The Circle of Power

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Preface

Global warming and climate change, peak oil, population growth; it is evident the world is in crisis. Can humanity find the natural resources and the energy it needs to sustain itself beyond this century? Will the planet remain a congenial host to our species, or will its favor leave us, casting us into a dry, cold minor Ice Age, bankrupt of fossil hydrocarbon fuel?

Planners, policymakers and thoughtful citizens are looking into the future, trying to devise intelligent strategies to deal with the looming global changes. They observe the melting of glaciers and tundras, the breakup of ancient Antarctic ice sheets, the intensifying ferocity of tropical storms, the expansion of deserts, the accelerating demise of many animal species from plankton and frogs to fish and polar bears.

Equally evident is the stagnation and even reversal of human development to end world poverty. Astounding inequites, gross injustices, wars, plagues, shameless exploitation of the young, weak, sick, poor and female; all show beyond dispute that human society has yet to develop a consciousness beyond the merely tribal, beyond the narrowest of clan, class and ethnic loyalties.

In this report I consider the following questions:

1, what are the best sources of energy from both a global perspective, and for any given nation?, and why?;

2, from each of the perspectives of the United States and China, which would be the better choice to produce the nation's electrical energy, coal or nuclear power?, and why?

At the turn of the century, the United Nations hosted a conference to develop a set of world development goals to guide the membership's efforts. These Millennium Development Goals (MDG) were identified as follows:

1, eradicate extreme poverty and hunger;

2, achieve universal primary education;

3, promote gender equality and empower women;

4, reduce child morality;

5, improve maternal health;

6, combat HIV/AIDS, malaria and other diseases;

7, ensure environmental sustainability;

8, develop a global partnership for development.

Clearly, the best types of energy technologies for the future are those that help achieve the Millennium Development Goals. (1) the United Nations Development Programme supports projects to make energy services available to poor communities, to help them develop a higher standard of living as measured by the Human Development Index (HDI). (2) These goals engage the efforts of people in the technically advanced and economically prosperous nations as well, because today's world is too small not to feel the impact of distant poverty. (3) The three reports cited here, by the UN and the government of the United Kingdom, are both instructive and inspiring. As a matter of simple physical and economic fact, poverty can be eliminated.

Given the conditions described up to this point, what are the best "energy choices in an age of global warming?" The New Economics Foundation (NEF) has made an extensive study of this question, and their detailed report shows that local microgeneration from renewable energy sources powering local distribution networks, which are then linked into larger-scale regional and national networks is the best choice.

> Nuclear power is being promoted as the answer to climate change and energy insecurity. But, as a response to global warming, it is too slow, too expensive and too limited. And in an age of terrorist threats, it is more of a security risk than a solution. Instead, the characteristics of a flexible, safe, secure and climate friendly energy supply system apply to renewable energy. In comparison, it leaves no toxic legacy and is abundant and cheap to harvest both in the UK and globally.
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> Individually renewable energy sources like wind, solar and geothermal could, in theory, meet all of the world's energy needs. But the jump from theory to practice would face many obstacles. Practically, however, a broader combination of renewable energy sources, tapped into with a range of micro, small-, medium and large-scale technologies, and appled flexibly, could more than meet all of our needs.

> The potential of getting energy from a decentralised system of very small-scale, microgeneration from renewable sources has been overlooked.
>
> Micropower provides local choice and control, the option of relying on local fuels and spurring community economic development. (4)

The NEF report settles our first question, renewables are preferable to fossil fuels and nuclear power.

Why then do we bother to pose the second question: coal versus nuclear? The rest of this report addresses that.

I. Concentration of Power

The circle of power is

--> physical --> political --> economic --> military --> physical -->.

Acquisition of power in any of the four elements enables a concentration of power in subsequent elements along the circle.

The proper source of physical power depends on the concentration to be maintained. Consider two opposing configurations of power, one centralized and the other distributed.

The aspects of centralized power can be:

1, fossil fuels: coal, oil & gas, nuclear fission;

2, strong centralized "government" (a controlling elite);

3, corporate capitalism (plutocracy);

4, a large, industrialized military (and imperialism).

The aspects of distributed power can be:

1, renewable sources of energy, local production and use, linked micro-nets;

2, local resource and political control (zero democratic deficit);

3, broad distribution of "production" and equity;

4, security afforded by distributed domestic sources and local self-reliance.

II. Coal Versus Nuclear?

The United States of America can be powered entirely by renewable energy.

