

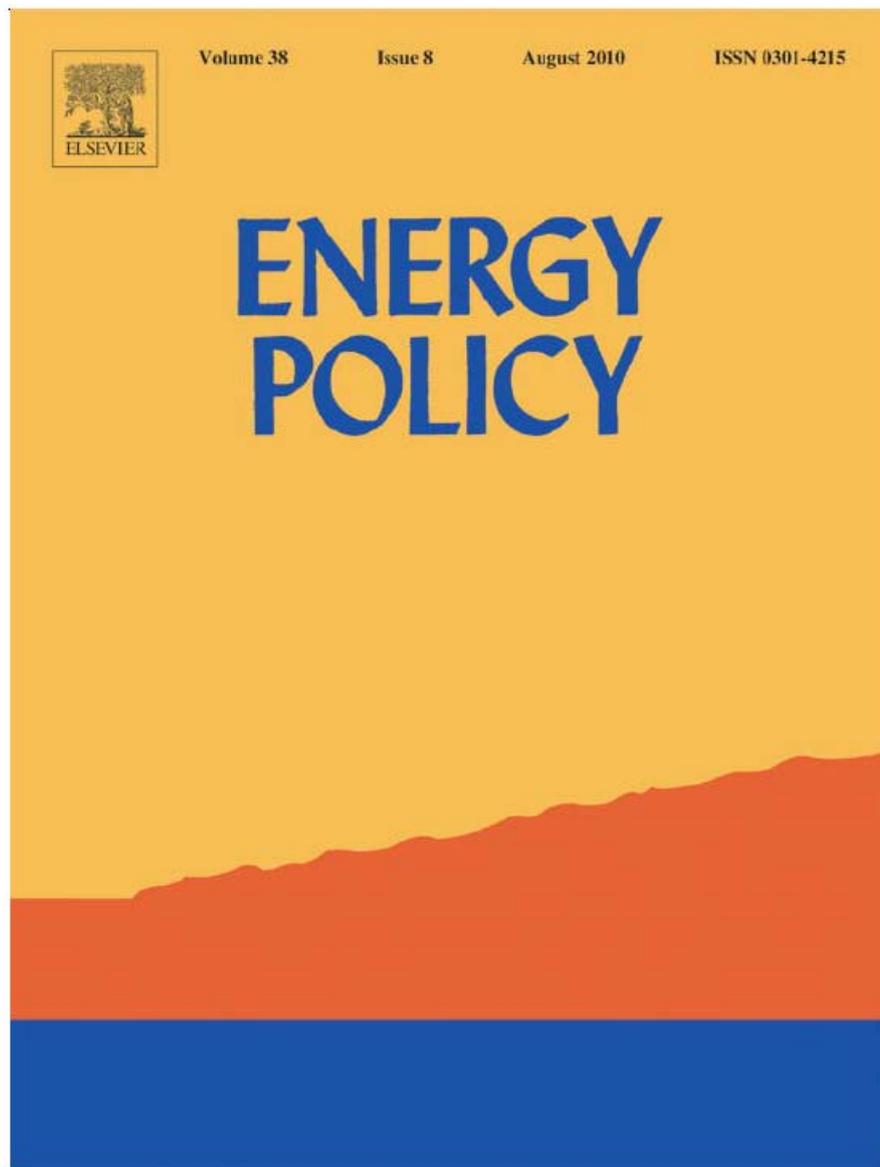
Global energy crunch: how different parts of the world would react to a peak oil scenario

Jörg Friedrichs, University of Oxford

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Global energy crunch: How different parts of the world would react to a peak oil scenario

Jörg Friedrichs^{a,b,*}

^a University of Oxford, Department of International Development, Queen Elizabeth House, 3 Mansfield Road, Oxford OX1 3TB, United Kingdom

^b St Cross College, 61 St Giles, Oxford OX1 3LZ, United Kingdom

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ABSTRACT

Peak oil theory predicts that oil production will soon start a terminal decline. Most authors imply that no adequate alternate resource and technology will be available to replace oil as the backbone resource of industrial society. This article uses historical cases from countries that have gone through a similar experience as the best available analytical strategy to understand what will happen if the predictions of peak oil theorists are right. The author is not committed to a particular version of peak oil theory, but deems the issue important enough to explore how various parts of the world should be expected to react. From the historical record he is able to identify predatory militarism, totalitarian retrenchment, and socioeconomic adaptation as three possible trajectories.

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1. Introduction

The Stone Age came to an end not for a shortage of stones. The Coal Age came to an end not for a shortage of coal. But, contra former Saudi Oil Minister Sheikh Yamani, the Oil Age may come to an end for a shortage of oil. This is what the proponents of “peak oil theory” suggest. Peak oil theory predicts that oil production will soon start a terminal decline. Most authors imply, further, that no adequate alternate resource and technology will be available to replace oil as the backbone resource of industrial society.¹

To be sure, the demise of oil has been predicted many times over. Oil shortages were predicted in the 1920s, 1930s, and 1940s. Peak oil theory was first introduced in 1956 by oil geologist Marion King Hubbert. In the oil crisis of 1973, US Ambassador to Saudi Arabia James Akins declared that “This time the wolf is here” (Akins, 1973). Similar cries were heard in the second oil crisis of 1979.

Although the history of oil is the chronicle of a death foretold, oil is a finite resource. It will run out at some point. Extrapolations of unfettered growth are clearly more misleading than predictions of a peak in global oil production. And peak oil theorists proffer serious arguments why, despite many alarms in the past, Cassandra will turn out to be right this time. In this article I am not going to repeat their arguments. I am not personally

committed to peak oil theory, and I will be more than happy if Cassandra is proven wrong this one more time.

However, given the momentous importance of oil the precautionary principle mandates to take warnings of peak oil seriously and assess possible consequences. In this spirit, I am not debating peak oil but simply asking the “what if” question: *what is likely to happen if peak oil occurs?* As a baseline for my assessment, I assume a post-peak decline of global oil production in the order of 2–5% per year (Hirsch, 2008). In line with most peak oil theorists, I further assume that no adequate alternate resource and technology will be available to replace oil as the backbone resource of industrial society.

While a global peak of oil production would per definition be a planetary event, reactions would differ in different parts of the world. Insofar as globalization has been fuelled by cheap and abundant energy, traded as a commodity on a free market, increasing conflict over scarce energy would undermine the very foundations of the world-wide social, economic, and political normalization processes that have been observed over the past few centuries.

