

ENERGY 2050
Risky Business

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Acknowledgements

Scenario work *creates* options wich lead to better strategic decisions. Too often we in business are not too good at *creative, inductive* work that is strong enough to influence the allocation of large resources.

Thus, I want to thank *all* participants who had, or developed in the course of this work, a great tolerance for ambiguity, without ever losing sight of the fact that their industry's future was at stake.

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And while scenario work is always team work, three individuals stood out:

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David Bodanis, our writer, who wrote the first report on energy which is both exciting and a joy to read; and

Pallavi Hiremath, our designer, who made it all come together in the form you now have in your hands.

Ulrich Golüke

Manager, Scenario Unit

April 1999

Understanding Risk

Understanding Risk

Energy is a risky business these days. These are not simple risks, which more careful management could avoid. Rather, they are fundamental to the way the industry is evolving.

What would you do, for example, if:

- Wal-Mart became your greatest competitor, and started giving away energy for free
- Firms such as Sony began *producing* energy, instead of using it
- Cars were operated without any contribution from oil companies
- International authorities would take away your license to operate, un less you could show you produced zero damage to the environment
- Exporting your product to less-advanced foreign markets was nearly guaranteed to be a failure

All these events are ones which our analysis shows are likely - or indeed are already underway.

In this new world, simply continuing with business as usual - or just making a few precautionary investments in renewables, or in broader services - will not be good enough. But yet, our analysis also suggests that in the next decade, a number of energy companies will be richer, and better protected from risk, than ever before.

How can this be? The energy business already deals with many risks: technological, political and contractual. It seems to be a full range, but yet a new attribute of risk is appearing.

Call it connected risk.

All past strategies for dealing with risk - all the procedures which business has developed over decades or even centuries – depended, in the end, on risks being independent of each other; limited in space and time. Because they were separable this way, it was possible to build up accurate actuarial tables. It is what the modern insurance industry depends on.

That has changed. A globalized, connected world of over 6 billion violates those basic assumptions. Risks are no longer so isolated, and mishaps spread. For example:

- When a reactor design turns out to have a fault, all reactors of that type become a liability overnight. If operating or maintenance procedures

are faulty, you may find you have to take half your capacity off-line overnight.

- Even when faults are not 'objectively' that serious, the wide spread of modern media can make any incidence look large and threatening.
- New distributed energy production and usage technologies allow en tirely new players to enter the business almost at will. This means that the capital intensiveness which had once been a 'useful' barrier to en try, is now the reverse. It can become a barrier that locks you inside, within an isolated valley: turning many players into mere dinosaurs, desperately trying to shed stranded assets and escape.

Life is very different in this new world of connected risks. In the past, there might have been a few hundred plaintiffs in a class action lawsuit. But now, where could one possibly go to buy insurance coverage against a lawsuit alleging your responsibility for damaging the climate of earth's entire population?

The very skill sets one acquired are no longer sufficient. Standard technological and political skills are now merely a part of what is needed. Today one also needs to be a brand manager (of a commodity which many of your customers do not even realize they are buying); an emissions trader; a venture capitalist.

The Scenarios

... in brief

F . R . O . G .

World Being Envisaged

Imagine that GNP starts rising quickly around the world again, but this leads to trade tensions and widespread ecological problems. Nations begin turning inward, and the world economy enters a deep reverse.

How it Happens

OECD-based firms are attracted to the potentially fast-growing markets in Asia and Latin America. But all the technology transfers and investments means that the developing countries soon increase their own abilities, and are able to displace foreign firms.

That alone would have inspired resentment in OECD nations, but it is made worse by the fact that the rapid industrialization, in Asia especially, leads to higher levels of greenhouse gases, pressure on global food prices, and oscillations in financial markets. Instead of initiating joint action to deal with these problems, there is an increasingly resentful attitude between trading nations.

By the 2020s, rising trade barriers have slowed world growth considerably. The habit of innovation and fresh expansion has been almost lost. Each step in the slowdown arose so gradually - and there were many local pockets of prosperity and clean environment - that the full signals were never seen.

Energy Implications

Coal is the great winner, as are fossil fuels generally. In a world without concern for controlling CO_2, their wide availability and price advantage makes them impregnable. Long-distance transmission systems are favored, since users in wealthy countries want power stations kept far away. Battery and other storage technologies get an important niche, to help guard against uncertainty in supplies, as well as in parts of transport.

The losers are all systems that are expensive, or that take a long time to produce returns. Nuclear power and hydroelectric projects

nearly halt. Renewables are the greatest failure. Unable to compete on direct price, no one except a few eccentrics or niche users bothers with them.

Why this is Plausible

The reflex of major economic blocs putting up trade barriers in times of stress is a common one, as with the early years of the worldwide 1930s Depression, or rising Asian protectionism at the end of the 1990s. Sharply rising greenhouse gases are near certain if high growth levels are maintained for another decade.

Energy supplies are highly vulnerable to international tensions, as with the need to escort tankers near Iraq in the latter stages of the Iran/Iraq war. The education and strong economies needed for innovation are equally fragile, as seen in the large numbers of Korean science postgraduates who withdrew from universities in America then faced unemployment at home when their economy weakened in 1998.

Business Implications

Strong positions in coal and traditional fossil fuels will be favored. Firms which thought that high-tech and innovative technologies were the way to go would have wasted their time, since high litigation and a generally querulous attitude within societies will slow innovation. Large projects, such as major, border-crossing pipelines, will be hard to fund.

Amid all the tensions, oligarchy and protected markets are likely to return. Skills in heavy engineering and in standard, economy of scale marketing, will prevail.

Early Signals

Watch for international conferences ending in recriminations; watch also, very closely, for early signs of the insurance industry withdrawing from selected sectors. Check the state of environmental 'choke-points' in rapidly developing countries, be they emissions policies, impending water shortages, or demographic surges.

See if increases in private schools seem to be leading to a smaller educated pool in the near-future: also if increases in private security guards seem to mark a general turn inward. Track the progress of legislation which makes liability easier or harder to prove.

GEO*polity*

World Being Envisaged

Imagine that deregulation is reversed, and an international bureaucracy guides the world's energy markets.

How it Happens

Business continues as usual till 2003, but a series of weather shocks attributed to global warming make people demand international controls on greenhouse gases. Led by a revamped World Trade Organization, the resulting organization - termed 'GEO*polity*' - soon enforces strict directives to shift the world's economy away from high carbon fuels.

There are successes at first, but by the late 2010s, complaints arise about GEO*polity*'s over-bureaucratic approach, especially when several of the industrial projects it favored turn out to be badly chosen and administered.

By the 2020s, a revamped GEO*polity* is created, taking a more indirect approach. Tradable permits are strongly encouraged; energy suppliers are subsidized in giving rebates to efficient users; there is wide research in alternate technologies, and tax incentives for insulation are in place in almost all countries. The oil-producing economies see a near total collapse, but most other areas experience a steady - if slow - development, especially as population growth has eased considerably.

Energy Implications

Low-carbon energy sources are the great winners, and especially ones already available: Natural gas, some renewables, hydroelectric (including small-scale hydro) and nuclear energy. Coal is strongly discouraged, through direct taxes and the removal of subsidies. Fuel cells and other alternate systems are encouraged for transport, though gasoline's proven advantages keep it in place in many areas.

Later, as the GEO*polity* authorities take the more indirect approach, insulation and energy efficiencies are even more strongly encour-

aged. Renewables spread widely, as subsidized research, protection against liability and then economies of scale take effect. Coal remains a dirty word.

Why this is Plausible

People often turn to large-scale government authorities for a solution to their problems, as with the agreements on international financial institutions which were set up in the late 1940s and lasted for decades. This is especially likely when business has been vilified, as - alas - tends to happen at regular intervals. The weather shocks which could start off the scenario have solid scientific backing.

Responsibility for energy policy is especially likely to be passed into government's hands. OECD countries have experienced decades of regulation; in much of Asia there is a tradition of accepting governmental supervision; the US has residual memories of the Tennessee Valley Authority experience and government-led rural electrification as well.

Business Implications

There will be advantages to having strong positions in renewables and perhaps nuclear; to be able to provide transport energy sources beyond straightforward petroleum products; to be situated in energy-savings goods as these become desired. Prior positions in coal and oil will be a liability, though the ability to retrofit scrubbers or raise the efficiency of installed capacity would be useful.

Throughout, good skills in dealing with bureaucracies - especially international ones, far removed from one's home base - are central. Financing for the projects which GEO*polity* has agreed upon will be easy to get, however large they are, and obstructive litigation will be legally blocked. Projects which GEO*polity* has not declared support for will be hard to start.

Early Signals

Look out for anti-business moods, which might be evidenced in the villains chosen in popular films. Watch closely to see if current concern with tradable permits becomes self-regulated by business, or whether it is kept under tight government control. Follow the articles in Nature and Science on the latest evidence related to greenhouse gases (and other global effects). See if non-profits that are tightly linked with governments are accepted, instead of losing popularity because of those links.

J A Z Z

World Being Envisaged

Imagine that the new business style which had once been restricted to Silicon Valley spreads quickly around the globe.

The steady trends of dematerialization, combined with the great profits available in customizing services, are what pulls the new entrepreneurial style from its Silicon Valley stronghold. As the business landscape changes, firms such as Wal-Mart, Sony and Virgin are soon plucking customers from traditional energy suppliers: offering bundled deals, where convenience comes first, and energy is simply an added commodity.

How it Happens

Latin America and parts of Europe and Asia do well, responding with surprising boldness to the new opportunities, and often merging citizens groups with the new-style practices. But losing countries - and losing groups within wealthy countries - react angrily by the 2020s: imposing stiff taxes where possible.

To counter some of the main critiques, the new organizations voluntarily uphold codes of 'green' practice. Consumer watchdogs publicize laggards. Where large-scale resistances do remain, the new business styles often infiltrate like a happy virus, creating localized regions of success.

Heavy, slow-changing energy systems become dinosaurs. Renewables and other new technologies take off, not by governmental mandate, but because firms are drawn to the profits in energy sources that are still at early stages of development. Modular and other dispersed energy systems - which a service-centered world demands - spread quickly.

Energy Implications

Retrofitting of housing stock becomes a growth industry, as does technology to upgrade inefficient older power plants. There are markets in new types of small motors, individual solar cells, and other consumer-targeted items. Homes and cars often generate excess energy, which is fed back into pooled sources.

Information technology pervades the energy field, and its use in monitoring, supply auctioning and repairs is taken as matter of course. Advances in

nanotechnology and biotech turn most late 20th century technology into museum curiosities.

Profits already increasingly come from customizing services in many fields. Non-energy firms are constantly looking for new opportunities, and mortgage firms and supermarkets have already begun giving away 'free' energy.

Why this is Plausible

New business forms in the past - the mediaeval European trading fairs; 19th century trusts - often spread from protected, 'virus'-like niches. Technology has often been held back by conventional practices, so highly deregulated outlets, with a global sweep, could greatly accelerate advance.

More scientists are active today than have lived in all human history. If high-quality education spreads to even a third the under-25 population of developing nations, the numbers available will soon more than double.

Business Implications

Understanding the subtleties of customer demand will be central. Being skilled only in heavy engineering, or in dealing with regulators, is a guarantee of failure.

Successful firms will enter into alliances with partners far removed from their usual fields, absorbing the unique skills they bring. Innovation will be at a premium: not as part of easily ignored mission statements, but locked-in through high salary rewards, and regular spinning off of semi-autonomous divisions to experiment with new technologies, and new forms of partnership. Profits will depend less on large capital investments, than on the appropriate creative use of available resources.

Since boycotts are easily carried out, stakeholder awareness is high. There will be a premium on dual nationals who can customize portals into once-distant markets, as well as on financial and risk specialists who can assemble complex projects.

Early Signals

Watch for unsuspected new arrivals in the energy field. See if business is treated favorably in popular films, and if international agencies have problems recruiting top university graduates. Keep a close eye on research parks, including those in developing countries, and see if many OECD graduates begin going there to complete their research degrees. Watch for trends in individual-scale energy systems, and track how well non-profit organizations which have started working with businesses are accepted.

The Scenarios

... in full

F.R.O.G. – King Coal

From 'The Economist Retrospective Survey - 2050':

"The world-wide recession which hit in 1998 turned out to be briefer than expected. By 2001, world trade had risen to record levels, and energy companies once again began to export their latest equipment to Asia and Latin America.

"The possibilities of growth seemed tremendous. Back in the 1990s, a typical OECD country such as Britain had a total generating capacity of 80GW. In China alone, however, that much new generating capacity had been ordered in the same decade.

"As the new century began, targeting such markets seemed an excellent way of escaping from stagnant markets at home.

"No one realized how disastrously it was going to end...

I. DEVELOPING COUNTRIES STARTED GAINING

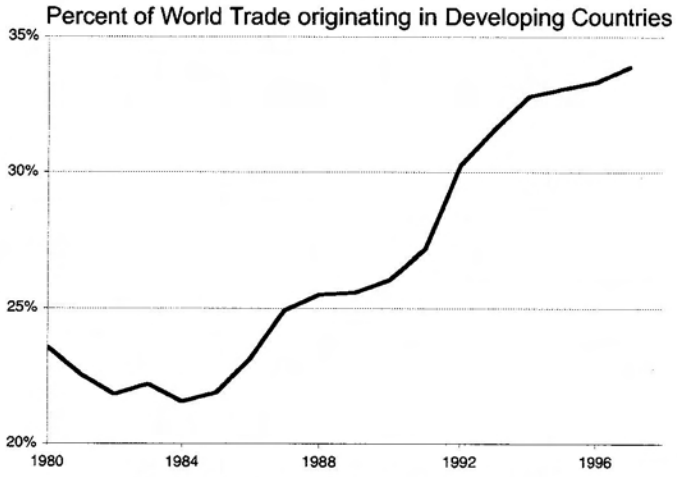
An Unexpected Development

The first signs of failure had actually occurred several years before, but been missed in the euphoria of the earlier, mid-1990s boom. China's telephone switching industry, for example, had been so backward in the early 1990s that it had seemed an easy export market for Western firms. All the Western investor had assumed that would continue.

