

3 July 2008

Prime Minister Yasuo Fukuda
1-6-1 Nagata-cho, Chiyoda-ku
Tokyo 100-8968, Japan

Dear Prime Minister,

Your leadership, and continued leadership by Japan, is needed on the matter of climate change, a matter with ramifications for life on our planet, including all species. Prospects for today's children, and especially the world's poor, hinge upon success in stabilizing climate.

For the sake of identification, I am a United States citizen, director of the NASA Goddard Institute for Space Studies and Adjunct Professor at the Columbia University Earth Institute. I am a member of our National Academy of Sciences, have testified before our Senate and House of Representatives on many occasions, have advised our Vice President and Cabinet members on climate change and its relation to energy requirements, and have received numerous awards including the World Wildlife Fund's Duke of Edinburgh Conservation Medal from Prince Philip. I write today, however, as a private citizen, a resident of Kintnersville, Pennsylvania, USA.

Japan has been a strong supporter of actions to mitigate dangerous climate change, including the Kyoto Protocol. It is not Japan's fault that international action has failed so far to slow emission of dangerous gases. But as the host for the upcoming G8 meeting, you can initiate discussion of an approach that could meet the challenge humanity faces.

The past approach, and extensions now under discussion, are fatally flawed and would doom our children and grandchildren to an increasingly impoverished life on a more desolate planet. Clear thinking and bold leadership of the international community are essential in the next 1-2 years to change the course of human history.

Climate Situation.

Global climate is approaching critical tipping points that could lead to loss of all summer sea ice in the Arctic with detrimental effects on indigenous people and wildlife, initiation of ice sheet disintegration in West Antarctica and Greenland with progressive, unstoppable global sea level rise, shifting of climatic zones with extermination of many animal and plant species, melting of most mountain glaciers with loss of freshwater supplies for hundreds of millions of people, and a more intense hydrologic cycle with stronger droughts and forest fires, but also heavier rains and floods, and stronger storms driven by latent heat, including thunderstorms, tornados and tropical storms.

My address tomorrow¹ to the United Nations University G8 Symposium summarizes scientific data revealing that the safe level of atmospheric carbon dioxide (CO₂) is no more than 350 ppm (parts per million), and is likely less than that. Implications for energy policy are profound, as atmospheric CO₂ is already 385 ppm. A course that minimizes climate change is still feasible^{2,3}. But basic fossil fuel facts must be acknowledged to define that course.

Source of Fossil Fuel CO₂

(a) Today's Emissions (b) In the Air Today

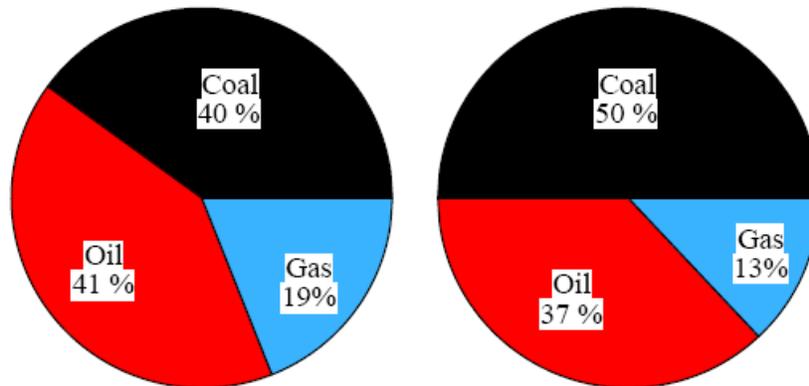


Figure 1. Contribution of each fossil fuel to 2007 CO₂ emissions (a) and to excess CO₂ in the air today (b) relative to pre-industrial CO₂ amount.

Fossil Fuel Facts.

Oil slightly exceeds coal as a source of CO₂ emissions today (Figure 1a). But, because of the long atmospheric lifetime of past emissions, fully half of the excess CO₂ in the air today (from fossil fuels), relative to pre-industrial times, is from coal⁴ (Figure 1b). Moreover, coal use is now increasing, while oil production has stagnated. Oil production will peak and be constrained by available resources earlier than will coal production.

Coal is central to solution of the climate problem. Coal is not only the main cause of excess CO₂ in the air today; it has the greatest potential for future emissions (Fig. 2a). Due to coal's dominance, solution to global warming must include phase-out of coal use except where CO₂ is captured and sequestered. If coal is phased out uniformly between 2010 and 2030, except where CO₂ is captured, atmospheric CO₂ will peak at 400-425 ppm and then begin to decline (Fig. 2b). Maximum CO₂ depends upon whether EIA (Energy Information Administration) or IPCC (Intergovernmental Panel on Climate Change) oil and gas reserve estimates are more realistic.

