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Anatoly Karlin on Eurasia, geopolitics, and peak oil

Review of “Global Catastrophes and Trends” (V. Smil)

By [AK](#) | Published: September 28, 2009

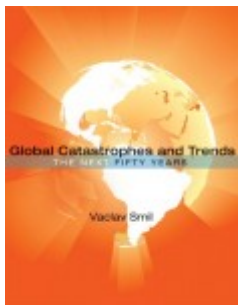
Smil, Vaclav – **Global Catastrophes and Trends** (2008)

Category: futurism, climate change, geopolitics, catastrophes; Rating: 5/5

Summary: [Google Books](#)

Vaclav Smil, an energy theorist and language connoisseur, brings his talents to bear on this idiosyncratic, incisive and balanced book on the global future. From the outset, he outlines his skepticism in universal theories of history (such as Fukuyama’s “ahistorical” end of history thesis or the numerous prognoses of imminent civilizational collapse) and attempts at quantifying current trends to make point forecasts (e.g. predictions that nuclear power would make energy too cheap to meter in the halcyon days of the industry). Instead, he emphasizes the role played by the sheer complexity of human systems and their discontinuities – for instance, who could have imagined that a generation after the death of Mao, China would be the workshop of the world helping underwrite US military dominance? Having established “How (Not) to Look Ahead”, Smil introduces his method – analyzing key variables categorized by a) unpredictable salvations – “catastrophes”, b) powerful trends (the effects of globalization, global demography, the energy transition), and c) the shifting balance of power between the Great Power (the marginalization of Japan, an unstable Islam, Russia’s partial resurgence, the uncertain rise of China and an increasingly faltering United States). It is one a method I highly favor and I agree with most of the arguments he makes in his book, albeit there are a few major exceptions.

Fatal Discontinuities



First, he classifies the catastrophes or “fatal discontinuities” into: 1) known catastrophic risks (asteroid strikes, earthquakes, super-eruptions), 2) plausible catastrophic risks (nuclear war, pandemic) and 3) speculative risks (“grey goo” or takeover by machines). [There is another [classification of existential risks](#) by Nick Bostrom].

The likelihood of world-changing natural disasters occurring is vanishingly small. Though floods and earthquakes killing up to 100,000’s of people happen about once or twice per decade, their global effects are very limited.

An asteroid capable of terminating industrial civilization will need to have a diameter of about 2km+ (by darkening the sky with micro-particles and destroying the ozone layer), but the chances of such asteroids striking the Earth decrease exponentially with greater size. In any case the majority of large Near-Earth Objects have already been identified and identified as safe. Predicting super-eruptions is much harder, though again based on the geological record the

chances of an unprecedented catastrophe are minimal – which would have to be on the scale of the Toba, Sumatra event 72,000 years ago, which ejected 2,000km³ of ejecta and reduced the world human population to 10,000. An example of a modern threat is [a super-eruption of Yellowstone](#), which is about due though we'd have to be *extremely* unlucky to have it blow up during our lifetimes. Another possibility are submarine landslides forming tsunamis, such as at La Palma, the Canary Islands, where a 500km³ slide would create [a mega-tsunami with repeated walls of water](#) up to 25m striking Florida.

The second category includes pandemics and mega-wars. During the last generation, the onslaught against disease stalled and went into partial reverse, with a growing list of contagious diseases (the most significant of which is HIV / AIDS), failures in eradication (e.g. polio) and antibiotic resistance (multi-drug resistant TB – which now finished off many AIDS sufferers). There also remains [the specter of an influenza pandemic](#), which will be [deeply disruptive](#) and potentially highly virulent. Though a repeat of 1957 or 1968, or the current swine flu for that matter, aren't going to have much effect, the consequences of the return of a Spanish Flu-like pandemic (1918) will be devastating. Arising out of the natural disease reservoir of South China, the flu can spread more rapidly (air transport, globalization, greater urban populations) and a mortality profile hard on the younger cohorts (15-30 years) will have devastating effects on aging European societies. Globalization will shut down as countries close borders, with highly disruptive effects on national economies. However, we are much better prepared for handling a pandemic today than in 1918 due to better nutrition and technological advances such as mechanical respirators, antibiotics for treating secondary infections, antivirals, and math models for optimizing quarantines and vaccinations.

