

Age of Scarcity: China at the doorsteps to survival in a low-carbon future

Abstract

In the wake of the first decade of the 21st century, a looming Malthusian spectre appears to be returning to halt us. World population is approaching 7 billion by 2011, though with a steady decline in growth rates, it is expected to stabilize around 8 to 10.5 billion by 2050. However, unlike previous Industrial Revolutions, large new economies especially China and India are adding Three Billion New Capitalists (1) seeking to follow the American Dream all at the same time. Explosive urbanization and a rising consuming middle-class characterize much of the emerging world (2). Demand for energy and raw material has increased exponentially while environmental strains and resource limitations are taking their toll. The world's main rivers and fresh water sources are running dry (3) as global resource scarcity is compounded by careless waste and Climate Change. The world is increasingly becoming 'Hot, Flat, and Crowded' (4). National, political, geographic, economic and social disparities and barriers exacerbate problems of scarcity and poverty where the needs are the most acute. In the money world, a seismic change has also been happening as painful lessons are still being learnt from the risks and excesses of capitalist fundamentalism. Meanwhile, the existing West-dominated world order is being challenged by the swing of the pendulum from the West to the East. As an exemplar of this shift, China is both convergent in globalization but divergent in economic, political, cultural, and religious outlook. Yet, China's footprint is becoming more and more global, from Africa, Latin America to the Middle East. All these breed uncertainty and mistrust, complicated by the need for energy security and the classic security dilemma facing rival powers. New regional alliances are growing in South East and Central Asia, and the Asia Pacific. This paper critically examines the foregoing background and attempts to respond to some forward-looking questions. In this age of global scarcity and uncertainty, should the world seek minimalism over surfeit - an innovative and green lifestyle of conservation, moderation and frugality over old-hat waste, excess and vanity? To what extent cutting-edge green technologies may offer win-win solutions and business opportunities? Will this be the epoch of revolutionary change when the internal combustion engine is moving to the museums as the whole world embraces super-efficient battery-driven cars supported by green power grids? As some of the ills of the Washington Census are laid bare, would the Beijing Consensus be as problematic in fulfilling the needs of Development? To what extent the Invisible Hand of Capitalism needs to be regulated by the Theory of Moral Sentiments? Should Development pay more attention to the 'Gross National Happiness Index' than sheer GDP growth? Should Confucian Balance, Harmony and Golden Mean replace a zero-sum game? Do we need a 'Collapse'(5) of civilizations in this century to jolt us into the ethos of a global village where all our fates are linked and where our future lies in a new awakening and a new direction to adapt and transform our very lifestyles?

- (1) Clyde Prestowitz, *Three Billion New Capitalists: The Great Shift of Wealth and Power to the East*, Basic Books, 2005
 - (2) Mckinsey Quarterly, *Comparing Urbanization in China and India*, July, 2010
 - (3) Fred Pearce, *When the Rivers Run Dry: What happens when our water runs out?*, Eden Project Books, 2006
 - (4) Thomas Friedman, *Hot, Flat, and Crowded*, Penguin, November 2009
 - (5) Jared Diamond, *Collapse: How Societies Choose to Fail or Survive*, Penguin, January, 2006
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Key Words

Rise of the Middle Class; Urbanization; Population Growth; Ecological Constraints; Energy Security; Geopolitics; Green Technologies; Minimalism; Confucianism; Golden Mean; Development

Introduction

On 3 May 2011, the United Nations Population Division revised its world population growth projection from around 9 billion to 10 billion by the end of this century. If fertility rates in Africa and other parts of the developing world should prove to be half a child above the median variant, the world's population is expected to reach 10.6 billion by 2050 or 15.8 billion by 2100 (1).

The Malthusian challenge is magnified by the explosive growth of urbanization in the world's most populous countries, such as China, India (2) and Indonesia, driving rapidly rising consumption of food and other resources. Unlike previous Industrial Revolutions, this time around, it is not just one country at a time, but all the large populations all at once (3).

Meanwhile, extreme weather conditions in China and around the world seem to warn that time is fast running out to find a global solution to ecological sustainability. Mountains of dire scientific evidence of the Intergovernmental Panel on Climate Change (IPCC) are crying out to be acted upon.

- (1) *World Population Prospects: The 2010 Revision*, Population Division, UN Department of Economic and Social Affairs, 3 May 2011
- (2) Mckinsey Quarterly, *Comparing Urbanization in China and India*, July, 2010
- (3) Clyde Prestowitz, *Three Billion New Capitalists*, Basic Books, 2005

The world, as Thomas Friedman depicts in his book, is becoming increasingly *Hot, Flat and Crowded* (4), with grave implications for national development, international relations, and Mankind's very survival, if past civilizations are any guide (5).

China's 12th Five Year Plan (2011-15) is changing course towards a slower but more balanced and sustainable growth model. However, a reasonably speedy rate of growth is still needed to generate over 10 million extra jobs a year to turn China's massive pool of excess labor from the countryside into potential urban consumers. This process is to complete hopefully before China's population profile starts to age rapidly in the coming decades. To maintain stability with sufficient growth, China is hence embarking on mankind's largest and fastest urbanization drive, whose insatiable demand for resources worldwide is changing global geopolitics and geo-economics in an era of increasing scarcity against the background of Climate Change.

The cumulation of these global trends and China's acute environmental and water problems begs the question whether rapidly rising consumption levels for so many countries on this planet are sustainable, and whether human survival requires a concerted change in mindset and lifestyles towards a common low-carbon future. Perhaps a new Ecological Civilization is called for, where green and innovative Minimalism is chic, where Less is More, and where the Golden Mean is Norm in lieu of excess and vanity.

Environment Constraints

There is considerable difference between how Climate Change is viewed in the West compared with how it is perceived and increasingly felt in the developing world. While some in the West may still be seeing Climate Change as a looming, if somewhat distant risk, it is for the developing world, China in particular, a clear and present national danger.

China has achieved economically in 20 years what has taken the West 100 years. However, she is now facing all at once the environmental consequences equivalent to a hundred years of industrial growth. On 26th December 2006, China released a

(4) Thomas Friedman, Penguin, November, 2009

(5) Jared Diamond, *Collapse: How Societies Choose to Fail or Survive*, Penguin, January, 2006

first-ever *National Assessment Report on Climate Change*, a 400-page multi-departmental research publication. China's average temperature is expected to rise 1.3 - 2.1 degrees Centigrade by 2020. Glaciers on the Qinghai-Tibet Plateau, a main freshwater source for China and neighboring countries, are shrinking by 131.4 sq km per annum. Those in Western China are melting down by 27.2% by 2050. Extreme weather conditions including floods and droughts are likely to lead to increasing water and food scarcity as well as diseases. The Report called for a dramatic transformation of China's development model.

The clarion call was extremely timely, if not already much overdue. At the international press conference of the Fifth Session of the 10th National People's Congress on 16th March, 2007, Premier Wen Jiabao categorically stated that notwithstanding China's impressive growth, he remained deeply concerned about the nation's environmental risks. He feared that China's current development was becoming '*unstable, unbalanced, uncoordinated, and unsustainable*'. It was no surprise that China played a highly proactive role in galvanizing an international agreement on the Bali Roadmap on Climate Change in January 2008.

China's current industrial development bias is causing mounting national distortions. At far back as the National People's Congress in March 2005, Premier Wen flagged up the '*Five Imbalances*' in China's national development: Rural versus Urban, Human versus Environmental, Economic versus Social, National versus Local, and Inward versus Outward Investment. That's also why President Hu Jiantao has repeatedly stressed the need for 'people-based governance' (or 'government for the people') and a 'people-focus' instead of a 'growth-focus' approach to development.

