



BOOK-REVIEWS

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Global Trends 2030: Alternative Worlds

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The fifth quadrennial installment of the NIC series “aimed at providing a framework for thinking about the future...by identifying critical trends and potential discontinuities,” described as “megatrends” (factors that will likely occur under any scenario) and “game-changers” (critical variables whose trajectories are far less certain). As appreciation of diversity and complexity grows, “we have increased attention to scenarios or alternative worlds we might face.” Alternatively stated, “*We are at a critical juncture in human history, which could lead to widely contrasting futures.*” The world of 2030 “will be radically transformed.”

1. MEGATRENDS AND RELATED TECTONIC SHIFTS

1. **Individual Empowerment.** This “most important megatrend” (both a cause and effect of most other trends) will “accelerate substantially during the next 15-20 years owing to poverty reduction and a huge growth of the global middle class, greater educational attainment, and better health care.” (p. iii) For the first time, “a majority of the world’s population will not be impoverished,” due to the expanding global economy, rapid growth of developing countries, and widespread use of new communications and manufacturing technologies. “The potential for greater individual initiative (is) key to solving the mounting global challenges over the next 15-20 years. On the other hand, in a tectonic shift, individuals and small groups will have greater access to lethal and disruptive technologies (particularly precision-strike capabilities, cyber instruments, and bioterror weaponry).” (p. iii) [Also see **Lone Wolf Terrorism: Understanding the Growing Threat** by Jeffrey D. Simon (Prometheus Books, Feb 2013).]
2. **Diffusion of Power.** Asia will surpass North America and Europe combined in terms of global power based on GDP, population size, military spending, and technological investment. China alone will probably have a larger economy than the US a few years before 2030. The health of the global economy increasingly will be linked to how well the developing world does: in addition to China, India, and Brazil, regional players such as Colombia, Indonesia, Nigeria, South Africa, and Turkey will become especially important. [Also see *GFB Update* newsletter for April 2012 on the emerging multipolar world.] “The shift in national power may be overshadowed by an even more fundamental

* The quadrennial Global Trends report of the National Intelligence Council appears to have several serious deficiencies, notably a downgrading of climate change impacts. A companion review of an earlier report on **Climate Change and National Security**, based on a 2008 NIC-sponsored workshop, provides an important Supplement

shift in the nature of power: enabled by communications technologies, power will shift toward multifaceted and amorphous networks that will form to influence state and global actions.” (p.iv)

3. **Demographic Patterns.** Global population will be close to 8.3 billion people in 2030, up from 7.1 billion in 2012. Four demographic trends will fundamentally shape economic and political conditions: aging countries (facing an uphill battle to maintain living standards), a shrinking number of youthful societies, migration, and urbanization (urban construction in the developing world “could roughly equal the entire volume of such construction to date in world history”).
4. **Growing Food, Water, and Energy Nexus.** “Demand for food, water, and energy will grow by approximately 35, 40, and 50% respectively owing to an increase in the global population and the consumption patterns of an expanding middle class” (p.iv). Nearly half of the world’s population will live in areas experiencing severe water stress. Climate change will worsen the outlook for availability of these critical resources, as wet areas get wetter and dry areas get more so. “We are not necessarily headed into a world of scarcities, but policymakers and their private sector partners will need to be proactive to avoid such a future. Many countries probably won’t have the wherewithal to avoid food and water shortages without massive help from outside.” (p.4) In a likely tectonic shift, the US could become energy-independent. Hydrofracking technology has expanded the life of natural gas reserves from 30 to 100 years and also enabled additional crude oil production such that crude oil prices could collapse, causing a major negative impact on oil-export economies. [Also see **Full Planet, Empty Plates: The New Geopolitics of Food Security** by Lester R. Brown (W.W. Norton, Oct 2012), which underscores and amplifies food and water scarcity. Brown warns that “armed aggression is no longer the principal threat to our future; the overriding threats in this century are climate change, population growth, spreading water shortages, rising food prices, and politically failing states” (p.121).]

2. GAME-CHANGERS

1. **The Crisis-Prone Global Economy.** Various regional and national economies will “almost certainly” move at significantly different speeds, reinforced by the 2008 global financial crisis. China—despite a likely slowing of its growth from 10% to only 5%—will contribute about one-third of global growth by 2025. The key question is whether the divergences and increased volatility will result in a global breakdown and collapse or whether the development of multiple growth centers will lead to resiliency. “A return to pre-2008 growth rates and previous patterns of rapid globalization looks increasingly unlikely, at least for the next decade... (and) another major global economic crisis cannot be ruled out.” (p.vi) The McKinsey Global Institute estimates that the potential impact of an unruly Greek exit from the euro zone could cause eight times the collateral damage as the Lehman Brothers bankruptcy.

2. ***The Governance Gap.*** As power becomes more diffuse, “a growing number of diverse state and non-state actors, as well as subnational actors, such as cities, will play important governance roles. The increasing number of players needed to solve major transnational challenges—and their discordant values—will complicate decision-making. Lack of consensus between and among established and emerging powers suggests that multilateral governance to 2030 will be limited at best. The chronic deficit probably will reinforce the trend toward fragmentation” (p.vii). Prospects for achieving progress on global issues will vary across issues. Some 50 countries are in the awkward stage between autocracy and democracy, and “many countries will still be zigzagging their way through the complicated democratization process.” Other countries such as China and the Gulf countries will continue to suffer from a democratic deficit. Widespread use of IT will be a double-edged sword: social networking will enable citizens to coalesce and challenge governments, but IT will provide governments with unprecedented ability to monitor their citizens. The largely Western dominance of global structures such as the UN Security Council, World Bank, and IMF will probably be transformed by 2030 to be more in line with the new economic players.
3. ***Potential for Increased Conflict.*** The past two decades show fewer major armed conflicts and fewer civilian and military casualties. Disincentives will remain strong against great power conflict: too much is at stake. Intrastate conflicts have gradually increased and will likely do so in countries with a youthful ethnic minority and insufficient water and arable land. “Though by no means inevitable, the risks of interstate conflict are increasing owing to changes in the international system. US unwillingness and/or slipping capacity to serve as a global security provider could contribute to instability. Three “baskets of risks” could increase chances of interstate conflict: changing calculations of key players (notably China, India, and Russia), increasing contention over resources, and a wider spectrum of more accessible instruments of war.”
4. ***Wider Scope of Regional Instability.*** “The Middle East and South Asia are the two regions most likely to trigger broader instability” (p.viii). If the Islamic Republic maintains power in Iran and is able to develop nuclear weapons, the Middle East will face a highly unstable future. “South Asia faces a series of internal and external shocks during the next 15-20 years” (youth bulges, rising food prices, energy shortages, inequality). An increasingly multipolar Asia is one of the largest global threats. Countries in Sub-Saharan Africa, Central America, and the Caribbean will remain vulnerable to state failure through 2030, providing safe havens for global criminal and terrorist networks and local insurgents.
5. ***Impact of New Technologies.*** Four “technology arenas” will shape economic, social, and military developments: *Information Technology* entering the big data era (providing global access and pervasive services, but also threats of an Orwellian surveillance state); *New Manufacturing and Automation Technologies* such as 3-D printing and robotics with the potential to change work patterns (they will improve productivity and diminish the need for outsourcing, but make more low-skilled workers redundant and exacerbate inequality); *Security of Vital Resources* (key resource technologies include GM crops,