But the developing countries did not remain passive receivers of superior Western technology for long.

By the end of the 1990s, China's locally produced telephone switching equipment was just as good, or better, than what the large Western exporters could produce. As the years moved towards 2005, there were similar developments in selected areas of petrochemicals, and electricity generation as well. It was a once-in-a-generation shift.

Developing Countries are catching up ...



Source: calculated from Vital Signs 1998, Worldwatch Institute

(Note: Y-scale does not start at origin)

There was much precedence for this. Japan had gone the same route in the 1960s, just as South Korea had done in the 1980s. There is a powerful trend from the history of technology that countries which enter last upon a technology often manage to advance in it more quickly than any others. Germany had come later to chemicals than Britain, and soon leapfrogged it; Japan had come later to electronics than America, and soon surpassed it as well.

Even back in the first Clinton administration, Seoul had one of the world's highest concentrations of Ph.D.s per capita. Now, in 2006, parts of Sao Paulo, Kuala Lumpur, Bangalore and the Hong Kong hinterland began to match that. But the over-confidence which years of superiority had given the West kept the majority of business and political leaders from seeing this coming.

Finance and a Bonus

Technology alone is not enough to create self-directed projects. Funding has to be available as well - and here Asia was in a wonderful position in the first decade of the new century. The central bankers responsible for Europe's new unified currency were so concerned to establish their low-inflation credentials that many European banks began to scour foreign markets even more than before. Asia and Latin America seemed attractively far away from these unduly tight restrictions.

"It was called the demographic bonus, for this is the age group with the highest savings rate."

It also helped that money seemed 'safe' when it was loaned to Asia. After the banking debacles of 1998-9, Thailand, Malaysia, Korea and even large parts of China had substantially improved the transparency of their surviving financial institutions.

Most of all, a great deal of funds were being locally generated now. Peasants have large families, but middle class couples have smaller ones. Many Asian countries had started slowing their population growth as far back as the 1970s. As a result, in the decade 2000-2010 there was a great 'bulge' of parents in their 30s and 40s. It was called the demographic bonus, for this is the age group with the highest savings rate. As a result - here and in parts of Latin America as well - the rising locally-based energy companies did not lack for funds.

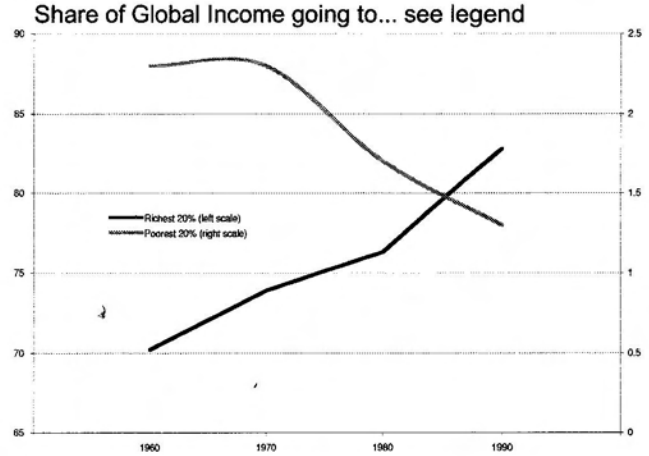
OECD contrast

Had this been all that happened, there would simply have been worldwide economic growth, with the developing countries gradually increasing their share, while the traditionally wealthy countries kept their own position as well.

It did not turn out like that.

The US was the first country to show signs of fundamental weakness. For decades after WWII, the US had prided itself on being a unified, middle-class country. But even as far back as the 1980s that had been more of a myth than a reality. Salaries began to separate, with a wealthier 20 percent or so lifting away from the majority. By 2005 a new upper middle class had largely turned its back on

.... but the Rich keep getting richer



Source: State of the World 1994, Worldwatch Institute

society. It chose private schools for its children, and private security guards for its offices and neighborhoods.

Education suffered most of all. In the 1970s, Proposition 13 on the California state ballot had led to lowered funding for Californian schools, as a tax-saving measure. In barely a decade, California's school spending - and student scores - had dropped from the top five in the nation, to near the very bottom. The great ballot initiatives of 2004 - in Seattle, Atlanta, Orlando and Santa Fe - extended that across the nation. Universities increasingly depended on foreign-born students for entry into their science-based graduate departments; factories and - most tellingly - even research labs, were now increasingly set up outside US borders.

Europe and Canada preserved their educational systems, but suffered a slow-down for a different reason. The great downsizing movement of the 1980s and 1990s had produced many firms which were - in the jargon of the time - 'lean and mean'. But once every competitor was similarly 'lean', it was hard to get an edge on them.

One solution would have been deft shifts into new fields, and indeed several pharmaceutical firms did manage to do this. But most energy, automobile and chemical firms chose a different path, and simply engaged in mergers with established competitors. This had excellent short-term results. Cost went down, and there was access to larger markets. A few strategists worried that this was not much of an investment for the future, but investors were so keen on guaranteed profits that they had little choice but to go along.

"Most firms simply engaged in mergers with established competitors."

Litigation fears were the final reason for holding back. The energy industry was familiar with this effect, since in the last quarter of the 20th century, litigation - or just the threat of litigation - had brought the nuclear industry to a near halt in almost every country outside Japan or France. The population throughout Europe and much of North America aging, and wanted nothing to change what it was used to. Innovation was incremental, and slow; the blur-fast technology shifts which computer technology had once given signs of unleashing throughout society were now a thing of the past.

"Litigation fears were the final reason for holding back."

Controlled risk

It was a cautious atmosphere, dominated by this mind-set that continually saw sunk costs already in place. It did not, however, stop large foreign contracts going ahead. The lure of profits was too great. In 2004, London's traditional finance centers - eager to not fall too far behind Frankfurt - had begun marketing what were called RSIs

(Risk Separation Instruments). These were a way, it seemed, to insulate individual investments from the wider risk that might lurk abroad.

"In 2004, London's traditional finance centers had begun marketing Risk Separation Instruments."

Their first main success had come in 2006, when one of the newly merged American oil monoliths wanted to invest in an energy project straddling Argentina's borders, but did not want to have to make a single decision about whether it was worth taking the risk to go ahead. Instead, for a price, the London clearing house 'sold' to other investors the overall risk of volatility in those South American economies. All the oil company was left with was the risk of its particular energy project.

Scandinavian and Swiss firms - some of the most cautious of the economic investors in Asia - were especially attracted to RSIs. By 2009, even the World Bank was offering RSIs, most notably in the shared grid systems it proposed for the India/Pakistan borders. The project had long been supported by the UN, as a way of reducing political tension there, but firms had been leery because of the risk. Now, with the RSIs, it finally got underway.

Environmental ease

The unexpected collapse of the environmental movement made things easier. Trained ecologists had always insisted on nuanced predictions, but the media regularly broadcast shriller voices. There were predictions of great floods in the Nile delta, and massive agriculture failures in Canada and Asia. When those did not come true, there was a great ease; a feeling that business as usual really was all right after all. It is true that the California mudslides back in 2003 had briefly been declared a sign that global warming triggered by rising CO_2 really had reached danger levels. But when the rains and mudslides were not repeated again by 2008, or 2009, this too was seen as further proof that everything was fine.

"The unexpected collapse of the environment made things easier."

The new upper middle class had also been making sure that *local* conditions improved. In prosperous Marin County, north of San Francisco, newspapers were recycled as a matter of course; in wealthy neighborhoods in Hamburg, consumers bought detergents with green labels wherever possible. Years of earlier legislation were taking effect. The Rhine was cleaner than it had been in years; streams throughout North America had been improved; urban air quality in most OECD cities was better as well. No glaring sustainability limits looked about to be hit - quite the opposite - so there also

seemed little reason to bother with the confusing details of Kyoto Accord enforcements. Other international accords were quietly left to slip away as well.

Ominous quiet; Differences are masked

For several years globalization went on like this, with the developing nations steadily gaining on the historically wealthier ones. Few OECD citizens were especially troubled by this however, since constant growth masked the growing imbalance. The bull market that had begun in 2001 was still going strong in 2009, and incomes were higher than they ever had been before.

Young people in Malaysia and Argentina still looked up to Hollywood; the UN Security Council was still dominated by the few countries that had been dominant decades before. The successful NATO/Russian intervention to safeguard the new Caspian pipeline seemed a further sign that the old world still prevailed, and that the old powers were still dominant. There was a harmony; a feeling of cautious synchrony.

It was soon to change.

II. TENSIONS RISE

Slowdown

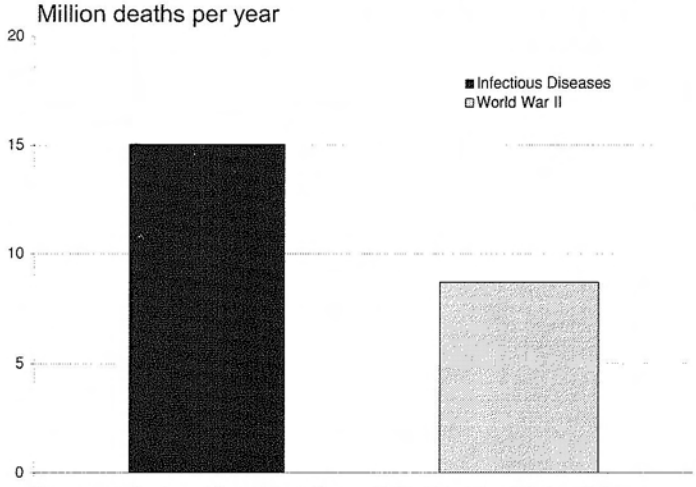
The recession which hit in developing countries in late 2011 took almost all economic analysts by surprise. The business cycle was felt to be a thing of the past. Central bankers tried the usual measures, but they did not work. Something more was going on than just the usual problems of over-supply, or surges of destabilizing speculation.

The free market is a powerful tool, unleashing immense human powers; drawing individuals forward wherever price opportunities show that needs are waiting to be fulfilled. But as Adam Smith himself had pointed out, after years of steady growth, a distortion enters into those prices:

Scarce goods can become so valuable that there is an incentive to continue seeking them out even when doing so makes the scarcities worse.

In China, for example, Beijing's emptying aquifers had made it profitable to dig deeper wells - but that simply lowered the aquifers further. Industry there was finding it nearly impossible to get the water they needed at anything approaching the prices they needed to be competitive. The effects went wider. In one country after another, high prices for prime fish had given great incentives for fishermen to violate any quotas, and scoop up the last of these now extra-valuable targets. Optimal farmland had been turned into housing; other housing had been built on dangerously exposed flood-plains.

Each year, twice as many people die from Infectious Diseases than were killed annually in WW II



Source: calculated from Vital Signs 1996, Worldwatch Institute

A great instability had been created. So many peasants had migrated to the suddenly attractive cities that educational systems could not cope; sewage was not properly treated; quality of life was often unattractive. Delhi and Bangkok had been crowded before, but with hundreds of thousands of extra cars lung diseases were serious. Bottlenecks began to appear, and not simply due to lack of infrastructure, which could be rectified by more port or roads construction. Instead it was affecting more fundamental matters: many nations could not get sufficient fuel; so much topsoil and cropland had

been lost that it was hard to grow more food locally when current account problems made imports difficult.

No Support for Taking a Break

At one point, early in 2012, the political movement called the 'Revivalists' looked like it might come to power, and lead a strategic pause in growth, to give time for some of these problems to be worked out. It had begun in India, then quickly spread - through satellite broadcasts and Internet groups - to several other developing or mid-income countries, which had long traditions of resenting foreign domination. Thailand, Ukraine, China and Argentina were regions where local activists especially took up the Revivalist call.

Technocrats soon pushed the Revivalists' calls aside, however, and in this they were supported by the mass of the ordinary population. Fast growth is what had brought living standards forward over the past decade. If incomes were falling now, it seemed only logical to push directly forward to try to build it up again. Revivalist activists were arrested, and there were show trials against them in China and Ukraine. Politicians could not let those upstarts win. Memories of the riots of 1998 that had helped topple governments in Korea, and Indonesia were still fresh.

Citizens, and leaders, understood the social contract. Government did not have to be democratic. In China especially there was only the slightest layering of Western-style local elections. But governments did have to deliver the growth their citizens expected.

Deficit financing soon shifted into high gear. One developing country after another decided that an export drive greater than anything seen so far would have to be the solution.

OECD Resentments

The artificially pumped-up export surge came at a particularly bad time for the wealthier, OECD countries. They had depended on the developing countries as a market for their own exports. But precisely because they had depended on it, they had weakened internally, and not dealt with their fundamental lacking in education, long-term research, and the legal systems that made it hard to develop genuinely innovative products. It had been masked by the shared worldwide growth, but now that was over.

Incomes slowed here as well, and a great mood of resentment began to spread. No nation likes seeing its own position threatened.

"European and American citizens could no longer pretend their past glory was based on real merit."

France had been resentful as Germany surpassed it economically through the 19th century; the US had been resentful when Japan had, briefly, shown signs of doing the same in the 1980s. Now in 2012 the crumbling of superiority was now clear through the OECD nations. European and American citizens could no longer pretend their past glory was based on real merit. A decade of fast global growth had changed this. Their hi-tech, superior firms were - as the rush of high quality goods from Asia and Latin America showed - no longer so hi-tech or superior after all.

Just to make it worse, Western media chose this moment to begin focusing on the wider consequences of the growth which the fast developing nations had undergone. Greenhouse gases had been rising steadily, with Asia and several Middle Eastern countries being some of the fastest growing contributors. Scientists knew that a few years of this alone had not been responsible for the worrisome jolts in weather patterns that were being noticed, but it was easy for an angry media to ignore those provisos. Camera crews showed toxic wastes which had been generated in the new economies being dumped near European shores. When there were oscillations in financial markets, and pressure on global food prices, it was automatic now to choose these scarily enlarged distant countries to blame.