The choice of "coal versus nuclear" presumes:

1, oil will soon be depleted (true enough);

2, a high concentration of political, economic (corporate) and military power are to be preserved;

3, the option to make a social transformation to broad political and economic equity (closing the democratic deficit) is not acceptable.

The question as posed presupposes that "the deciders" are a power elite.

Solar energy collection at 1% conversion efficiency to electricity, on 2% of the land area of the United States would provide the total electrical energy use of the USA, 4 x 10^12 kwh/yr.

Noting the land fraction given, it should be possible to power the nation by covering the domestic US military bases in solar energy systems. Think of this as a conversion of a concentrated military element to the distributed configuration. Beat your swords into solar panels.

The combination of renewable energy sources: wind, ocean (wave and tide), solar (photo-voltaic and thermal) and bio-mass (e.g., potty effluents converted to methane and water, though it is true the burning of methane releases CO2) can supply national energy needs, in association with energy efficiencies of use and design (e.g., energy-generating and conserving architecture). Conversion to mass transit (local networks linked to regional linked to national; mass transit can be "free," that is nationally subsidized) can shift mobility energetics from the combustion of petroleum fuels and natural gas to electricity from renewable sources.

III. Military Power

Any modern military, and in particular the US military, will depend very heavily on fossil fuels (hyper-extrasomatic energy). The military requires a large consumption of some or all of coal, oil, gas and nuclear fuel to provide mobility and concentrated force.

Military mobility is very inefficient: fighter jets, helicopters, warships, tanks; all are "big," "heavy," consume fuel in large quantities (e.g., hovering flight), and are moved often, over large distances, with heavy loads, and with rapid acceleration.

Concentrated force, or military power, is "firepower." This requires both armaments and chemical industries. Concentration of troops and heavy equipment (recall the requirement of rapid mobility) in turn require extensive and rarely efficient supply streams.

The inability of the US military to sustain concentrated force in a (foreign) theater of action requires a US war strategy of extreme and brief action. Once spent, the force structure is open to "infection" and "decay" as is well known, notably from the Vietnam and Iraq Wars.

Large area, low power energy systems are inconsistent with military needs; yet such distributed power is far more secure and resilient. Pipelines and power stations are easier to target, and their loss easily weakens a wider region.

Therefore, the lack of consideration of renewable energy for national power is because it does not offer a source of significant military power -- despite being intrinsically more secure, economically equitable and environmentally sustainable.

IV. Fossil Fuel Powers Elite Self Interest

The lack of support for renewable energy is a political decision by controlling elites to retain concentrated power at all costs, including: democracy, economic justice, environmental sustainability and even species survival as evident from the willingness to incur increasing global warming.

The reason coal, oil, gas and nuclear energy are the most fiscally economic choices among energy technologies is because they are the preferred options for the preservation of concentrated power. National and international economics are then skewed by controlling elites so government subsidies and favorable treatment of corporations over popular aspirations then ensures the real costs of fossil fuel technologies are socialized as private subsidies and public taxes, environmental decay and limited availability of alternatives. Renewables are "more expensive" because the economy is gerrymandered to flow into fossil-fueled capital interests.

From the widest perspective of world and national populations, renewable energy technologies (which include efficiencies of use, design and social arrangements) have lower total cost; this includes environmental impacts and the requirements of waste management. It may be that these technologies have a lower ratio of kwh/$ than fossil technologies under the current regime of skewed "market" and "regulatory" conditions, and favorable official and unofficial government subsidies. The purpose of such economic gerrymandering is to carve out private profits at public expense, and the claim

that fossil technologies offer higher kwh/$ is invalid and disingenuous under such circumstances.

For military power, physics would favor fossil fuels: oil, gas, coal and nuclear. For sustainable human development, physics favors renewables.

"Economics" is arranged to suit the preferred energy technologies by those with the power to make decisions and control the politics. Those decisions are made on the basis of self-interest not human development interest, as is evident by social, economic and environmental conditions, and the response to global warming.

The choice "coal versus nuclear" is an issue of optimization within a controlling elite, which presumes its domineering continuation.

V. Top-Down International Politics And The Nuclear Option

On the issue of "coal versus nuclear," international politics is a negotiation between national elites (e.g., China versus the U.S.) that presupposes their tacit agreement to support each others' domineering domestic role.

Top-down political configurations of controlling elites and dependent national populations can be:

1, the corporate capitalism owning the US government (private capital buying out public interests);

2, the state capitalism of China (centralized bureaucracy accumulating private capital);

3, a mix of US and Chinese models in Russia.

A shift from coal to nuclear power is the clear choice for national elites, particularly in the West, because global warming and the potential for abrupt climate change represent a larger and more immediate threat than any potential nuclear catastrophe.