China's current development is largely driven by environmentally unfriendly, energy-inefficient, carbon-intensive, low-margin and over-export dependent industrial production. The health problems are only too obvious. According to a World Bank Report, *Cost of Pollution in China* (6), an evaluation of health losses due to ambient air pollution using willingness-to-pay measures estimated the cost at 3.8 % of GDP. In 2007, the World Bank conservatively estimated the overall cost of pollution at 5.8% of GDP. Other estimates have put it even as high as 8 to 12%.

(6) *Cost of Pollution in China: Economic Estimates of Physical Damages*, Rural Development, Natural Resources and Environment Management Unit, East Asia and Pacific Region, The World Bank, Washington, D.C., February, 2007

What is more, with China becoming the world's largest CO2 emitter, her insatiable demand for the world's raw materials, and the size and speed of growth of her economy, alarm bells are beginning to ring across the globe of the threats not only to China's own environment and public health but to the world's economy and ecosystem as well, as in Jonathan Watts' book, *When a Billion Chinese Jump* (7).

A large part of the problem is backward technology, inadequate civic mindedness, local protectionism and vested interests, legitimate or otherwise. These are manifested in various mining disasters and cases of reckless environmental exploitation at the expense of water and air quality. With a relatively short history, the Ministry of Environmental Protection is fighting an uphill battle against other departments or authorities more concerned with growth-related agendas.

Water Crisis

Water is on top of China's ecological threats. In fact, in one form or another, water has been China's headache for past millennia. But now, because of China's national imperative of rapid urbanization, this threat is taking on Herculean proportions.

China's per capita fresh water resource is only one third of the world's average. Throughout the country, water resources are very unevenly distributed: 36% of the land south of the Yangtze has 80% of China's water, where it is historically prone to flooding of devastating proportions. 64% of the land north of the Yangtze has only 20%, chronically beset by droughts. Worse still, all of China's 7 main rivers and 25 out of her 27 largest lakes have now become polluted. 300 million inhabitants do not have ready access to safe drinking water. 25% of the land is threatened by desertification. Similar but worse than most of the world's largest rivers, the Yellow River is running dry as a result of years of increased irrigation, urbanization, silting and climate chaos (8).

Water use in China is very unproductive and wasteful. According to a World Bank

(7) Jonathan Watts, *When a Billion Chinese Jump*, Faber and Faber, July, 2010

(8) Fred Pearce, *When the Rivers Run Dry*, Random House, 2006, Chapter 14.

report (9), agriculture accounts for 65% of China's water consumption. Yet, water productivity in agriculture is the lowest of all sectors, due to pervasive waste in irrigation systems, and suboptimal allocations. Only about 45 % of water for agriculture is actually used by farmers on their crops. Industry accounts for 24 % of total water withdrawn, but the water recycling level is 40 % on average compared to 75–85 % in developed countries.

Water pollution is widespread: only 56% of municipal sewage and 92% of industrial discharge are treated . Two-thirds of the rural population does not have access to piped water. The arid North is increasingly relying on groundwater, resulting in rapid depletion of aquifers, lowering of water tables, drying up of lakes and wetlands, and subsidence in many cities.

The World Bank's *Cost of Pollution in China* study (10) estimated that the water crisis is already costing China about 2.3 % of GDP, comprising 1.3 % due to water scarcity and 1 % to water pollution. The Report recommends a package of remedial measures covering water governance and rights administration, water markets and pricing, protection of river basin ecosystems, pollution management and prevention.

Nor does the '*South-to-North Water Diversion Project*', the world's and probably history's most ambitious project of its kind, look certain to resolve China's water crisis. There are increasing concerns about the volume and quality of water in the Yangtze that is supposed to be diverted, as well as the impact of such diversion on the ecology and the people of the Yangtze region downstream. The project was originally supposed to open by the 2008 Olympics, but has been dogged by myriad problems (11). The middle route is now to become operation in 2014, and the eastern route, by 2013. As planned, the Western route straddles across the Tibetan plateau at an average altitude of 10,000 to 13,000 feet to help irrigate the Yellow River basin. It has been deemed too difficult to implement for now.

(9) *Addressing China's Water Scarcity* (47111), Jian Xie with Andres Liebenthal, Jeremy J. Warford, John A. Dixon, Manchuan Wang, Shiji Gao, Shuilin Wang, Yong Jiang, and Zhong Ma, The World Bank, 2009, p. xx

(10) *Cost of Pollution in China*, The World Bank, February, 2007

(11) Edward Wong, *Plan for China's Water Crisis Spurs Concern*, New York Times, 1 June, 2011

Because of mounting problems of drought in the North, there are now talks of diverting waters from Tibet's Yarlung Zangbo River to the Yellow River (12). But the resultant impact on the downstream Brahmaputra River, on which livelihoods of about 500 million people depend in vast delta and basin areas in India, Bangladesh, Nepal, Bhutan and parts of Myanmar, remains to be addressed. The potential ecological threat is causing grave concern in India (13).

Similarly, for the first time, the State Council openly admitted in a statement on 19 May 2011 that there are problems with resettlement, ecology and seismic geology with the Three Gorges Dam project (14).

Energy and other commodities

According to the International Energy Agency (IEA), China overtook the US as the world's largest energy consumer in 2010, though on a per capita basis, Chinese consumption is only about one-third of the OECD average (15). On average, each Chinese citizen consumes only about one fifteenth of primary energy as an American, a fifth as much as a Japanese, but twice as much as an Indian. But in terms of energy input per unit of GDP produced, China is very inefficient. In 2000, on average, industrial energy intensity in China was about 50 % higher than in

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- (12) Zhang Ke, Diversion Debate, ChinaDialogue, 13 June, 2011 at http://www.chinadialogue.net/article/show/single/en/4349-Diversion-debate?utm_source=Chinadialogue+Update&utm_campaign=de173063b6-newsletter+03+May+2011&utm_medium=email (accessed on 14 June, 2011)
- (13) See live TV debate on the Brahmaputra on Times Now of The Times of India on 13 June, 2011 at <http://www.andrewleunginternationalconsultants.com/chinawatch/2011/06/the-brahmaputra-a-possible-creative-solution-to-a-transnational-water-conflict.html> (accessed on 14 June, 2011)
- (14) Michael Wines, *China admits problems with Three Gorges Dam*, International Herald Tribune, 19 May, 2011 at http://www.nytimes.com/2011/05/20/world/asia/20gorges.html?_r=1 (accessed on 14 June, 2011)
- (15) International Energy Agency, 20 July, 2010 at http://www.iea.org/index_info.asp?id=1479 (accessed on 20 June, 2010)

industrialized countries (16) and paled in comparison with countries like Japan, the United Kingdom and the United States.

China's manufactured export is largely energy and labor intensive, reliant on foreign brands, external proprietary technologies and other forms of foreign intellectual property. The extent is some 50%, compared with 5% in the case of Japan and the US. Only about 3% of China's manufacturers possess their own proprietary technologies. For example, only \$1 of pure profit is generated out of a \$32 DVD player after deducting \$18 royalty for the proprietary brand owner and \$13 for production costs. Likewise, only 1.65% is domestically captured of the value of an iPod made in China. Although China is the world's leading IT merchandise exporter, she accounts only for 15% of the value added, of which 60% is derived from foreign invested enterprises. It has often been said that China has to produce mountains of DVD players to buy a Boeing 747 or an Airbus.

Gross export accounts for 40% of China's GDP, compared with only 11% of the US. In contrast to the US's reliance on internal consumption, China's over-dependence on exports exposes the country disproportionately to dramatic downturns in world markets. This has become painfully evident from the massive factory closures and job losses during the global financial crisis. It also binds China in the increasingly tense global competition and rivalry for the world's natural resources, including oil and gas, minerals and other raw materials.

As crude oil prices breached \$147 a barrel on 11 July 2008, countries across the globe woke up to the harsh realities of an energy-hungry world. Inhabited by a fifth of mankind and industrializing at a breakneck pace, China finds herself in the thick of a global energy scramble.