"A few voices argued for calm, but the media were in no mood to listen."

No longer were these countries our trading partners, to be dealt with, be it with the usual easy superiority, or even through a wary acceptance. In times of stress, people like finding enemies. The angry nationalizations in Russia, parts of North Africa and Venezuela made it worse. So did the show trials which saw Western executives subpoenaed - and arrested - to testify before courts in India and in Brazil for failings in their locally-run subsidiaries. A few voices argued for calm, but the media were in no mood to listen. These distant countries were harming us. No one will want to be tolerant of someone who is doing that.

Backlash

The demagogic backlash began in the American South, but was soon picked up in France and other European nations as well. It matched the inner tensions which had accumulated over the years of growth in the OECD nations. There had been a constant feeling of resentment towards people outside one's own ethnic group, or religious views, or income level. There had also been an increased acceptance of litigation: a querulous touchiness, which sent people to the courts to resolve problems in a direct, confrontational way. With

"There had been a constant feeling of resentment towards people outside one's own ethnic group, or religious views, or income level."

those attitudes so well established, feeling resentful against foreign countries was simply more of the same.

Scholarships were cut for foreign students at British and French universities; visas - through the Helms-Livingston act of 2013 - were cut for foreign nationals in Silicon Valley. Some of the most dynamic minds were removed from the institutions where their innovation could have been used, and sent back to their home countries, where slowing economies made it hard to get a job. It was similar to what had happened a generation before when large number of Korean science postgraduates had withdrawn from universities in America, then faced unemployment at home, when their economy had weakened in 1998.

The 2013 amendment had little immediate effect on the world economy, but the broadcast images of students and young software executives being sent home - in a few notable cases before jeering crowds at US airports - did little to increase any desire for cooperative international action by the countries to which they were returning.

The 'Pride of Sapparo' events

As the recession entered its third year, in 2014, international organizations had been profoundly weakened. Politicians who supported them were in increasing danger of being turned out of office.

Perhaps the last effort to keep to the old system came when Japan began to complain about highly raised SO_2 emissions drifting over from Chinese power plants, which were responsible for a worrying rise in childhood asthma in Nagasaki, Kobe and greater Tokyo. At first Japan took its complaints to the few remaining international organizations, but when they proved to have no power, Japan unilaterally instructed its banks to call back its funds invested in China.

"In late November 2013, a Japan-bound supertanker was torpedoed by an unidentified submarine."

To an unsettled China, weakened by slowly growing trade barriers anyway, and with a national government that could not afford any sign of weakness before its restless citizens, this was too much. Four months later, in late November 2013, a Japan-bound supertanker, passing through one of the many narrow passageways on the sea journey from the Middle East, was torpedoed by an unidentified submarine.

China never declared responsibility, and although Japan obtained a ruling in its favor from the World Court in the Hague, the US and other major powers had no desire to engage in direct war with China. Japan's further protests went unheard, and world media attention soon shifted elsewhere. But now, when memories of WWII had almost entirely passed from living memory, Japan's long-dormant military tradition began to rise once more.

III. KING COAL

A World of Risk and Threat

The previous generation had come to take safe international trade for granted. At the start of the 21st century, it had been cheaper to transport a few pounds of bulk cargo entirely across the Pacific, than to send a postcard from Bremen to Hamburg. But this was only because the sea-lanes were guaranteed by overwhelming US Navy superiority. That changed now. Americans were unwilling to vote the funds to further increase their Navy's size. Rogue submarine attacks continued at occasional intervals in the Pacific; land to sea missile attacks, combined with mines, began to interrupt oil shipments from throughout the Middle East.

"Rogue submarine attacks continued at occasional intervals in the Pacific."

Computer piracy became almost as great a threat. Nations had no overwhelming superiority against private groups, and suffered as a result. Information controls were destroyed, and shipping directions and fuel supplies interfered with; safety mechanisms in long-distance natural gas pipelines could be shut down as well. Sometimes the cyber-piracy was a proxy act for hostile countries; often it was simply for private extortion.

"And in the late 1970s, one oil company after another pulled its investments out of Third World countries."

At first the spot market tried to cope, but soon something more fundamental began to happen. The world has often shifted its energy systems when risks are too large. Supertankers replaced pipelines from the Middle East after 1956, not because of any flaw in pipeline design, but because the Suez crisis of that year showed how risky it was to depend on those land-based pipelines. American utilities had first shifted to oil on a large scale not because their country was running out of coal - far from it - but because coal supplies had been becoming uncertain, due to a powerful miner's union, while oil supplies were safer. And in the late 1970s, one oil company after another pulled its investments out of Third World countries, to avoid the risk of nationalization.

"The very shape of the world's energy system began to change."

So it was now. Through the 2010s, the very shape of the world's energy system began to change.

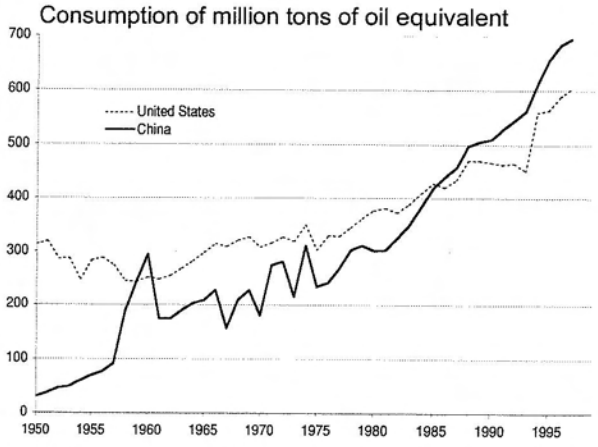
Coal

Coal was the great success story. The earth's crust contains vast quantities of it, and with countries desperate for guaranteed energy supplies, legislation that had made its extraction and use expensive - rules about desulphurization equipment; about mining safety and the like - began to be superseded.

China had already been using large amounts, and now simply increased its consumption. The breakdown of security guarantees on its western and northern borders enhanced this shift, for no Chinese leader was going to trust in natural gas pipelines that had to cross long, politically unstable regions. Since the seas were unsafe, other countries made the same choice wherever possible. Because businesses were increasingly oriented to the short-term, it helped that coal did not involve any expensive or new infrastructure; that it did not entail any long-term technological gambles either.

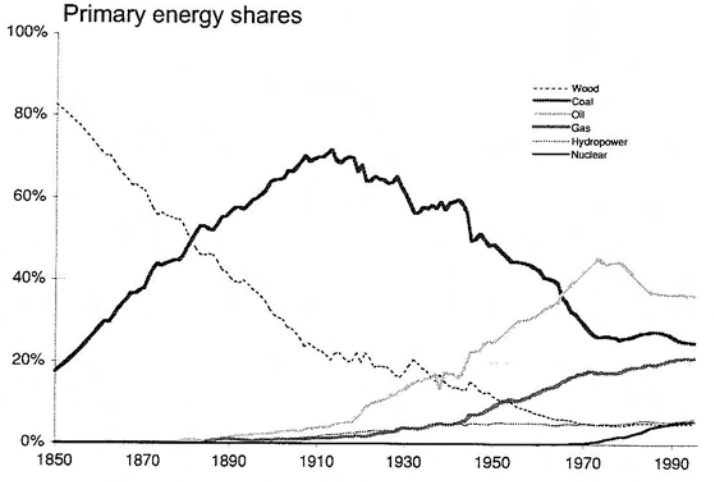
Large shifts on this scale had happened before, and with surprising speed. In 1955, the great majority of Europe's energy had come from coal. By 1972 - a bare 17 years later - that figure had fallen to 22 percent. What the world was experiencing now was simply a shift back.

Coal wins



Source: Vital Signs 1998, Worldwatch Institute

The relative share of energy carriers shifted before

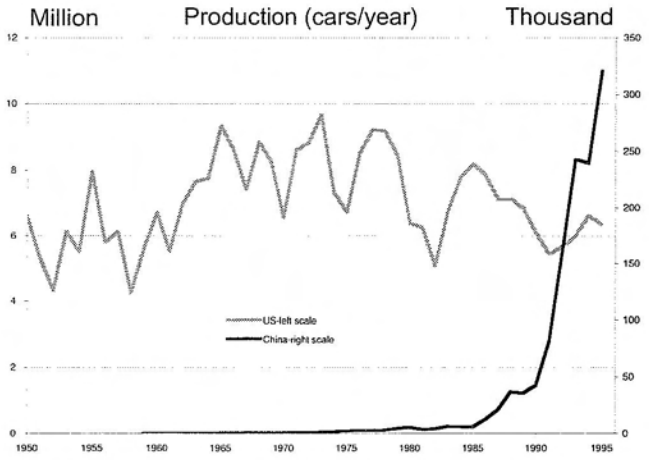


Source: Technology & Global Change, Arnulf Grübler, pg 250 Fig 6.19

Transport

It was not identical to the last time coal had been king, since the world's car fleets needed mobile energy sources. As a result, 'coal-powered' vehicles became popular - but not through the old-fashioned expedient of having coal-fired engines in each car. Instead, coal was increasingly burnt in distant power plants, and then the energy released as electricity was shipped back, for battery powered or hybrid cars to use.

People love cars, in the past...

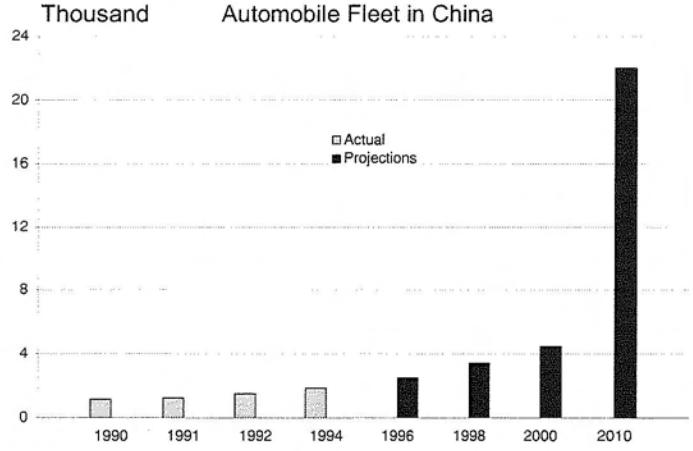


Source: Worldwatch Institute magazine Sept/Oct 1996

There had been hints of that back in the 1990s, when legislation mandating zero-emission cars in California had been unconcerned whether it left net pollution unchanged. What would get poured out in particulate and CO_2 from smokestacks in distant Arizona was not dealt with; all attention was simply on ways to ensure that there would be fewer smog-producing fumes from tailpipes in Los Angeles.

By the late 2010s, this attitude was taken further. The US had long exported polluting manufacturing industries to the Mexican side of the US/Mexico border. Now this was extended to electricity production, and clusters of the lowest-priced systems were installed there. In Europe, an income-desperate Romania became a center for belching smokestacks of generators, whose electricity was sent back to Germany, France and Italy.

... in the future



Source: Who will feed China?, Worldwatch Institute

It was a cynical attitude in many ways, but it fit in with the narrow-focus mood, that problems that were pushed far away were no longer our obligation to deal with. The world's vehicle fleet grew, in rich and poor countries alike, but there was little support for major governmental infrastructure to help it along. A few major toll road systems were built, where returns were guaranteed, but not much else. As a result congestion grew far worse, and a large sub-market grew up, of entertainment and business devices to make use of the time stuck in traffic.

"Congestion grew far worse, and a large sub-market grew up of entertainment and business devices to make use of the time stuck in traffic."

Displacement Technologies

Long-distance transmission and energy conversion technologies flourished in this world. They fed the 'coal-powered' cars, and helped keep whatever pollution was generated in the process far, far from sight. Battery technologies and mobile generation sources were encouraged as well. Some of this was small batteries for car fleets, which always did well when interrupted oil supplies sent gasoline prices high. Larger, free-standing units were in demand for homes or neighborhoods. The situation was analogous to the way wealthy people in East Africa had often had their own mobile generators, to take up the slack when the official grid broke down. As national economies got more difficult, such generators were increasingly demanded as backup for neighborhood and small regional networks.

"Long-distance transmission and energy conversion technologies flourished in this world."

Fossil Fuels

Fossil fuels generally did well. There were hardly any citizen-organized pressure groups arguing for CO_2 reduction, for too many years had passed without any clear signals of global warming. A few businesses wasted time consulting with these quaintly named 'stakeholders', but even these last holdouts soon gently abandoned them.

Governments knew what their citizens wanted - there was a constant mood of angry, assertive complaints - and exorbitant gasoline taxes which had held down oil use in Europe were gradually eased. Decades before there had been a consensus that government agencies could guide the market away from what pure cost considerations laid out, but that was long gone.

"Fossil fuels generally did well."

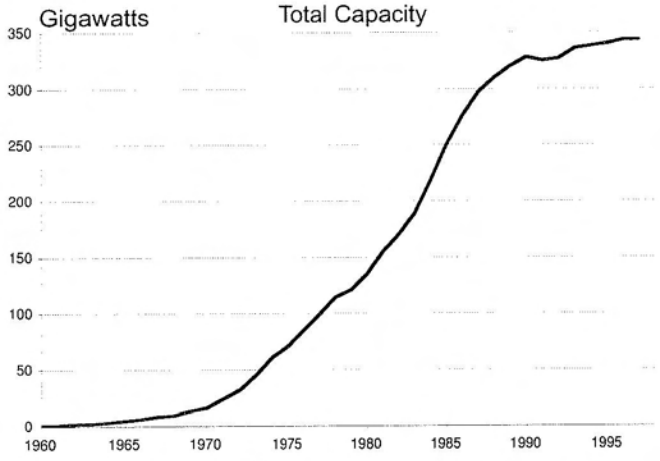
Middle Eastern oil countries should have done well, but the dangers of guaranteeing shipping held down their advantages. Saudi Arabia remained independent in name, but without comprehensive American protection, its policies were entirely the plaything of nearby Iraq. Venezuela did much better, for its location close to the enormous North American and Brazilian markets guaranteed high demand for its oil. The few remaining Alaskan oil fields which had been undeveloped in the previous era had of course long been entered.