Just as another pandemic is almost certain to happen, so there will continue to be violent conflict, terrorism, genocides, perhaps even another large-scale democide or mega-war with tens to hundreds of millions of casualties – despite that [the incidence of violent conflict fell by 40%](#) since the early 1990's and the agreed reductions in the US and Russian nuclear arsenals. Some may be transformational and fundamentally change the course of world history (Smil identifies the Taiping Rebellion, the American Civil War, WW1 and WW2 as transformational). The risk remains of an accidental nuclear war between the US and Russia killing hundreds of millions, or the rise of an revisionist, expansionist power unleashing WW3. The potential deaths accruing to war are several OM's (orders of magnitude) higher than for all natural catastrophes.

Smil points out that terrorism is 1) nothing new, having gone through four “waves” – a) Russia's *narodnaya volya* assassinations, b) decolonization, c) PLO, IRA, Basque ETA, and Western left-wing groups favoring bombings and aircraft hijackings, and d) modern Islamic terrorism beginning with the Iranian Revolution / Hezbollah, later extending to the Palestinian intifada and al-Qaeda, at the symbolic start of a new century (1400) by the Islamic calendar, 2) has rarely been effective with a few exceptions like 9/11 (and even there its value lay mostly in symbolism – [\[the spirit of terrorism\]](#), disproportionate public fear and official overreaction), for the chances of dying from terrorism are extremely low. Since producing mass casualties is extremely difficult, terrorists have to settle for “mass disruption” instead of “mass destruction”.

His final category of fatal discontinuity are “imaginable surprises”, such as annihilation of the Earth by exotic particle experiments, unforeseen climatic shifts (e.g. a drastic cooling), [grey goo](#)

eating the biosphere within a few days, etc. He correctly doesn't put much stock into these sci-fi scenarios.

Unfolding Trends

Smil makes some general observations about trend analysis. First, they tend to follow a pattern of incremental engineering process (cheaper, more efficient) and gradual diffusion, yet are sometimes marked by profound discontinuities, e.g. fertility transitions, the continuing failure to control nuclear fusion. Surprises can occur because a) long-term trends aren't recognized in time, such as the Soviet Union's post-1965 stagnation, b) can't predict which trends will become embedded in society, and which ones will veer off course, c) their unknowable effects on human society (e.g. will the oil peak be moderated by a smooth transition to gas or renewables, or does it herald the end of industrial civilization?). With that said, Smil now focuses on three things: 1) the coming energy transition, 2) Great Power dynamics and 3) the future of globalization.

Smil now moves into his *forte* – global energy systems. The first point he makes is that the basis of today's industrial system was formed a long time ago and that improvements since then paled in significance. "The most important concatenation of these fundamental advances took place between 1867 and 1914", when engineers realized electricity generation, steam and water turbines, internal combustion engines, inexpensive steel, aluminium, explosives, synthetic fertilizers, electronic components, thus laying the "technical foundations of the twentieth century" [much like men like Marx, Bismarck and Garibaldi laid its ideological foundations]. A second Golden Age occurred in the 1930's and 1940's, which saw "the introduction of gas turbines, nuclear fission, electronic computing, semiconductors, key plastics, insecticides and herbicides".

This technological base requires huge, uninterrupted supplies of energy for its existence. The sources of energy remain constant for long periods due to the difficulty of substitution, which involves discarding old infrastructures and building anew. As a share of world total primary energy supply (TPES), coal went from 95% in 1900 (excluding phytomass), to just 28% in 2005, while crude oil rose from 4% in 1900 to 27% in 1950 and 46% in 1975, but dropped to 36% by 2005. Natural gas expanded significantly since the mid-century, reaching 24% of global TPES by 2005. All together, fossil fuels supplied 88% of global TPES in 2005, compared to 93% in 1975. Despite all the talk about environmentalism and energy security, there has been no walk; ours is still a predominantly fossil-fuel based civilization.

In the future, Smil foresees that a) there will be no oil peak, b) coal is unlimited except by concerns over climate change and c) gas will rise in importance because of its relatively low carbon per unit of energy ratio and advances in LNG technology.