In addition to energy, China has a rapacious appetite for numerous other commodities and raw materials. According to Standard and Poor's, in 2010 China accounts for the lion's share of global demand for copper (39%), aluminum (43%), steel (42%), iron ore (60%), and coking coal (52%) (17). Not only are these

(16) Paul H Suding, *Chinas Energiewirtschaft und Energiepolitik*, Mimeo, 2005

(17) Reported in Mineweb, a web-based international mining publication, at <http://www.mineweb.com/mineweb/view/mineweb/en/page72068?oid=128450&sn=Detail> (accessed on 16 June, 2011)

materials essential for fueling China's exports, they are indispensable for the country's breakneck growth in urbanization, in transportation, and in the remarkable metastasis of a Chinese middle-class.

Urbanization

According to a McKinsey Global Institute report, by 2015 China will be adding 350 million more urbanites in 221 new cities, each with a population of over one million, compared with 35 such cities in the whole of Europe at present. 5 billion square meters of roads will have been built, 170 mass transit systems completed, 40 billion square meters of floor space in 5 million more buildings, including 50,000 skyscrapers, equivalent to 10 New York cities. China's GDP is expected to have multiplied 5 times during this period. By 2030, there will be a billion people living in China's cities (18). China aims to achieve a 75% urbanization rate by 2050.

Much of the required commodities and other raw materials needs to be imported. However, this coincides with a similar, if somewhat less awe-inspiring urbanization drive in other regions of the developing world, including India, Indonesia and Brazil. This is unlike previous Industrial Revolutions in the 18th and 19th centuries. Rivalry, increasing scarcity and rising prices worldwide are therefore to be expected.

Rising Middle-Class

Taking stock of the value of China's emerging middle class, a McKinsey Quarterly study (19) indicates that 77.3 % of households lived with less than RMB 25,001 a year in 2006. By 2015, this proportion will drop to 9.7%. Instead, 79.2% will consist of the lower and upper middle classes, up to the household annual income bracket of RMB100,000. Adjusted for purchasing power parity, this is roughly equivalent to \$40,000 in the US. The remaining 11% (9.8% in 2005) will be the mass affluent with an annual household income of RMB100,001 to 200,000 and

(18) McKinsey Global Institute, *Preparing for China's Urban Billion*, March 2008

(19) *The Value of China's Emerging Middle Class*, by Dianna Farrell, Ulrich A. Gersch, and Elizabeth Stephenson in McKinsey Quarterly 2006 Special Edition, pages 60 – 69.

the global affluent with an annual household income level over RMB 200,000. The mass affluent cohort is expected to jump to 36.4% by 2025. This may be considered as China's 'real middle-class'.

A more recent study by McKinsey in July 2009 (20) analyses the consumer behavior of 1,750 wealthy Chinese consumers in 16 cities in households earning more than \$36,500 annually. This is equivalent to the spending power of a US household making \$100,000 a year. China's four richest cities—Shanghai, Beijing, Guangzhou, and Shenzhen—account for about 30 % of all wealthy consumers. The top ten cities are home to some 50 % of them, compared with 25% in the US.

But this concentration is giving way to the much faster growth of the wealthy (mostly entrepreneurs) in the second-tier or even third-tier cities. From 2008 –2015, their growth in Tier-1 cities (21) is expected to be 25%, in Tier-2 cities 32% and in Tier-3 cities 43%. One clear distinguishing feature is their youth. 80 % are under 45 years of age, compared with 30 % in the US and 19 % in Japan.

All the above means that as early as 2015, China is expected to have become one of the leading consumer markets in the world, with an annual turnover of RMB 20 trillion, about the size of Japan's consumer market today.

Transportation

To drive her breakneck urbanization, over the next 30 years at a total cost of 2 trillion yuan, China will be building 3,000 km of roads each year, to create a '7-9-18' network of 85,000 km national expressways, longer than the US interstate network by 10,000 km. 7 major arteries will radiate from Beijing: 9 from north to south and 18 from east to west.

This huge expanse of expressways anticipates that car ownership will jump from a low base of 16 per thousand of population in 2002 to 267 per thousand by 2030. The current car ownership of 50 cars per 1,000 population in June 2011 is still way

(20) *Understanding China's Wealthy*, McKinsey Quarterly, July 2009

(21) Chinese cities are grouped into tiers according to level of total consumption and potential future growth. Source: 2008 McKinsey survey of wealthy Chinese consumers; McKinsey Global Institute

below the world average of 131.64 (22). But China's burgeoning demand for cars already accounts for a quarter of global growth.

Likewise, China is undertaking the world's largest railway expansion since the 19th century. The total length of China's rail network is now 7,431 kilometers (4,617 miles), carrying 25% of the world freight traffic with 6% of the world's total length. By 2020 it is expected to increase to 100,000 km, serving 90% of the country's population.

What is more, China is about halfway through the construction of the most extensive high-speed rail (HSR) network in the world, using the world's fastest trains. During test runs, some trains achieved over 400 km/h (249 mph), setting a world record. Initially, in the interest of better safety, the limit is set at 300 km/h, as in the case of the much-anticipated Beijing-Shanghai high-speed rail line. In the light of experience, the speed could reach 350 km/h in the future, according to the authorities.

The grand plan is to promote a global 'HSR revolution' with a transcontinental network linking China to far-flung regions of the world. For example, a high-speed rail link between Beijing and London will take only two days. The China-Europe network is expected to straddle 17 countries. Although, exact routes are not yet determined, its main connection to Europe would probably go through India, Pakistan and the Middle East. It would also extend south to Singapore and northeast into Mongolia and Russia. Prospecting and survey work for the European network has been undertaken. It is understood that central and eastern European countries are keen to start. Construction for the Southeast Asia link has already commenced and Myanmar is about to begin building its portion of the link. China is understood to prefer funding the whole project itself in exchange for the natural resources it lacks. The plan is to complete the whole network in 10 years.

(22) *Worldwide Passenger Cars (per 1,000 people)*, The World Bank Group, March, 2011

As conceived, this is likely to be the largest infrastructure project in history. Creating such a network would solidify China's central role in the Asian economy if not in the whole world (23).

Energy Security

China has to continue to industrialize fairly quickly to create about 10 million new jobs a year to absorb the massive excess labour from the countryside. A thriving consumer middle-class needs to be grown to achieve a more balanced and less export-dependent economy. It is imperative for China to take advantage of the current period of relative internal stability to lay a solid economic foundation to meet the looming challenges of an ageing population, which is expected to emerge after a few more decades.

Underpinning all this fast growth is energy security. Relying on an abundant reserve of coal for 77% of her energy use, China has a relatively high level of overall energy self-sufficiency: 94% compared with the OECD average of 70%. However, coal is not a perfect substitute for crude oil for urbanization and economic development. In aggregate, China only accounts for 8% of the world's crude oil demand compared with 25% for the US, but China already contributes one-third of the global oil demand growth, while both China and the US each sits on only about 3% of the world's oil reserves.

Like the US, China relies heavily on import for 40% her crude oil, hoping to gradually reduce it to 12–15% in the long term. This compares with Japan's almost total import dependence and India's 60 – 70%. Meanwhile, unlike previous Industrial Revolutions, nearly half of the countries in the entire world are industrializing at the same time (24). It is no surprise that global competition for oil and gas is becoming intense.

(23) Zachary Shahan, 'China wants to connect its high speed trains to Europe (Largest infrastructure project in History)' 13 March, 2010, in Clean Technica, a blog on clean energies at <http://cleantechnica.com/2010/03/13/china-wants-to-connect-its-high-speed-rail-to-europe-largest-infrastructure-project-in-history/> (accessed on 14 June, 2011)

(24) Clyde Prestowitz, *Three Billion New Capitalists*, Basic Books, 2005

A vast proportion of fossil fuels is concentrated in relatively few, and mostly geopolitically unstable countries. Apart from supply sources, much of China's energy is imported by sea to the industrial east coast through the Strait of Hormuz near Iran, where events would be beyond China's control. In addition, a great deal of this has to pass through the Malacca Strait where the Indian Ocean connects to the South China Sea. This choke point is controlled by America's 7th Fleet. These are critical transportation routes where China remains highly vulnerable. It goes without saying that China's energy security would be better served by developing a wider network of friendlier supply sources and safer transportation routes across the globe.