precision agriculture, better irrigation, solar energy, advanced biofuels, and enhanced oil and gas extraction via fracturing); *New Health Technologies* (they will continue to extend the average age of populations around the world by ameliorating debilitating physical and mental conditions and improving overall well-being; the greatest gains are likely to be in countries with developing economies and an expanding middle class).

6. ***The Role of the United States.*** The relative decline of the US and the West vis-à-vis the rising states “is inevitable,” but the degree to which the US continues to dominate the international system could vary widely. “The US most likely will remain first among equals among the other great powers in 2030,” but the unipolar moment is over and Pax Americana is “fast winding down.” Western partners have also suffered relative economic declines. Replacement of the US by another global power seems the least likely outcome to 2030. The emerging powers are not a bloc, and do not have any unitary alternative vision. “A collapse or sudden retreat of US power would most likely result in an extended period of global anarchy.”

3. POTENTIAL BLACK SWANS THAT WOULD CAUSE THE GREATEST DISRUPTIVE IMPACT

In the midst of the summary of “Game-Changers” (pp.vi-xii), a single page chart (p.xi) with no explanation and no listing in the table of contents briefly describes eight such developments: 1) a severe pandemic that “could result in millions of people suffering and dying” in less than six months; 2) much more rapid climate change (“most scientists are not confident of being able to predict such events”); 3) Euro/EU collapse caused by an unruly Greek exit from the euro zone; 4) a democratic China could dramatically boost Chinese “soft” power worldwide; an economic collapse could trigger political unrest and shock the global economy; 5) a reformed Iran (a more liberal regime that dropped nuclear weapons aspirations and focused on economic modernization would bolster chances for a more stable Middle East); 6) nuclear war or WMD cyber-attack (“the chance of non-state actors conducting a cyber-attack—or using WMD—is increasing”); 7) solar geomagnetic storms that could knock our satellites or the electric grid; 8) a collapse or sudden retreat of US power.

4. ALTERNATIVE WORLDS

“We have more than enough information to suggest that *however rapid change has been over the past couple decades, the rate of change will accelerate in the future.*” (p.xii; emphasis added). To “encourage all of us to think more creatively about the future,” four scenarios are provided with “built-in discontinuities” that represent distinct pathways for the world out to 2030.

1. ***Stalled Engines.*** This “most plausible worst case” is a “bleak future” where the US and Europe turn inward, the euro zone unravels quickly causing Europe to be mired in recession, the US energy revolution fails to materialize, global economic growth falters, Sunni-Shiite violence erupts in the Gulf, a deadly virus erupts in Southeast Asia, and “all boats sink.”

2. **Fusion.** The “most plausible best case” in which the US, China, and Europe dampen the specter of a spreading conflict in South Asia leading to a major change in bilateral relations and worldwide cooperation to deal with global challenges; China begins a process of political reform, bolstered by its increasing role in the international system; global unilateral institutions are reformed and made more inclusive; the global economy nearly doubles in real terms to \$132 trillion, and “all boats rise substantially.” Technological innovation “is critical to the world staying ahead of the rising financial and resource constraints,” and this scenario is only possible with strong political leadership.
3. **Gini Out-of-the-Bottle.** A world of extremes and greater inequality (as measured by the Gini Coefficient widely used by economists), where countries in the euro zone core are globally competitive, while others on the periphery are forced to leave the EU; cities in China’s coastal zone continue to thrive but inequalities increase and social discontent spikes; major powers are at odds and more countries fail; the world is reasonably wealthy but less secure as “the dark side of globalization” poses an increasing challenge. “Differences between haves and have-nots become starker and increasingly immutable.” Parts of Africa suffer the most, and a growing number of states fail. Marxist and Maoist-insurgencies increasingly spread in rural areas worldwide, as globalization spawns more class struggle.
4. **Non-state World.** NGOs, multinational businesses, academic institutions, wealthy individuals, and megacities flourish and take the lead in confronting global challenges. A growing global public opinion consensus among elites and many of the growing middle classes forms the base of their support. Authoritarian regimes find it hardest to operate in this increasingly democratized world. Smaller and more agile countries in which elites are more integrated are apt to do better than larger countries. “Networks thrive in this hyper-globalized world where expertise, influence, and agility count for more than weight or position.” This is nevertheless a patchwork and very uneven world, where some global problems get solved, but security threats pose an increasing challenge.

5. COMMENT: “BLACK SWAN DOWNSIZING” AND OTHER COMPLAINTS

This global synthesis of megatrends and game-changers offers many important ideas, and is well-worth considering, especially for the emphasis that the world of 2030 will be radically transformed, and the highlighting of power diffusion, various game-changers, and four scenarios of worst case growth (all ships sinking), best case growth (all ships rising), far greater inequality, and a world of powerful non-state actors.

