Necessary Action to Address Climate Change
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The Inescapable Reality

Earth receives slightly more radiant energy than it emits into space, which makes it slightly warmer year after year. This imbalance is caused by our use of fossil fuels (coal, natural gas, and oil) that add carbon dioxide (CO₂) and other greenhouse gases to the atmosphere, thus blocking some of the far-infra-red radiation that would otherwise send energy back into space.

CO₂ is part of the natural carbon cycle. When we breathe out, we emit CO₂, returning carbon that was derived from the food we eat. The carbon in the food we eat was originally contained in plants, which got their carbon from the atmosphere by photosynthesis using energy from the sun. The carbon we breathe out is already in the carbon cycle. But we have been burning fossil fuels that have been sequestered in Earth for millions of years. This adds about two parts per million CO₂ to the atmosphere every year.

It is too easy to look at the facts—400 ppm of CO₂ and barely 0.8 °C warming since the start of the industrial revolution began—and sit back saying, “thank heaven it’s no worse.” But current levels of global warming have not reached equilibrium with the atmospheric CO₂ concentrations of recent years. The feedbacks coming from the natural responses to warming are not fully known quantitatively, and are still very much in progress.

It is estimated that only 15 percent of the warming effect of added CO₂ comes from the direct initial insulating effect of the greenhouse gases. The other 85 percent comes from feedbacks, some of which takes decades to come into equilibrium with atmospheric conditions.

Negative feedback occurs when certain effects of global warming cause cooling. For example, the particles and sulfur dioxide that are emitted when burning coal reflect heat into space. Without those effects, the warming since the beginning of the industrial would be 1.1 °C higher, or 1.9 °C.

Positive feedback occurs when certain effects of global warming further increase the warming by reducing the reflection of sunlight back into space, or by causing the further release of greenhouse gases. For example, when increasing atmospheric CO₂ warms the ocean, methane can be released. Warming also increases the release of methane that is stored in the tundra. Released methane eventually becomes CO₂ in the atmosphere but, while it is still methane, it is a much more powerful greenhouse gas than CO₂.

Results from studies of long-term climate behavior show that it takes a very long time for Earth to come to equilibrium between temperature and CO₂ content. Fig. 1 shows that, if humans could keep the atmospheric CO₂ at its present level of 400 ppm, the climate would go on warming until equilibrium is reached at a global average temperature 4 °C above the pre-industrial level. This sheds new light on the goal of holding the global temperature increase to 2 °C. That goal cannot be realized without removing some CO₂ from the atmosphere.

How close are we to a tipping point beyond which global warming will continue without the need for humans to add any greenhouse gases where over thousands of years the warming would give rise to a transition from a generally cool climate, with polar ice-caps, to a generally warm climate, without ice-caps? Such transitions have occurred, taking the Earth from a warm to a cool age or from cool to warm, and they are accompanied by major extinctions of species. We are already part way into the current extinction.

We face a world emergency. For Earth to continue to support human life, we must completely stop burning fossil fuels at least within sixty years, and recapture some of the CO₂ now in the atmosphere to bring the CO₂ content down to 330 ppm.
Putting a Price on Carbon

We have not been paying the true cost of our dependence on fossil fuels. It is time to stop subsidizing fossil fuels and pay the real costs, including cleaning up the waste. Now that we must reduce emissions from fossil fuels to zero, a host of strategies will be needed. Voluntary measures are always best, as in Ontario, which has been closing its coal-burning power stations. But there will be industries that will cling to fossil-fuel burning as long as it provides the cheapest power source. To counter this general situation two broad financial strategies have been proposed, which amount to pricing carbon.

**Cap-and-trade** systems involve the government issuing permits and allowing them to be traded. The government determines the number of permits to be sold and the amount of fossil carbon to be mined or pumped. Because the mechanism for price discovery is to sell permits at auction, the industry or the market decides the price they will pay for permits. With a cap the government decides the quantity, and the market decides the price.9

Companies that reduce their CO₂ emissions so that they do not need all their permits could sell them to companies who need additional permits. There may be provisions for excess permits to be held over from one time period to the next, to be borrowed from future allocations, which would allow for a thriving derivatives market and have the overall effect of slowing the reduction of emissions.

A system of offsets enables companies to purchase rights to emit, for example, from a country that has forests that could be burned but would be preserved in exchange for the offset. However, this mechanism can only increase emissions above what the governments issuing permits originally intended, and is counterproductive in reducing emissions.