Coal and oil differ fundamentally. Oil is used mainly in vehicles, where CO₂ cannot be captured. Extractable oil is nearly half gone. Most remaining oil, much of it in the Middle East, surely will be used with the CO₂ injected into the air. Limitations on drilling in the Arctic, off-shore areas, and public lands can help keep exploited reserves closer to the IPCC estimate than the larger EIA estimate, but most readily available oil will end up as CO₂ in the air. In contrast, scenarios that keep coal in the ground, or used only where the CO₂ is captured, are feasible.

The upshot is that large climate change, with consequences discussed above, can be avoided only if coal emissions (but not necessarily coal use) are identified for prompt phase-out. A corollary is that a strategy based on 20%, 50%, or 80% CO₂ emission reduction is doomed to failure, because it would allow substantial coal emissions to continue indefinitely. Once CO₂ emissions are in the air, they cannot be retrieved. The only practical solution is to avoid coal emissions.

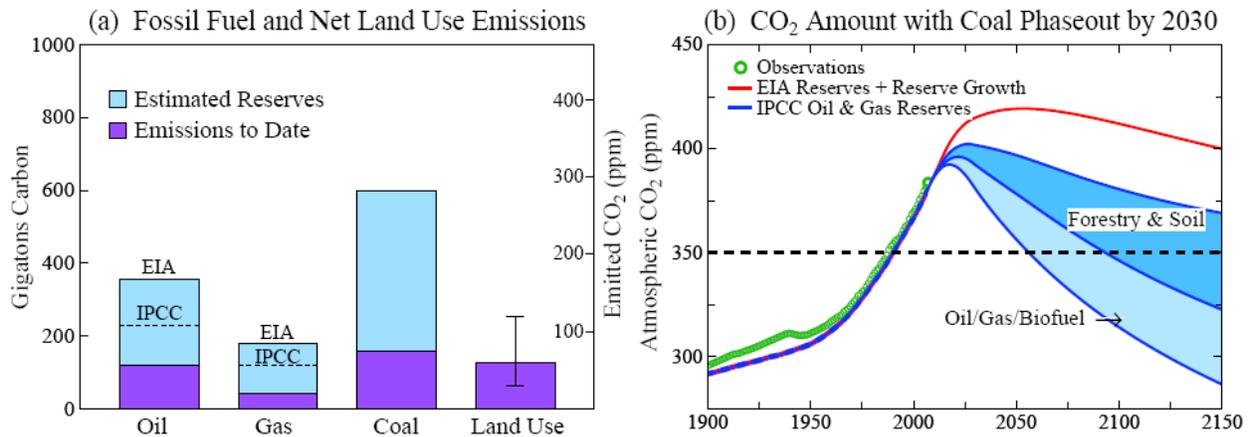


Figure 2. Contribution of fossil fuels and land use to past CO₂ emissions and remaining reserves (a) estimated future CO₂ amount if coal emissions are phased out by 2030². Red line is for EIA oil and gas reserve estimates; blue lines use IPCC reserve estimates².

Real world trends present a sobering picture. Coal's relative contribution to CO₂ emissions is increasing almost worldwide in recent years, as shown for the eight largest CO₂ emitters in Fig. 3. Absolute coal emissions are also increasing, as shown for Japan, United States, Germany and United Kingdom in Fig. 4. Moreover, there are plans for construction of new coal-fired power plants in many countries, plants that would have a lifetime of half a century or more.

Leadership in halting these plans is essential if we are to avoid handing our children a problem that is out of their control. Choices among alternative energy sources – renewable energies, energy efficiency, nuclear power, fossil fuels with carbon capture – these are national matters. But decision to phase out coal use unless the CO₂ is captured is a global imperative, if we are to preserve the wonders of nature, our coastlines, and our social and economic well being.

Responsibility.

Responsibility for global warming is proportional to cumulative CO₂ emissions (Fig. 5b), not to current emission rates⁴ (Fig. 5a). This is physical fact, not an ethical statement. It is a result of the long lifetime of atmospheric CO₂. Responsibility of the United States is more than three times larger than that of any other nation (Fig. 5b). The United States, Europe, Japan, Canada and Australia are responsible for most of the fossil fuel CO₂ in the air today.