The GT2030 report seems to be thorough and comprehensive, with three pages of acknowledgements (pp.138-140) citing various workshops, institutions, and individuals consulted in 20 countries. This includes the International Futures model of the University of Denver Pardee Center, the Global Growth Model of McKinsey & Company, the Atlantic Council of the US, Gregory Treverton of RAND, the LBJ School of Public Affairs, the Santa Fe Institute, the Naval Postgraduate School, the China Center for Contemporary World

Studies, Russia's Institute of World Economy and International Relations, and much more. However, it appears that few if any climate scientists and environmental scientists are on this list, and UN and OECD reports are ignored. "Sustainability" and anything related to threatened planetary boundaries are nowhere to be found in the report, and there is no mention of "Green Growth" advocated by OECD and the World Bank; rather, the industrial era notion of "growth" as measured by GDP is used throughout, with no qualifications as to its many problems.

The Global Trends report does mention more extreme weather due to climate change, but the likelihood of worsening climate—viewed by many as the overriding issue of the 21st century—is relegated to a box on p.31 (which does acknowledge that sea level could rise by a meter or more by 2100) and to far-out "black swan" status. The Megatrend on growing demand for food, water, and energy does mention climate change exacerbating availability of these critical resources, but downplays the problem with the upbeat note that "we are not necessarily headed into a world of scarcities." This is certainly possible, but how likely?

The curious box on p.xi, not listed in the table of contents, describes eight "potential black swans." No definition of Nassim Nicholas Taleb's trendy term is provided by NIC, but Taleb defines it as "highly improbable," a *rara avis* that implies far less than classic wild card probability of 2% (a joker in a deck of cards), especially over the next 15-20 years. The question of rough-gauge probability is very important, because most climate scientists would very likely assign a far greater probability of "much more rapid climate change," placing it in the 10-40% "not-so-wild card" range, if not a probable or near-certain development. Similarly, public health experts would likely view a "severe pandemic" as more probable than a mere black swan. From a scholarly viewpoint, this is a sloppy treatment of a critical concern.

Climate change is already a serious problem in many major countries, as described in **Climate Change and National Security**, an NIC-sponsored study not acknowledged by GT2030 (see following GFB review). One of the four Megatrends in the 2012 report, "Diffusion of Power," cites eight nations as emerging global and regional economic powers, of which six of them are assessed as having serious climate-related problems as of 2008 (China, India, Colombia, Nigeria, South Africa, and Turkey), very likely to worsen in the years ahead.

The key criticism is that climate change deserves to be listed as one of the NIC Megatrends, if not the most important one. Doing so, however, questions any plausibility of the all-boats-rising "Fusion" scenario and would likely displace substantial acceleration of individual empowerment as the NIC's "most important megatrend." Not that empowerment isn't desirable, but it is far more problematic than NIC forecasts (or wishes), especially if seen in the context of mounting problems of climate change and environmental degradation. This is extensively explained in **Global Environment Outlook 5** (UN Environmental Programme, June 2012, 525p) and by **OECD Environmental Outlook to 2050: The Consequences of Inaction** (March 2012, 350p). Two recent reports to the Club of Rome continue this theme: **Bankrupting Nature: Denying Our Planetary Boundaries** by Anders Wijkman and Johan Rockström (Routledge, 2012; GFB Book of the Month, Jan 2013), which warns that "pres-

tures on key ecosystems have increased exponentially,” and **2052: A Global Forecast** by Jørgen Randers (Chelsea Green, 2012; GFB Book of the Month, July 2012), which points to rising climate-related costs reducing global consumption (and thus “individual empowerment”).

Another criticism of the Global Trends report is that game-changing black swans and wild cards are under-reported. In addition to the eight “potential black swans” on p.xi, several others are scattered throughout the text, e.g. natural disasters that might cause governments to collapse (p.49), spread of wheat rust (p.34; a “nasty wild card”), accelerated melting of the Greenland ice sheet and/or the West Antarctic ice shelf (p.31), a huge volcanic explosion or earthquake (p.49), and methane gas levels rising rapidly due to melting tundra (p.119). A few other wild cards (or not-so-wild cards) for better and/or worse should also have been added, such as collapse of ecological services such as bee pollination, “a deadly disease killing two billion people” (suggested by Jørgen Randers, and starkly contrasting with the NIC’s “black swan” of a pandemic afflicting and killing merely “millions”), widely available life extension technologies, many new life forms created by synthetic biology, nanotechnology extensively developed, discovery of extraterrestrial intelligence, and some new source of energy that is cheap, non-polluting, and widely available.

The four concluding scenarios are all illuminating (especially Nonstate World), but none of them consider environmental conditions, other than a brief mention in passing in the Fusion scenario that “Arctic ice melts at a far more rapid rate than anticipated and rampant exploitation of resources in the Arctic has begun” (p.119). Surely the threats of climate change deserve featuring in at least one scenario, and some mention in all. See, for example, **America’s Climate Choices** by the National Research Council (National Academies Press, May 2011, 118p; GFB Book of the Month, Oct 2011), a synthesis of four NRC panel reports totaling 1,444 pages, warning that climate change “poses significant risks for a broad range of human and natural systems.” In Canada, **Paying the Price: The Economic Impacts of Climate Change for Canada** (National Roundtable on the Environment and the Economy, Sept 2011, 168p; www.nrtee/trnee.ca) covers costly impacts on timber supply, coastal areas, health care, and ecosystem stress. A recent popularized overview, **Overheated: The Human Cost of Climate Change** by Andrew Guzman of the UC-Berkeley Law School (Oxford University Press, Feb 2013, 260p), summarizes sea level rise, food and water challenges, the many negative impacts on human health, and potential climate wars in the Middle East and elsewhere.

Speaking of the Middle East, no mention is made in GT 2030 of intensified faiths and rising Islam, two closely related “Mega-Trends” identified by former RAND analyst Yehezkel Dror of the Hebrew University of Jerusalem in **Israeli Statecraft: National Security Challenges** (Routledge, 2011; GFB Book of the Month, Sept 2011). One doesn’t have to be an Israeli to see these trends, but apparently it helps! Dror also identifies megatrends similar to GT2030 (e.g., more non-state actors, intensified kill and damage capacity, declining US hegemony) and likely “ruptures” (notably necessary for expensive and difficult global action on climate issues, as well as rising power of civilizations not based on the Bible).