In this article I focus on oil importing countries, which constitute the vast majority of states. Because an event comparable to peak oil has never happened at the global level, I study cases where oil supply disruptions in the order of 20% have occurred at the national level.² I believe that studying such national analogues to peak oil as “proxy” cases is the best

* Correspondence address: University of Oxford, Department of International Development, Queen Elizabeth House, 3 Mansfield Road, Oxford OX1 3TB, United Kingdom.

E-mail address: joerg.friedrichs@qeh.ox.ac.uk

¹ For quick introductions and overviews see Hubbert (1969), Hirsch et al. (2005), United States Government Accountability Office (2007), Brandt (2007), Bentley and Boyle (2008), Hirsch (2008), Aleklett et al. (2010).

² This is far above the threshold that the International Energy Agency stipulates for an international oil supply disruption (7%), and also much higher than the shortfalls of global oil production during the two oil crises of the 1970s (less than 7%).

analytical strategy available to gain clarity about the effects peak oil would have on oil importing countries.

My first case is Japanese PREDATORY MILITARISM before and during the Pacific War. The spectre of future resource shortages had played an important role in shaping Japan's imperialist strategy ever since the end of World War I. When an American oil embargo became imminent, in 1941, Japan pre-emptively attacked the US Naval Base at Pearl Harbor and radicalized its war of conquest in order to gain access to the rich oil supplies of the East Indies.

My second case is TOTALITARIAN RETRENCHMENT in North Korea after the end of the Cold War. When subsidized deliveries of oil and other vital resources from the Soviet Union were disrupted, the "Hermit Kingdom" reacted in a shockingly reckless way. Elite privileges were preserved in the face of hundreds of thousands of North Koreans dying from hunger. While this may be morally repugnant, it clearly represents another possible reaction to a peak oil scenario.

My third case is SOCIOECONOMIC ADAPTATION in Cuba, which was challenged by a similar disruption of subsidized deliveries from the Soviet Union. While this plunged Cuba into a deep crisis, there was no mass starvation comparable to North Korea. Instead, Cubans relied on social networks and non-industrial modes of production to cope with energy scarcity and the concomitant shortage of food. They were actively encouraged to do so by the regime in Havana.

These cases suggest three possible "peak oil trajectories", i.e. paths that different parts of the world might take in case of peak oil. This does not imply that responses to a global peak of oil production would follow exactly the same lines as the national reactions to oil supply disruptions described in the case studies. We can easily imagine additional trajectories, such as the mobilization of national sentiment by populist regimes. In any case, the cases are sufficiently similar to a peak oil scenario to conjure up a number of plausible conjectures on how different parts of the world would react to a peak oil scenario.

So-called "techno-optimists" object to "Malthusians" that a global decline of oil production would not only lead to higher prices but also trigger a transition from oil to other energy sources, such as renewable energy or a new generation of nuclear reactors. But alas, this argument is countered by another piece of historical evidence. After the American War of Secession, the South of the United States was deprived of slaves as the backbone resource of its socioeconomic way of life. One would expect this to be the easiest case for a smooth energy transition. After the Civil War, Southerners only had to look to the North of their own country for investment and innovative technologies. Nevertheless, the modernization of "Dixieland" took at least a century. Since a similar "upgrade" does not seem to be available in the event of peak oil, one should not be overly optimistic about a smooth transition to a post-oil (or post-carbon) society.

In Sections 2–4, I present three historical cases. Each outlines the response of a country to an acute or (in the case of Japan) anticipated oil supply disruption. In Section 5, I formulate specific hypotheses about the determinants of different peak oil trajectories. In Section 6, I present my fourth case study on the American South to counter the view that the transition to a post-oil society will be easy. In Section 7, I offer specific conjectures on how different parts of the world would react to a peak of global oil production. In the final section I discuss possible factors that may mitigate the negative impact of peak oil.

2. Predatory militarism: Japan, 1918–1945

In September 1945, Japan was so fuel-starved that it was difficult to find an ambulance with sufficient fuel to transport Premier Tojo to a hospital after his attempted suicide. Pine roots

had been dug out from mountainsides all over the country in a desperate attempt to find a resinous substitute to fossil fuel. Much of the Japanese air force and navy had been sacrificed in kamikaze raids, at least in part because there was not sufficient petrol to refuel planes and ships to return from their sorties and keep fighting (Yergin, 1991: 362–367).

Ultimately, this was a dramatic case of a self-fulfilling prophecy. The main lesson the Japanese military had taken home from World War I was that a country cut off from raw materials was bound to lose in a military contest. In their view, Germany had lost because it did not muster the necessary industrial base or access to foreign markets to achieve wartime autarky. To be prepared for a total war, resource-poor Japan would therefore have to control access to strategic resources. Only a self-sufficient economic bloc in East Asia would sufficiently prop up Japanese industrial capacity to secure the desired status of a great power (Barnhart, 1987: 9–21; Beasley, 1987).

It was precisely to prevent fuel starvation and dependency on other strategic resources that Japan embarked on aggressive military campaigns. After a liberal interlude in the 1920s, the next decade saw the invasion of Manchuria (1931) followed by the invasion of China (1937). The paramount goal was to achieve self-sufficiency in an economic bloc that was later, in 1940, to be proclaimed as the "Greater East Asia Co-prosperity Sphere".

But even from the cynical viewpoint of Japanese military planners, the targets had not been selected wisely. While Manchuria and the other occupied territories yielded significant quantities of food, coal and iron ore, very little petroleum came from these areas. Instead of becoming more self-sufficient, Japan grew even more dependent on the importation of critical commodities – especially from the United States. The situation was particularly dire for petroleum, which was completely indispensable as a military transportation fuel. Since the US was the dominant producer of petroleum at the time, Japan was heavily dependent on American oil deliveries. Japan imported 90% of its oil, of which 75–80% was shipped from California. For the critically important gasoline, the dependence was even higher (Miller, 2007: 156–157).

With that in mind, it is easy to understand (not to condone) why the Japanese onslaught in East Asia degenerated into a total war in the Pacific when Japan felt threatened by the spectre of a US trade embargo. The only alternative to importing oil from the US was looting it from Borneo and Sumatra in the East Indies. To reduce Japanese vulnerability to a US embargo, a southward advance was thus most appealing – especially to elements in the Japanese navy.

The idea of a southward advance became more compelling in the context of the Second World War in Europe, as increasing demand for resources in the European theatre led to rising commodity prices. In the late 1930s the US, which had hitherto limited itself to token gestures, gradually began introducing real economic sanctions against Japan. Given the worsening fuel scarcity and in anticipation of a full-blown embargo, the Japanese army began its southward advance. Japan started an offensive in southern China in 1939, and occupied the northern part of French Indochina in 1940 (Barnhart, 1987: 136–175).