Per capita fossil fuel CO₂ emissions are also a useful measure. Per capita current emissions are shown in Fig. 6a for the eight nations with largest total emissions, in order of decreasing total emissions. The United States and Canada have the largest per capita emissions, while per capita emissions of Japan, Germany and the United Kingdom are about half that large.

Per capita responsibility for climate change is based on cumulative national emissions (Fig. 6b). The United Kingdom has the highest cumulative emissions per capita (2007 population), the United States is second, and Germany is third. Increased per capita responsibility of the United Kingdom and Germany is a consequence of their early entries into the industrial era. These facts are not an attempt to cast blame. Early emissions of CO₂ occurred before the climate problem was recognized and well before it was proven. Yet the facts are worth bearing in mind.

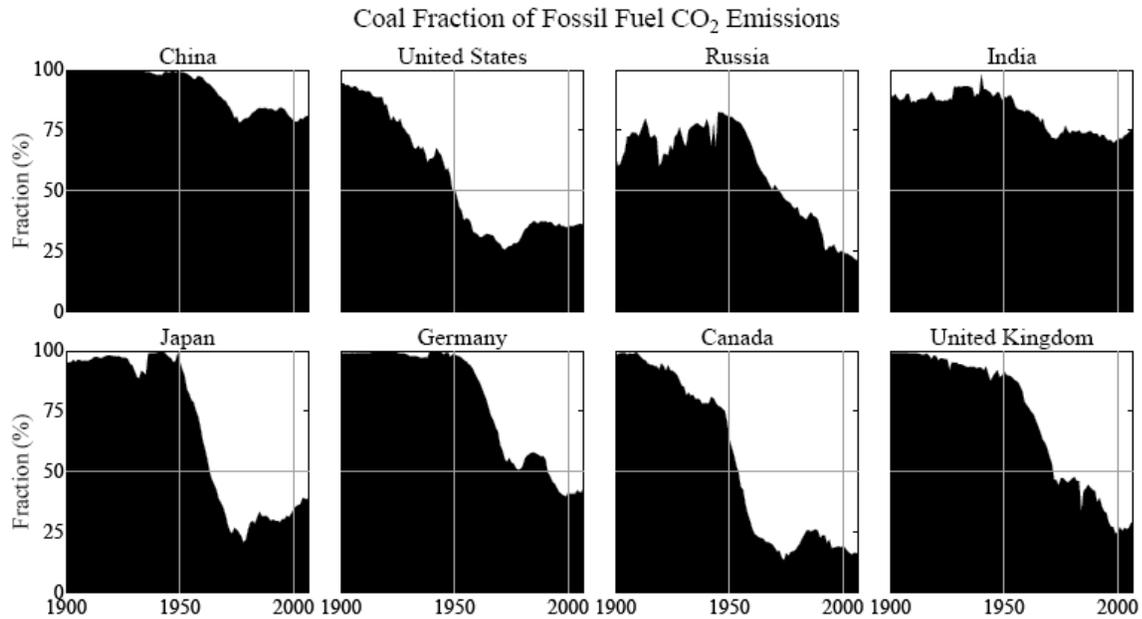


Figure 3. Coal fraction of CO₂ emissions in the eight nations with the largest fossil fuel CO₂ emissions in 2007. Concatenation of fossil fuel emissions data of the Carbon Dioxide Information Analysis Center and British Petroleum is described elsewhere².