A final complaint about the selective perception and distorted priorities of GT2030 is the report's focus on the industrial era definition of "growth," at a time of mounting criticism of mainstream economics for lack of attention to natural resources. (See *GFB Update* newsletter for Sept 2012 on new and appropriate economics). Placing a fair economic value on water and other ecosystem services, as advocated by the UN, World Bank, OECD, and scores of economic critics, would surely be a "game-changer" worth noting and promoting. Changing the economic focus from "Growth" to "Health," as advocated in the **Re/Source 2050** report from the Smith School of Enterprise and the Environment at the University of Oxford (Jan 2013, 83p; www.smithschool.ox.ac.uk), addressed to the financial and investor communities and advocating a "circular economy," would also be a positive "game-changer" worth considering.

In sum, when all the worthy "megatrends" are brought together and given proper priorities, the outlook to 2030 is even more worrisome than portrayed by the NIC. But if all of the positive "game-changers" were also assembled, as concerns sustainability and Green Growth, low-carbon economies, the benefits of energy conservation (see the IEA's **World Energy Outlook 2012**; Nov 2012, 668p; *GFB Book of the Month* Nov 2012; stressing the benefits of improved efficiency over new energy sources), and a focus on decent jobs for all and economic reform at national and global levels, the overall outlook would be much improved. Surely we deserve better from the National Intelligence Council.

Climate Change and National Security: A Country-Level Analysis

Edited by Daniel Moran

(Prof of National Security Affairs, Naval Postgraduate School, Monterey, CA).

Washington: Georgetown University Press, April 2011, 310p, \$29.95pb.

This extraordinary book “seeks to appraise the intermediate-term security risks that climate change may pose to the United States, its allies, and to regional and global order,” (p.1) and to be “broadly representative of the security challenges that climate change may pose during the next few decades.” (p.3) It considers the most readily anticipated effects of climate change, along with known political and social conditions of important states and regions, based on country-level data prepared by Columbia University’s CIESIN (Center for International Earth Science Information Network). CIESIN’s data on temperature change, freshwater availability, and sea-level rise are summarized in Appendixes A and B.

These meticulous and amply-documented essays originated as presentations at a workshop sponsored by the National Intelligence Council, prepared for the U.S. House of Representatives in June 2008. But are the forecasts for 2030 out-of-date? Not at all. As stated by Daniel Moran in his conclusion, “it is most unlikely that any new insight will be achieved in the next twenty years that will falsify today’s scientific consensus so decisively as to render the issue of climate change inconsequential to public life.” (p.269)

Many books on climate change have been published, and many of these warn in general about floods, droughts, storms, threats to agriculture, and displaced populations. The value of these essays is that they are country-specific, as concerns questions of state capacity, social resilience, population movement, and the differential impact of climate change across the agricultural and industrial sectors, and on sub-national regions. “The most important source of cohesion among the contributors to this book is a shared sense that, whether or not the Earth’s climate is palpably hotter in twenty years than it is now, the politics that surrounds climate almost certainly will be.” (p.269) It may be easy to underestimate the threat that climate change poses to the stability of otherwise well-established regimes. Climate change poses an especially insidious sort of challenge to policy, combining gradual accumulation of relatively subtle effects and an increasing tendency toward dramatic events liable to galvanize public opinion. “*Climate change will, without question, provide many opportunities for governments to embarrass themselves.*” (p.271). These strains will not necessarily lead to outright state failure, but such an outcome is possible.

Chapters are as follows. Note especially the growing fragility and/or serious threats to China, Vietnam, The Philippines, India, Pakistan, Bangladesh, Turkey, Egypt, The Maghreb, and Southern Africa.

1. **China.** “Climate change is expected to wreak havoc on China” through decreased precipitation (declining runoff to the six largest rivers in China has been observed since the 1950s), increased desertification, increased severity and frequency of weather events such as heat waves, glacial melt with severe impact on lakes and rivers, and sea-level rise of 0.4 to 1.0 meter by 2050 (which would submerge an area the size of Portugal

along China's eastern seaboard, e.g.: most of Shanghai is less than 2 meters above sea level). Due to climate change, "domestic instability within China is probable if current trajectories continue." (p.13) Particularly at risk are China's agricultural system and its ability to maintain strong economic development and foreign trade.

2. **Vietnam.** The world's 13th most populous country [89 million in 2010] is poised to become a major regional actor in the next two decades, but global climate change places it in jeopardy: "Vietnam is likely to be one of the countries most affected by global climate change." (p.38) It is one of the most disaster-prone countries in the world, with a coastline of 3,200 km regularly lashed by typhoons producing large-scale flooding, and tropical storms are increasing in frequency and impact.
3. **The Philippines.** Rising sea levels pose an enormous risk to a country [94 million people in 2010] with 7,150 islands and >36,000 km of coastline, and some 15 million people living in the 1-meter low-elevation coastal zone. Even in the best of times, the frequency of typhoons, floods, earthquakes, and volcanic eruptions makes the Philippines one of the most disaster-prone countries. Recent decades have brought unprecedented and mounting levels of stress in every major ecological zone, after "decades of sustained environmental degradation." Urban areas are also under mounting stress, with major infrastructure deficits in water, sewage, drainage, transport, and pollution control.
4. **Indonesia.** The world's fourth most populous country [236 million in 2010] has >17,000 islands and a coastline of >54,000 km. Nearly all major cities are in coastal areas vulnerable to rising sea levels, although only 1.1% of the population is in the 1-meter zone. Temperature changes are expected to be relatively modest, but, even so, can affect important food sources such as rice, maize, and fisheries.
5. **India.** Water shortages will affect agricultural production, especially in already-arid areas. Snow melt from the Himalayan glaciers could alternate between abnormally low flows in early summer and winter and very high flows during the monsoon, "posing the double risk of drought followed by flood." If monsoonal rains become increasingly erratic, "there will likely be serious food shortages in the regions that depend on them." If so, rich/poor and urban/rural gaps could widen further. The vulnerability of a large portion of India's population is likely to be worsened by climate change. A large-scale migration of Bangladeshis to India could produce major conflicts, and relations with Pakistan are likely to be further complicated by disputes over water.
6. **Pakistan.** In the next 20 years, climate change will stress the Pakistan state and exacerbate its current fragility. But climate threats "will almost certainly be dwarfed by other political, economic, and military factors in determining (Pakistan's) fate." If the Pakistani state collapses before 2030, it will not be because of climate change alone. But "climate change will contribute to domestic and regional competition, conflict, and hardship during the next 20 years."
7. **Bangladesh.** The 7th most populous country in the world [164 million people in 2010] is "extraordinarily vulnerable to the impacts of climate change, particularly rising sea levels." Bangladesh has already been ravaged by catastrophic floods in 1998, 2004,