When the full-blown American trade embargo finally came in July 1941, Tokyo took it as the ultimate confirmation that there was no other choice than to move into the Dutch East Indies and to tap the rich mineral resources available there, and particularly the petroleum that was being extracted in the British part of Borneo. To secure its flank in the imminent offensive, the Japanese navy famously endeavoured a preventive attack against the US Pacific Fleet stationed at Pearl Harbor. The intention was to roll over East Asia and create a geopolitical bloc while the US was still directing most of its attention towards the European theatre, and

later to negotiate some settlement with America from a position of relative strength (Miller, 2007; Kershaw, 2007; Record, 2009).

None of this is to deny that Japanese imperialism reaches back to the late 19th Century, that imperial Japan was a military aggressor, and that the war in East Asia started in 1931 rather than 1941. On the contrary, this is an important part of the story. To prevent military strangulation, during the 1930s resource-starved Japan tried to build a regional economic bloc. The American trade embargo further radicalized this geopolitical bent. Japan was prompted by the spectre of fuel scarcity to scrap the Open Door policy of free trade and to radicalize its strategy of predatory militarism to secure vital energy resources.

3. Totalitarian retrenchment: North Korea, 1990s

While Japan in the 1930s and early 1940s went on conquest to assert its status as a great power and secure foreign supplies, the totalitarian regime of North Korea in the 1990s retrenched in order to preserve elite privileges after the demise of the Soviet Union. Between 1995 and 1998, a terrible famine led to the starvation of an estimated 600,000 to 1 million people, or 3–5% of the population (Goodkind and West, 2001: 234). This was in glaring contradiction to the country's self-proclaimed national ideology of self-reliance (*juche*). In line with that ideology, up until the 1980s the regime had heavily invested in coalmines and hydropower to satisfy North Korea's enormous energy needs. Furthermore, Pyongyang had developed a toxic industrialized agriculture to feed the highly urbanized North Korean population. Farming in North Korea was based on irrigation, mechanization, electrification, and the prodigious use of chemicals. In 1990, estimated per capita energy use was twice as large in North Korea as in China and over half that of Japan (Williams et al., 2002: 112).

All of this came to naught with the demise of the Soviet Union, when it turned out that oil was the Achilles heel of the North Korean economy. Since North Korea does not possess any proven reserves of petroleum, oil was mostly imported from the Soviet Union in exchange for political allegiance. In 1991, Russia stopped subsidized exports of oil and other inputs to North Korea. Two years later, Russian exports to North Korea were down by 90% (Haggard and Noland, 2007: 27–32).³ This had dramatic effects. While the North Korean regime reserved most remaining fuel for the military, the rest of the industry nearly collapsed and agricultural production languished around subsistence level. Already in 1991, Pyongyang launched a "Let's Eat Two Meals a Day" campaign. In 1994, when Kim Il-sung bequeathed leadership to his son Kim Jong-il, a serious food crisis was looming. After a series of decent harvests due to favourable weather conditions in the early 1990s, severe floods and droughts led to the North Korean Great Famine between 1995 and 1998 (Haggard and Noland, 2007: 73–76).

The Great Famine is a paradigm example of how the lack of a key resource such as oil can have momentous repercussions. Most obviously, North Korean land machines depended on oil. Without fuel, tractors and other machines were not running. The next problem was transportation. Fuel was needed to bring fertilizer and other inputs to farms, and agricultural products to urban consumers. Fuel was also needed to ship coal from mines to fertilizer plants, where coal was converted into soil nutrients.⁴

³ In 1993 China refused to step in for Russia, demanding hard currency for any further exports to North Korea and radically cutting deliveries of "friendship grain".

⁴ In North Korea, coal was used in the production of fertilizers both as an energy source and as a chemical feedstock (Williams et al., 2002: 117–119). Fertilizer use fell by more than 80% from 1989 to 1998 (FAO/WFP, 2008: 14).

Fuel was further needed to get coal to power stations for electricity generation. Thus, electricity was yet another problem. Without sufficient electricity, irrigation pumping and electrical railways became intermittent. This further affected transportation. Without reliable trains, it became even more difficult to bring coal to fertilizer plants or power stations, to transport fertilizer to farms, and to get agricultural products to urban consumers (Williams et al., 2002).

Thus, interlocking energy shortages combined with food shortages and a general decline of infrastructure to produce an almost hopeless situation. While the entire economy was damaged, the consequences were worst in agriculture where there was plummeting food production, considerable loss of arable land, and a rapid depletion of soil fertility. Restoring soil fertility would have required large amounts of lime, which however could not be transported without fuel. In a desperate attempt to replace land machines, draft oxen slowly became more numerous. But, unlike tractors, work animals compete with humans for food. The energy crisis also compelled many poor people to rely on biomass for cooking and heating. Unlike fossil fuel, however, the extraction of biomass reduces soil fertility, which in turn aggravated the agricultural crisis.

As a result of such interlocking vicious circles, the production of rice and maize fell by almost 50% between 1991 and 1998. North Korea was thus compelled to apply for international food aid. After a considerable time lag, the worst starvation was stopped in the late 1990s. But since North Korea's industrial farming cannot be restored without a viable energy regime, even today there is still a protracted food crisis with a risk of further famines.⁵

To some extent it is true that the Great Famine was due to a malfunction of North Korea's Stalinist regime (Natsios, 2001). However, Pyongyang's performance is a failure only when measured against the standards of liberal democracy. On its own (cynical) terms, the regime has been incredibly successful. The crisis prompted North Korean elites to abandon the Stalinist path of wasteful industrialism, and allocate systemic scarcity instead. This negative policy choice made it possible to avoid an economic and political opening, thus preserving cherished elite privileges. While the Soviet Union and most other communist regimes have disappeared, the Democratic People's Republic of Korea is still on the map. North Korea has even become a nuclear power, which sometimes enables Pyongyang to extort international concessions. While such brinkmanship may be morally repugnant, Korean-style totalitarian retrenchment is without doubt one possible response to a severe energy supply disruption.

4. Socioeconomic adaptation: Cuba, 1990s

Cuba faced an energy supply disruption in the 1990s similar to the one experienced by North Korea. If anything, the Cuban supply shock was more severe, with the CIA estimating the decline of fuel imports between 1989 and 1993 at a whopping 71% (quoted in Díaz Briquets and Pérez López, 2000: 250).⁶ Subsidized energy supplies from the Soviet Bloc ceased to 100%.

⁵ See the Special Reports of the FAO/WFP Crop and Food Security Assessment Mission to the DPRK (especially FAO/WFP, 1999 and FAO/WFP, 2008).