Regional security

In the *Middle East*, China is fostering closer ties with Saudi Arabia, which accounts for 17% of China's oil imports. When HRH King Abdullah paid a state visit to Beijing in January 2006, on the cards was the supply of Saudi oil for China's strategic reserves. These include facilities in Zhenhai, 160 km south of Shanghai, and in Qingdao, Shangdong Province. According to Vice Premier ZengPeiyan, China needs to maintain a strategic reserve equivalent to 90 days consumption involving both government and business participation over the next 15 years. Separately, China has now become Iran's largest petroleum export market in the wake of a \$70 billion deal in November 2004 to develop the Yadavaran, one of the world's largest oil fields. Apart from supply, OPEC President Ahmad al-Fahd al-Sabah visited Beijing in late December 2005 to discuss oil price modalities, as China, being the world's second largest oil consumer, has a major influence on global oil prices.

In *Central Asia*, a 1,200 km pipeline from Kazakhstan to North Xinjiang has been completed, bringing into China 10 million barrels of crude oil a year. Xinjiang remains China's biggest provincial supplier of crude oil and gas, linked by massive pipelines to China's industrial east coast. China's influence in Central Asia has grown since the founding of the Shanghai Cooperation Organization (SCO) in June 2001, where China and Russia hold a great deal of sway. The SCO was originally formed to combat international terrorism but has since broadened its cope to include energy, trade and other ties. Its original members include Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan. It has since vastly expanded its scope and influence by welcoming, as Observers, Iran, India, Pakistan, Afghanistan and Turkey. Afghan President Hamid Karzai was in Beijing on 19 June 2006 following a summit meeting of the SCO in Shanghai. The latest annual Summit was held in the Kazakhstan capital Astana on 15 June, 2011, which was

attended by Iranian President Ahmadinejad as Observer. While the scope of mutual cooperation amongst members is fairly broad, all members are strategic energy players in one way or another.

Similarly, China is building up a friendly network of energy and raw material supplier countries in *Africa*, which now accounts for one-third of China's oil import. However, much of these much needed natural resources is in the hands of some of the most problematic or unstable countries on the continent, such as Sudan and Angola, which export the vast majority of their oil to China. China is often accused of dealing with unsavory regimes around the world, including Africa, thereby undermining the West's efforts to promote human rights and better governance. There are also concerns that China's footprints in Africa do not help the local environment. Some African countries are complaining about cheap Chinese imported goods destroying the local competition and Chinese imported workers replacing their jobs.

In *South America*, China is likewise becoming a main customer for natural resources such as oil from America-bashing Venezuela and soybeans from Brazil. This is beginning to alter some of the geopolitics right in the backyard of the United States.

In the case of *Russia*, China suffered a major setback when, following prolonged negotiations, a massive eastward pipeline was chosen to be built within Russian territory at much greater cost, bypassing northern China to go straight to ports near Japan and the rest of the north Pacific. Only a southward link from eastern Siberia to Xinjiang has been provided as a concession. Nevertheless, an increasingly energy-confident and assertive Russia needs good rapport with China as a means to maintain global power balance. As Russia is a main energy supplier of the world, there remains vast potential for closer Sino-Russian energy cooperation.

No other Western country's economy has been transformed in recent years as much as *Australia* in meeting China's demand for minerals and other resources. Even there, China lost to Japan's Osaka Gas, which has secured an annual supply of 1.5 million tonnes of liquefied natural gas (LNG) for 25 years from the huge Gorgon field off the NW coast of Australia. The field is operated jointly by Chevron, Royal Dutch Shell and ExxonMobil. 2.5 million tonnes of the fuel will be supplied separately to the West Coast of the US annually for 20 years. LNG is cheaper and cleaner than oil and is expected to displace oil in primary consumption by 2050.

Nowhere else is competition or rivalry with China more sharply defined than in the *South China Sea and the East China Sea*, complicated by territorial disputes over certain islands. These include the dispute with Japan over the Diaoyu/Senkaku , with Vietnam, Philippines, Brunei and Malaysia over the Nansha/Spratly and with Vietnam over the Xisha/Paracel. Tiny though some of these islands are, they involve the sensitive principle of national sovereignty as well as potential reserves of 7 trillion cubic feet of natural gas and 100 billion barrels of oil. Clashes and conflicts with China along these sensitive sea lanes are increasing and could threaten to ignite a potential powder keg in these waters, including the strategically important Malacca Strait, where the United States has an overwhelming military presence. Much depends on the diplomatic vision and skills and the trust-building efforts between the countries concerned, including energy exploration cooperation, agreed codes of conduct, and managing domestic nationalistic sentiments.

Global geopolitics and geo-economics

In an increasingly energy-hungry world, *China's Rise* is increasingly being seen in negative terms as the existing West-dominated world order struggles to accommodate the resurgent Chinese juggernaut with a divergent political and value system. This runs the risk of translating into a classic 'security dilemma' usually associated with the rise of a new power (25). A spate of influential 'real-politik' or 'zero-sum' thinking is already on the horizon (26).

In an era of increasing scarcity, set against the background of Climate Change, there are five drivers at work:

First, rapidly rising energy prices have dramatically boosted the strategic influence and financial firepower of countries exporting fossil energy, including Russia, Iran, Venezuela, and oil-rich countries in the Middle East, whose petrodollars are buying up equities across the globe. For example, the Abu Dhabi Investment Authority acquired 7.5% of Carlyle Group for \$1.35 billion and 5% of Citigroup

(25) *China's Ascent –Power, Security, and the future of International Politics*, Robert S. Ross & Zhu Feng (Ed.), Cornell University Press, 2008; and *China's Rise –Challenges and Opportunities*, Bergsten, Freeman, Lardy, and Mitchell, Petersen Institute and CSIS, Washington DC, 2008

(26) Robert D Kaplan, *Monsoon- The Indian Ocean and the Future of American Power*, Random House, 2010; Gideon Rachman, *Zero-Sum World*, Atlantic Books, 2010, and Niall Ferguson, *Civilization: The West and the Rest*, Penguin Press, November 2011.

for \$7.5 billion. This was outdone by the Kuwait Investment Authority, which bought a \$14.5 billion stake in Citigroup, along with Saudi Prince Alwaleed bin Talal and Singapore's Temasek. Abu Dhabi-backed Aabar invested \$2.7 billion in Daimler to become its largest shareholder. Saudi Arabia, a gigantis inter paris amongst the Gulf Cooperation Council (GCC) states, is slated to have a domestic investment fund of \$600 billion with projects in the pipeline over 20 years. The attitude of OPEC countries on what currencies in which to keep their oil wealth would have a profound impact on the US dollar and global financial stability.

Second, new energy geopolitics and geo-economics are re-defining relationships in Central Asia, as in the case of the Shanghai Cooperation Organization mentioned above. Australia is fast emerging as a major provider of much sought-after mineral resources, including uranium for the world's remaining nuclear energy programs. Resource-rich countries in South America, such as Venezuela and Brazil, are becoming more internationally prominent. Brazil is now the world's leading exporter of ethanol, produced from her abundance of sugar cane. With 65% of her cars already using bio-fuels, Brazil is a living laboratory for some of the world's business-savvy auto giants on cue to revolutionize the world's car industry with green-energy vehicles.

Third, insatiable global energy demand has given Africa a newfound dynamism. With Climate Change and increasing food scarcity, Africa is well endowed with 60% of the world's remaining uncultivated arable land. The continent is thus well poised to become the 'Food Basket' for the rising populations of the world. China has a pervasive presence in Africa along with renewed interest of the European Union and the United States.