and 2007, and floods are occurring more frequently. A 1-meter rise in sea level would submerge one-fifth of the country. “The disruptive possibilities of climate change, both internally and externally, may weaken the capacity of the Bangladeshi state in many ways. They may also strengthen its authoritarian tendencies.” (p.109) Complete failure of the state is very unlikely, but the combination of limited resources, simmering public discontent, and possible radicalization may accentuate the crisis of governance. Sea-level rise, severe storms, repeated floods, increased water salinity, and worsening water scarcity will affect the availability of food.

8. **Russia.** Geology, geography, and climate may make Russia not merely a survivor, but a beneficiary of environmental changes elsewhere experienced as deterioration. Rising global temperatures are likely to reduce stresses and constraints of life in the high northern latitudes, and should reduce heating costs. Rising sea level is unlikely to flood significant areas, and changes in temperature and rainfall may benefit agriculture on balance. Thawing could unlock “vast known reserves of oil, natural gas, and other natural resources.” But climate change will create stresses that affect Russia indirectly; the worst-case scenario of climate-induced violence would arise from conflict with China. An influx of southern immigrants due to climate change is likely to reignite violence in the North Caucasus (or Caspian) region.
9. **Central Asia.** The five former Soviet countries already face notable risks of destabilization. Probable areas of concern in order of likely magnitude: locally significant shortages of water, immigration/refugee flows from Afghanistan and China, food shortages from fluctuations in harvests or food prices, and an increased appetite for authoritarianism as a way to address problems of resource scarcity.
10. **European Union.** Although climate change poses “significant risks to vulnerable infrastructure and health,” the primary areas of concern are environmental migrants from neighboring regions, sea-level rise, and changes to the geopolitics of the Arctic. Threats to availability of water and food among Europe’s less-developed trading partners are a particular concern. “It seems certain that the politics of climate change will retain a prominent place in European public life.” Transatlantic climate politics appear likely to remain contentious. “The EU appears poised to sustain global leadership on the issue, possibly adding to the global sense that the US is to blame for accelerating climate change.” (p.149)
11. **Turkey.** Serious environmental stress in coming decades may lead to both conflict and external aggression, in addition to population movements. Rising temperatures will have their most adverse effect on the southeastern part of Turkey. Tourist sectors of Turkey will suffer from rising water levels. Increasing erosion has led to a substantial loss of topsoil, reducing agricultural output and raising food prices. A UNDP study estimates that 86% of Turkey’s total land area is vulnerable to desertification. Water will most likely become a scarce commodity, and illegal trade in water supplies may emerge.
12. **Persian Gulf.** The region is one of the world’s hottest, most water-starved environments, with water demand projected to double by 2025. All of the Gulf states have taken

dramatic steps to build desalinization plants. Despite these prudent steps, Persian Gulf regimes will remain vulnerable to fluctuations in global energy markets and “will face profound environmental stresses resulting from climate change in the coming decades.” Governments will continue to “publicly embrace green development policies at home while joining together with other states to forestall a global system that will limit emissions... They will also seek to avoid schemes that distribute their wealth to the less-developed world to pay for climate-related mitigation and adaptation efforts.” (p.173)

13. **Egypt.** Rapid population growth will increase demand for water and energy resources, at the same time that rising temperatures may reduce drinking water from the Nile Basin, which provides 95% of Egypt’s water. Concentration of population and economic production in the Nile Delta means that many Egyptians will likely suffer due to even a moderate rise in global sea level. One Egyptian environmental expert views Egypt as “the third most vulnerable country in the world to climate change, surpassed only by Bangladesh and Vietnam.” The World Bank concludes that climate change would result in “catastrophic consequences” for Egypt.
14. **The Maghreb.** Climate change will affect Morocco, Algeria, Tunisia, and Libya in profound ways, and these countries are “already characterized by exceedingly fragile environmental conditions.” The agriculture sector is precarious, with temperatures and dry days expected to rise, resulting in decreased yields of key crops. Coastal regions are at risk from sea-level rise and inundations, and accompanying salinization of coastal groundwater. This will have an impact on the tourism sector. The major domestic social impact from climate change will be accelerated and probably chaotic urbanization, as migrants leave stressed rural areas. Climate refugees from the Sahel and Sub-Saharan Africa will create further stress and civil conflict.
15. **West Africa I.** “By 2030 considerable parts of Nigeria may confront issues related to climate change, which could seriously affect agricultural production, water availability, and coastal environmental conditions.” Desertification in the north and erosion elsewhere are major concerns. A rise in sea level may pose serious risks to important parts of the country. In a worst-case scenario, climate change could contribute to state failure. Senegal faces the most widespread and adverse climate change problems, but its ability to cope surpasses that of Nigeria and Cote d’Ivoire.
16. **West Africa II.** Projected 2030 climate changes for Guinea, Liberia, and Sierra Leone are modest. Given the history of instability in the region, “climate change adds only a few drops of fuel to this tinderbox.”
17. **Southern Africa.** Much of what is probable in the next 20-30 years has already begun in many parts of the region: increasing temperature, more frequent and severe drought, and problems of freshwater availability. Climate change will likely lead to conflict over food, access to water, and economic opportunity. South Africa accounts for 80% of water use in Southern Africa, but only 10% of the total water resource.
18. **The Northern Andes.** Bolivia in 2030 will be in the worst position of the region’s countries in agricultural productivity. Ecuador will be in the worst position in the event

of a 1-meter rise in sea level. Glacier retreat is a critical issue not only in Bolivia and Ecuador, but in Peru and Colombia. All four countries are experiencing high or rising level of social conflict and political turbulence, making this region the most volatile part of Latin America. “The nature of political and civil society in these four countries leaves little room for optimism about effective responses to the challenges of climate change.” (p.256). However, there is substantial and growing variation in the capacity of subnational governments in each of these countries.