"A few businesses wasted time consulting with these quaintly named 'stakeholders', but even these last holdouts soon gently abandoned them."

Nuclear

Nuclear power took an interestingly split path. In most OECD countries it continued its long fade downwards. Investors wanted fast economic returns, and were not interested in such big projects. Also, the fact that the industry had been shrinking for years meant that the most-qualified engineers and managers had often chosen not to work in that field. The quality of their replacements left much to be desired. These unfortunate supervisory skills, as the Crown Commission's inquest later revealed, were what had been responsible for the major radioactive leakage on the shores of the Irish Sea in 2011.

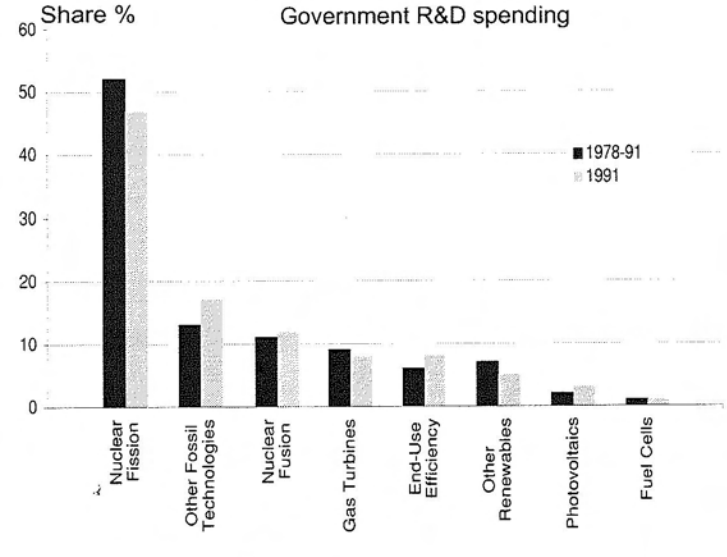
Nuclear, a second S-curve is needed



Source: Vital Signs 1997, Worldwatch Institute

In a few of the developing nations which were not supplied with coal, however, it was different. Elites there had the power to guarantee that decommissioning costs would be covered and that no delaying class action suits would get in the way of immediate construction. Japanese firms were especially active in these exports, building on the enhanced nuclear system which a determined civil service had seen begun.

Renewables still lose out in R & D



Source: Power Surge, Worldwatch Institute

Losers

The losers were all the technologies that were initially more expensive when widespread, lightly regulated coal came back: photovoltaics, wind, wave, etc. There was little incentive for much insulation or conservation either, since those also did not offer the immediate payoff which selling standard energy products provided.

Hydroelectric power would have made resurgence if the developing countries had their way. Much of the opposition to dams, after all, had been led by outside institutions, such

as the World Bank and its early successors. But in an environment of high risk and low trust, putting together stable financing packages of the necessary size was almost impossible. With the breakdown of international cooperation, there were fewer organizations that could fund such large projects.

"The losers were photovoltaics, wind, wave, etc."

Exports

As to exports, there was still a certain amount of dumping of dated equipment to poor countries, despite the barriers of national pride, since there was now little official obstacle to their sale, even if they did produce high levels of CO_2 or other emissions. There also was a small market for very high quality goods, pulled in by elites in all countries. Those were items such as photovoltaics that would keep a local area clean, or very high quality small generators. Rising protectionism kept many of these goods from being freely traded, but since high-profit goods, especially ones desired by local elites, have a way of finding holes in any official barriers, a certain trade in these items continued.

"Rising protectionism kept many of these goods from being freely traded, but high-profit goods have a way of finding holes in any official barriers."

IV. A WORLD TURNED INWARD

Oligarchy Returns

By now, well through the 2020s, the deregulation movement that had once seemed so powerful was long gone. The business landscape had shifted, and oligarchy had returned, building on a steady wave of mergers. Some of this was the natural tendency of business to search for safe, guaranteed markets. It is what had happened in the US after the first deregulation movements, of the 1970s, when the number of airlines first rose, then quickly fell, as consolidation and the advantages of centralized efficiency took over. It had happened even earlier, in the 1920s, when the huge oil trust which governments had broken up, soon coalesced back together in efficient groupings again.

"The deregulation movement that had once seemed so powerful was long gone."

In the uncertain world of the late 2020s, there was even more demand for such guarantees; for anything that would guarantee efficiency. Managers of large businesses felt that they were scrambling within an imploding system. They tried to squeeze ever more value out of their assets, but it was hard, since everyone around them was also scrambling to maintain their relative position. Getting the rights to large, non-contested markets was an ideal way out.

"Managers of large businesses felt that they were scrambling within an imploding system."

It helped that the public was in no mood for ideological experiments. Oligarchies were seen as being good at guaranteeing supplies, and that was all that counted. This did not mean that all firms became hugely centrist. Local demagogues often picked on energy companies operating in their territory, and so highly dispersed structures were often maintained, where it did not matter if one part was cleaved off in a random nationalization.

"Oligarchies were seen as being good at guaranteeing supplies."

Trade Barriers

Tariffs increased, as one country after another put up barriers against competitors. On September 16, 2031, the great Strasbourg conference - the last international conference calling for a return to unrestricted trade - officially declared its fail-

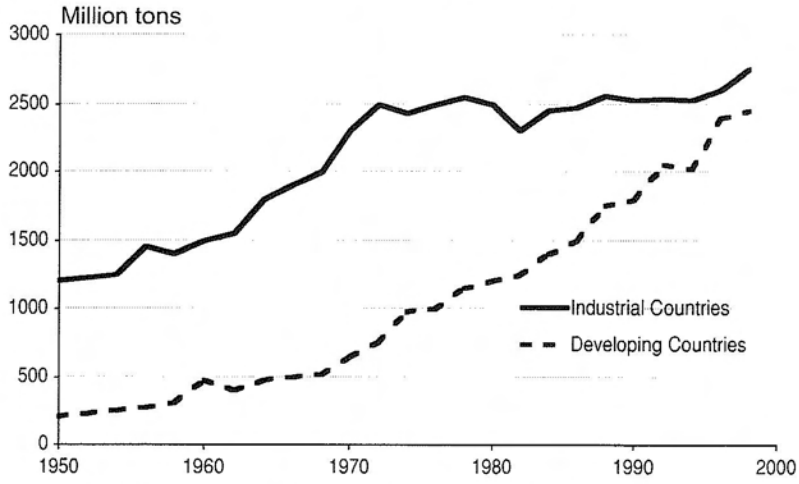
ure. That accelerated a spiral downwards, for the first wave of tariffs had slowed trade enough to make things worse, which now raised calls for even higher tariffs to make up for it. Politicians succeeded who called for a closing of borders, and a general turning inward to solve their nation's problem. The cold-eyed successors of Le Pen in France, Mahatir in Malaysia and Buchanan in America came to power.

"On September 16, 2031, the great Strasbourg conference - the last international conference calling for a return to unrestricted trade - officially declared its failure."

It did not help that all the years of unregulated growth were now having worldwide, ecological effects. Border skirmishes over fresh-water diversions had begun. Massive, border-crossing CO_2 emissions were clearly affecting climate, but aside from occasional bouts of armed intervention, the main response was just to try to block this away, or get its effects delayed, as much as possible.

Regional and then religious trading blocs began to appear, as people turned only to those who believed as they did. France and Italy found that their natural gas was cut off. Their traditional suppliers in North Africa were turning away, to the great pan-Islamic unities emerging to the East, where the call of factors other than immediate cash prices were becoming more important. And in a development not seen for centuries, city-states began to rise again. Their high barriers were forbidding to outsiders, but gave a much-desired linking, a sense of security, to those inside.

CO_2 is rising especially in developing countries



Source: Adapted from Vital Signs 1998-1999, pg 67 Fig 2, Worldwatch Institute

Reversal in Developing Nations

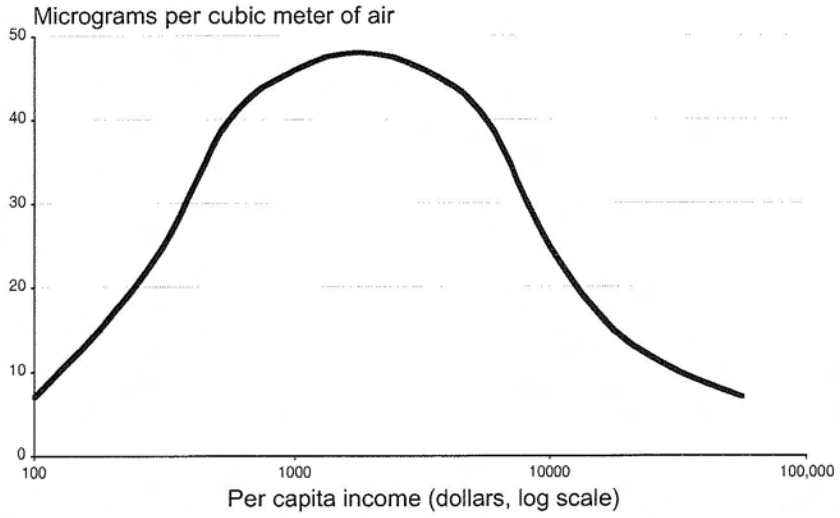
The countries that had once been surging into fast development suffered greatly. Brazilian industries that had exported to North America and to some of the once-booming western Africa states had nowhere to go; Indian firms that had traded with China and other East Asian countries found that markets closing as well.

Internal growth was difficult, and not simply because the newly isolated home markets were so small. Local firms back in the growth years come to turn to local insurers for their largest projects, but those insurers had themselves pooled the risk of

those projects through reinsurance trades with larger, international funds. The increasing trade barriers brought that to an end. No longer did hundreds of trainees from local insurance groups meet at Lloyds in London; no longer could big projects in the now increasingly isolated states go forward with any security. That was especially grievous, for type faults began to appear in several of the standard nuclear plants that had been imported. Wherever single-style systems had been quickly brought in - in genetically non-varied seeds; in a single design of hi-tech water treatment centers - faults which appeared were not localized but spread quickly through all the similar types.

Growth began to choke on itself even more than before. Developing countries were suffering, as per capita incomes fell, and any shift to less polluting industries and transport was long since reversed. A few nations tried to pull themselves out. Thai and Argentinean leaders had put much effort into shifting to natural gas as a solution, since it was an abundant fuel, with few polluting effects. But those efforts only briefly succeeded. It was too hard to organize the funds, hire qualified servicing crews, and - above all - overcome the continued insecurity of sea transport.

Urban concentrations of sulfur dioxide



Source: Adapted from Sustainable Development & The Energy Industries, pg 328 Fig 2

Innovation was no longer the magical solution it once had been. The glory years of high growth before 2010 had been powered by the insights which bright postgraduates, often returning from top American and European universities. Now, though, their home governments could not send them there, and America and Europe were no longer in a mood to come up with thousands of scholarships for non-natives. The engineering, software and biotech students who continued to graduate from top local institutes found it hard to find firms that could use their talents. A few succeeded by going it alone, but the communal ethos was against that, and venture capital funds were hard to find.

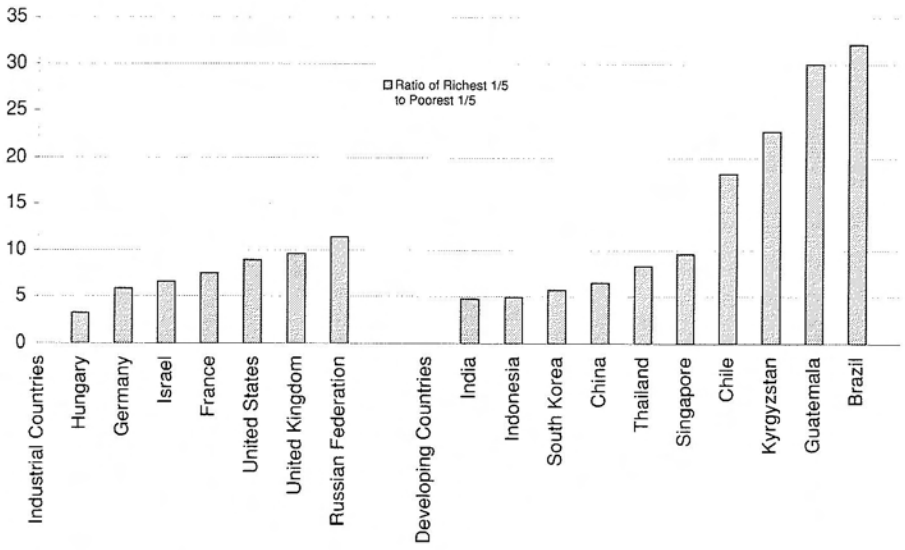
Internal Splits

In many of these countries, massive inequalities returned, and there was an amoeba-like splitting of the population. In India, for example, the more prosperous

members of the professional classes had long been used to spending summer months in cooler resort homes. Now that was made permanent.

The enhanced resorts were called Gandhi towns, in homage to the plain-living founder of their independent nation, and they were immensely attractive. Situated an average of 200 miles from the main cities, no direct air pollution reached them, water supplies were safe, and security was far easier to maintain. Local power was provided by clean photovoltaic or wind resources, while hydrogen resources were available as backups, for those times when troops could not control the main coal-powered facilities, located safely far away, on the edges of the urban agglomerations. To contain the urban populations, fundamentalist currents were channeled as resentment against Pakistan.