**In fee-and-dividend or carbon-tax systems,** the government charges a fee or tax per ton of carbon on all fossil fuels up-stream at the point of extraction: the mine, well-head, or port of entry. Because there are far fewer points of fossil fuel extraction than points where the CO₂ is eventually emitted, this is more efficient than cap and trade. By raising the price of fossil energy at the source, prices throughout the economy would reflect the amount of fossil fuel used directly and indirectly. The carbon tax or fee must be high enough to cause a change away from burning these resources, and to speed up their replacement by renewable sources for both energy and industrial products.

With either fee-and-dividend or carbon-tax systems, the government determines the fee or tax. It then sells as many carbon production permits as the industries want to buy at the determined price. Thus, the government decides the price, and the market determines the quantity. This would have big effects on both the demand and supply sides.

On the demand side, with higher energy prices, less energy would be used, unneeded lights would be turned off, light bulbs would be changed, computers would be turned off promptly, thermostats would be adjusted, families would vacation closer to home, and so on.

On the supply side, if the retail price of fossil-based electricity was increased, this would make renewable energy production more profitable in comparison. There would be an investment boom with production of renewable energy increasing every year.

In a **fee-and-dividend** system, all revenue from the fee would be returned to consumers as a dividend on an equal *per capita* basis unrelated to individual energy expenditure, so that initially people using less than the average amount of energy would come out ahead, and those using large amounts of energy would find their energy dividend did not cover their energy costs.
In a carbon-tax system, it is assumed that all revenue will accrue to the government imposing the tax. Many legislators have signed a pledge to “oppose any legislation relating to climate change that includes a net increase in state or local government revenue.” In the case of fee-and-dividend, there is no effect on government revenue, since all revenue is returned to consumers on an equal per capita basis. A tax, on the other hand, increases government revenue, even if the revenue is earmarked for good works, such as augmented unemployment pay for coal-miners unemployed by the new policy, or accelerated research and development for renewable energy sources. Legislators who have signed the pledge can vote for a fee-and-dividend system without violating their pledge.

Electrify Ground Transport

Ground transportation must be electrified as soon as practicable and liquid fuels phased out. Major changes in planning and the long-term view are required.

Increase Research in Renewable Energy

Research into renewable energy and its applications must be given high priority so coal-burning electricity generation can be replaced with renewables as soon as possible.

Encourage Research on Removing Carbon Dioxide

If atmospheric CO₂ concentration needs to be below 330 ppm, research into methods of removing CO₂ from the atmosphere or from the ocean is most urgently needed to limit warming and reverse ocean acidification. The huge problem of reducing the carbon content of the atmosphere needs much study and application, but one can say unambiguously that tree planting wherever that is practicable and ceasing the destruction of tropical rainforests will help. The tree line has moved north in Canada and Russia, but the trees need encouragement to expand northward.

Lifestyle and Economic Changes

The larger cause of this world emergency is overconsumption, coupled with a large human population. While much of that consumption is attributable to the burning of fossil fuels, the degree to which the developed nations have become immersed in consumption goes beyond the use of any one type of resource or product. Consumption leads inevitably to excess waste even where recycling is maximized.

Fig. 2 shows how the world exceeded a sustainable footprint in 1968, and, since nothing was done to prevent the wrong sorts of growth, the footprint has now reached 1.5, meaning that we are polluting the planet at 1.5 times what it can absorb and remain in good health.

The waste then amounts to pollution, once the capacity of the Earth’s ecological system can no longer absorb it. The waste is not only in the air in the form of greenhouse gases, but in the ocean, which is losing alkalinity because of the absorbed carbon dioxide and is further being polluted with plastics, and by warm spots or chemical pollutants giving rise to dead zones. We have pollution through the use of landfills, a cumulative problem without an end in sight.

All of this has been caused by the current style of economic system. In order to maximize profit, the system must encourage consumption, which has been accomplished by the persuasive nature of modern advertising. One can sum up our current, neoclassical economic system by stating that it maximizes the throughput of resources from extraction to pollution.

The world emergency presented by climate change cannot be addressed by governments, non-governmental groups, or corporations acting alone. It requires a basic change of attitude by the population and a substantial breakaway from the neoclassical economic system. To try to preserve the present system and simultaneously deal with climate change would require too many strictly enforced regulations.

The health of the ecosphere must be the central focus. The changes require letting go of financial control of the economy in favor of control through resource management. In the spirit of preventing further downgrading of the ecosphere on which we depend, we need a new form of economy. Far from attacking North American values, the following recommendations point out what might be the only way to preserve those values by preventing the collapse of civilization.