19. **Brazil.** The largest country in Latin America is taking steps toward a leadership position in global climate change negotiations. Brazil does face climate change risks, especially the likelihood of increasing internal migration from the Northeast to the Southeast, and from rural areas to major cities. There is potential for great political stability in the region, however, because of Paraguay’s vulnerability to climate change. There is also “widespread” but exaggerated anxiety in Brazil that the ecologically important Amazon region will be internationalized.

Some important conclusions by Moran (all on p.272):

- “climate change is likely to increase social inequality within countries at almost every level of development”;
- “it is also likely to heighten strains between urban and rural populations, a crucial fault line throughout the developing world, and one across which large-scale population movements are likely to be especially stressful”;
- “the critical path connecting climate change to social and political failure lies less through rising temperatures or rising sea level than through the changing distribution of freshwater”;
- “as public consciousness of climate change and its perils expands, so too will public awareness that the historical responsibility for these perils is not universally shared but lies at the feet of a handful of states”; China is now the largest producer of greenhouse gases, and Indonesia will soon outstrip all of the EU as a carbon emitter; India and Russia also rank high in generating greenhouse gases; “however, none of these nations is likely in the period that concerns us, to surpass the United States on a per capita basis.”

COMMENT

Through detailed socio-political analysis of individual nations—and regions within them—one can gain a far greater appreciation of the specific impacts of climate change in the decades ahead, and well-populated countries that are most at risk: Bangladesh, China, India, Vietnam, The Philippines, Turkey, Egypt, Nigeria, and South Africa. The only complaint with this book is that it invites curiosity about other countries, e.g. Canada (probably a net loser; see www.nrtee-trnee.ca), the U.S. (a net loser, especially in arid regions), Mexico (expecting increased temperature and decreased precipitation; a strong national climate change law was passed in April 2012), Japan and South Korea (presumably taking steps toward sustainability), and Australia (where many weird weather events have recently taken place).

World Energy Outlook 2012

International Energy Agency (Paris). Paris: IEA (dist. by OECD), Nov 2012, 668p, 150 euros (PDF E120) from www.iea.org or OECD. (www.worldenergyoutlook.org)

The quantity and quality of energy supply are central to our future. This annual report is, by far, the most extensive and authoritative survey of energy trends, which are projected to 2020 and 2035. Much press attention, at least in the US, has been given to the startling forecast that the US will become the world's largest oil producer by 2020 (see below). But there is much, much more to this important report that deserves attention.

Notably, a central theme of the IEA report involves four scenarios: **Current Policies** (business as usual baseline), **New Policies** (the central scenario, assuming recently-announced commitments cautiously adopted), **450 Scenario** (policies providing a 50% chance of limiting global increase in temperature to 2°C, and CO₂ at 450ppm), and **Efficient World Scenario** (all economically viable energy investments are made, which lowers growing demand for fossil fuel and boosts economic output.)

Many people worldwide applaud the transition to renewable sources of energy. So does the IEA, but, as indicated here, there is still a long way to go before renewables make a major impact. Conversely, many people also believe that we have reached or will soon reach the point of “peak oil,” which will accelerate use of renewables. This wishful thinking is nowhere to be found in the hard-nosed IEA report, which views global oil demand rising through 2035, with any shortfalls made up by “unconventional oil” and rapid development of Iraq's extensive oil resources. Not good news for climate change, of course, but these are the sober realities ahead. “Wild cards” may appear (e.g., a US carbon tax, new technologies not on the horizon), but IEA does not consider them.

The quotations below are merely a small sampling of the many significant points that are made in this dense report.

1. GENERAL FINDINGS (*emphasis added*)

1. **US Developments.** “Energy developments in the US are profound” and their effect will be felt worldwide. “By around 2020, the US is projected to become the largest global oil producer (overtaking Saudi Arabia until the mid-2020s) and starts to see the impact of new fuel-efficiency measures in transport. The result is *a continued fall in US oil imports, to the extent that North America becomes a net oil exporter by 2030.*” (p.23) Even a few years ago, output of oil and gas had been widely assumed to be in inevitable decline. “*This energy renaissance has far-reaching consequences for energy markets, trade, and, potentially, even for energy security, geopolitics, and the global economy.*” (p.74)
2. **Sustainability.** “Taking all new developments and policies into account, *the world is still failing to put the global energy system onto a more sustainable path.*” (p.23) Even with the New Policies Scenario—our central scenario—“global energy demand grows

by more than one-third over the period to 2035.” Despite growth in low-carbon sources of energy, “fossil fuels remain dominant in the global energy mix, supported by subsidies that amounted to \$523 billion in 2011, up almost 30% on 2010 and six times more than subsidies to renewables.” (p.23)