⁶ Official Cuban figures for imported raw materials and other vital inputs to industrial production and electricity generation are on a similar level (reported in Wright, 2009: 68). Even according to the most conservative estimate of the US Energy Information Administration, the consumption of petroleum and electricity in Cuba fell by 20% between 1989 and 1992 (<http://tonto.eia.doe.gov/country/index.cfm>, downloaded 18 June 2009).

In 1990, Fidel Castro was forced to proclaim a national emergency called the “Special Period”. The crisis devastated the entire Cuban economy. Machines lay idle in the absence of fuel and spare parts. Public and private transportation was in shambles. Workers had difficulties getting to their jobs. Factories and households all over the island were struck by unpredictable electrical power outages (Pérez-López, 1995: 138–140). As in North Korea, the most painful effects were felt in the food sector. The nutritional intake of the average Cuban – especially protein and fat – fell considerably below the level of basic human needs (Alvarez, 2004: 154–169). Consumers resorted to chopped-up grapefruit peel as a surrogate for beef, and some people started breeding chicken in their flats or raising livestock on their balconies (Pérez-López, 1995: 138).

Nevertheless, people in Cuba were not dying from malnutrition and starvation; homeless people and gangs of street children, turned into scavengers, were not characteristic features of Cuban townscapes. Nor were violence, crime, desperation, and hopelessness characteristic features of Cuban neighbourhood life (Taylor, 2009). This is in remarkable contrast to North Korea. Although reliable reports on the situation in North Korea are scarce, reports from exiles indicate that during the 1990s life in the “Hermit Kingdom” was solitary, poor, nasty, brutish and short (Natsios, 2001). As mentioned, there was a famine killing 3–5% of the North Korean population. While life was certainly hard during the “Special Period”, nothing of that sort occurred in Cuba.

To some extent, Cubans were helped in their efforts to cope with the crisis by a benign climate, revenue from tourism, remittances, foreign investment, and international aid. Also, the regime in Havana was more humane than its counterpart in Pyongyang. After some initial tinkering, it undertook cautious reforms. The country was opened for tourism, parts of the informal sector were legalized, and various forms of local self-help were encouraged (Pérez-López, 1995).

However the real miracle was done by the Cuban people. Against all odds, ordinary people managed to get along due to the remarkable cohesion of Cuban society at the community level. Although Cuba is highly urbanized, the typical *barrio* is an urban village. Households are tightly embedded in neighbourhood life. Most families have lived in the same home for generations. The typical Cuban household is shared by an extended family. Cuba's multi-generational family households include aunts, uncles, and cousins. People cultivate close relationships with friends and relatives inside and outside the *barrio* (Taylor, 2009).⁷

One should not idealize this. Families stood in their homes because the regime had frozen the property structure after the revolution. People were cramped into narrow spaces because that was all they had. The regime had invested in community development not so much to create social glue but rather to increase political control. But be that as it may, most Cubans could rely on their families, friends, and neighbours. This local solidarity, or social capital, helped them to make ends meet during the “Special Period”. As one inhabitant of a vulnerable neighbourhood put it, the crisis brought people closer together because it forced them to rely on one another (quoted in Taylor, 2009: 140).

Traditional knowledge was also decisive in feeding the population. Although most land had been collectivized after the revolution of 1959, about 4% of Cuban farmers had kept their plots. Another 11% was organized in private cooperatives (Burchardt, 2000). The survival of traditional family farms along-

side industrial agriculture turned out to be an important asset. Independent farms were more resilient to the crisis than state farms because they operated with less fuel and agrochemical inputs. Cuba's remaining family farmers kept important traditional knowledge that could now be recovered. Other formerly independent farmers had moved to state farms or urban areas, where they provided valuable know-how for self-provisioning and urban agriculture.

Urban agriculture was a local self-help movement, facilitated by the availability of traditional knowledge in combination with organic technologies and the Cuban-specific rustic ingenuity. Idle stretches of land between concrete blocks or in urban peripheries were turned into organic gardens. Vacant or abandoned plots in close vicinity to people's homes were transformed into garden sites. People occupied these urban wastelands to grow vegetables and other foodstuffs. By the mid-1990s, there were hundreds of registered horticultural clubs in Havana alone. An urban cultivator from Havana explained in an interview: “When the Special Period started, horticultural clubs were organized by farmers themselves. (...) Special emphasis was made to involve the whole family in these activities. (...) We wanted also to develop more collaboration and mutual help among ourselves; we exchanged seeds, varieties, and experiences. We achieved a sense and spirit of mutual help, solidarity, and we learned about agricultural production” (quoted in Carrasco et al., 2003: 98).

Again, one should not idealize this. Environmentalists have exalted Cuban farming during the Special Period as a social “experiment”, or even alternative “model” of organic agriculture (see for example Rosset and Benjamin, 1994; Cruz and Sánchez Medina, 2003). In reality, Cuba's detour into low-input agriculture was of course not driven by ecological consciousness but by dire necessity. From the second half of the 1990s, when the economic situation improved and industrial inputs became more widely available, Cuba started drifting back to industrial farming. Nevertheless it is encouraging to note that, during the early and mid-1990s, Cubans managed for a few years to mitigate an atrocious resource supply shock by their remarkable community ethos. The comparison with North Korea shows that this was not a minor achievement.

5. Peak oil trajectories

The case studies suggest three different patterns how societies can respond to energy supply disruptions. Despite the fact that peak oil would initially be experienced as a global energy crunch rather than a series of national crises, it seems reasonable to expect a similar gamut of reactions. Countries prone to military solutions may follow a Japanese-style strategy of predatory militarism. Countries with a strong authoritarian tradition may follow a North Korean path of totalitarian retrenchment. Countries with a strong community ethos may embark on Cuban-style socioeconomic adaptation, relying on their people to mitigate the effects of peak oil. It is of course possible to imagine other reactive patterns, such as the mobilization of national sentiment by populist regimes.

Given their military capabilities, the United States and China would be the most obvious candidates for a “Japanese” strategy of predatory militarism. The US may be tempted to use its unrivalled power projection capacity to secure privileged access to oil. It has happened sometimes in the past, and may happen more often in the future, that US decision makers find military coercion more effective than trade. China is no match for the US, but it would be capable of using its military muscle to secure access to oil and gas in Central Asia. Elsewhere the PRC would be unlikely to use a predatory strategy because, for the foreseeable future, its

⁷ In a survey, 86% of people from vulnerable neighbourhoods in Havana declared that they could count on support from relatives, 97% from friends, and 89% from neighbours (Taylor, 2009: 142).

maritime forces and air power are not strong enough. Countries like India, Brazil or Israel have even more limited military clout, but might be tempted to engage in geopolitical operations in their regional neighbourhood.