Fourth, energy security has come up on top of many countries' political agendas. President Obama in his inaugural speech recognized 'that the ways we use energy strengthen our adversaries and threaten our planet'. Similar calculations of energy security also inform the EU's energy policy, conscious of the long arm of Russia's energy reach. China has emphasized the importance of sustainable development starting with the 11th Five Year Plan (2006-10) with the target of reducing emission and energy input per unit GDP by 10% and 20% respectively over the period. This is followed up in the latest Five Year Plan (2011-1015).

Last but not least, a University of Iceland study shows how global warming may

change the balance of the world's economic gravity dramatically towards the Arctic (27). We are already witnessing a flurry of activities (especially Russia) in staking territorial claims on the Arctic's cornucopia of oil, gas and mineral deposits. Over the next few decades, the melting of Arctic ice will open up much shorter shipping lanes connecting the North Atlantic with the North Pacific. The Canadian archipelago, the Bering Straits, the Davis Strait, the Denmark Strait, the passage between Iceland and Norway, and the so-called GIUK (Greenland, Iceland and UK) sea lanes are likely to gain commercial and geopolitical importance. The same would apply to Alaska, the Kamchatka Peninsula, the Sea of Okhotsk, and the Aleutian Islands. In an extreme scenario, if global warming persists at its current pace past 2100, the centre of the world's economic gravity is likely to shift towards the Northern Hemisphere near the Arctic, which is expected to be virtually ice-free by then. At the same time, the world's current temperate zones may become overheated and the Southern Hemisphere relatively marginalized economically. Even if this extreme scenario does not materialize, the on-going geopolitical and geo-economic implications for countries with Arctic territorial claims such as Russia, Canada, the Nordic countries and the US would demand serious attention. Those countries such as China and India without direct and ready Arctic access may have to sit up and think. Needless to say, these implications are over and above the threats of rising sea-levels, disrupted Gulf Stream flows, methane release from melting permafrost in the Siberian tundra, more frequent extreme weather conditions, and other looming ecosystem dislocations. Before the world can find an effective way to reverse the momentum of Climate Change, the global geopolitical and geo-economic landscape is poised to change almost beyond recognition in the latter part of the 21st century.

Food Security

In March, 2007, a joint governmental report warned that with unchecked Climate Change, China's production of wheat, rice and corn will decrease by 37% by the latter half of the 21st century with the result that China will suffer a food shortage of 5-10% within the next 20 years. This was well before the United Nations revised

(27) Trausti Valsson, *How the world will change with Global Warming*, University of Iceland Press, 2006

its world population projection on 3 May 2011, from 9 to 10 billion by 2050 (28).

As more and more countries are industrializing on a large scale and as the world population continues to grow, there is increasing demand for food crops and grain-intensive meat. This demand has been accentuated by the world's sudden embrace of bio-fuels following concerns about climate and energy security. Unfortunately, bio-fuel production in some places is achieved at the expense of agricultural land usable for food crops. So a long-term rise in global food prices seems inevitable.

China has 20% of the world's population but only 7% of the world's arable land. Following WTO entry, China is open to highly-subsidized agricultural imports from the West produced with enormous economy of scale. More than 20 million Chinese farmers have abandoned their land to seek alternative livelihood. China is now the largest purchaser of US cotton and soybeans. Compared with a 50% subsidy in the US, 60% in the EU and 76.7% in Japan, China's agricultural subsidy stands at only 1.23% of gross production. Many other developing countries, including India, face a similar challenge. To a large extent this has caused the collapse of the Doha Round of international trade negotiations.

In the last Five Year Plan (2005-2010), China embarked on building '*a new socialist countryside*' in addressing the so-called '*Three Agrarian Problems*' – farmers' livelihood, agricultural productivity, and the development of the rural areas. According to the Petersen Institute (29), the results were rather impressive:

(a) Partial reimbursement (about 30%) of healthcare costs has registered a 20-fold increase by 2007, covering 730 million people, quadruple the number covered in 2005;

(b) Additional health insurance (2009-2011) will extend the coverage to 90% of the population by 2011. (Government pays half or more of the costs, up from 16% in 2001);

(28) *World Population Prospects: The 2010 Revision*, Population Division, UN Department of Economic and Social Affairs, 3 May 2011

(29) Morris Goldstein and Nicholas Lardy, *The Future of China's Exchange Rate Policy*, The Petersen Institute, Washington D.C., July 2009, pp.36-37

(c) Old Age Pensions for retirees now averaged RMB 1,173 in January 2009 (higher than the national average wage, although still well below the going wage in cities);

(d) A minimum living standard guarantee program with dramatically-increased monthly payments from RMB50 in 2002 to RMB140 by 2008.

All the above improvements will sustain livelihood and living standards in the agricultural sector. In the new Five Year Plan (2011-15), emphasis has been put on keeping prices stable, cutting water consumption per unit of value-added industrial output by 30%, maintaining annual grain production capacity at no less than 540 million tones, and ring-fencing farmland reserves at no less than 1.818 billion mu (121.2 million hectares).

Food Security is increasingly grabbing the attention of many other countries dependant on food imports. A number of Middle East and North Africa (MENA) energy-rich but food-scarce nations are already exploring agricultural investments overseas as a strategic option. For example, Saudi Arabia has signaled investment in agricultural and livestock projects overseas. Libya has talked to Ukraine about growing wheat in the former Soviet republic. China is beginning to become more proactive in acquiring farming resources overseas. In 2008, the Ministry of Agriculture was exploring the possibility of acquiring land in Brazil for soybean production (30). In recent years, Chinese settlers are also known to have acquired farmland in Africa for agribusinesses (31).

China's Action Program for Sustainable Development

Considering all the above imperatives and challenges, it has long been recognized that China has to go Green to survive. Meanwhile, the international obligations under Climate Change have become a hot topic. In the wake of the United Nations Conference on Environment and Development in 1992, China formulated '*Agenda 21 – A White Paper on Population, Environment and Development in the 21st Century*'. This embodied the principle of 'common but differentiated responsibilities' for mitigation and adaptation measures adopted at the United Nations Framework Convention on Climate Change (UNFCCC).

(30) Financial Times, 8 May 2008

(31) Deborah Brautigam, *The Dragon's Gift – The Real Story of China in Africa*, Oxford University Press, 2009, Chapter 10.

According to the International Energy Agency (IEA), China's per capita CO2 emissions from fossil fuel combustion improved to 3.65 tons in 2004, equivalent to 87% of the world average and 33% of the level in OECD countries. Emission intensity also fell from 5.47KgCO2/\$ in 1990 to 2.76KgCO2/\$ in 2004 in constant prices. This was a reduction of 49.5% compared with the world average reduction of 12.6% and OECD's average of 16.1% for the same period.

In June 2007, following detailed research, the National Development and Reform Commission published a *National Climate Change Program* for the coming decades up to 2050. In fact, well before its publication, China has in fact been undergoing a quiet Green Revolution.

China's quiet Green Revolution

The World Energy Council, headquartered in London, points out that China, with the highest energy intensity level in 1980, registered the strongest improvement in energy productivity - around 7.5% p.a. between 1990 and 2000, although this trend has since drastically declined to only 1% p.a. China's **energy intensity** is now slightly above the world average level, whereas it was 80% higher in 1990. But in industry and businesses, China's energy efficiency per unit GDP growth is still very low by international standards: about 146 % less efficient than Japan, 73% less efficient than the US, and even 47% less efficient than India, according to a report by Economist Intelligence Unit in 2011 (32).

The last Five Year Plan (2006-10) narrowly delivered reduction of energy input per unit GDP by 20% and carbon dioxide emission by 10%. The latest Five Year Plan (2011-15) mandates that non-fossil fuel is to rise to 11.4% of total primary energy consumption, energy intensity to reduce by 16%, and **carbon dioxide emission** by 17%. Both state-owned and private enterprises would be on cue to re-jig their operations and explore new opportunities in the coming years, although as usual there are bound to be some laggards and cheaters.