3. **Emissions.** “Emissions in the New Policies Scenario correspond to a long-term average global temperature increase of 3.6°C.” (p.23)
4. **Efficiency.** “Energy efficiency is widely recognized as a key option...but current efforts fall well short of tapping its full economic potential.” (p.24) Even with New Policies in place, four-fifths of the potential in the buildings sector and more than half in industry still remain untapped.
5. **The 2°C Goal.** “The climate goal of limiting warming to 2°C is becoming more difficult and more costly with each year that passes.” (p.25) The 450 Scenario examines actions necessary to achieve this goal, finding that “almost four-fifths of the CO₂ emissions allowable by 2035 are already locked in by existing power plants, factories, buildings, etc.”
6. **Electricity Access.** “Despite progress in the past year, nearly 1.3 billion people remain without access to electricity and 2.6 billion do not have access to clean cooking facilities.” (p.29) Nearly \$1 trillion in investment is needed to achieve universal energy access by 2030, and abandon use of traditional biomass.
7. **“Thirstier” Energy.** Water is essential for energy production: for power generation, for extraction and processing of oil/gas/coal, for transport, and increasingly for crop irrigation to produce biofuels. “The projected rise in water consumption of 85% over the period to 2035 reflects a move towards more water-intensive power generation and expanding output of biofuels.” (p.29) In sum, “energy is becoming a thirstier resource,” and water is growing as a criterion for assessing the viability of energy projects. The vulnerability of the energy sector to water constraints is widespread, affecting, among others, shale gas development, power generation, and Canadian oil sands.
8. **Energy Prices.** Price remains an important determinant of energy trends, and “history has shown that energy prices are notoriously difficult to predict.” (p.38) It is unlikely that the future will follow any of the precise paths in the four IEA scenarios, which simply demonstrate how markets could evolve under certain conditions. (In the New Policies scenario, the average crude oil import price rises to \$120/barrel in 2020 and \$125/barrel in 2035. Under the Current Policies Scenario, higher prices are needed to balance supply with the faster growth in demand reaching \$145/barrel in 2035. In the 450 Scenario, lower oil demand means less need to develop costly oil and a decline to \$100/barrel by 2035).
9. **Iraqi Oil.** “Iraq makes the largest contribution by far to global oil supply growth.” (p.26) Its ambition to expand output after decades of conflict is not limited by the size of its resources or costs of production. Four chapters are devoted to the Iraq outlook for oil and gas (pp.385-498). Oil output is expected to rise from 3 million barrels/day in mid-

2012 to 6 mbd in 2020 and 8.3 mbd in 2035 (11 mbd in the high case; 5.3 mbd in the delayed case). Without this supply growth, oil prices would be almost \$15/barrel higher by 2035. Iraq stands to gain almost \$5 trillion from oil exports through 2035. In 2012, the Iraqi Ministry of Oil announced 143 billion barrels of proven reserves, and some 215 billion barrels of undiscovered resources. Exploration is expected to “add substantially to proven reserves over the coming decades.” (p.422)

10. **CCS Technology.** “The pace of development of carbon capture and storage technology remains highly uncertain. It could prove to be critical to the prospects for coal use in many regions.” (p.47) In the long term, it is also likely to be critical to prospects for natural gas and energy-intensive industries globally. The technology exists, “but only a handful of commercial-scale CCS projects are currently operating.”

2. THE FOUR SCENARIOS

1. **Current Policies Scenario.** The baseline, where government policies enacted or adopted by mid-2012 continue unchanged. Under this scenario, use of coal grows from 2,378 Mtoe in 2000 and 3,474 in 2010, to 4,417 in 2020 and 5,523 in 2035. Oil grows from 3,659 Mtoe in 2000 and 4,113 in 2010, to 4,541 in 2020 and 5,053 in 2035. CO₂ emissions rise from 30.2 Gt in 2010 to 44.1 in 2035. [NOTE: Clearly not acceptable.]
2. **New Policies Scenario.** Where existing policies are maintained, and recently-announced commitments and plans are implemented in a cautious manner. Under this “central” scenario, use of coal grows from 3,474 Mtoe in 2010 to 4,082 in 2020 and 4,218 in 2035. Oil grows from 4,113 in 2010, to 4,457 in 2020 and 4,656 in 2035. CO₂ emissions rise from 30.2 Gt in 2010 to 37.0 in 2035. [NOTE: Still not acceptable.]
3. **450 Scenario.** Rather than a projection based on past trends, a plausible energy path is described, consistent with actions having about a 50% chance of meeting the goal of limiting the global increase in average temperature to 2°C, which requires a limit of 450 ppm of carbon-dioxide equivalent in the atmosphere, now at about 390 ppm (some argue—strenuously—that a lower target is necessary; see Bill McKibbin’s www.350.org). In the 450 Scenario, coal grows slightly from 3,474 Mtoe in 2010 to 3,569 in 2020, and declines by a third to 2,337 in 2035. Oil also grows slightly from 4,113 in 2010 to 4,282 in 2020, declining to 3,682 in 2035. CO₂ emissions rise slightly from 30.2Gt in 2010 to 31.4 in 2020, and then decline to 22.1 in 2035. [NOTE: Far better than above, but still quite likely to be too little, too late, to forestall ruinous climate change.]
4. **Efficient World Scenario.** Explores the results of improving energy efficiency in every way that makes economic sense, involving necessary policies to eliminate market barriers. Four chapters are devoted to discussing efficiency (pp.267-384). Key steps include strengthening measurement and disclosure of energy efficiency to make gains more visible to consumers, regulations to prevent sale of inefficient technologies, and financing instruments. Realizing this scenario would boost cumulative economic output through 2035 by \$18 trillion. A chart on p.299 lists dozens of sub-sectors and technologies where improved efficiency is possible for industry, transport, and buildings.

Another chart on p.329 lists key policies by sector (e.g. stringent building codes, retrofits, retirement of inefficient industrial facilities, support for smart grids).