Though I am in qualified agreement with b) and c), Smil ridiculing of the oil peakists in a) is singularly unconvincing. He claims the Hubbert model is "simplistic" in that it is "based on rigidly predetermined reserves" and ignores "innovative advances or price shifts". The first point is flat out wrong. It applies to Hubbert's first model, but in his later work [he devised a method that did away with the need for guesstimates of URR](#) (ultimately recoverable reserves) – and which gives pretty much the same results, indicating that the effects of technology and higher

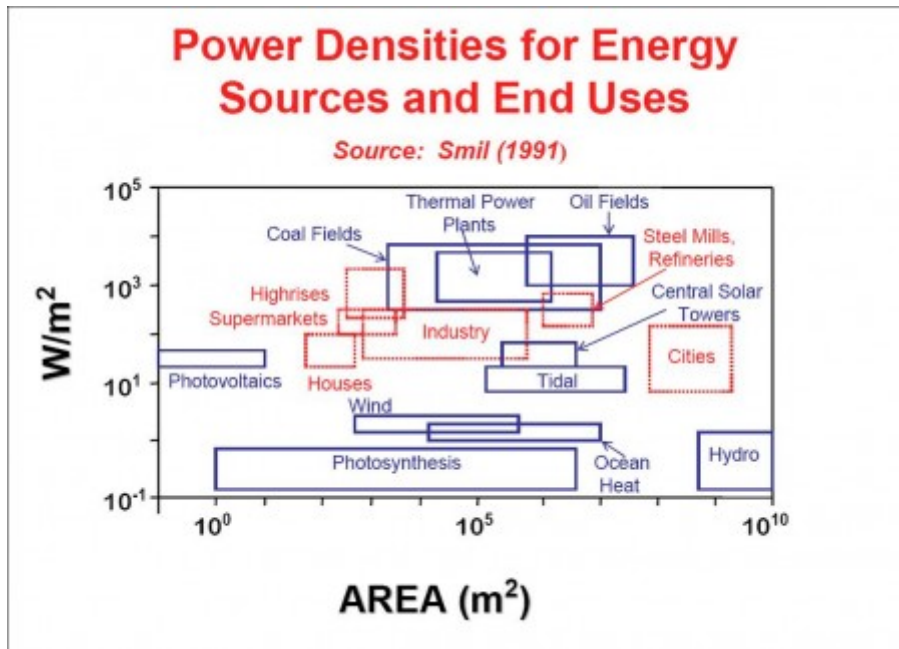
prices are limited. Taking the case of the US, despite the discovery of oil off Alaska and the Gulf, despite there having been more exploration in the country than in the rest of the world combined, despite the periods of high prices during 1973-1986 and 2002-2008, despite its light regulatory environment and access to cheap credit – [American oil production has declined relentlessly](#) since the early 1970's. Quite simply, the evidence indicates that the power of depletion will eventually defeat ever greater and smarter extraction attempts. Anyhow, read one of these overviews from [2007](#) or [2009](#) for a more indepth explanation of peak oil.

However, I agree with Smil that the transition to other non-fossil fuel sources will be a drawn out process, considering that most of the “prime movers” in our society are oil-based (the steam turbines that generate 70% of global electricity output, the gasoline-fueled internal combustion engine, the diesel engine, the gas turbine, and the induction electric motor). [I would note that these difficulties are going to be aggravated by peak oil].

Addition difficulties include a) the scale of the shift, b) lower energy density of replacement fuels, c) substantially lower power density of renewable energy extraction, d) intermittence of renewable flows and e) uneven distribution of renewable resource extraction.

1) Global civilization uses fossil energy at a rate of 12 TW, a twenty-fold increase from the late 1890's (total world TPES is around 13 TW). Only solar power has a significantly larger than current TPES is solar flux at 122 PW, which is 4 OM greater; otherwise, wind (<10 TW), ocean waves (<5 TW), and today energy / geothermal (<1 TW). Though Earth's net primary productivity (NPP) / terrestrial photosynthesis yields solid fuels (biomass) at the range of 55-60 TW, exploiting it will further degrade vital ecosystemic services, and besides humanity already appropriates 30-40% of global NPP as food, feed, fiber and fuel (with wood and crop residue accounting for 10% of current TPES).

2) Coal and oil are far more energy-dense than wood and in general biomass cultivation will take up 4-5 OM more space than conventional oil / gas infrastructure. “In order to energize the existing residential, industrial and transportation infrastructures inherited from the fossil-fueled era, a solar-based society would have to concentrate diffuse flows to bridge power density gaps of 2-3 OM”. As an example, even using Brazilian ethanol from sugar cane to replace all current gasoline, diesel and kerosene used in transport would require the subjugation of 1/3 of the world's cultivated lands – or all agricultural land in the tropics. Corn ethanol has half the power density of sugar cane ethanol. Large-scale adoption will have catastrophic impacts on food self-sufficiency.