Empower Women—Stabilize Population

Empowering and educating women combined with availability of contraception has proven to be the best way to decrease the rate at which the human population is increasing. The goal is to achieve a stationary human population size that Earth can support.¹¹

Resource Accounting and Governance

Widespread resource accounting for national or regional control of resources is an important strategy for reducing extraction and minimizing pollution. Inherent in neoclassical economic accounting is the neglect of externalities. Nothing is an externality when one recognizes that humans are embedded in the ecosystem. The ecosystem is our home, not external to it.

Restore the Commons

One mechanism for managing resources is to restore the concept of the Commons, that air, water, and land, at least some of it, are resources held in common for the entire commonwealth of life, not
just humans. Governance of the commons must involve all stakeholders and consider the effects of all actions on the accompanying ecosystem.12

Maximize Recycling to Minimize Resource Extraction
A simple example of maximizing recycling can be seen in the manufacture of paper. Paper fiber can be recycled about six times to produce paper of adequate quality, but only half of all paper in the U.S. is recycled and it constitutes a large proportion of the waste found in landfills.13 Recycled paper is currently more expensive than new paper because trees have been undervalued, as if the supply is inexhaustible. Under a truly sustainable system for use of forest resources and full resource accounting, fees for cutting down trees for paper pulp would be set to bring the price of new paper beyond the price of recycled paper.

Useful and Practical instead of Glamorous and Luxurious
Placing value on what is useful and practical rather than glamorous, luxurious, and wasteful is a much needed attitude change. Instead of the unrelenting push for more, we need to change our societal goal to enough.14

Reform Advertising
Advertising must be controlled or advertisers induced to collaborate with the new outlook, through new understanding or rules. This very difficult step is essential if the disease of consumerism is to be cured.

Abolish Planned Obsolescence
Cradle-to-grave strategies must be adopted in industrial production where planned obsolescence is abolished through an emphasis on high quality products. If one purchased a service rather than a product and the corporation was responsible for maintaining the product and its eventual disposal, it would be in the best interest of the corporation to make products that would last and be easily repaired.

Benefit Corporations
One problem is that our economic system is based on corporate charters with profit for shareholders as their only mission. Benefit corporate charters require actions for the common good as a part of the work of the corporation. As of June, 2014, half of all U.S. states have passed legislation that provides for the registration of Benefit Corporations.15 Corporations should be encouraged to change their corporate charters and the legislatures in the remaining states should be encouraged to provide for Benefit Corporations.16

Reduce Inequality
Reducing inequality both within and between countries is not only necessary for fairness, it is necessary for stability of the global economy.17 In the U.S., inequality is increasing, so it is necessary to restore adequate minimum wage, food stamps, unemployment insurance, Social Security, Medicare, Medicaid, and other social programs. For developing countries, retain the knowledge base and expertise of the World Bank and the International Monetary Fund, but replace the two organizations with new ones that would be funded through publicly owned banks. The iniquitous and socially injurious conditionalities imposed upon borrowers must be lifted.

Monetary Reform
A huge fraction of the present money supply is tied up in the speculative investment sector called the “third economy.”18 Curing the disease of excess in the third economy may need taxes on short-term speculation and almost certainly will need heavier taxation of the highest incomes and elimination of tax loopholes for the rich.

Money is currently created by private banks making loans through the fractional reserve system where only a small portion of the loan amount must be kept on deposit (in the U.S. 3-10%). One way to reform the monetary system is to establish publicly owned banks, so that the creation of money is not just in the private sector.19

Publicly owned banks can be used to fund interest-free public projects, such as, upgrading aging electrical grids, expanding public transportation systems, and other projects that facilitate the reduction of carbon emissions. Such funding amounts to the creation of new money and would be helpful in times of high unemployment.

Maximize Employment
Unemployment is widespread and must be a prime concern, not only for social justice, but also because a change of economic system must be seen to improve social conditions. Otherwise such change would meet huge political opposition. Maximizing employment can be accomplished with special emphasis on the employment of youth by upgrading the infrastructure and restoring the commons, all of which keep jobs at home.

Tax Reform
The tax system can be used to create incentives to achieve some of these aims. An attitude change is required, especially on the part of governments.

Facilitate Discussions on Needed Changes
Much discussion is urgently needed among governments, industry and private citizens to reduce the wastage in every sector, and on the future of ground transportation, housing, municipal planning, and food quality to reach an economy of sufficiency that will be sustainable.

References
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9 An example of cap-and-trade was a bill introduced by Representatives Henry Waxman and Ed Markey and passed in 2009 in the U.S. House of Representatives (American Clean Energy and Security Act”; ACES, H.R. 2454 of the 111th Congress), but died in the Senate.
10 This diagram was supplied to Derek Paul by Footprint News, courtesy Mathis Wackernagel and coworkers.
15 Benefit Corp Information Center <benefitcorp.net>.