(32) *Primary Energy Intensity, World Map by Country (2009) - Trends in Global Energy Efficiency 2011: An Analysis of Industry and Utilities*, researched and written by Enerdata and the Economist intelligence Unit, under the aegis of The ABB Group, headquartered in Switzerland

The International Energy Agency (IEA) estimates that China will be investing \$2.3 trillion in energy development during the period 2001-30. Of this, \$200 billion is earmarked for **renewable energy development** within the next 15 years. This is expected to grow from 7% to 10% annually by 2010 and 20% annually by 2020. In 2008, renewable energy accounted for 8.5% of China's primary energy utilization. In 2009, China added a massive 37 GW of renewable power generation capacity. The target is to increase this to at least 15% by 2020, according to China's National Development Reform Commission (33). The government is said to be planning to boost renewable energies to 20% of China's total energy needs (34).

Barring insurmountable obstacles in addressing some of the ecological concerns outlined earlier (under Water Crisis), the gigantic 'South-to-North Water Diversion' project at a cost in excess of \$60 billion is likely to ameliorate the aridity in the Northern regions, at least partially. Likewise, the Three Gorges Dam, the largest dam in human history, is set to increase China's **hydroelectric power** from 108 GW to 290 GW by 2020. With a generating capacity of 163 million KW in 2008, China's hydroelectric power potential is estimated at 400 GW.

China is the world's largest solar-panel manufacturer, accounting for almost 70 % of the global **solar-energy** market, with a capacity of 18 GW in 2010. China's large-scale photovoltaic manufacturers have developed rapidly in recent years. They are well positioned to exploit the explosive growth in the international solar-energy industry, which is expected to grow by at least 30% annually in the next five years. China expects to increase solar panel production to 300 million square metres providing 2 GW of power by 2020, displacing 40 million tonnes of coal annually. The NYSE-listed Chinese solar energy corporation Suntech has made its founder China's 4th richest man with a wealth of over \$1.4 billion.

(33) UPI.com, (United Press International), 6 July, 2009, at http://www.upi.com/Business_News/Energy-Resources/2009/07/06/China-to-increase-renewable-energy/UPI-88591246919997/ (accessed on 20 June, 2011)

(34) Yu Tianyu, *China Daily*, 10 August, 2009 at http://www.chinadaily.com.cn/business/2009-08/10/content_8548125.htm (accessed on 20 June, 2011)

According to the Worldwatch Institute in Washington DC, China has 30 million solar households, or 60% of the world's installed solar capacity, with photovoltaic (PV) energy accounting for 65 MW. Concurrently, plans are being drawn up for a new generation of energy efficient buildings, incorporating solar power where appropriate, for possible application nationwide. China is now a leader with advanced technology in the solar energy industry. In late 2009, US-based Applied Materials Inc., one of world's largest solar photovoltaic equipment suppliers, established a solar technology center in Xi'an, Shaanxi province, which remains one of the world's biggest and most-advanced private solar energy R&D facilities.

Two-thirds of China's land area receives more than 2,000 hours of sunlight annually, more than many other regions of similar latitude, including Europe and Japan. This gives China a potential solar energy reserve equivalent to 1,700 billion tons of coal. Though adopting a single time-zone, China's large area actually covers three time zones. When electricity is at peak demand in the early evening in the eastern areas, the western part of China can still supply solar energy available in the daytime.

With a currently installed solar energy capacity of less than 1 GW, China is expected to double its former target for solar energy capacity from 5 GW to 10 GW by 2015. The target by 2020 is 50 GW. By 2018, grid parity is expected to be achieved in China, two years ahead of the United States.

CHINA overtook America as the world leader in **wind energy** in 2010, according to an annual report by the Global Wind Energy Council. Over the past decade, China's installed wind capacity has grown exponentially from 0.3GW in 2000 to 42.3GW in 2009, and now accounts for 22% of the world's total wind power capacity. In 2010, more turbines were installed in China than America (35). Wind power, much of it in Inner Mongolia, is expected to grow from 1 GW to 30 GW, to power some 13-30 million households by 2020.

China is committed to building 2 new **nuclear power plants** annually for the next 15 years. By 2008, China's nuclear power generation capacity has increased to 8.85 million KW. Following Japan's nuclear fiasco in Fukushima starting in March 2011, China was the first country to call a halt to her own nuclear energy program to review safety standards. The program is likely to resume after new safety measures are put in place. This could include using a safer fuel like thorium. This

(35) The Economist, *Wind from the East*, 3 February, 2011

is because over-reliance on external energy sources is liable to potential risks of overt or covert blackmail, using energy as an asymmetric ‘weapon of mass disruption’. So, even if nuclear energy may represent no more than 10% of China’s total energy demand, it is likely to be retained at least as an insurance policy. Once installed, nuclear reactors are much less polluting than fossil fuel.

China relies on her abundant *coal* resources to fuel her industrialization and urbanization. But coal is dirty and coal mines are dangerous. Back in 2004, China’s coal industry accounted for over 35 % of the world’s production but 80% of global coal-mining–related deaths. The proportion of coal in primary energy consumption dropped from 72.2 % in 1980 to 69.4% in 2007. But there is no way that coal can entirely be replaced by renewable energies to satisfy China’s soaring energy demand. China therefore stands to benefit hugely from cleaner, safer, and more affordable coal extraction and liquefaction technologies. The closure of small, inefficient, and often unsafe coal-fired facilities less than 10m KW had been completed by 2007. The next closure will be those with a capacity of less than 50m KW. About 70 GW of obsolete capacity was phased out between 2006 and 2010, and 8 GW more is to be scrapped in 2011. Along with improved safety standards, this should help to ameliorate increasing concerns for safety.

In addition, China is partnering with South Africa’s SASOL to build a *Coal to Liquid (CTL)* plant in each of the inner provinces of Ningxia and Shaanxi at a total cost of \$10 billion. The production target will rise from 10 million tonnes of crude oil in 2010 to 30 million tonnes by 2020, equivalent to about 16% of China’s overall crude oil output. The International Finance Corp, the World Bank’s private sector lender, has signed an equity-and-loan deal with the Xinao Group to convert coal into dimethyl ether, a cleaner gas used for cooking and heating or as a substitute for diesel fuel.

As for *bio-fuels*, China is the world’s third largest ethanol producer, generating 1 billion gallons annually in Heilongjiang, Jilin, Liaoning, Anhui, and Henan, where the use of gasohol, a mixture of petrol and ethanol, has been made mandatory. Since December 2007, economic incentives are provided to encourage bio-fuel production by making use of nonfood agricultural products such as forest biomass, sweet sorghum and cassava. Increasing use has been made of human and animal waste to produce energy so that since 2007, 26 million households have switched to methane gas generated in this way.

Forests are powerful absorbers of carbon emissions. China has started as early as 1978 to build a forestation belt of 4,480 km, sometimes referred to as the *Green Great Wall*, the world’s largest single ecological project. It is absorbing 1 billion

tons or 20% of China's carbon dioxide emissions by 2010. China's forest coverage reached 20.36 % or 195 million hectares by the end of 2008, beating a goal of creating 20 % coverage by 2010. For the Five Year Plan (2011-15), forest coverage is to rise to 21.66 % and forest stock to increase by 600 million cubic meters. This would be a much needed counterweight against the on-going encroachment of 2.6 million sq km desertification threatening the livelihood of some 400m people in China. It is also understood that China has been cracking down hard on illegal logging and illegal trade of timbers.

China's burgeoning *civil society* is increasingly involved in the low-carbon agenda. Both local and international environmental NGOs are being actively engaged. Greenpeace, for example, was invited by the Chinese government to contribute suggestions to the development of China's Renewable Energy Law, which was enacted on 1 January, 2006. It has also been delivering a climate change project in China for the past years.