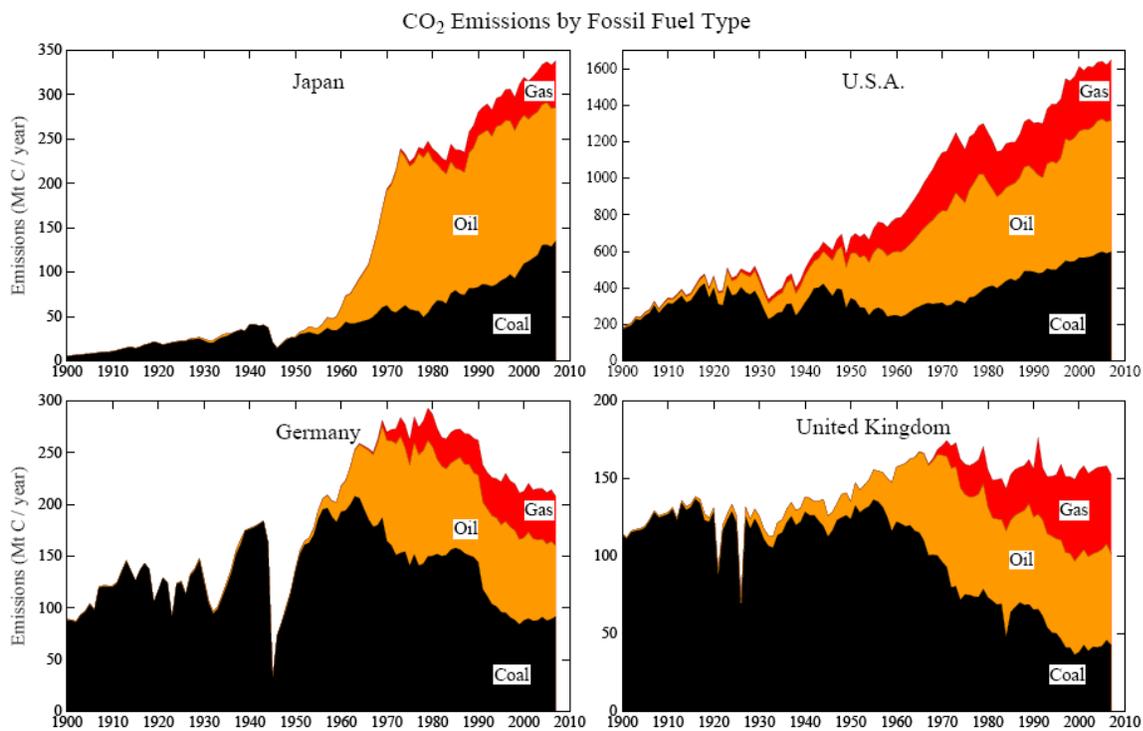


Figure 4. CO₂ emissions by fossil fuel type in four countries. Note the different scales, emissions from the United States being several times larger than those of the other countries.

Fossil Fuel CO₂ Emissions

(a) 2007 Annual Emissions (b) 1751-2007 Cumulative Emissions

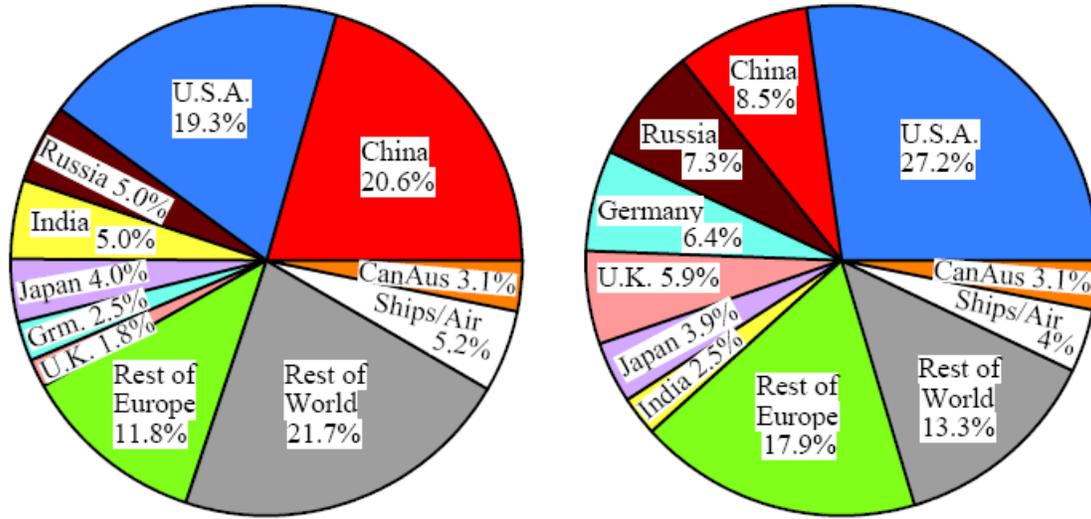


Figure 5. Annual (a) and cumulative (b) fossil fuel CO₂ emissions by country.