Unequality is back



Source: Vital Signs 1997, Worldwatch Institute

OECD Slowing

These effects spilled over to the one-time wealthy countries. Without bright foreign students, innovation slowed at MIT and Silicon Valley's research labs. Trade was down, so there were smaller markets for new products. Asia's demographic bonus had long since dried up, and there was no longer that stream of funds either. Investments were increasingly limited to what a country's own domestic savings could provide. The outer world was no longer a place where ideas and fresh products and useful funds came from; it was, more often on the news or in political discussion, simply a miser-

" It is not the owners of stagecoaches who built railways."

- Schumpeter, 1911
"Theorie der wirtschaftlichen Entwicklung."

able or competing domain, where refugees assembled, or dangerous military encampments were being built up. Japan's decision to remain as isolated from the world system as possible was felt as especially ominous here, even though its new industrial emplacements in Manchuria had - so far - been accepted peacefully by the regional governments in place there.

Home-grown innovation in the other one-time OECD countries was incapable of making up for the shortfalls. The years of taking developing markets for granted - as a place where merely average technology could be sold - now had their effect. Since so many projects had been funded on a standard cost-plus basis, there had been little incentive to improve, for all charges could simply be passed along. Europe had once hoped that fresh energies could be unleashed by new stock exchange listings for local hi-tech firms, but those hopes had long since fizzled out. A negative, backward-looking attitude was taking over. The great number of baby-boomers from the last century were now well into their retirement years, and what they wanted above all else was security, and an assurance that nothing substantial would change. They were quick to sue if anything they did not like took place.

New power technologies and fuels were especially susceptible. Funds that could have gone for product development ended up being spent simply covering risk; the fact that the insurance industry was so damaged from earlier huge payouts made that even more expensive. Only coal-fired plants got research funds, but that was simply because coal was so fundamental that any efficiency boosts there could be counted on being translated into profits. That is why there was continuing work on coal liquefaction for transport, as well as straightforward work on drilling platforms and the like. Otherwise no one was investing for 10 years or longer. Firms which had thought that high-tech and innovative technologies were the way to go forward found they had wasted their time. Funds were pulled to quick, low-risk projects with a sure return.

"The optimistic period decades before was now long gone."

It was a powerful mind-set, quite deadly for each nation's future. Education especially suffered, as there were ever more ballot initiatives or political candidates that reduced state funding of schools. The optimistic period decades before, when taxpayers had invested in top-rate school systems to educate the future generation, was now long gone.

A few individuals and political leaders tried to bring things back. They even had support from the firms that still had personal contacts across the globe, because they had brought locals into senior executive ranks before the trade barriers had gone up. But the

"The moment technology slowed down, everyone with an installed base immediately had a great deat to lose."

task seemed impossible. Everything that went wrong occurred slowly, and separately. There was no clear jolt to push anyone onto a different path. Also, the moment technology slowed down, everyone with an installed base immediately had a great deal to lose if they encouraged fresh products. And as to social innovation, or new political attitudes that would turn things around? That was out, entirely: Times were harsh, and this was no moment to engage in wasteful experiments, that might lower each nation's guard.

"Times were harsh."

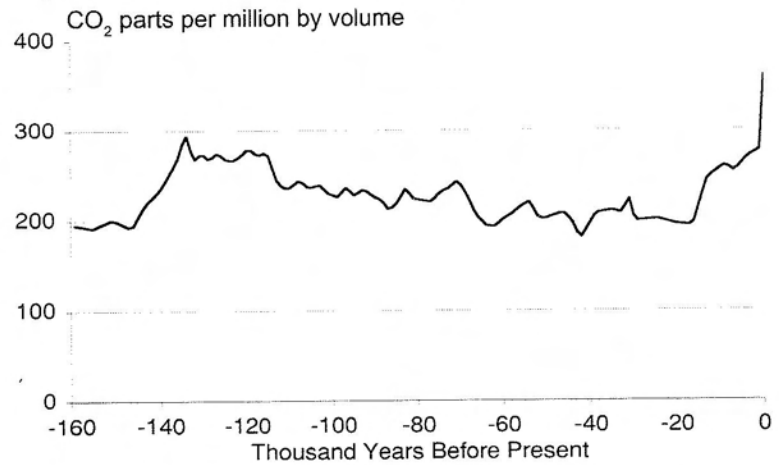
An old parable tells of a frog that was put in a kettle of cold water. The heat was gradually increased, but since it occurred so slowly, the frog did not react, and stayed within that dangerous kettle till it died.

GEO*polity* – Kyoto Rules

It is now 40 years since the establishment of our beloved GEO*polity* organization, and as there are young citizens not fully aware of the blessings which it has bestowed upon us - the order and security which it has granted to us all - the Auditor-General has most kindly granted me the time to write out this brief history.

In the '90s of the last century, Earth's carbon dioxide levels had reached their highest levels since 160,000 BC. Mankind was aware of this, due to ice core samples taken from the Antarctic continent, but little action was taken to avert the impending crisis....

Maybe the Climate is changing



Source: Vital Signs 1995, Worldwatch Institute

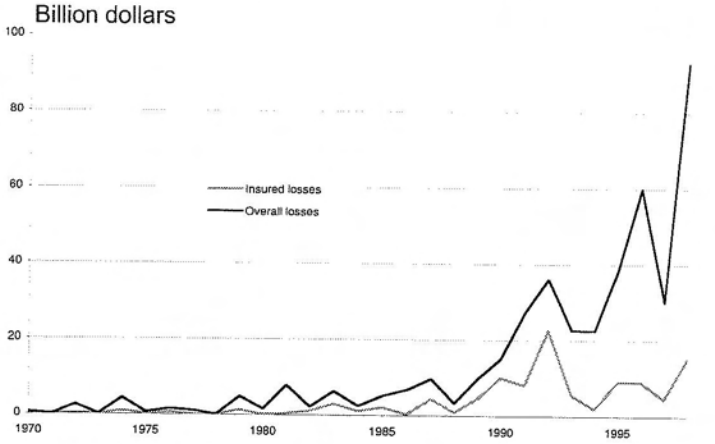
I. GEO*polity* BEGINS

Eco-Shock

The first flooding occurred in the Nile delta, in the late summer of 2003. Natural coastal barriers had been shrinking for decades, due to sediment trapped behind the distant Aswan dam. Only a few thousand people died in the first floods, but many more fell to new forms of bacterial infection which bred in the stagnant, overflowing waters.

Rioting broke out, in protest at the Cairo government's inability to cope, but this was displaced on the world's news-screens by the far graver crisis beginning a few weeks later in Southeast Asia, and the Indian subcontinent, where strangely unseasonable weather conditions destroyed peasant crop harvests over large regions. World grain reserves had been declining steadily since the late 1980s, and since this coincided with the unforeseen rainfall surges that held down the US and Canadian harvest, famine occurred in parts of Malaysia, Northeastern India and China. And then, even as the news reports from inland regions of China were first coming in, the unabated North American rains led to mudslides in California, on a scale that had not been recorded in over a century. In all the confusion, stock markets and even bonds began oscillating strangely. Insurers were pulling out of one national market after another.

Disaster happens, and insurance cover gets less



Source: Vital Signs 1998, Worldwatch Institute

United Response

Humans are a highly suspicious species, and under times of mild stress often refuse to act together. In the 1970s, when an American president declared that high gasoline prices were the moral equivalent of war, he was quickly met by opponents wearing pins with the mocking acronym 'M.E.O.W.', and his political calls were not answered. At times of greater stress though, a wartime-style cohesion can

"Humans are a highly suspicious species."

"At times of greater stress a wartime-style cohesion can take effect."

take effect. A later American president, unsurpassed in his ability to read the popular mind, once mused that if humankind were faced with a threat from outer space, they would put down their national differences, and join together to battle the threat.

This is what happened after the famine and floods of 2003, just as it had after previous disasters. Following the decades of Napoleon's wars, Western Europe's leaders set up institutions to resolve future conflicts by peaceful means, and these lasted for almost a century. After the 1930s Depression and WWII, the Bretton Woods agreements establishing an international monetary system were accepted, and strictly abided by, for decades after as well.

"People simply wanted the uncertainty to end. It had been too much, too fast."

In 2003, a few neutral scientists still were not convinced the floods and harvest shortfalls were more than isolated events, but politicians picked up the near-universal public mood that future global shocks had to be averted, and that was enough. People simply wanted the uncertainty to end. It had been too much, too fast.

The new 'GEOpolity'

The new authority which was established in response to the 2003 turmoils developed out of the World Trade Organization, since this was the global organization with the greatest reputation for being crisply competent. The core staff that had been enforcing the Kyoto Accords was immediately brought over, while additional technocratic staff was supplied by the elites of the Japanese MITI, the French Civil Service, the U.S. Treasury, and several respected non-profits. It quickly renamed itself 'GEO*polity*' - for 'Global Ecosystems Organization'.

"The core staff had been enforcing the Kyoto Accords."

If the floods and crop failures had arisen a decade before, big business might have been turned towards to fix it, but the wild currency fluctuations that had occurred in the last two years of the 20th century had discredited pure capitalism, or at least the belief that unfettered transactions, alone, could maintain a stable system. Conventional national governments were also too weak; discredited from their failures to resolve persistent unemployment at home, let alone the constant bluffing and then retreats in face of the ongoing India/Pakistan tension. The U.S. was still the world's strongest military power, but no one - not least its own politicians - wanted it to take on the full burden of acting alone.

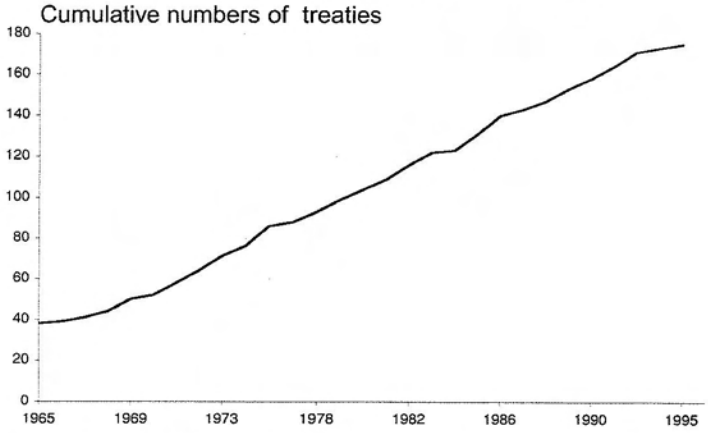
"The 20th century had discredited pure capitalism."

II. WHAT A DIRECT BUREAUCRACY DOES

Strict Rules: First Energy Shifts

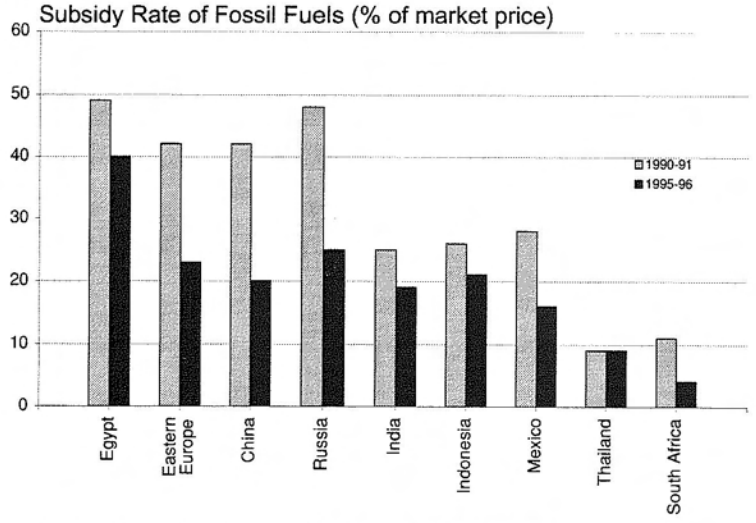
An eco-shocked world demanded firm early action, and the powerful GEO*polity* bureaucracy responded to the call. Rising carbon dioxide levels were seen as the reason for the environmental disturbances. GEO*polity* immediately put in place strict rules to cut back on those emissions. There were higher taxes on coal and oil, and cutbacks worldwide in subsidies for higher carbon fossil fuels. On the positive side, GEO*polity* gave strong support for nuclear energy and natural gas. Planning permission was suddenly available for the facilities GEO*polity* wanted, while regulations were imposed hampering the oil pipelines or coal facilities it did not. Firms with long-term commitments in coal did badly, but ones that had taken positions in renewables, natural gas and nuclear suddenly found the path forward wide open, and their choices a source of public support.

Ecological treaties have a long history ...



Source: Worldwatch Institute

Subsidies, though diminishing, are still a potent tool

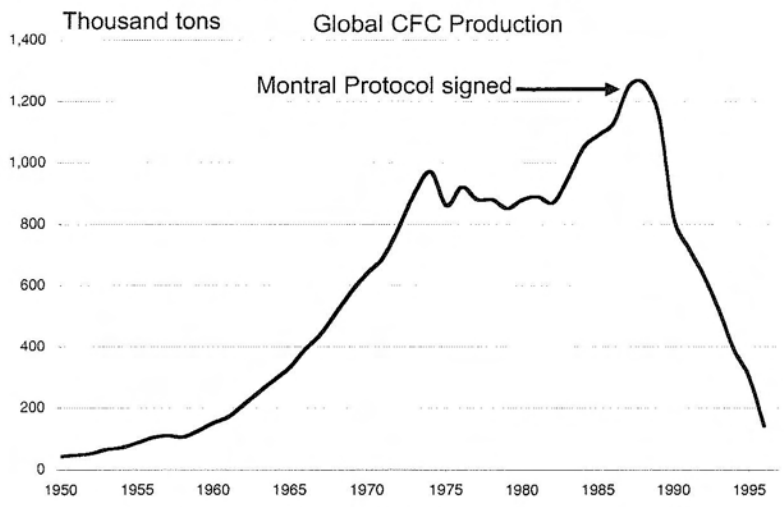


Source: State of the World 1998, Worldwatch Institute

Some economists proposed more indirect measures, but there was no support for doing anything but attack the problems directly. The goal was to shift the world's fuel mix, and these direct measures - taxes and regulations - were accepted as the quickest way.