A “North Korean” solution of totalitarian retrenchment that “screws” the population to preserve elite privileges is most likely in countries with a strong authoritarian tradition. In consolidated democracies, totalitarian retrenchment is much harder to imagine. Nevertheless, the history of 20th Century Europe shows that even democracies can and do sometimes degenerate into tyranny. It is difficult to predict to what point even in consolidated democracies political culture could deteriorate in a protracted and serious crisis. Political elites in less consolidated democracies might experience fewer constraints and scruples right from the start. For example, elites in the second-wave democracies of Latin America may have lesser qualms than their counterparts in Western Europe about “screwing” their own population to preserve elite privileges.

Compared to predatory militarism and totalitarian retrenchment, “Cuban-style” socioeconomic adaptation is far more desirable from a moral viewpoint. At the local level, many people in developing countries may be able to mitigate the effects of peak oil by reverting to community-based values and a subsistence lifestyle.⁸ Such a regression would be comparatively easy for people in societies where individualism, industrialism and mass consumerism have not yet struck deep roots. Socioeconomic adaptation would be more difficult for people in Western countries, where individualism, industrialism and mass consumerism have held sway for such a long time that a smooth regression is hard to imagine. And yet, survival in many presently industrial Western societies may ultimately depend on support from local communities and a subsistence-based lifestyle.

All of this can be formulated as three causal propositions, or “hypotheses”.

Hypothesis 1. The greater a country’s military potential and the stronger the perception that force will be more effective than the free market to protect access to vital resources, the more likely there will be a strategy of predatory militarism.

Hypothesis 2. The shorter and the less a country or society has practiced humanism, pluralism and liberal democracy, the more likely its elites will be willing and able to impose a policy of totalitarian retrenchment on their population.

Hypothesis 3. The shorter and the less a country or society has been exposed to individualism, industrialism and mass consumerism, the more likely there will be an adaptive regression to community-based values and a subsistence lifestyle.

As always there are winners and losers, and oil exporting countries would be in a more comfortable position. Other things being equal, they could use the increased revenue from oil exports to increase their power and wealth, while subsidizing domestic oil consumption and bolstering their economies – if, that is, they do not fall prey to predatory militarism; and if they evade the “resource curse” that has bedevilled so many developing countries in the 20th Century.

In the transition, large private Western companies such as Exxon and Shell would lose further ground to the state-controlled companies of oil exporting countries such as Saudi Arabia’s Aramco or Nigeria’s NNPC. As a consequence, even oil importing countries would increasingly rely on state-controlled companies such as China’s CNPC (Vivoda, 2009). Both in the realm of power

politics and on the “marketplace of ideas”, the ability of Western countries to impose liberal democracy through instruments such as development assistance and economic conditionality would further dwindle (Leder and Shapiro, 2008).

This can be formulated as yet another causal proposition, or “hypothesis”.

Hypothesis 4. In the event of peak oil, there will be winners and losers. It seems reasonable to expect a redistribution of power and wealth from oil importers to oil exporters, and from private to state-controlled companies.

6. Energy shift?

Could there not be an energy shift from oil to some alternate technology or resource? So-called “techno-optimists” object to peak-oil theorists that scarcity would not only lead to higher oil prices but would also trigger a transition to other energy sources, such as renewable energy or a new generation of improved nuclear reactors (Smil, 2008). For example, some optimists predict that innovative technologies such as solar energy or nuclear fusion will eventually make oil redundant (Bradford, 2006; Weiss and Bonvillian, 2009).

Since global energy shifts have happened in the past, for example from coal to oil, is it not unimaginative and unnecessarily defeatist to discard such a possibility for the future (Podobnik, 2006)? Could there not be a revolutionary technological breakthrough, or some other positive surprise, around the corner that would catapult industrial society “beyond oil” (or even “beyond carbon”)?

It is far from my intentions to exclude the sudden appearance of a *deus ex machina*, such as the discovery of a new energy source or a revolutionary technological breakthrough. However, time is an issue. Exploration takes time, and the implementation of new technologies takes even more time. What takes most time of all, is the formation of the “new consciousness” necessary for radical social change. This can be gleaned from yet another case study: Dixieland.

The socioeconomic backbone resource of the Old South was slaves. Precisely because the slave economy worked, white Southerners were willing to defend it in the bloody War of Secession of 1861–1865 (Fogel, 1989; Wright, 2006). The abolition of slavery after the War plunged the South into a deep crisis. The War was followed by the Reconstruction Era (1865–1877), when the victorious North tried to enlist dissident elites and former slaves to impose its political and socio-economic institutions on a reluctant South. Despite the introduction of representation and suffrage for former slaves, reconstruction was mostly thwarted by the recalcitrance of traditionalist Southern elites. Heavy subsidization of railroads by Republican state governments in the South did not lead to the hoped-for modernization but rather to corruption, making a few investors rich and otherwise contributing to soaring public deficits. After the withdrawal of the last federal troops from the South, race inequality was re-established under the banner of white supremacy (Fitzgerald, 2007).

Later in the 19th Century, Southern elites were not prevented by their conservative values from embracing industrial capitalism. Initially, this amounted to an uneasy compromise between cherished industrialization and dreaded modernization. On the one hand, Southern elites became obsessed with the idea that an industrializing “New South” would rise like phoenix from the ashes of the “Old South”. On the other hand, they remained loyal to time-honoured values of agrarianism and patriarchal society. As Mark Twain put it in 1883, cultural life on the Mississippi was characterized by “practical, common-sense, progressive ideas, and progressive works, mixed up with the duel, the inflated speech,

⁸ Given the high population pressure in most parts of the developing world, however, many others would fall victim to famine, disease, and conflict.

and the jejune romanticism of an absurd past that is dead, and out of charity ought to be buried” (Twain, 2006: 264).

This was reflected in a quasi-colonial economy. While railroads were finally built on a massive scale, often with Northern capital, Southern industrialization was initially dominated by low-wage and labour-intensive manufacturing. Most industries were dedicated to the processing of agricultural goods (e.g. cotton mills) or natural resources (e.g. blast furnaces). The real industrial takeoff came much later, after several generations of socio-economic backwardness, and after the New Deal of the 1930s (electrification) and the war economy of World War II. In the mid-20th Century, Dixieland finally became a growth region and came to be seen as part of the American “Sunbelt” (Cobb, 1984; Wright, 1986). The Civil Rights Act of 1964 put an end to official race segregation in the South, although some race issues remain until the present day.