Per Capita Fossil Fuel CO₂ Emissions

(a) 2007 Annual Emissions (Tons Carbon/Year/Person)
(b) 1751-2007 Cumulative Emissions (Tons Carbon/Person)

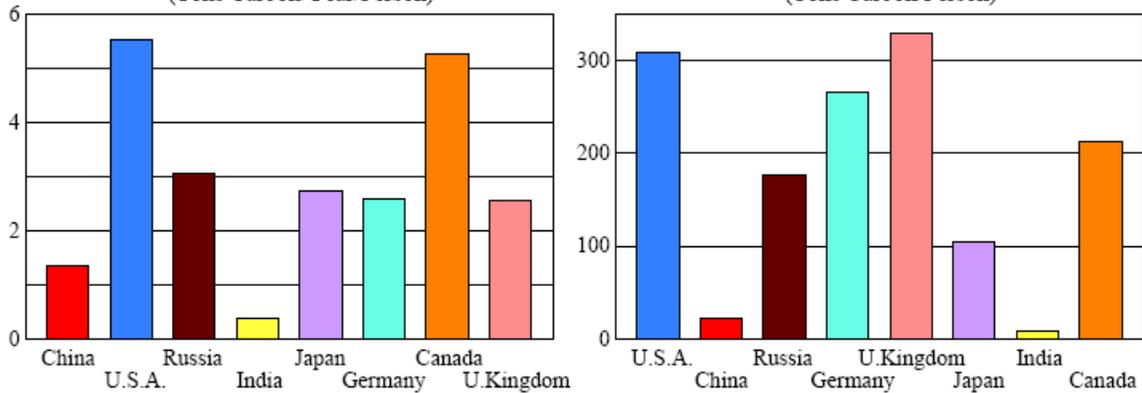


Figure 6. Per capita fossil fuel emissions today in order of national total emissions.

Strategic Approach.

If developed nations had a moratorium on coal-fired power plants, and then phased out coal use by 2020 except where CO₂ is captured, and if developing countries followed a similar path with unsequestered coal use phased out by 2030, atmospheric CO₂ could follow the scenario shown in Fig. 2b. Maximum CO₂ would be 400-425 ppm, depending upon oil and gas reserves and the degree to which fossil fuels are extracted from public lands and off-shore areas.

This low (~400 ppm) limit depends upon one huge caveat, in addition to a prompt coal moratorium and phase-out of coal emissions: emissions from unconventional fossil fuels, such as tar shale and tar sands, must be kept small by either a carbon tax or requirement of CO₂ sequestration.

An appropriate carbon tax rate would obviate bizarre propositions such as cooking the Rocky Mountains to drip oil from tar shale. A reasonable growing carbon tax rate would hasten transformative changes needed for the clean post-fossil-fuel era, i.e., greater energy efficiency and carbon-free energies. The carbon tax should be accompanied by improved efficiency standards for appliances, lighting, vehicles and buildings, and altered utility profit motives,

G8 leaders should compare notes on “green” taxes. In hard economic times with high fuel costs the public will rebel against any carbon tax – unless 100% of the tax is returned immediately, monthly, to the public on a per capita basis^{3,5}. The public is fed up with politicians spending their money in cahoots with alligator-shoe-wearing toad-eating (just kidding) lobbyists. Carbon taxes will drive energy innovations and the dividend will spur the economy. Taxes can be fruitfully initiated on a national basis; any trade disadvantage should be eliminated via an import duty on products produced in other countries that do not impose a comparable carbon tax, with 100% of the duty added to the per capita dividends.

CO₂ can be brought back to 350 ppm this century in the coal-phase-out scenario (Fig. 2b) via improved forestry and agricultural practices, including reforestation and use of biochar to enhance soil fertility and sequestration of carbon², which together realistically can reduce CO₂ by ~50 ppm. Faster return below 350 ppm can be obtained via CO₂ capture at gas-fired power plants and power plants burning bio-waste. Stabilization of climate would likely also require reduction of non-CO₂ climate forcings such as methane, tropospheric ozone and black soot⁴.

Summary. There is urgent need for actions to stem climate change. The Earth’s climate history and ongoing climate changes show that our climate today is approaching tipping points, which, if passed, could have devastating consequences.

Fundamental knowledge about fossil fuel carbon reservoirs reveals an imperative: coal use must be promptly phased out except where CO₂ is captured and sequestered. Yet building of new coal-fired power plants continues unabated.

Leadership must not ignore fossil fuel facts. A strategy adopting CO₂ reduction targets, whether voluntary or mandatory, is doomed to failure unless it prohibits coal emissions. Fig. 4 illustrates the importance of coal even in the era of abundant oil. Germany and the United Kingdom achieved CO₂ emission reduction by phasing down coal use. Japan and the United States failed to achieve emission reductions, mainly because of increasing coal use. In the future, as oil use peaks, coal will be increasingly dominant in determining atmospheric CO₂ change.