[\[source\]](#)

3) Renewables don't satisfy base load power requirements of an industrial society. Load factors are 75%+ for coal-powered power stations or 90%+ for nuclear power stations, whereas wind power is just 20-25%.

4) Renewable flows are also unevenly distributed, just like 60%+ of easy hydrocarbons are locked up in the Persian Gulf Zagros Basin. Jakarta has as little sun as Edmonton (shared with equatorial zone). Many areas are either too still or *too windy*, i.e. will be heavily damaged by hurricanes.

5) Costs won't necessarily decline. To the contrary, photovoltaic silicon prices have more doubled; prices of steel, aluminium, plastics, etc, for wind turbines also drastically increased due to the underlying rise in oil prices.

Smil reiterates some pretty standard arguments on nuclear and hydrogen. The nuclear industry expanded quickly until the 1970's, but stalled at that point because it previously hadn't included costs like state-subsidized nuclear R&D, decommissioning costs and waste disposal (and later negative PR like Chernobyl). Hydrogen is not a realistic option barring the mass spread of cheap solar power. Concludes that this energy transition will be fundamentally different from previous one, which was driven by declining resource availability (deforestation), higher quality of fossil fuels (energy density, easier storage, more flexibility) and lower cost of coal and hydrocarbons. According to Smil, none of these factors apply to the fossil economy – though he expresses some concern over its contribution to climate change.

Having outlined his idea of the main trend of the next fifty years, Smil turns to a standard analysis of the shifting balance of international power between the US, China, Japan, Russia, Islam, and Europe. He cautions against subscribing to the conventional wisdom, pointing out that

a) the Soviet collapse and Japan's post-1980's stagnation were largely unforeseen, b) the tendency of the US to surprise, going from decline / deindustrialization in the 1980's to a vigorous "new economy" in the 1990's before becoming fiscally and militarily overstretched in the 2000's.

Geopolitical Trends

Smil does not believe **Europe** holds out much promise, unlike some [delusional commentators](#). It is in long-term, centennial economic decline relative to the rest of the world and its economies are mired in inefficiency, unemployment and bureaucracy, and are less technologically dynamic than Japan or the US. Both [Britain](#) and [Spain](#) face separatist challenges and are economic basketcases. France is over-regulated dirigisme and has problems with integrating its 10% Muslim population (remember the burning banlieues?), but is at least demographically healthy – unlike Italy and Germany, which are rapidly aging and about to depopulate rapidly with very negative economic effects (they might be in a [fertility trap](#), in which ever smaller generations need to pay higher tax burdens which limits their reproductive freedom). In particular, Italy is sinking back into corruption and Mafia influence, its artisanal manufacturing is being destroyed by Chinese competition and there remain huge gaps between the Nord and Mezzogiorno. He reiterates Mark Steyn's [Eurabia theory](#) arguments (crudely summarized as lots of under-reported young, fertility, fanatical Muslims simmering in ghettos), which has a number of holes in it. Finally, the EU structure itself is disconnected from national electorates and reality in general, and has no inspiring sense of mission; further expansion will just weaken it further. [Agreed with most things - I believe the EU by 2020 will be a much less significant institution and European nations will be tottering, preoccupied with trying to solve their own internal problems].

After a period of euphoric hubris in the 1980's, when it seemed **Japan** would be number one, the country crashed into a long, ongoing period of stagnation marked by crippling deflation, the fall of the Nikkei from a peak at 39,000 in December 1989 to below 10,000, and the appearance of the NEET generation (not in employment, education or training). Though it remains rich, well-off and technologically advanced, there is a moral anomie as long-term jobs vanished and fertility plunged to around 1.2 children per woman. Smil is pessimistic on Japan due to a) its ingrained conservatism [though would the [recent electoral win by the Democratic Party of Japan](#) later be regarded in the same vein as the Meiji reforms?], b) the continued hostility of neighbors reinforces its security dependence on the US, especially to counter challenges from China and North Korea, and c) the start of depopulation in 2005, retirement wave in 2010's as the 1950's baby boomers retire, and the prospective massive aging of the population (medium age 50 by 2025, more 80+ than 0-14 year olds by 2050). Japanese culture does not accept immigrants and it will not be saved by robots.