A blue-print for China's Sustainable Industrial Development

At her current stage of development, China simply cannot give up industrialization and urbanization by way of building a solid economic foundation before an ageing population profile starts to set in within the next couple of decades. In the light of all the challenges outlined above, a more sustainable industrial development model was mooted in a two-part document issued by the State Council in October 2008, detailing key action targets for the 11th Five Year Plan (2006-10). The following components are noteworthy:

- To transform the pattern of economic and societal development through 'less input, less consumption, less emission and high efficiency', including energy optimization, energy conservation and eco-preservation.
- To promote advances in science and technology and international cooperation to cope with climate change and to protect the world environment along the principle of 'common but differentiated responsibilities'.
- To raise the proportion of renewable energy in the primary energy supply by 10% and the extraction of coal-bed gas by 10 billion cubic meters.
- To make concrete progress in building a water-conserving society, to complete installation of anti-flood systems in large rivers; and to raise the drought resistance standard of farmlands.

- To accelerate the development of the service sector by increasing its value-added contribution to the GDP by 3%.
- To raise the value-added proportion of hi-tech industries to total industrial production by 5%, capitalizing on the progress made in such high-tech industries as information technology, bio-engineering, aeronautics, space aviation, new energy, new materials, and marine industries.
- To promote energy efficiency, conservation, and emission reduction in production processes, projects and buildings, including clean coal and clean power-generating technologies such as poly-generation and carbon dioxide sequestration; and to restrict energy-and-emission intensive industries.
- To push ahead the development and utilization of renewable energies including biomass, marsh gas, solid and liquid bio-fuels, and to capitalize on progress made by 2007 in hydroelectric, solar , wind, and nuclear power .
- To develop a Recycling Economy. China enacted a ‘Circular Economy Promotion Law’ on 29 August 2008, governing all stages of the utilization, consumption and reuse of resources in the society and in industries, including water resources and building and production materials

The promotion of hydro, nuclear, coal-seam gas, biomass, wind, solar, terrestrial heat, wave and other renewable energies is being actively encouraged across the provinces, embracing a variety of sectors and *innovations*.

Under the aegis of a ‘*Project 863*’ launched in March 1986, China has been quietly working on the development of a variety of alternative vehicles, including electric, hybrid, compressed natural gas (CNG), and hydrogen fuel-cell electric cars. As China is slated to have 330 million cars by 2030, a larger car population than the United States, green cars are clearly the answer to the China Dream of a mobile middle-class.

GM has invested more than \$1 billion in *hydrogen-fuel-cell-electric cars* as part of a strategy to revive its global leadership in the car industry. It has signed a collaboration agreement with Shanghai to develop a prototype and supporting urban infrastructure. Electric cars with a reach of 120 miles and a speed of 80 mph are also being manufactured in Tianjin. Indeed, coupled with the development of advanced micro-power, energy-storage and smart power grids, these green innovative technologies are set to spawn a whole new generation of *Cars of the*

Future . This is expected to dramatically revolutionize the world's car industries as well as to help extricate the world from over-dependence on oil (36). The strategic importance of the coming 'green car revolution' is evident from a Pentagon-funded study on how fuel efficiency, lightweight car materials, advanced bio-fuels, and other technological breakthroughs could achieve *Winning the Oil Endgame* (37).

A '**Low Carbon Eco-city Strategy**' was launched by the Chinese Society for Urban Studies in a report to policy makers in October 2009. The report was to be distributed to officials in 600 Chinese cities. As China is rapidly urbanizing, new innovative 'eco-cities' are gaining momentum as municipal party secretaries try to be Greener than others. There was a much-hyped false start at Dongtan on Chongming Island, 15 km north of Shanghai, in cooperation with UK's Ove Arup and Partners. Now green urban concepts are catching on nationwide as China is building 221 new cities across the land by 2025 (as outlined under Urbanization above). This eco-city momentum will help spawn a low-carbon era in China's urban development.

More and more **innovative and practical technological solutions** are appearing on the horizon, particularly in the United States and Europe, including thin photovoltaic films, solar thermal technology with computerized concentrators, leveraging hydrology in massive hydroelectric dams (possible application to the Three Gorges) to store solar energy, algae bio-fuels, application of bio-technology to yeast and enzymes as agents for cellulosic biomass transformation, geothermal and tidal technologies, and underground coal gasification. Of overriding importance is the rolling-out of interconnected 'smart power grids' nationwide, if the erratic supply of solar, wind and tidal energies are to be captured and distributed to meet different demand and pricing requirements across an entire region. There are also innovative applications for urban development such as green cement and green buildings. Some of these new technologies are elaborated upon in '*Earth : The Sequel*' by Fred Krupp, President of Environmental Defense Fund with Miriam Horn in 2008 (38).

(36) Iain Carson & Vijay V Vaitheeswaran, *Zoom: The Global Race to Fuel the Car of the Future*, Twelve, Hachette Book Group, USA, 2007.

(37) Amory Lovins et al, Rocky Mountain Institute, *Winning the Oil Endgame*, AAPG, 2004

(38) Fred Krupp and Miriam Horn, *Earth : The Sequel – The Race to Reinvent Energy and Stop Global Warming*, W.W.Norton and Company, 2008

International cooperation

In a joint announcement on clean energy cooperation in 2009, President Hu Jintao and President Obama outlined strategic advantages of working together in this area. A US-China Clean Energy Cooperation Agreement was signed on 17 November, 2009, including the establishment of a US-China Clean Energy Research Center in collaboration with the World Resources Institute, supported by \$150 million in combined public-private funding from the US and China. This will facilitate joint research and development of clean energy technologies with a focus on advanced coal research, carbon dioxide capture and storage, building energy efficiency, and clean vehicle technology. Also included are : a US-China Electric Vehicle Initiative, a US-China Energy Efficiency Action Plan, a US-China Renewable Energy Partnership, a '21st Century Coal' project on Carbon Capture and Storage technologies, and a US-China Energy Cooperation Program covering such areas as renewable energy, smart grid, clean transportation, green building, clean coal, combined heat and power, and energy efficiency. The possibilities for expanding similar cooperative efforts with other countries are limitless.

International Green investments

China's green revolution coincided with a surge in green investments worldwide. The latter was only \$30 billion in 2003, growing to \$49 billion in 2005, and \$63 billion in 2006. The growth has been 20-30% per annum and is set to provide the biggest job and wealth creation opportunity in the 21st Century (39).

In bio-fuels, such investments have come from some of the world's top visionary business leaders, for example, Microsoft co-founders Bill Gates and Paul Allen, and Sun Microsystems founder Vinod Khosla. In advanced all-electric cars, they include such names as Warren Buffet, Larry Page and Sergey Brin, co-founders of Google, and Elon Musk of PayPal fame. China is very much in the game: it is no coincidence that the United Nations has set up a world carbon trading exchange in Beijing (40).

(39) The Economist, 18 November 2006.

(40) Financial Times, 5 Feb, 2007.

International cooperation and investment in the field of Energy, Food and Climate Security require ready and long-term capital. In the aftermath of the global financial crisis, there is no other source of capital better placed than Sovereign Wealth Funds (SWFs). Derived from oil or trade surpluses, these funds have rapidly risen in the Middle East and Asia, including a \$300 billion China Investment Corporation (CIC) Fund. According to an earlier study by Merrill Lynch, SWF investments were expected to reach as much as \$12 trillion by 2015. Investments by these funds in cutting-edge technological solutions to energy, food and climate security will open up vast opportunities for China's cooperation and trust-building with countries possessing these technologies and expertise, such as the US, the EU, Japan, South Korea as well as India.

The world's largest SWFs are in the Middle East. Joint investments by Middle East's and China's SWFs in green technologies would cement their growing energy ties. They would also serve to enhance their respective international image as responsible stakeholders in response to Climate Change. Last but not least, such joint investments could mitigate the rising anti-Globalization backlash as flagged up by Nobel laureate Joseph Stiglitz (41).