VI. Global Warming

Global warming triggering an abrupt climate change -- to a colder, dryer "mini Ice Age" within one or two decades -- is an alarming possibility rapidly growing in probability (recent observations of arctic melt, CO2 accumulation and average temperature show an accelerating pace unanticipated even in recent years). If realized, this could undermine the physical (e.g., agriculture, food production) and social (e.g., mass migration) conditions enabling controlling elites to maintain themselves. The politics and economics of today could

collapse. The emission of CO2 is direct threat to the suppositions upon which existing political power is based. Thus, the emission of CO2 must be stopped. The elite conundrum, how to do this while preserving control and optimizing their profit margins?

VII. Nuclear Catastrophe

The threats of nuclear: proliferation, terrorism, blackmail, accidents and even war are more remote than the threats posed by global warming. If all industrial CO2 and greenhouse gas emissions ceased immediately, the world would still warm for over a decade before equilibrating (if no abrupt change is triggered). A Chernobyl scale disaster (i.e. ~30,000 premature deaths, lingering widespread radioactive contamination) every few years is still minor (in the elite perspective) in comparison to a mini Ice Age commencing in one or two decades as the world runs out of oil, with perhaps under 5% to 10% of the fossil endowment remaining.

The threat of possible misuse and malicious abuse of the nuclear power waste stream are lower level threats, and can likely be forestalled longer (by a combination of advanced control and processing technologies, and protective military power) than the looming, irreversible catastrophe of global warming triggered climate change.

From the perspective of the Western power elite, the choice is clear -- nuclear now.

VIII. U.S. Versus Chinese Perspectives On Coal-Versus-Nuclear

The single largest source of CO2 emission is the United States, 4.5% of the world's population produces over 24% of world CO2 emissions. The most likely potential source of comparable magnitude in the immediate future is China, burning its coal to raise the per-capita electrical energy consumption of its people (1484 kwh/c in 2002, versus 13,456 kwh/c for the USA; c = capita), and its economic gross domestic product (GDP). Today, China has 21% of global population and produces 12% of global CO2 emissions.

As an average, each American consumes 9 times more electrical power than a Chinese individual, and consequently produces 9 times as much CO2. Americans release CO2 at 5.3 times the average world per capita emission, while the Chinese release at 0.57 times the average global per capita emission.

If the Chinese were to consume 3084 kwh/c, they would equal America's total electrical energy consumption and CO2 emissions, and the ratio of American to Chinese per capita use and emission would be 4-to-1 (alternatively, the projected use and emission of 4 Chinese would equal that of 1 American).

However, the global emissions of CO2 would be minimally 12% above today's quantity.

Clearly, China has the potential to become the largest national source of CO2 emissions.

In order for the US power elite to convince the Chinese power elite that a change to nuclear power is best, they will have to address Chinese issues of financing, control, development and reciprocity.

IX. Financing Chinese Nuclear Power

For the Chinese to switch from coal to nuclear power, they will have to have financing that makes the development of nuclear power as immediately profitable, in kwh/$, as the continued exploitation of Chinese coal. This financing plan must also account for the employment of the many Chinese workers displaced by the cessation of coal mining. A successful plan of this type would be a boon to China's environment and public health.

X. Controlling Chinese Nuclear Power

To minimize its balance-of-payments and security concerns, China would want to have complete control of the technology and fuel sources of its nuclear power industry. This suggests that if the U.S. has preferences as to the types of reactor designs, fuel cycles and waste processing and storage methods to use, it would have to freely share its technical knowledge in these areas. China would have to see its degree of control over the proposed nuclear power infrastructure as complete as that over its present domestic coal industry. Also, the proposed nuclear power system must be seen to keep the Chinese military as powerful as planners had intended it to be with oil and coal-fired power (civilian nuclear power might free fossil fuels for primarily military use, and reduce the need for oil importation).

XI. Development of Chinese Nuclear Power

China would want to see the rate of development of the proposed nuclear power system to be such as to support the rapid rate of expansion of the Chinese economy, both at the rate experienced today and, in future, at rates targeted by Chinese economic planners. This means that the proposed nuclear power system must be judged capable of equaling or surpassing the planned performance of the Chinese coal-fired system, both in load-carrying capacity and scheduled rate of expansion. There can be no delay in the effort to raise energy production, GDP and consequently the human development index of the nation (increased with higher per capita electrical consumption, but negatively affected by coal industry environmental impacts).