3. MAJOR SOURCES OF ENERGY

1. **Oil.** Even in the New Policies scenario, *“growth in oil consumption in emerging economies, particularly for transport in China, India, and the Middle East, more than outweighs reduced demand in the OECD, pushing oil use steadily higher.”* (p.26) Oil demand reaches 100 mbd in 2035, up from 87.4 mbd in 2011, and the average price rises to \$125/barrel in 2011 dollars by 2035. The transport sector now accounts for more than half of global oil consumption, and this share increases as the number of passenger cars doubles to 1.7 billion and the demand for road freight rises quickly (in part because fuel-economy standards for trucks are much less widespread). *“The net increase in global oil production is driven entirely by unconventional oil”* — light tight oil in the US and oil sands in Canada. (p.26)
2. **Natural Gas.** Global demand grows in all scenarios, but the outlook varies by regions. Low prices and abundant supply in the US enable gas to overtake oil around 2030 to become the largest fuel in the energy mix. China’s consumption will grow rapidly, from 130 billion cubic meters in 2011 to 545 bcm in 2035. Unconventional gas from hydrofracking accounts for nearly half the increase in global production to 2035, but there is uncertainty in many countries about the extent and quality of the resource base, and concerns about environmental impacts.
3. **Coal.** *“Coal has met nearly half of the rise in global energy demand over the last decade, growing faster even than total renewables.”* (p.27) Whether coal demand continues to rise strongly will depend on policies that favor lower-emissions energy sources, deployment of more efficient coal-burning technologies, and—especially in the longer term—CCS technology. Policy decisions carrying the most weight for the global coal balance will be in China and India, which account for almost three-quarters of projected non-OECD coal demand growth, whereas OECD coal use declines.
4. **Nuclear.** *“The anticipated role of nuclear power has been scaled back”* in the wake of the 2011 Fukushima accident. Japan and France seek to reduce nuclear power, while its competitiveness in the US and Canada is challenged by relatively cheap natural gas. Projections for growth in installed nuclear capacity are lower than in 2011. While nuclear output grows in absolute terms (driven by expanded generation in China, Korea, India, and Russia), *“its share in the global electricity mix falls slightly over time.”* (p.28)
5. **Renewables.** A steady expansion of hydropower and rapid expansion of wind and especially solar results in renewables will account for almost one-third of total electricity output by 2035. Consumption of biomass and biofuels grows four-fold. The rapid increase in renewables is underpinned by falling technology costs, rising fossil-fuel prices, carbon pricing, and especially by continued subsidies—from \$88 billion globally in 2011 to nearly \$240 billion in 2035.

Other chapter topics discuss electricity demand and supply, “emissions lock-in” (in that the average lifetime of energy infrastructure is long), oil production prospects under each scenario, water for energy and regional stress points, and measuring progress toward energy for all.

An Annex provides extensive tables for energy demand in various sectors and for energy sources through 2035 under each of the first three scenarios (for the world, US, OECD, US, Japan, EU, Russia, China, India, Africa, Latin America, and Middle East).

COMMENT

There is much that is worthwhile and important in these 668 pages of extensive IEA analysis, which include numerous charts and tables.

But several complaints should be aired:

1. No index is provided to enable quick access to specific topics scattered in the 668 pages.
2. The 450 Scenario and the Efficient World Scenario do not appear to be compared, nor is there any mention of how the two might be pursued together.
3. Only a single paragraph appears to be devoted to carbon capture and storage technology (CCS) to handle the anticipated increase in carbon emissions, and there is no mention of the role of endangered forests, oceans, and soils as carbon sinks.
4. Similarly, only a single paragraph is devoted to global geothermal electricity generation (p.230), expected to increase from 11 GW to 40 GW by 2035, but still a small share of renewables at that time. Testor et al. and Gore (see below) see far more promise.
5. At the least, a chapter on the world’s major energy companies would be helpful, but this topic seems to be taboo. For starters, see **Private Empire: ExxonMobil and American Power** by journalist Steve Coll (Penguin, May 2012, 685p, \$36), on the world’s largest energy giant, with operations in some 200 nations and territories.
6. The lack of considering potential “game-changing” wild cards (and not-so-wild cards), as regards both technology (e.g., small and widely-distributed nuclear reactors) and legislation (e.g., a carbon tax, especially in the US).
7. The 150 euro price will deter all but the largest organizations from purchase.

Global Energy Assessment: Toward a Sustainable Future, by the German Advisory Council on Global Change and the International Institute for Applied Systems Analysis (Cambridge University Press, Oct 2012, 1,882p, L75pb; www.globalenergyassessment.org), a huge analysis involving over 500 researchers, appears to offer even more than the IEA Outlook reviewed here. It emphasizes an integrated energy system strategy and options with multiple benefits, notably energy efficiency (the most cost-effective near-term option), renewables (which could be >90% of primary energy in some regions by 2050), and co-production (of synthetic transportation fuels, cooking fuels, and electricity with CCS). Similar to

the IEA Outlook, the GEA also advocates universal access to electricity and cleaner cooking fuels and stoves by 2030.

ALSO SEE three other very different energy overviews:

1. **Sustainable Energy: Choosing Among Options** (Second Edition) by Jefferson Testor and four others (MIT Press, Oct 2012, 1,019p, \$90) is a rather technical textbook, with 21 chapters on such topics as technical performance, project economic evaluation, energy systems, geothermal (the global resource base is large and well-distributed, and the technical potential is “vast”), ocean wave and tidal, energy management, synergistic complex systems, and all of the other usual energy sources.
2. **The Quest: Energy, Security, and the Making of the Modern World** by Daniel Yergin (Penguin, Sept 2011, 804p; GFB Book of the Month, Nov 2011), an engagingly-written overview that covers much if not all of the IEA topics: the new world of oil, the history of peak oil theory, the “shale gale” of unconventional gas and oil, climate and carbon, the potential for biofuel, and much more. But Yergin sees geothermal as “limited by geology and the availability of the right kind of ‘hot rocks’ underground.” (p.714)
3. **Our Choice: A Plan to Solve the Climate Crisis** by former Vice President Al Gore (Rodale, Nov 2009, 416p; GFB Book of the Month, April 2010), reporting on more than 30 “Solutions Summits” of leading experts convened by Gore, on such topics as the climate change threat, the potential of concentrated solar thermal power, biomass, geothermal power (potentially “the largest source of power in the US and world”), forests and soils as carbon sinks, depleted soils enhanced by biochar, limits of CCS, energy efficiency improvements, smart grids, and more. This book, which still has much to offer, provides the starkest contrast to the IEA analysis of what is desirable and feasible for addressing energy-related responses to climate change.

To conclude on a hopeful note, a recent article by Elizabeth Kolbert (*The New Yorker*, 10 Dec 2012, pp.29-30) reports on growing bi-partisan interest in a US **carbon tax**, which is now even supported by ExxonMobil. She cites Bob Inglis, a former Republican Congressman, who told the Associated Press that “*I think the impossible may be moving to the inevitable without ever passing through the probable.*” If so, as Kolbert notes, “it would have global significance”—surely as great as the recent upheaval in oil and gas supplies. And it would remind us, once again, of the need to be alert to a wide range of possibilities.