China's Green Opportunity

According to a McKinsey Quarterly report (42), China's Green House Gas (GHG) emissions in 2005 amounted to 6.8 metric gigatons of CO₂ equivalents (GtC). An unrestrained -growth with 'frozen'-technology scenario would push this to 22.9 GtC by 2030. A scenario with comprehensive abatement measures would put this back to 7.8 GtC with reductions to be achieved through new policies (8.4 GtC) and full technological abatement (6.7 GtC) respectively. The latter scenario covers Green Power, Green Transport, Green Industry, Green Buildings, and Green Ecosystems, including land management techniques and sustainable agriculture.

(41) Joseph Stiglitz, *Globalisation and Its Discontents*, and *Making Globalization Work*, W.W. Norton & Company, New York and London, 2002 and 2006. I have advanced the same arguments in my article '*China and the Middle East: An Eastern Alchemy for Global Harmony*' dated 17 February, 2007 at http://www.andrewleunginternationalconsultants.com/publications/2007/02/china_and_the_m.html

(42) McKinsey Quarterly, *China's Green Opportunity*, May 2009

As outlined above, it is evident that cutting-edge green technologies may offer many win-win solutions and business opportunities.

Ecological Civilization and Minimalism

In an Age of Scarcity, it is not just about energy security, pollution, competition and geopolitics. If China, with a population the size of a fifth of mankind, and India, which is set to overtake China as the world's largest population in several decades, were to replicate the American Dream by multiplying 15 times their energy consumption per head, it is not beyond imagination that one planet would not be enough.

Indeed, legendary global investor Jeremy Graham of GMO predicts that because of the historic emergence of rapidly rising large economies and world population build-up, the simultaneous global demand for finite commodities and food resources is pitching the world towards 'a disaster of biblical proportions' (43). In particular, China's increasing lion's share of the world's commodities is perceived as frightening.

Vice Minister Pan Yue of China's Ministry of Environmental Protection advocated a vision for an 'ecological civilization' (44). Throughout recent centuries, the world has been embracing an 'industrial civilization' with a vengeance, forgetting the ancient wisdom of harmony between Man and Nature, as exemplified in Confucianism, Daoism and Buddhism. Now, with the threat of Climate Change and global Malthusian limits looming large, it is none too early to re-think mankind's lifestyles in keeping with the dictates of Mother Nature. Or, as James Lovelock puts it, how we can save humanity from '*The Revenge of Gaia*' (45).

(43) Post by Henry Blodget , Business Insider, dated 13 June, 2011 at <http://www.businessinsider.com/jeremy-grantham-commodity-prices-2011-6#> (accessed on 22 June, 2011)

(44) See '*Pan Yue's vision for ecological civilization*' by Mary Evelyn Tucker in Sustainable China on 8 December, 2008, at <http://www.sustainablechina.info/2008/12/08/a-meeting-with-pan-yue/> (accessed on 21 June, 2011)

(45) James Lovelock, *The Revenge of Gaia*, Allen Lane, 2006

As the world's resources are being stretched to the seams, there are many legitimate questions that should be asked. Should the world seek minimalism over surfeit - an innovative and green lifestyle of conservation, moderation and frugality over waste, excess and vanity? As some of the ills of the Washington Census are laid bare, would the Beijing Consensus be as problematic in fulfilling the needs of development? To what extent should Adam Smith's *Invisible Hand* of capitalism be guided by his long-forgotten *Theory of Moral Sentiments*? Should development pay more attention to a '*Gross National Happiness Index*' (as in the case of Bhutan) than sheer GDP growth? Should Confucian *Balance, Harmony* and *Golden Mean* replace a zero-sum game?

Confucianism, which underpins the philosophy of the Beijing Consensus in upholding the role of the state, abhors excess, and extremism or 'fundamentalism' in modern jargon. One of the main causes of the global financial crisis, for example, can be traced to a fundamental belief that the market, including the unstoppable financial ingenuity of Wall Street, should be best left unfettered, only to find that the whole system was eventually pushed to implosion.

Likewise excessive consumerism is spreading across the globe. One may well ask if it is necessary to have more clothes than one may care to remember, or more appliances and household decorations that one may struggle to put them. While going back to the ascetic poverty of yesteryears is no longer realistic or desirable, there is a certain chic in Minimalism not only in design and décor but as an innovative and green everyday lifestyle, upholding conservation, moderation and frugality over vanity and surfeit.

This sits well with the Confucian concepts of *Balance, Harmony* and *The Golden Mean* and seems to hark back to the ancient elegance of the Tang Dynasty poem

‘*Ode to Humble Abode*’ (陋室铭) (46).

If more and more people across the globe choose to embrace an innovative minimalist lifestyle, it is bound to have a positive impact on the world’s resources. In China, it would help to ameliorate the country’s mounting challenges of energy security and ecological sustainability, if not set an example to the world of how the Confucian concept of harmony with nature could be lived in modern times.

Doorstep to human survival in a Low-Carbon Future

Yet, all this is much more than preferred lifestyles and philosophical debate. It is really a matter of national and global survival. The pressing ecological strains around the world and many perceived manifestations of Climate Change, including more unusual and extreme weather conditions, quickly disappearing glaciers and ice-sheets as well as massive reductions in bio-diversity, could be canaries in the coalmine which the world ignores at its peril.

Jared Diamond’s well-researched ‘*Collapse: How Societies Choose to Fail or Survive*’ (47) tells a cautionary tale how the ruins on Easter Island remind us that a civilization would eventually collapse while set in its own ways oblivious of looming ecological threats to its survival.

(46) 陋室铭 (唐刘禹锡 772 ~ 842 CE) - ‘山不在高，有仙则名。水不在深，有龙则灵。斯是陋室，惟吾德馨。苔痕上阶绿，草色入帘青。谈笑有鸿儒，往来无白丁。可以调素琴，阅金经。无丝竹之乱耳，无案牍之劳形。南阳诸葛庐，西蜀子云亭。孔子云：“何陋之有？”

‘*Ode to Humble Abode*’, Liu Yuxi, 772-842 CE (Tang Dynasty)

*Known will the mountain be, where fairies dwell, no matter how low.
Sacred will the waters run, where dragons hide, no matter not deep.
Mine is a humble abode, all for me to treasure.
The steps green with moss. The curtain, verdant with grass.
Laughter with scholars. No uncouth souls pass these doors.
My simple lute I play. My Sutras to enjoy.
Far from the madding music. And the vexing volumes.
A cottage of wisdom. A dwelling of intellectual delight.
Master Confucius asks, ‘Why is it humble?’*

(47) Jared Diamond, *Collapse: How Societies Choose to Fail or Survive*, Penguin, January, 2006

A new era is upon us. On the one hand is a world becoming more globalized, interconnected and inter-dependent, where enterprise, innovation, and technology know few national boundaries and where, after decades if not centuries of backwardness, huge countries and populations are finally emerging from poverty to embrace a middle-class lifestyle. On the other hand is a world finally showing signs of ecological exhaustion after humankind has relentlessly exploited its resources for millennia, including past Industrial Revolutions.

It is timely, if not already overdue, to ask whether our planet and its ecosystem can sustain continuing mindless exploitation of her finite resources. Will this be the epoch of revolutionary change when the internal combustion engine is finally moving to the museums as the whole world embraces high-speed trains linking eco-cities and super-efficient battery-driven cars fuelled by smart green-power grids? Do we need another global war or a civilization collapse in this century to remind us that there may be another way of life for all to share in this global village? When will we find that less is more, that surfeit and vanity do not buy happiness, and that Minimalism can be a way of life more innovative and satisfying? When will we finally grasp that on the same planet, all our fates are linked and our survival lies in a new awakening and a new direction to embrace an innovative low-carbon future?