As often happens when bureaucratic targets are very clear, there were a number of quick improvements. CFC production had declined rapidly in the late 1990s, in line with the precise directives set by the Montreal Protocols of 1987,

Regulations work !



Source: Vital Signs 1998, Worldwatch Institute

as amended in 1990. Just a decade after the 1975 legislation requiring improved efficiency in American cars, new vehicles coming off the assembly line had double the mileage of their predecessors; within another decade, they were emitting only five percent of the pollution they had before. So it was here, with the worldwide 2004-2005 shift away from indirect subsidies on high carbon fuels having the strongest effect. Countries that had held back natural gas fired generators, for the sake of preserving their coal industries, were now pressured to reverse course. The new plants quickly came on stream.

Strictness Accepted

The inflexible early directives of GEO*polity* were widely accepted, for reasons even beyond these first successes. In Asia there was a long-standing tradition of deference to authority, as well as the vivid memories of the 2003 famines. This more than made up, at first, for the cutbacks on coal which hit especially hard there.

GEO*polity*'s authoritarianism also resonated in Asia with what was now often nostalgically referred to as 'the glorious 20's: the two decades from the late 1970s to the late 1990s when so many Asian countries had achieved prosperity under similarly authoritarian leadership. Russian citizens accepted GEO*polity*'s strict approach for another reason: capitalism had never really taken in their country, and the idea that some centralized authority should run things seemed entirely natural.

In China, the residual Communist Party leadership was especially satisfied with GEO*polity*. Many of the coal-fired power plants in China had been built with private funding, and selectively cutting back a few of those plants was a way for the state to re-assert control. Keeping the entire nation motivated by the GEO*polity* directive was also a way to keep the still-prosperous cities in the Hong Kong hinterland from drawing away from Beijing's control.

Most of all, GEO*polity* restored China and Russia to an appropriate position of centrality in the world: listened to in the corridors of power; their consultations about coal levels reported worldwide, with the same attentiveness that had once been given to the huddled meetings of OPEC officials decades before. For while the Persian Gulf had possessed 2/3 of the world's oil, China and Russia - along with the US - had 80

percent of the world's coal. When GEO*polity* decided that rogue power plants operators in the Pacific region were emitting too much CO_2, it was a joint operation of the Chinese and Russian fleets that carried the international force of troops who took back control in the autonomous Kamchatka peninsula of Siberia to the north, as well as in the densely populated regions of Indonesia to the south.

Western countries also accepted GEO*polity*'s command and control style at first. There were residual memories of the successful linkages between local farmers and government, which had led to rural electrification in many OECD countries in the early 20th century, and which had been behind the successful land reforms in Taiwan and other countries in the years after WWII. For over a century the U.S. Department of Agriculture has been encouraging links with farmers, while often promoting a particular environmental line, such as contour plowing to limit topsoil escaping.

What made Geo*polity* especially accepted in the West now though was that the era of individual permissiveness which had come out of the 1960s was now long in the past. Schools throughout America and Western Europe encouraged responsibility; government programs were only accepted where they insisted on the acceptance of obligations. Aging baby boomers had had enough of unsettling change. Younger, Generation X adults, now politically powerful in their 30s and 40s, were often children of divorced parents, and also supported stability and certainty. Perhaps most importantly, across the planet, there was great comfort in sharing a purpose, and feeling that some central authority was in control.

Many firms that might have been expected to resist GEO*polity* were willing enough to support it, for they too wanted the protection it could provide. Business was more restricted under GEO*polity* than it had been during deregulation, but at least what was allowed was certain. In the years just before GEO*polity*, court cases had begun charging large energy firms with being responsible for global warming. The claims being demanded dwarfed the billions of earlier tobacco and asbestos payouts. Now that was over. When France and Japan had put their technocracy behind nuclear power in the 1970s, or when America had engaged in open-air atomic testing in the depths of the Cold War in the 1950s, large-scale litigation against any of the firms involved had been disallowed. GEO*polity* left the fuels and processes it did not want relatively unprotected, but litigation against the fuels was just not allowed.

"When France and Japan went nuclear in the 1970s, litigation against any of the firms involved was outlawed."

GEO*polity* raised its funds through national subventions, and also by the selective taxes. Governmental taxes on undesired energy forms had a long pedigree, going back at least to the Nordic experiments at the end of the 20th century, which too had been politically sustained by the belief that the sacrifices they involved served a higher, unifying purpose.

III. ENERGY IMPLICATIONS

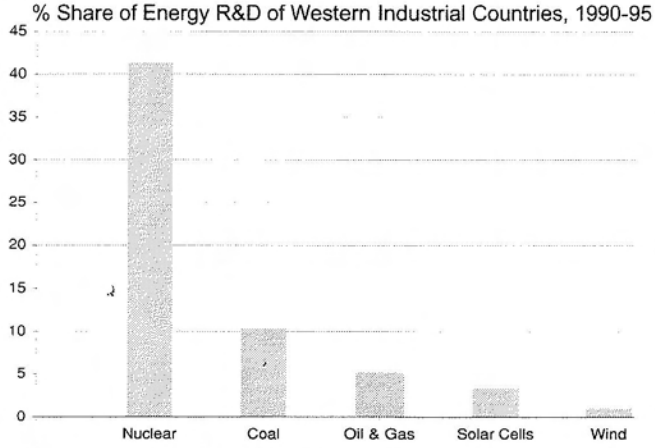
Directed Innovation: Further Energy Shifts

What GEO*polity* did with its great power and funds was not entirely negative; not simply a reduction of obvious CO_2 weak spots. Funds were also provided for hydroelectric projects, and civil engineering and turbine companies prospered. Latin American was especially favored, since the flow of its many rivers through different countries had made cooperative projects difficult before. GEO*polity*'s authority naturally raised the power of local regional groupings, such as Mercosur, to coordinate and fund those waiting projects. There was reforestation to encourage the take-up of atmospheric carbon dioxide. Wind power sites within transmission distance of major populations were also encouraged. Since natural gas was strongly promoted, a range of Caspian region pipelines were brought along. Port facilities for receiving it were given tax breaks, and funds were targeted to them.

"A few scientists complained that it was difficult getting funds for open-ended research."

In a few areas, entirely fresh research was promoted. Even with strong and widespread support for GEO*polity*'s objectives, it was hard to see any end to the individual car. Suburb to suburb commuting was the largest individual driving pattern in OECD countries - it had surpassed the traditional suburb to city pattern in America as long ago as the late 1980s - and this meant that mass transit could not easily replace it. The biotechnology industry was encouraged to look into new fuels, and improved fermentation processes for producing ethanol from plants were under development. Research into next-generation car batteries was funded, as was work on fuel cells; better pipelines for possible carbon sequestration from power plants were also being devised.

R&D, though lop-sided, continues



Source: Paper 134, Worldwatch Institute

A few scientists complained that it was difficult getting funds for open-ended research, of the sort where no pre-determined targets were aimed at, and the experimenter's own creativity was the only constraint. But with pressing environmental needs taking precedence, these complaints were largely ignored.

Much to the disappointment and surprise of environmentalists, the new GEO*polity* administration did not switch as many funds to renewable energy research as they

had hoped. Bureaucrats like large, easily replicable systems, while the public simply wanted solution that were ready and worked now. Because of the relatively low R&D in renewables before GEO*polity* began, photovoltaics and wave power were not at that stage. It did not help their case that French technocrats skillfully pushed the advantages of using France's already-installed base of CO_2-free nuclear stations as the basis of a massive export program.

Winners and Losers

This was France's world, as well as countries like it. Under Louis XIV, its belief in hierarchy and state-centered order had allowed it to dominate Europe; in the 1950s and 1960s a similar deference to a technocratic elites had led the country to high and sustained growth rates. Peasants from the French countryside had powered that transformation; using new American-style technology; building an infrastructure of great dams, roads, and in time nuclear power stations. France's diplomatic mandarins had deftly finessed arrangements to their national advantage in the bureaucratic cauldron of the early European Community. Now, in the early 2010s under GEO*polity*, all those abilities came to the fore again. Bewildered American and Nordic representatives could not understand how quotas always seemed to end up to Paris's advantage; how these seemingly friendly experts danced around them in final discussion papers.

"This was France's world."

"American and Nordic representatives could not understand how quotas always seemed to end up to Paris's advantage."

China's diplomatic and bureaucratic elites also managed very well, but the greatest success story was Japan. It did not have to worry about protecting its energy imports, for GEO*polity* had access to enough military might to take care of that. Nor was its aging population proving to be the hindrance which had once been expected. Instead, under GEO*polity*, Japan's skills in slow, incremental technology came to the fore. The shocks that had triggered GEO*polity* even had a salutary effect, ending the bickering government struggles which had regularly slowed Japanese growth in previous years.

"Japan's skills in slow, incremental technology came to the fore."

A mark of these successes was the shift in where top university students went for their graduate studies. In the 1880s, Germany had been a prime destination, because of its admired legal apparatus, as well as its dominance in new chemical industries. In the 1980s, graduates worldwide had aimed at America, for MBAs at Stanford,

Chicago or Harvard. By the 2010s however, a UN/Gallup surveys of 1,000 top international graduates found that France's Ecole Polytechnique was highest on their preference list, with Tokyo University's Department of Law coming a close second.

Arab nations were some of the biggest losers. GEO*polity* had taxed coal, but it had taxed oil even more. In theory that should have harmed high-cost North Sea oil producers the most, since Middle East producers had production costs so low that they could have absorbed the tax simply by lowering their profits, thus offering their oil at the same final price as before. But the regulations were drafted to disallow that. The low industrialization rates of the Arab countries had made them a less powerful market for OECD capital goods than the fast developing Asian powers, and that, combined with a lack of the nuclear arms which China and Russia possessed, had translated into less politicking pressure when the tax additions were imposed. Saudi Arabia suffered the most, for the religious dissension spreading from a politically broken Egypt - combined with ever-increasing difficulty in censoring video images of the Saudi elites at play in expensive foreign locations - finally cracked the tenuous hold of the House of Saud.

"GEOpolity had taxed coal, but it had taxed oil even more."

North African Arab countries did better, since French influence within GEO*polity* ensured that their natural gas supplies would be the first to get preferential export support. Partly this was because of proximity across the Mediterranean to France; partly because of the opportunity to support francophone cultures. For the same reason, any hydroelectric expansion which local Quebec governments wished to engage in was quick to be approved by the GEO*polity* bureaucracy.

Business

Businesses and especially energy companies were vilified at the start of GEO*polity*, since their oil products and power plants were seen as the most immediate cause of the eco-shocks of '03. It was a situation the industry was long familiar with, since exactly a century before, under John D. Rockefeller, it had been equally vilified as the incarnation of all evil. That first attack had quickly enough turned around, for within just a decade of the fiercest attacks on Standard Oil, an astonished British ambassador noted how the White House had 'completely reversed the prewar relationships under

"Businesses and especially energy companies were vilified at the start of GEOpolity."

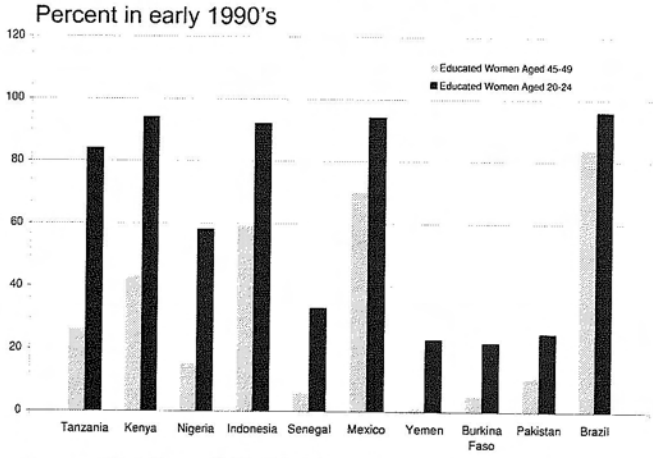
which it was nothing less than courting disaster for any member of the administration to incur the suspicion of an affiliation with the oil interests.'

The 2010s saw the same reversal, as energy firms quietly courted the powers that be in the central and regional GEO*polity* administrations. It was possible to maintain profitability, even while controlling less of their activity than before. They offered their services in fulfilling the direct research tasks which GEO*polity* had set; they efficiently helped meet the targets of miles of gas pipeline constructed, and numbers of coal scrubbers to be retro-fitted. Where GEO*polity* bureaucrats had been over-ambitious, and set goals which even the largest international construction companies could not fulfill on time, oil companies which had long understood the wisdom of helping great potentates were quick to volunteer their considerable expertise at cost. Oil companies which were able to use their North Sea and related rig expertise to set up offshore wind turbines were especially appreciated. The issue was not so much one of profits - that was secondary at first - but of appeasing the all-powerful technocrats, whose decisions controlled the market.

"The issue was not so much one of profits but of appeasing the all-powerful technocrats, whose decisions controlled the market."

Firms that developed their skills at navigating these bureaucracies prospered. Sometimes this led to direct gratitude and inside bidding in return for services rendered; sometimes - even more importantly - it led to having an inside track on exactly which of the many possible strands in GEO*polity*'s officially set policies were going to be carried out next. In the first, 1990s, administration of the late Lord Blair of Islington, the British government had declared support for the jobs which maintaining the British coal industry would ensure; yet it had also, quite contradictorily, declared support for reduced pollution, which only ending those jobs would produce. Which aspect of policy would prevail at any one time was of central importance for generating firms to know, and only close attention to the minutiae of government could grant that knowledge.