While there is a decently happy ending to the story, it took a century for the South to recover and catch up. This is remarkable because, to understand how a technological and socioeconomic upgrade might look like, Southerners only had to look to the North of their own country. There, industrial capitalism with its superior technology and know-how was unfolding before their very eyes. With the right incentives in place, attracting Northern investment and technology transfers would not have been too difficult. But although conditions for an industrial upgrade were uniquely favourable, the 100 years from the Civil War to the Civil Rights Act are replete of unpleasant memories such as race riots and labour revolts, as well as the Ku Klux Klan and Jim Crow Laws.

Dixie is a cautionary tale for those who believe that, after peak oil, there will be an easy technological upgrade. But if even in the US South, despite uniquely favourable circumstances, adaptation took a full century, then a technological upgrade will be even harder under the more challenging circumstances of a global energy crunch. The world would be struggling with an energetic downgrade, rather than an industrial upgrade as in the case of the American South. Developing energy technologies is never fast and easy, and even less so in times of crisis. After peak oil, we should expect extremely slow and painful processes of social and technological adjustment that may last for a century or more.

This can be stated as my last and most general proposition, or “hypothesis”.

Hypothesis 5. In the event of peak oil, we should not expect either immediate collapse or a smooth transition. People do not give up their lifestyle easily. We should expect painful adaptation processes that may last for a century or more.

7. Same crisis, different responses

Based on the heuristic insights and causal propositions gleaned from the case studies, we are now in a position to second-guess how different parts of the world would react to a peak oil scenario. Please note that my conjectures are limited to the first couple of decades after peak oil.⁹ Please do also note that the picture provided in this section is deliberately broad-brush. Nothing of what I am going to say must be understood in a deterministic way. All I can offer is some tentative and indicative conjectures, rather than point predictions.

My conjectures rely on prior knowledge about historical and institutional path dependencies. While the long-term future is fundamentally open, in the short and medium term there are significant path-dependencies that make some trajectories far

more likely than others. This applies to particular countries and regions. For example we roughly know which countries have large power projection capabilities, recent authoritarian traditions, and high levels of “social capital”. We also know which regions possess significant reserves of energy resources, and how these resources have been managed in the past.

As a baseline, I need to make some assumptions about peak oil. I assume that, after a short plateau, oil production will fall by about 2–5% per year. I further assume that no adequate alternate resource and technology will be available to replace oil as the backbone resource of industrial society.

In NORTH AMERICA, the United States combines extreme dependency on foreign oil deliveries with an unrivalled capability to project military power. This is not to deny that America’s free-trade ideology militates against the open recourse to military coercion. In fact, the US will support the free market for oil as long as it is convenient. When the oil market comes under pressure because of tightening supply, the US will continue to defend it for a while. But when soaring prices start crippling the national economy, US leaders may find that coercive diplomacy is more effective than free-trade rhetoric. The US is then likely to put the blame on foreigners and pursue a geopolitical strategy of “energy security” to protect the American way of life (Klare, 2008). Why keep negotiating with recalcitrant leaders such as Chavez if there is a military option? This is not to say that the military option is easy, as the Iraq war has shown. However, military coercion is likely to gain ascendancy relative to free-market rhetoric as oil supplies become scarcer. The resource-rich neighbours of the US, Canada and Mexico, would become tied more closely to the American core.

In SOUTH AMERICA, mid-sized oil producing countries such as Venezuela and Ecuador might try to profiteer from soaring oil prices. If they engage in a strategy of brinkmanship and deny the US oil on favourable terms, their regimes may be toppled. This would further increase anti-American resentment in the region, but opportunistic elites might ultimately acquiesce to American hardball tactics. In the past, Latin American elites have often opportunistically colluded with the US. Eventually, resource-rich Brazil may be able to escape intervention due to its larger size and geographical distance from the US. If Brazil manages to offer sufficient benefits to neighbouring countries, a regional state complex around Brazil may be possible. Otherwise, energy-poor Latin American states may enter a serious crisis. We may then see how much Cuban-style socioeconomic adaptation is possible in other Latin American societies.

After peak oil, WESTERN EUROPE would be in a difficult quandary. Although in principle Germany and France could easily arm, a credible military option is not available. Europeans have good historical reasons to dread predatory militarism, and the social consensus necessary for this strategy would not be forthcoming at the decisive initial stages of geopolitical positioning. In most of Western Europe, the path of totalitarian retrenchment does not seem to be available either. Concomitantly, Western European countries would be forced to strike opportunistic “bargains” with Russia and the oil exporting countries of North Africa. Unfortunately, however, such deals are inherently fragile and subject to constant renegotiation. Investment in renewable energy and innovative technologies might somewhat mitigate the transition, but ultimately Europeans could hardly avoid a transition to a more community-based lifestyle. Despite the present affluence of Western European societies (or precisely because of it), this would be extremely painful and last for several generations.¹⁰

¹⁰ Britain try to evade the quandary by stressing its special relationship with the US, but it is debatable whether the UK could offer enough benefits to its American ally to justify the burden of provisioning another 50 millions of “oil-suckers” with subsidized fuel.

⁹ For the long-term prospects I recommend Greer (2009); see also Greer (2008).

As a result, people would be forced to rely on local communities for their welfare if not their survival. However a regression to community-based values and a subsistence lifestyle would be difficult because the habits of industrial society are deeply rooted. Western Europe's problems would be compounded by social segregation along immigrant groups and/or religious fault lines which, on the one hand, might enhance communal support for specific groups but, on the other, would conjure up severe conflict in Europe's multiethnic societies.

The situation of JAPAN would be similar to Western Europe. In both cases, the unavoidable transition to community-based values and a subsistence lifestyle would be very painful and last for several generations. The situation would be somewhat different in countries and regions that have industrialized later and/or have a more recent authoritarian tradition. The paths of totalitarian retrenchment and socioeconomic adaptation are more easily available in EASTERN EUROPE and SOUTH EAST ASIA than in Western Europe and Japan.

In LEAST DEVELOPED COUNTRIES, common people with limited exposure to industrial lifestyles would be forced to rely for their survival on the cohesion of social groups. Particularly but not exclusively in SUB-SAHARAN AFRICA, state failure and conflict over scarce resources would become endemic. The inevitable end of the oil-based "green revolution" and the demise of international aid would wreak environmental havoc and human insecurity. The ecological situation would be aggravated by the soil being deprived of vital biomass as a combustible. The production of "biofuels" may mitigate the energy situation of wealthy strata, but would crowd out food production and thus exacerbate the plight of the poor. In most places, the unavoidable consequence would be famine, disease, and mass exodus. In some places, however, a revival of community-based values and a return to a subsistence lifestyle may somewhat mitigate the effects.