Leadership failed to address the energy/climate problem with a carbon tax during the past quarter century. The price is now being paid for that leadership failure; waste of cheap fossil fuels created dependency, reduced the supply, and increased demand. Resulting high prices now go to coffers in the Middle East and other oil-exporting nations. It is too late to cry over spilled milk,

or wasted oil, but there is still, barely, time to transition off fossil fuels, thus both solving the global warming problem and increasing energy independence.

The urgent stop-gap essential action to save the planet is a moratorium on new coal, as follows from the physics of the matter, explained above. By itself this action could cause energy shortages. Thus it must be accompanied by measures to spur energy efficiency, renewable energies, and other carbon-free energies. Technology choices should be largely determined by the market place, but governments should invest in infrastructure, such as low-loss electric grids, and in long-term research, such as fourth-generation nuclear power (which burns nuclear waste).

Prime Minister Fukuda, we cannot avert our eyes from the basic fossil fuel facts, or the consequences for life on our planet of ignoring these facts. If we continue to build coal-fired power plants without carbon capture, we will leave for our children a situation not of their making but out of their control, an impoverished future containing growing climate disasters associated with the passing of climate tipping points.

This is a situation that cries out for leadership. As the Group of Eight meets in Hokkaido the most important thing that the leaders could do is recognize and discuss the need for a moratorium on any new coal-fired power plants in their countries. If these countries, the ones most responsible for the excess CO₂ in the air today, would take that step, it would be a huge step for mankind and nature.

Indeed, if but one country would step forth to lead in this direction, it could be a turning point. Leaders in both the United Kingdom and Germany, with high per capita historical emissions, would seem to be good candidates, yet they have hesitated, despite “green” credentials.

In the United States, it seems that the public, the courts, and some state and local governments are seizing the initiative, and have succeeded in blocking a large number of proposed coal plants. Yet there is little near-term prospect for national United States leadership for a full moratorium.

Japan’s recent record, as shown by Figs. 3 and 4, is not good, the fractional and absolute portions of coal emissions approximately doubling in the past three decades. Growth of coal use is the primary reason for the upsurge in Japan’s total CO₂ emissions.

Prime Minister Fukuda, I hope that you will look at the fossil fuel facts that I have presented above and consider the possibility for leadership in this topic, which will be so important for our children and all the inhabitants of our planet.

Finally, Prime Minister Fukuda, I would like to thank you for helping make clear to the other leaders of the eight nations the great urgency of the actions needed to address climate change. Might I make one suggestion for an approach you could use in drawing their attention? If the leaders find that the concept of phasing out all emissions from coal, and taking measures to ensure that unconventional fossil fuels are left in the ground or used only with zero-carbon emissions, is too inconvenient, then, in that case, they could instead spend a small amount of time composing a letter to be left for future generations.

This letter should explain that the leaders realized their failure to take these actions would cause our descendants to inherit a planet with a warming ocean, disintegrating ice sheets, rising sea level, increasing climate extremes, and vanishing species, but it would have been too much trouble to make changes to our energy systems and to oppose the business interests who insisted on burning every last bit of fossil fuels. By composing this letter the leaders will at least achieve an accurate view of their place in history.

With all best wishes,
Yours sincerely,

James E. Hansen
Kintnersville, Pennsylvania
United States of America

¹ Climate Threat to the Planet: Implications for Energy Policy, J Hansen, available at www.columbia.edu/~jeh1

² Target atmospheric CO₂: where should humanity aim? J Hansen, M Sato, P Kharecha, D Beerling, R Berner, V Masson-Delmotte, M Raymo, D Royer, J Zachos, <http://arxiv.org/abs/0804.1126> and <http://arxiv.org/abs/0804.1135>

³ Global Warming Twenty Years Later: Tipping Points Near, J Hansen,
http://www.columbia.edu/~jeh1/2008/TwentyYearsLater_20080623.pdf

⁴ Dangerous human-made interference with climate: a GISS modelE study, J Hansen et al
http://pubs.giss.nasa.gov/docs/2007/2007_Hansen_et_al_1.pdf

⁵ “Carbon Tax and 100% Dividend”³ is a derivative of the cap and dividend approach described by Peter Barnes in “Who Owns the Sky: Our Common Assets and the Future of Capitalism”, Island Press, Washington, D.C., 2001 (http://www.ppionline.org/ppi_ci.cfm?knlgAreaID=116&subsecID=149&contentID=3867).