More Women are getting educated



Source: Vital Signs 1998, Worldwatch Institute

The same issue arose in GEO*polity*, only on an immensely larger scale. New products were good; but establishing personal relations with key regulators, and thereby learning which targets were likely to be selected next, was of far greater importance. In this process, canvassing the views of distinguished white males was no longer suffi-

"Texan and Saudi firms uncomfortable with these powerful Asian women were left behind."

cient. At various times in the decade before the 2003 disturbances, women had been in power or close to assuming power in India, Pakistan, Malaysia, Japan, the Philippines and Burma - six nations with a total population greater than that of Western Europe and North America combined. Their political successors were of proportionate power in GEO*polity*. Texan and Saudi firms uncomfortable with these powerful Asian women were left behind.

IV. ISOLATION, FAILURE AND OVERTHROW

Isolation and Failures

As businesses and national governments increasingly pandered to GEO*polity*, it gradually became cut off from the consequences of its actions. This was dangerous, for although GEO*polity*'s first sharp directives had been effective, by the early 2020s the failures of a strict, bureaucratic approach were becoming apparent to more and more people on the outside. GEO*polity*'s regulations were exhausting, and its micro-management was imposed by distant bureaucrats with insufficient expertise in the problems being faced, just as the World Bank had done in many developing countries years before.

"As businesses and governments increasingly pandered to GEOpolity, it became cut off from the consequences of its actions."

Even free markets can occasionally lock-in mediocre designs or resource choices, but bureaucratically-decreed investment decisions have a propensity to do it as a matter of course. Japan's renowned MITI had forced Japanese firms to concentrate on mainframe computers back in the 1970s, just as the personal computer revolution was about to begin. Now in the 2020s, even though nuclear energy produced no carbon dioxide, the French-inspired crash program to increase its prevalence had not been the wisest of resource uses. Nuclear power had produced only a small percentage of the world's output at the start of GEO*polity*, so even its doubling - a massive, expensive program - reduced global CO_2 levels barely at all.

"Free markets can lock-in mediocre designs or resource choices, but bureaucratically-decreed investment decisions do it as a matter of course."

China's active participation had been crucial to GEO*polity*, but this meant the vast quantities of coal which China and India burned were only gradually declining. The huge amounts of coal the world used going into the 21st century carried a huge inertia, which was difficult to overcome. Natural gas exploration and delivery had increased immensely, but just as with nuclear power, its initial levels had been so low - only about 14 percent of world generating capacity at the start of GEO*polity* - that even doubling the final capacity had only slight effects.

"CO_2 sources had proven equally hard to control."

Other CO_2 sources had proven equally hard to control. In poor countries, a great amount of CO_2 production could have been avoided if people had used more effi-

cient home appliances, or installed even the most basic of housing and industrial insulation. But in those poor countries the great majority were preoccupied with daily survival, as they always had been, and scarcely responded to these distant bureaucratic regulations that would have raised their costs - why throw out a serviceable appliance? - in the short term.

"These failures were hard to ignore, since GEOpolity had established wide awareness of global CO_2 levels, and now was held to them."

These failures were hard to ignore, since GEO*polity* had established wide popular awareness of global CO_2 levels, and now was held to them. The atmosphere works with long feedback delays, so the promise of a great shift downwards was impossible to fulfill within a bare two decades. And since mass opinion can often only be mobilized behind the simplest of slogans, there was little understanding that reducing other greenhouse gases could be cost-effective.

Harsher Directives

GEO*polity* responded to these public failures as most organizations will, by simply hardening its original views. The great tradeoff from the early days of GEO*polity* had been to leave the world's car fleet largely alone. (That had been part of the political trading needed to get full, North American approval.) Automotive CO_2 was supposed to have gone down through the mechanism of higher gasoline prices alone. But people liked their cars so much - demand was so inelastic - that there had only been a temporary dip. World car production and ownership rates soon rose enough to largely counterbalance that fall. The promise of fuel cells or hybrid vehicles taking off had not come true.

"GEOpolity responded to these public failures by simply hardening its original views."

Since the previous rules had not succeeded, GEO*polity* would now have to be harsher. The long-avoided Article VI rules from Geo*polity*'s founding charter were invoked. Driving quotas were imposed on North America and the other one-time OECD countries. A range of other intrusive measures were taken as well: there were interceptions of gasoline shipments; impoundings of the vehicle fleets of several large companies; arbitrary arrests of factory managers who may have violated efficiency-savings quotas.

Rising Dissatisfaction

It was too much. GEO*polity* had never constituted a world government, but simply had worked in parallel and slightly in command of pre-existing national governments. Those national governments and their independent courts had sustained the notion of individual rights, and resistance to arbitrary regulations. In 2003 and the first years after - at the gravest moments of world crisis - some of those rights had been willingly suspended. By the late 2020s though, the gravest weather changes and resource problems seemed to have been averted, and what remained was now accepted as a manageable part of ordinary life. A new generation had come of age, which had never looked up to GEO*polity* as an all-wise source of salvation. Also, there was less feeling that everyone was in the same boat. Citizens of wealthy countries who had been willing to slightly raise their taxes to help subsidize poorer countries' CO_2 reductions now thought again.

"A new generation had come of age, which had never looked up to GEOpolity as an all-wise source of salvation."

The Interregnum

The interregnum struggles lasted for 20 months, and at one point looked close to provoking international war. But the armed forces which had been seconded to GEO*polity*'s control from national armies refused to follow the directives ordering action against recalcitrant countries. Too much of GEO*polity*'s once-great authority had been diminished, and no looming ecological threat was seen as strong enough to justify these acts.

"The armed forces which had been seconded to GEOpolity's control from national armies refused to follow the directives ordering action against recalcitrant countries."

Three major factions began to take shape. The first one, associated with GEO*polity*'s senior secretariat, was willing to revoke Article VI, but still wanted to maintain a hard, militarily-backed regulatory system. But the secretariat's credibility was greatly diminished when a series of massive explosions occurred in the network of hastily constructed Liquefied Natural Gas (LNG) deep-water docking terminals. Investigators traced the faults to shoddy construction techniques which certain members of the secretariat had approved, and although censorship was applied in many countries, substantial fragments of the report reached the public.

The second faction, which wanted to end GEO*polity* entirely, grew in strength after the explosions. Isolationists in the American West and South gave it strong sup-

port; so too, in a strange alliance, did many regional administrations in Greater China. The new natural gas plants and alternate fuels had taken over some of the gaps which GEO*polity*'s coal-reducing directives had insisted upon, but the substitutions had never been complete, or entirely cost-effective. Separatists in both the Guangzhou region and the increasingly autonomous Manchurian industrial zones felt hampered by the rules. But although there was widespread upset at GEO*polity*'s excesses, the desire to nestle under some overarching governmental authority was too strong to let this view prevail either.

The faction which triumphed was a third one, which promised that it was possible to continue oversight of the still fragile world ecology, yet to do so in a way that avoided the worst sorts of direct intrusion. Even more, the third faction promised that its approach would automatically start up a positive shift in life-styles to lead large parts of the world away from the worst dangers. Supporters of the first two factions united in declaring these promises irresponsible; sheer examples of pandering to the masses' desire for neo-religious fulfillment. But that had little effect. Enough people still wanted guarantees; certainty. On September 16, 2031, the third faction assumed power.

"The faction which triumphed was a third one, which promised oversight of the still fragile world ecology, in a way that avoided the worst sorts of direct intrusion."

V. WHAT INDIRECT BUREAUCRACY DOES: 'NEW GEO*polity*'

Financial Incentives

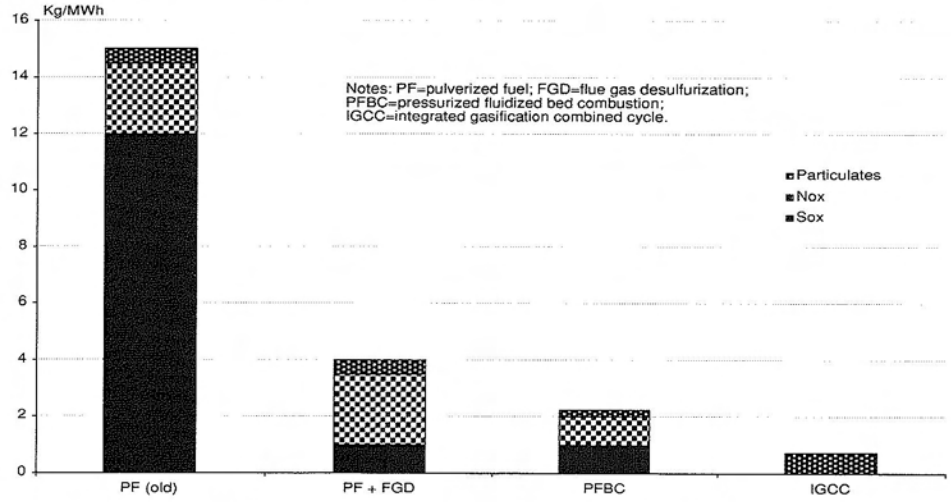
The revamped authority was called NEW GEO*polity*. Instead of concentrating primarily on shifting the world's fuel mix, as its predecessor had attempted, it declared its commitment to reducing wastages. Its work was based on two slogans, the first of which was called 'lease-averaging'.

"The first of which was called 'lease-averaging'."

Lease-averaging was given its first trial in the stronghold of NEW GEO*polity*'s opponents, within the Manchurian industrial zone. The owners of 200 of the main factories and offices outside Harbin and Sheyang were told that from now on they would send their payments for energy costs not to the local energy companies, but to NEW GEO*polity*. At the same time, NEW GEO*polity* would bring in energy auditors from Beijing to design and then fit more efficient machining, ventilation, and lighting systems.

Only 80 of the factories accepted the offer, but as the improvements came on stream, energy usage went down, in many places by over 30 percent. Users never had to face the hurdle of higher initial charges, since those were entirely borne by NEW GEO*polity*. As the other managers saw their competitors now enjoying lowered monthly energy costs, they petitioned NEW GEO*polity* to be let in on the trial scheme.

Coal works. Emissions are down ...



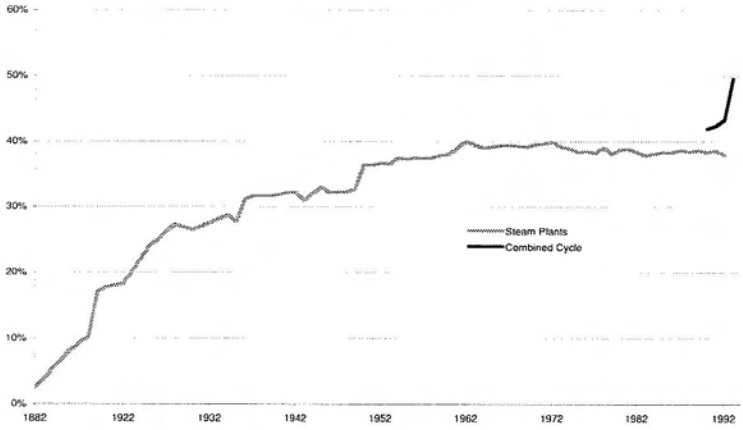
Source: Adapted from Sustainable Development & The Energy Industries, pg 184 Fig 2

In wealthier countries, NEW GEO*polity* carried out lease-averaging in a form reminiscent of certain experiments in the secondary mortgage market in America in the 1990s. Just as in the Manchurian case, the individual owners had no need to put

up initial capital themselves to be able to get savings or loans to help with energy efficiency.

NEW GEO*polity* had to cover its own initial costs, but these were not as great as opponents had suggested. Concentrating on secondary mortgage providers greatly magnified the money which NEW GEO*polity* put up. Also, the success of the Manchurian experiment was publicized, and quickly sought for in Madras, Buenos Aries and then in the heartland of the one-time OECD countries. Each success reduced the extra charges that were demanded to cover the ostensible risk of these retrofits and energy-savings. There was an added benefit. The great number of housing retrofittings helped keep unemployment down, for that was a task that inherently involved detailed, local work.

... and electric efficiency is up, again



Source: Power Surge, Worldwatch Institute

Changing Mind-Sets

To further encourage popular support, through the 2030s NEW GEO*polity* began promoting the belief that efficiency savings were an active rather than a passive response to the world's problems. The new directorate was persuaded to do this by NEW GEO*polity*'s research department, which had found a curious article from the old journal 'Foreign Affairs', published decades before the atmospheric CO_2 problems peaked. The article had listed possible advantages of increasing growth through upped efficiency, but the author had unfortunately titled his suggestion a 'Soft' energy path - and this had immediately discredited his views in the corridors of power.

The NEW GEO*polity* directorate commissioned a study of late 20th century mass psychology, to better understand the power of labels in shifting belief. Railway systems that were seen to be funded by government 'investment', it found, generally received great support; but ones relabelled as funded by government 'subsidy', saw any support quickly fall. (The effect was what energy companies had experienced in the first decade after the 2003 shocks as well: at first vilified as the carbon-emitters, several had

"Systems that were seen to be funded by government 'investment', received great support; but ones relabelled as funded by government 'subsidy', saw any support quickly fall."

managed to shift popular perceptions enough to be thought of once again as the needed energy-suppliers.)

Virtual-Creation

As a result of these studies, NEW GEO*polity* labeled its next program 'Virtual-Creation', emphasizing the solid, positive contribution efficiency would create. The modality was shifting as well, and in 'virtual-creation' responsibility was offloaded even more directly to the final users than it had been in 'lease-averaging'. NEW GEO*polity* oversaw further cuts in usage, yet without being directly involved in collecting payments, selecting energy auditors, or supervising their work. It did this by simply reimbursing utilities and oil companies for part of whatever savings they created.

"Its next program was called 'Virtual-Creation'."

The model for this was the practices of the one-time California utility, Pacific Gas and Electric (PG&E). Back in 1980 it had been a standard 20th century utility, with plans for nuclear and other power stations to fulfill the demands of the growing economy within which it was set. Little more than a decade later though, it managed to abolish all of its own construction and engineering functions - and still earn more money than ever before. The reason was simply that California government regulators of the time ruled that it could keep between 15 and 30 percent of whatever savings in energy usage it managed to get its customers to achieve.