The author sees **Islam** being in a fractured state (secular / spiritual, Sunni / Shia / others, etc) in a difficult relationship with modernity, fighting the same internal civil war that characterized early modern Christianity. His short exegesis of the Koran finds that there is support for many interpretations of just how restrictive Islam has to be, and this forms an ideological battleground between the extremists and moderates. Signs of this backwardness include the Iranian fatwa against Rushdie, the prevalence of bizarre conspiracy theories on the Arab street, and Islamic countries accounting for just 2% of the world's scientific publications. [To this we can add the

Mohammed cartoons controversy and the 2003 UN Arab development report that produced the astonishing statistic that more books are translated into Spanish per year than have been translated into Arabic in all history]. There are several inequalities within the ummah (e.g. oil-rich Saudi Arabia and Pakistan) and internal instability, in part caused by the demographic explosion [usually in water-stressed environments, I'd add] which results in youth bulges – young men with no job prospects who are susceptible to joining violent groupings. Even as the region simmers, the outside world will be forced to take an interest due to its stranglehold over the world's oil supplies (the five Persian Gulf nations produced about 1/3 of the world's oil in 2005, and this figure is projected to rise substantially).

It is evident he knows his stuff when talking about **Russia**, or at least is well-read on it. Contrary to most analysts, but like Stratfor (and myself), he believes it is resurgent in a real way, even though its longer-term prospects are uncertain. He lists its strengths as being an energy superpower (especially with respect to gas) with a big intellectual capacity and a formidable military that is being rearmed with newer-generation weapons. However, he foresees significant challenges in the form of its cyclical, hydrocarbons-based economy [as confirmed by the 2008 crisis, though the deeper problem is dependence on foreign credit], its unstable democracy, the Islamist insurgency in the Caucasus, and above all its negative demographic trends [I've written a lot about this, just search the site].

China is gradually returning to its old position of global economic predominance, its growth helped by Deng Xiaoping's economic liberalization, FDI, the one-child policy, a cheap, disciplined and relatively skilled labor force, mass urbanization and migration to the coasts, and a certain degree of innovation (state-funded research facilities, as well as flouting of IP and large-scale industrial espionage). It is "a Communist government guaranteeing a docile work force that labors without rights and often in military camp conditions in Western-financed factories so that multi-national companies can expand their profits, increase Western trade deficits, and shrink non-Asian manufacturing". It is economically mercantile, seeking resources around the world and if current growth trends continue, China could match US military spending by 2020. However, there are substantial problems with a) the population (severe 118:100 male-female imbalance, rapid aging and undeveloped pension system), b) the economy (huge rural-urban inequality, high taxes on peasantry and violent expropriations by business-state symbiosis), c) the environment (deforestation and soil erosion from Maoist era, little arable land per capita that is shrinking from salinization, desertification and urban expansion, needs more food but irrigation is constrained by water shortages and crops are already very intensively fertilized, falling water tables and toxic rivers, very poor air quality and now leading CO2 emitter), and d) cultural mediocrity (not as much soft power as the US).

India is nowhere near as powerful as China, and the same factors limiting the latter militate against India. It's GDP is twice smaller; though its Gini index of income inequality is better (35 versus 45), this is a product of its underdevelopment, besides its deep social stratification / de facto caste system persists; malnutrition, immunization rates and adult illiteracy are all much worse in India; China has 3x the electricity-generating capacity and 17x the container port capacity. Though democratic, it is likewise deeply corrupt, bureaucratic and ecologically degraded. It faces a nuclear-armed Pakistan and the prospect of tens of millions of Bangladeshi refugees spilling over once their country sinks under the rising seas.

Smil is an all-round pessimist, believing the **United States** may go the way of the Roman Empire. According to him, its woes include increasing economic and foreign policy challenges [see [Shifting Winds](#)], uncontrolled Hispanic immigration that threatens its long-term territorial integrity and Protestant “work ethic” values, and perennial budget deficits (in particular the structural nature of the current account deficit, formed due to its reliance on oil imports to sustain the suburban arrangements and the collapse of its domestic industrial base – mundane manufacturing, the auto industry, and now even aerospace and the food industry. It has a poor education system (see results of PISA international standardized tests), retiring baby boomers about to cash in on state obligations and their savings, obesity and a general cultural decline. However, the possibility of open discussion of these failings is a persistent American strength.

