. Despite being excluded from the first phase of implementation, China, India, Mexico, Thailand and almost a hundred other non-Annex countries did ratify or otherwise agree to the Protocol. This gives hope that many of these countries will be receptive to future plans that include more of the world in the task of reducing greenhouse gas emissions.

One such future plan that is gaining more support is called “Contraction and Convergence” . This plan would involve all countries, not just developed countries. The method of assigning emissions limits for each country would be population based, giving each country a right to pollute based on the number of inhabitants it supports. This would especially target such culprits as the US whose per capita emissions are far above the rest of the world. Like Kyoto, countries could trade emissions credits, so countries such as those in Africa who would be far below their emissions quota could sell emissions rights to countries such as the US. Each year, the total global emissions quota would decrease, so eventually all countries must cut back on emissions, and no-one can continue their current level of emissions simply by buying credits. There would also be a population cap at some point in this process, where the population from a certain year would be used to determine the proportion of emission shares each country gets in the future. This would deter countries from increasing their populations simply to obtain a greater share of emission rights. (“Contraction”)

Perhaps the biggest obstacle to this plan is the support of countries with the most emissions, such as the US, Russia and Australia. Their current refusal to ratify the Kyoto Protocol killed any chance it had to be implemented, and effectively showed their power to stymie plans that are not in their best interest. Unless such countries can be made to comply, the success of any global plan to reduce greenhouse emissions will be in jeopardy.

As the evidence for climate change grows stronger, and harder for countries to ignore, it looks likely that plans to reduce global emissions are not going away. As most of these greenhouse gasses originate in the burning of fossil fuels, there is likely to be a strong effect on energy usage if emissions are cut. On a positive note, both of these plans encourage the trading of emissions credits. Economically, this keeps the overall cost of reducing emissions lower. This plan also rewards countries who invest in clean alternative energy projects abroad. Such rewards would be a boost to the renewable energy industry. Furthermore, by trading emissions credits, countries who profit from selling part of their CO<sub>2</sub> credits must then invest that money on clean energy and clean industry in order to stay within their now reduced quota.

*[A point made strongly in Lloyd Orr's chapter]*

Even with the ability to trade emissions credits, all countries will have to change their energy habits as overall global emissions are reduced. Energy sources that emit copious CO<sub>2</sub>, such as coal, would have to be either phased out, or used in conjunction with new technology to capture the CO<sub>2</sub> emitted.

*This is a huge technological problem. I don't know of a practical way of doing it. One ton of carbon produces about four tons of carbon dioxide when it is burned, so an enormous amount of CO<sub>2</sub> would have to be sequestered. It has been suggested this might be done in the oceans, but then there is the worry that climate change might change ocean currents and temperatures in such a way as to cause the oceans to burp up the stored carbon dioxide suddenly – over a time period too short for humans to adapt.*

If new technology is employed, coal electricity generation will become more expensive. If coal use goes down, the use of more expensive alternative energy sources would likely rise. Although one alternative option, nuclear electricity generation, can be less expensive than coal, this does not take into account the initial cost of the nuclear plants. As many new nuclear plants would have to be built to take the place of coal plants, that cost really

cannot be neglected. Basically, energy is going to be much more expensive. From electricity generation to industry and transportation, companies will have to spend more to make a clean product, and the consumers will feel this.

*It's inevitable that depletion of cheap fossil fuels and environmental protection are going to make energy more expensive, and consumers are just going to have to get used to this. The cheapest and most effective things we can do immediately are to increase energy efficiency and conservation. Speeding up change is matter of public education.*

With energy more expensive, efficiency and conservation will be important factors for countries reducing their emissions. According to John Sheffield in Energy: Science, Policy and the Pursuit of Sustainability, if the US were to implement efficiency improvements to its industries, transportation and buildings it could cut its energy usage by half. Other experts say that the world as a whole, most of which uses energy even less efficiently than the US, could employ efficiency-adding measures and use three to four times less energy than is currently used. (“Energy”) While such efficiency measures would have a price, it would almost certainly be cheaper than any other means of cutting energy-related emissions in half. Moreover, if countries were to simply promote conservation the cost of those emissions reductions would be zero. Such efforts, as simple as carpooling, walking or bicycling instead of driving short distances, keeping thermostats a few degrees cooler in the winter, or relying more on fans and open windows to stay cool in the summer would also save significant amounts of energy.

*A large electric exhaust fan uses less than 1/10<sup>th</sup> the energy of an air conditioner and is far superior from an energy and environmental standpoint – and perfectly satisfactory from the standpoint of comfort except on extremely hot and humid days, which are rare in Indiana.*

As many of them depend on the personal lifestyle choices of the population, they would however be harder to implement.

Energy usage and economic growth are also closely related. As a country's economy grows, so does its energy usage.

*One of the key ideas in the text is that long-term sustainability will require breaking the connection between economic growth and growth in the use of non-renewable resources and the production of material things. This is a matter of what society values (see Lloyd Orr's chapter).*

Conversely, energy shortages can stall a country's economic growth. As countries are forced to reduce emissions, some developing countries might not have the money to cleanly produce as much energy as they need to continue their economic growth. This could prevent them from ever being able to compete with current economic superpowers. Other countries, such as Russia or the Middle East, whose economies depend on the export of fossil fuels could suffer as well. Hopefully, solutions can be found that will limit this economic impact.

Reducing global emissions will play an important role in the future. Individual countries may not be in favor of the methods employed to accomplish this, but they will be necessary to ensure a stable global climate. While the Kyoto Protocol is not likely to be a successful method of accomplishing global emissions reductions, it served as an important first step in getting the world community to recognize the effects of their emissions, and begin thinking of how to reduce them. Most importantly, reducing emissions will have positive effects on world energy use that would otherwise be too unpopular to implement. The increase in prices that will result will lead to more conservation, increased efficiency, and increased reliance on alternative, renewable energy sources. All of these changes bode well for a sustainable future.

*A nicely written, well-balanced paper, and informative paper that I enjoyed reading.*

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