The elites of oil producing countries such as Nigeria, Angola and Mozambique would keep selling their oil to the highest bidder, especially if the bid is backed by sufficient military clout and if there are no onerous obligations with regard to democratization and human rights. Unless the US insists on its dysfunctional democratization agenda, it will have better access to African resources than Europe, China, or Japan. It is an open question how much the citizens of the African petro-states would benefit from the revenues (but people in those African countries that do not produce oil or gas would probably suffer more).

In Asia, RUSSIA has enough energy to provide for its own needs. It would become a more important regional player due to its abundant energy resources. CHINA depends on exports. It may not yet have accumulated enough wealth to insulate itself against the demise of international free trade. To preserve its industrial capacity, China might be tempted to secure access to oil and gas from Central Asia by military means. INDIA has less military clout, but might also be tempted to engage in operations in its neighbourhood. Small and resource-poor outposts of industrial society, such as Singapore, would struggle to survive.

The oil producing countries in CENTRAL ASIA and the MIDDLE EAST would benefit more than in the past from their comparative advantage. Due to the effects of rising oil prices, their economies would continue to grow in relative and absolute terms. As a result, their oil consumption would be stable or even increase at a time when it would be declining in the rest of the world (Rubin, 2009: 57–83). While the "resource curse" would persist in countries with particularly corrupt elites, in others political freedom would improve alongside the level of industrialization and the standard of living. The Middle East would almost certainly replace Western Europe as the most attractive destination for Muslim migrants.

8. Final thoughts

A key assumption of this article is that, in the event of peak oil, no obvious alternate resource and technology would be at hand to replace oil as the backbone resource of industrial society. To mitigate the impact of peak oil, a massive crash program to develop a mix of substitute resources and implement adequate technologies would be desperately needed. The program would have to start early, as it would come to fruition only after much more than a decade (Hirsch et al., 2005). In the absence of such a crash program, and after the onset of the crisis, rather than grandiose designs we should expect haphazard moves to make the best of a very difficult situation (Moriarty and Honnery, 2009).¹¹

The most attractive resource to mitigate the impact of peak oil is NATURAL GAS as a transition fuel. Although gas reserves are limited, they are relatively more abundant than oil reserves. Recently, there have been encouraging developments in the extraction of unconventional gas, and notably shale gas. However, it remains to be seen if reports of an "unconventional glut" can be trusted (The Economist, 2010). As always, technology and infrastructure are major challenges. The exploration and exploitation of shale gas takes time. While oil is easily traded and transported as a liquid fuel, gas requires pipelines or needs to be liquefied. In any case the world's vehicle fleet runs on oil, not gas. Compensating a decline of 2–5% of oil production per year with gas would be a tall order.

At least for a couple of decades, COAL would become a more important energy source. Coal is still fairly abundant in Asia, Australasia, and the United States (Heinberg, 2009; Höök and Aleklett, 2009; Lin and Liu, 2010). Increased carbon emissions would lead to very harmful consequences for the environment and global climate, not least because heavy investment in clean coal technologies is unlikely under crisis conditions. Rising oil prices would make coal mining and transport more difficult, but coal-rich countries are highly motivated to tackle such challenges as long as coal production makes financial and energetic sense.

To gain access to available OIL RESERVES, protected areas from the Arctic to Antarctica would be cleared for exploitation. Unconventional oil from tar sands and oil shale would be exploited, regardless of the harmful environmental consequences. As in the case of clean coal technologies, heavy investment of scarce financial resources in environmentally friendly technologies is unlikely under crisis conditions. Another downside of these otherwise desirable technologies is that they tend to reduce the energy return on energy invested (EROEI), which would hardly be acceptable in a situation of soaring energy scarcity.

In the unlikely event that massive financial resources and planning horizons of more than 15 years were still available after peak oil, NUCLEAR REACTORS would be rushed through regardless of the risks involved. However, this can never do the trick. The current share of nuclear power in world energy production is only a few per cent, and it could hardly expand much under crisis conditions. Moreover, uranium is as finite as any other energy source.

To the extent possible in times of economic turmoil, there would be further investment in RENEWABLE ENERGY. But alas, this could hardly make up for the losses. As in the case of nuclear power, the share of renewable energy in world energy production is only a few per cent, and it is not clear how much and how quickly it could expand under crisis conditions. As any other energy source, renewable energy requires inputs of energy, raw materials, and investment. Nevertheless, the odds for renewable energy are better

¹¹ Especially the gradual decline of petrol-based transportation after peak oil would pose a severe challenge to the implementation of ambitious modernization programs.

than for nuclear energy. From an ecological viewpoint, the greatest hope for the mitigation of peak oil is a combination of conservation, energy efficiency, and renewable energy.

If a mix of substitute fuels can be found, and if alternate technologies are developed in time, this may mitigate the impact of peak oil and postpone the decline of overall world energy consumption for a while. But there is always another time, as infinite growth on a finite planet is impossible. At some point, industrial society will start crumbling and free trade will begin to disintegrate.

This is certainly not a cosy world to imagine. Most of us would prefer fossil-fuelled industrial society to continue unabated, although perhaps mitigated to avoid the worst effects of climate change (Homer-Dixon, 2009). But even though we may not like the idea of a global energy crunch, it would be utterly imprudent not to take the spectre of peak oil very seriously.