He then proceeds to make the argument that “US leadership is in its twilight phase” and that the “coming transition will be unprecedented” due to the global nature of its hegemony. He plausibly affirms that no nation is strong enough to replace the US as the sole superpower, meaning that there will probably be more chaos, instability and wars. Smil predicts that in sum the world will regret its passing.

Smil concludes with an analysis of globalization, making the points that it is an ongoing historical process originating in the 16th C and blossoming from the 1950’s with the arrival of the tanker revolution, now blossoming in the intricate production chains and JIT system exemplified by Wal-Mart’s relation with China. There is a stabilizing force, interdependence, which expands the economic scope of every globalized nation far beyond the limited autarkies of history, but at the same time makes them ever more vulnerable to disruption of these links; the destabilizing force is the growing inequality between nations (e.g. failed states), though a caveat is that when calculated by population there is an improvement mainly thanks to China (but nullified when taking into account the intra-national growth of inequality – which increase since 1970 in all the major countries like the US [35 to 47], Japan [25 to 37], China [25 to 50], Russia [25 to 40]. There is now no global “middle class”, according to Smil, which makes the system unstable. [Here I disagree - East-Central Europe, Latin America and even China fit the bill here].

Environmental Change & Conclusion

This next long section is a detailed analysis of the likely course and effects of global warming. Most of the stuff is pretty basic and I’ve already summarized in my reviews of [Six Degrees](#) (Mark Lynas) and [The Last Generation](#) (Fred Pearce).

His most interesting discussions are of human influence of the nitrogen cycle (which they’ve affected to a far greater degree than the carbon cycle) and the spread of antibiotic resistance. “Losses of nitrogen from synthetic fertilizers and manures, nitrogen added through biofixation by leguminous crops and nitrogen oxides released from combustion of fossil fuels are now adding about as much reactive nitrogen (c.159 Mt N/year) to the biosphere as natural biofixation and lightning does” (in contrast human interference in carbon cycle through land use changes and fossil fuel burning amounts to 10% of annual photosynthetic fixation of the element and sulfur is equal to 1/3. This leads to mass leaching, eutrophication, growth of algae and phytoplankton, and the subsequent decomposition deoxygenates water and kills bottom-dwelling aquatic species. The worst hypoxic zones are the Gulf of Mexico, the lagoon of the Great Barrier Reef, the Baltic

Sea, the Black Sea, the Mediterranean, and the North Sea. Nitrogen oxides formed during combustion contribute to photochemical smog in urban areas around the world and acid rain. It's use will increase as Asia demands higher crop yields and Africa needs to stop its increasing nutrient mining.

The other worrying trend he discusses at length is the rise of antibiotic resistance on the part of pathogens, as penicillin and its descendants become increasingly less effective. This is inevitable, but is much facilitated by widespread self-medication, over-prescription and poor sanitation in hospitals. If these negative trends continue, influenza deaths will sky-rocket due to the inability to treat bacterial pneumonia, and treating tuberculosis and typhoid fever will become very difficult. A nightmare scenario can arise if this is accompanied by increasing malnutrition and AIDS, which make people far more susceptible to these secondary diseases.

In the last chapter, "Dealing with Risk and Uncertainty", Smil sums up and embellishes his ideas, asserts the necessity of properly quantifying risks, cautions on the fallacies of linear extrapolation of current trends, and notes that even during a collapse there are silver linings, using the construction of the basilica of Santa Sabina in Rome (422-483) during the waning years of the Roman Empire (ended in 476) as an example.

In conclusion, this is a very good and entertaining book. There are some East European-style grammatical mistakes and perhaps a bit too much personal boasting, but otherwise it provides a realistic appraisal of the real potential catastrophes facing humanity (i.e. big wars and pandemics, not terrorism, earthquakes or "grey goo") and the dominant trends of the next fifty years (geopolitical flux / non-polarity, climate change & pollution, the energy transition). He approaches the subject very rigorously-scientifically so one gets a good perspective of possible futures, my only major disagreements with him being on his disbelief in the oil peak theory and paying too little attention to the social and geopolitical ramifications of climate change (he doesn't really consider the catastrophic possibilities, sticking to the middle-of-the-road consensual IPCC forecasts). Read it, but bear in mind that it is neither comprehensive nor infallible.

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