XII. Reciprocity

The necessary forms of financing, control and development of the proposed Chinese nuclear power system to replace domestic coal-fired power that would both meet China's needs and appeal to US (elite) preferences may be impossible to realize. The Chinese governing and planning elite could easily ask that the United States modify its behavior as a response to the crisis of global warming. Possible Chinese responses might be:

1, why don't you, the U.S., drastically increase your energy efficiency, especially in your transportation (i.e., mobility) sector?; burn less oil and emit less CO2;

2, we, China, plan to burn our coal as required to raise our GDP and HDI as rapidly as possible; we realize we are socializing the cost of our rise out of material poverty by adding to world CO2 emissions, but proportionately, we are far more sparing of the world than you in the U.S. and Europe have been in your own economic developments up to and including today, you can easily economize to offset what we may add to global CO2 emissions;

3, part of our effort to raise our Chinese standard of living includes an effort to develop a next-generation domestic nuclear power infrastructure to take over from our coal-fired power industry; but we do not see this happening for a decade or more due to practicalities set by physics and economics; and we do not see you as justified in asking that we slow the pace of our economic development, nor speed up the implementation of immature next-generation nuclear power technologies, nor spend capital (or assume debt) to purchase foreign power technology to assuage environmental fears you say much and do little about.

Conclusions

Renewable energy sources are the best choices when human development and environmental sustainability are the goals.

Fossil fuels and nuclear power require significant concentrations of capital and physical plant in order to produce. The energy distribution model for fossil fuel and nuclear power is one of a high concentration point source feeding a widely distributed diffuse load, which includes unavoidable transmission losses. This energy distribution model mirrors top-down political and economic systems where a powerful, controlling elite manages a passive and dependent population. Also, large and wasteful military establishments are maintained at public expense to implement the coersion that elite policy requires.

In contrast, renewable energy sources are inherently both local and diffuse, and they work best when powering human activity in their immediate vicinity.

Thus, renewable energy networks are analogous to political and economic systems of broad equity, local development and local control. Since there is little need to control events at remote distances in order to secure energy resources, there is little need to maintain a large and wasteful infrastructure of coersion. So, there is little likelihood of creating animosity that would invite attack, and you have the built-in security of a diffuse energy supply network that is too resiliant and widespread a target to significantly damage.

Any national policy preferring fossil fuel and nuclear power over renewables is a political decision to maintain elite minority control, it is not based on purely objective parameters identified by physics, engineering and economics which recognizes the Millennium Development Goals.

Continuing with fossil fuels and nuclear power as our primary sources of electrical energy would represent a significant global public sacrifice, including irreversible environmental damage, incurred to support private profit for a small minority of the world's people.

> Secure power is distributed power.
> Which would you rather live in:
> a nation of 200 nuclear power plants,
> or one with 200 million solar collectors?
> Which would you prefer after the air raids?
>
> -- (poem, 1979).

If we assume that highly stratified economic systems with top-down politics are to be maintained dispite global warming, then nuclear power is the source of choice for the centralized energy systems. Renewable energy could be added locally, as convenient.

Global warming is here now, at best we can only slow its rate of rise, hoping it does not trigger a catastrophic climate shift before equilibrating in a decade or two. Some type of future nuclear catastrophe is a possibility of increasing probability. The outlook inherent to an elite leadership class (some would say their hubris) would see the liabilities of nuclear power (proliferation, waste, terrorism) as additional factors still capable of being controlled by devising new technology and applying military force. Global warming is past this point, we can only reduce CO2 emissions and hope for the best.

Thus, it is in the interests of the US elite to convince the Chinese elite to move from coal to nuclear power. It is also in the interests of the US elite to reduce the quantity of domestic CO2 emissions, however this runs into conflict with their own basis of concentrated power.

The generation and distribution of energy mirrors the political economy. We observe that social control favoring highly concentrated wealth is polluting, impoverishing and ultimately unsustainable. If people matter, then energy is renewable, locally produced and used, and widely available with low expense.

Endnotes

[1] "The Energy Challenge for Achieving the Millennium Development Goals," UN-Energy, 22 July 2005, http://esa.un.org/un-energy/pdf/UN-ENRG%20paper.pdf

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[3] "Energy for the Poor: Underpinning the Millennium Development Goals," Department For International Development, Government of the United Kingdom, August 2002, ISBN-1-86192-490-9, http://www.dfid.gov.uk/pubs/files/energyforthepoor.pdf

[4] "Mirage and Oasis, Energy Choices In An Age Of Global Warming," New Economics Foundation (NEF), June 2005, ISBN-1-904882-01-3, http://www.neweconomics.org