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References

- Akins, J.E., 1973. The oil crisis: this time the wolf is here. *Foreign Affairs* 51 (3), 462–490.
- Aleklett, K., Höök, M., Jakobsson, K., Lardelli, M., Snowden, S., Söderbergh, B., 2010. The peak of the oil age: analyzing the world oil production Reference Scenario in *World Energy Outlook 2008*. *Energy Policy* 38 (3), 1398–1414.
- Alvarez, J., 2004. *Cuba's Agricultural Sector*. University Press of Florida, Gainesville.
- Barnhart, M.A., 1987. *Japan Prepares for Total War: The Search for Economic Security*. Cornell University Press, Ithaca, NY, pp. 1919–1941.
- Beasley, W.G., 1987. *Japanese Imperialism*. Clarendon Press, Oxford, pp. 1894–1945.
- Bentley, R., Boyle, G., 2008. Global oil production: forecasts and methodologies. *Environment and Planning B: Planning and Design* 35 (4), 609–626.
- Bradford, T., 2006. *Solar Revolution: The Economic Transformation of the Global Energy Industry*. MIT Press, Cambridge, MA.
- Brandt, A.R., 2007. Testing Hubbert. *Energy Policy* 35 (5), 3074–3088.
- Burchardt, H.J. (Ed.), 2000. *La última reforma agraria del siglo: La agricultura cubana entre el cambio y el estancamiento*. Nueva Sociedad, Caracas.
- Carrasco, A., Acker, D., Grieshop, J., 2003. Absorbing the shocks: the case of food security, extension and the agricultural knowledge and information system in Havana, Cuba. *Journal of Agricultural Education and Extension* 9 (3), 93–102.
- Cobb, J.C., 1984. *Industrialization and Southern Society*. University Press of Kentucky, Lexington, pp. 1877–1984.
- Cruz, M.C., Sánchez Medina, R., 2003. *Agriculture in the City: A Key to Sustainability in Havana, Cuba*. Ian Randle, Kingston, Jamaica.
- Díaz Briquets, S., Pérez López, J., 2000. *Conquering Nature: The Environmental Legacy of Socialism in Cuba*. University of Pittsburgh Press, Pittsburgh, PA.
- FAO/WFP, 1999. *Special Report: FAO/WFP Crop and Food Supply Assessment Mission to the Democratic People's Republic of Korea*, 8 November 1999.
- FAO/WFP, 2008. *Special Report: FAO/WFP Crop and Food Security Assessment Mission to the Democratic People's Republic of Korea*, 8 December 2008.
- Fitzgerald, M.W., 2007. *Splendid Failure: Postwar Reconstruction in the American South*. Dee, Chicago.
- Fogel, R.W., 1989. *Without Consent or Contract: The Rise and Fall of American Slavery*. Norton, New York.
- Goodkind, D., West, D., 2001. The North Korean famine and its demographic impact. *Population and Development Review* 27 (2), 219–238.
- Greer, J.M., 2009. *The Ecotechnic Future*. New Society Publishers, Gabriola Island.
- Greer, J.M., 2008. *The Long Descent: A User's Guide to the End of the Industrial Age*. New Society Publishers, Gabriola Island.
- Haggard, S., Noland, M., 2007. *Famine in North Korea: Markets, Aid, and Reform*. Columbia University Press, New York.
- Heinberg, R., 2009. *Blackout: Coal, Climate and the Last Energy Crisis*. New Society, Gabriola Island.
- Hirsch, R.L., 2008. Mitigation of maximum world oil production: shortage scenarios. *Energy Policy* 36 (2), 881–889.
- Hirsch, R.L., Bezdek, R., Wendling, R., 2005. *Peaking of World Oil Production: Impacts, Mitigation and Risk Management*. Available online at http://www.netl.doe.gov/publications/others/pdf/Oil_Peaking_NETL.pdf. Downloaded 31 March 2010.
- Höök, M., Aleklett, K., 2009. Historical trends in American coal production and a possible future outlook. *International Journal of Coal Geology* 78 (3), 201–216.
- Homer-Dixon, T. (Ed.), 2009. *Carbon Shift: How the Twin Crises of Oil Depletion and Climate Change will Define the Future*. Random House, New York.
- Hubbert, M.K., 1969. *Energy resources*, Committee on Resources and Man (Ed.), *Resources and Man: A Study and Recommendations*. Freeman, San Francisco, pp. 157–242.
- Kershaw, I., 2007. *Fateful Choices: Ten Decisions that Changed the World*. Penguin, New York.
- Klare, M.T., 2008. *Rising Powers, Shrinking Planet: The New Geopolitics of Energy*. Metropolitan Books, New York.
- Leder, F., Shapiro, J.N., 2008. This time it's different: an inevitable decline in world petroleum production will keep oil product prices high, causing military conflicts and shifting wealth and power from democracies to authoritarian regimes. *Energy Policy* 36 (8), 2850–2852.
- Lin, B.Q., Liu, J.H., 2010. Estimating coal production peak and trends of coal imports in China. *Energy Policy* 38 (1), 512–519.
- Miller, E.S., 2007. *Bankrupting the Enemy: The US Financial Siege of Japan before Pearl Harbor*. Naval Institute Press, Annapolis, MD.
- Moriarty, P., Honnery, D., 2009. What energy levels can the earth sustain? *Energy Policy* 37 (7), 2469–2474.
- Natsios, A., 2001. *The Great North Korean Famine*. United States Institute of Peace Press, Washington, DC.
- Pérez-López, J.F., 1995. *Cuba's Second Economy: From Behind the Scenes to Center Stage*. Transaction Publishers, New Brunswick.
- Podobnik, B., 2006. *Global Energy Shifts: Fostering Sustainability in a Turbulent Age*. Temple University Press, Philadelphia, PA.
- Record, J., 2009. *Japan's Decision for War in 1941: Some Enduring Lessons*. Strategic Studies Institute, Carlisle, PA.
- Rosset, P., Benjamin, M. (Eds.), 1994. *The Greening of the Revolution: Cuba's Experiment with Organic Agriculture*. Ocean Press, Melbourne, Australia.
- Rubin, J., 2009. *Why Your World is About to Get a Whole Lot Smaller: Oil and the End of Globalization*. Random House, New York.
- Smil, V., 2008. *Global Catastrophes and Trends: The Next Fifty Years*. MIT Press, Cambridge, MA.
- Taylor, H.L., 2009. *Inside el Barrio: A Bottom-up View of Neighbourhood Life in Castro's Cuba*. Kumarian Press, Sterling, VA.
- The Economist, 2010. An unconventional glut: newly economic, widely distributed sources are shifting the balance of power in the world's gas markets. *The Economist*, 11 March 2010.
- Twain, M., 2006. *Life on the Mississippi*. Folio, London.
- United States Government Accountability Office, 2007. *Crude oil: uncertainty about future oil supply makes it important to develop a strategy for addressing a peak and decline in oil production*. United States Government Accountability Office, Washington (GAO-07-283).
- Vivoda, V., 2009. *Resource nationalism, bargaining and International Oil Companies: challenges and change in the new millennium*. *New Political Economy* 14 (4), 517–534.
- Weiss, C., Bonvillian, W.B., 2009. *Structuring an Energy Technology Revolution*. MIT Press, Cambridge, MA.
- Williams, J.H., Hippel, D.Von, Nautilus Team, 2002. *Fuel and famine: rural energy crisis in the DPRK*. *Asian Perspective* 26 (1), 111–140.
- Wright, G., 2006. *Slavery and American Economic Development*. Louisiana State University Press, Baton Rouge.
- Wright, G., 1986. *Old South: New South: Revolutions in the Southern Economy Since the Civil War*. Basic Books, New York.
- Wright, J., 2009. *Sustainable Agriculture and Food Security in an Era of Oil Scarcity: Lessons from Cuba*. Earthscan, London.
- Yergin, D., 1991. *The Prize: The Epic Quest for Oil, Money and Power*. Free Press, New York.