"The reason was simply that regulators ruled that it could keep upto 30 percent of whatever savings in energy usage it managed to get its customers to achieve."

At first PG&E had tried to achieve the savings that would earn it this profit in a direct manner, sending in its own specialists to large industrial users, or giving individual customers rebates if they bought energy-efficient equipment. Gradually though it too had seen the advantages of stepping back from direct supervision, with all the difficulties of billing, and decision-making that entailed. First it shifted its rebates to the sellers of selected energy-efficient equipment, and then it went even further, accepting bids by industrial users, and giving out rebates to those which promised the greatest reduction in energy use. It did not have to concern itself with any of the inner details. In the mid 1990s, barely eight American states had experimented with such systems. In NEW GEO*polity* now, the program was applied world-wide.

Problems With the Indirect Methods

The CO_2 reductions that resulted were immense, and NEW GEO*polity* was safely established in world opinion. But although reformist economists had long promoted the indirect measures which NEW GEO*polity* had now taken, they, like so many other radicals, had never examined the new problems their very reforms would create. A number of unanticipated effects arose.

In the previous system, for example, there had been a market value for digging or pumping up fossil fuels, but (aside from estimates of future market earnings) there had been no value to leaving them in the ground. Under NEW GEO*polity* that shifted, and a program of set-aside payments began. This however produced the same distortions as the agricultural support systems which had once dominated the life of European and American farmers. Funds went to paying firms for buying up and then leaving fossil resources, with the result that several firms shifted away from research, efficiency or distribution, to capture these unexpected profits.

"Reforestation to absorb CO_2 had its own problems."

Reforestation to absorb CO_2 had its own problems. Jungles of ancient biodiversity were often cut down, and replaced with monocultures of tree species that had been designed simply to grow fast and absorb the maximum carbon. As those carbon-sink plantations matured, fires or simple decomposition could send most of the carbon back into the air, and the purchasing incentives had no controls over that.

"There also were problems with tradable permits."

There also were problems with tradable permits. Often they were hoarded, and problems similar to monetary deflation arose; at other times cartels appeared; in all cases, nations repeatedly argued about how the initial distribution of permits was to be set. And since all these systems - the auctions and rebates; the mortgage guarantees and the permit supervision and the reforestation incentives - were being applied world-wide, it was difficult to provide sufficient supervision. Tropical landowners, for example, often traded in carbon credits for forests which they had intended to plant anyway. Corruption was persistent, and seemingly impossible to entirely stop.

"There was some space for innovation in the NEW GEOpolity world, but not enough."

There was a greater weakness. Efficiency savings could only take the world so far, as previous experience had shown. In one of the world's first major fuel crises, as forests had been used up near major cities in the 16th to 18th centuries, the first stage of replacement had been simple efficiency, as better stoves were developed to use the remaining wood with less waste. But when the limits of those improvements had been reached, only the development of alternate sources of fuel, primarily coal, as well as the ability to ship it suffi-

cient distances, had allowed the nations of the time to sustain themselves. NEW GEO-*polity* was not creating new fuels; new energies. Renewables were more encouraged than they had been before, but it was slow. There was some space for innovation in the NEW GEO*polity* world, but not enough.

A Promise Fulfilled

Those short-comings were accepted however. The worst limits were only dimly visible on the horizon, and even more, the promise which NEW GEO*polity*'s opponents had once called irresponsible was now, actually being fulfilled. Slow, steady spreading of safe energy was changing the very nature of how great numbers of people lived.

It was an effect that had long been suspected. With enough energy available, education and health systems improve, and population growth slows. Women would no longer be treated as mobile baby factories, for schooling made their time more valuable. As chores involved electricity rather than muscle-power, so the sheer number of children around would be less important as well.

"With enough energy available, education & health systems improve, and population growth slows."

Mechanized equipment combined with enough education meant that peasants could engage in contour plowing that preserved topsoil; there was more electricity for night-time school reading or entertainment; more refrigeration, cutting down spoilage of food in the distribution chain as well.

The whole sequence might have seemed naive, wishful dreaming, but it was based on thorough statistical validation. And once established, the causality working in both directions helped it maintain itself. The energy that was provided 'caused' the easier life-styles, and the easier life-styles 'caused' the social improvements that allowed this energy to be provided. At one time authorities had estimated that 2,000 kWh per person per year was the threshold where these effects would become apparent. But that was based on archaic figures, using the primitive technology from

"The energy that was provided 'caused' the easier life-styles, and the easier life-styles 'caused' the social improvements that allowed this energy to be provided."

the 1990s. The long-running efficiency campaigns of NEW GEO*polity* had brought this figure far down, in many regions to 300 kWh or less.

For vast numbers of rural or slum-dwelling citizens who had been left out before, life within the safe bounds of NEW GEO*polity*'s indirect guidelines was more comfortable than anything they had ever known. For others, and especially young people in the world's great cities, that safety was tinged with a great nostalgia for the past.

"There was great popularity for events that relived the more fast-changing days of the 1980s and 1990s, which only a few elders of fading memory any longer had first-hand experience with"

NEW GEO*polity* felt slow and preplanned, with so many choices guided - however benevolently - by the government. In Asia particularly, there was great popularity for media events that relived the more fast-changing days of the 1980s and 1990s, which only a few elders of fading memory any longer had first-hand experience with: when their countries had been bursting forward, and everything had seemed possible.

JAZZ – Happy Virus

In the late 1700s, a new style of business began to appear in the UK. Over the next 50 years it transformed the world, as it spread the Industrial Revolution. No one had understood what power it would have, and many traditional firms - soon pushed into bankruptcy - had been convinced they could ignore it.

In the late 1990s, a new style of business began to appear… in California...

I. A NEW MODEL FOR BUSINESS

Silicon Valley

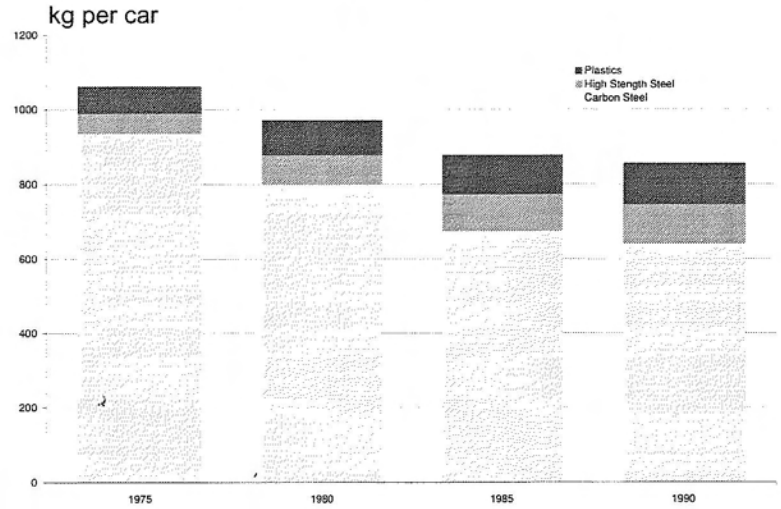
The first sightings of the new business forms had begun in the late 1970s. Two young men living in a valley near Stanford University, turned a small garage-built invention into a product - the Apple II computer - which brought them fortunes of several hundred million dollars each, while they were still in their mid 20s.

In subsequent years further oddities occurred: firms such as Netscape began giving away their products, entirely for free, yet managed to become far richer in the process; other computer firms would initiate product lines which could bring in over $100 million, yet were designed to be brought to a close within six months of their start.

Dematerialization

These practices might have remained restricted to Silicon Valley, but for the fact that 'dematerialization' was steadily spreading through society. Products started weighing much less than they had in previous years. The micro-chip on a Hallmark greeting card, weighing under one gram, had more computing power than the multi-ton computers of two generations before. Plastics were replacing steel; less oil was consumed even though economies were larger; keyhole surgeries that could be done on an out-patient basis were replacing traditional techniques that had used pints of blood, and kept patients in hospital for weeks.

Dematerialization ... in cars



Source: Adapted from Wernick, Consuming Materials:The American Way, Technological Forecasting & Social Change 53(1):111-122

Production runs in ordinary factories were increasingly customized as computerization spread. In one industry after another, hard-nosed production engineers with years of experience in their field began to be pushed aside. The well-tested production practices they were expert in became increasingly irrelevant. The 'solid' ob-

jects produced within their factories could, now, be altered just as quickly as the software controlling the factories' operations.

As a result, new ideas no longer had to come from insiders with direct access to the tons of steel or miles of pipeline that were laid out within the factories. Instead, anyone who could improve the software that ran them had to be listened to. Barriers to entry fell. The lightness and speed which typified Silicon Valley now bubbled to the surface on these unsuspecting factory floors.

Services and Heavy Engineering

Humans are a highly suspicious species, and do not easily part with established business forms that have served them well. The Silicon Valley techniques might be useful for flighty outposts in California, it was felt, or possibly even for variable control systems within factories, but its advantages in other areas were still strongly resisted. For computers were just a tool, and in fields where their use was only tangential, it was not seen how they could re-shape a firm's central work.

"Humans are a highly suspicious species, and do not easily part with established business forms that have served them well."

Humans are also a most practical species however, and when a few heavy engineering firms - ones clearly far removed from the wilder reaches of Silicon Valley - began to make great profits from a more refined understanding of what the new business style meant, then the resistances quickly went down. For the true lesson was not so much that software itself was all-important, but that it was now possible for almost all firms to take advantage of the high profits which a shift into customized, user-friendly services could provide.

An Aeronautic Experience

GE was one of the first great success stories with the new approach, and its dominance in the decade from 1995-2005 was based, in large part, on generalizing a breakthrough it had created in its turbine division just a few years before.

When GE wanted to make a jet engine superior to that of its arch rivals Rolls Royce, and Pratt and Whitney, it had used this new approach to raise its engine's efficiency by almost 30 percent. This was far above the industry's usual improvement

level, of 10 percent at most, and its competitors were startled. How had GE managed to get a group of engineers so much better than any one else's?

They had not.

The 'trick' had simply been to enter into the conceptual world of their customers: the big airline engineering and repair departments. Once they had done that the solution leapt out: engineering and repair departments hate when engines experience 'down-time'. That division of reality - into down-time and up-time - was only tangential inside GE, but was basic there. The solution had been within the world of the clients they shared with the other engine manufacturers all the time. The other firms, however, had not made the shift to viewing the world in a way to see just how important that was.

"How had GE managed to get a group of engineers so much better than any one else's? They had not."

As a result, GE's designers attached monitors to all their engines, that would tell when the engine was going to need parts repaired, even while it flew. The big airlines loved this. The amount of time they had to waste by keeping engines out of service was substantially reduced, because the servicing schedules could be planned more exactly. There had been a twist, a turn, a new recombination - and presto: 30 percent efficiency, pulled out of thin air.

"The 'trick' had simply been to enter into the conceptual world of their customers."

De-regulation

Even with these increasingly recognized advantages, the curious new Silicon Valley system - of efficiencies pulled out of empty air; of utterly unexpected new markets regularly being created - might not have spread, if it had not been for one further development. The long historical epoch when central government had been turned to as the answer to citizens' problems was now over.

The emergency dike construction which had avoided serious damage in the great Nile Delta floods of 2003 had been largely supervised by Bechtel and other great construction firms; the genetically diversified grains which ensured that famines were averted were recognized - as the late President Mandela of South Africa had declared, in his final UN speech - as being due to the skillful research of Monsanto and other respected biotech firms.

Bursts of deregulation had begun in isolated countries in the '70s and '80s of the last century. Now, in 2005, only a few isolated lands resisted its spread. Govern-

ment was back to the minimal caretaker role which it had last played a century before. With all the parts in place - the model of Silicon Valley, dematerialization, the growing profits from services, and now deregulation providing an open door - a new world could now unfold. The business form that was growing to dominate it came to be called 'Jazz', after the independently flourishing yet subtly linked musical lines in a jazz performance.

"With all the parts in place - the model of Silicon Valley, dematerialization, the growing profits from services, and now deregulation providing an open door - a new world could now unfold."

II. ENERGY INDUSTRY TRANSFORMED - 'FREE' ENERGY TO CONSUMERS

Energy companies were some of the last traditional industries to cautiously step, blinking and gasping, into the new Jazz terrain. Once they did so, however, a merciless Darwinian winnowing took place. Most failed before the new competition, but a few survived, and in the years till 2020 they transformed immensely fast.

"Most failed before the new competition."

Strange Competitors

The key shift was to accept that they would no longer have only their traditional competitors to worry about. Deregulation had often been sought as a way of escaping from the restrictive, misguided regulations of government officers. But when you open the doors to a field, it is not just firms that have traditionally been on the inside who can operate more freely. Outsiders too, scanning everywhere in the economy for areas where plump profits existed, could try to push right in. Their simplest technique was to just bundle energy offerings along with whatever they had traditionally sold.

"The key shift was to accept that they would no longer have only their traditional competitors to worry about."

There had been hints of this in the '90s of the old century, when a few adventurous firms from entirely outside the energy field had begun to offer 'free' energy as an enticement to new customers. In the UK, a mortgage firm offered zero-cost utilities for three years, so long as the customer locked herself into a mortgage with the offering firm. In the US, credit cards which had long offered free air miles began to add 'free' energy to their services as well.

Soon there were many such newcomers, swooping in to pluck the most lucrative segments of the consumer market from its habitual suppliers. They arrived from the strangest places. Sony stopped being a user of energy, and began to produce goods with solar cells, or a lifetime credit for the electricity used. It had no stranded assets in traditional systems, so had no reason to hold back. Large trucks delivering refrigerated goods were engineered to reduce the extra gasoline their drivers had once

needed to buy to run the powerful coolant motors, for solar cells and much improved systems for recapturing braking-energy began to supply that directly.

Wal-Mart

"Wal-Mart" became one of the most powerful of the new competitors. It had long offered complete financial management for some of its customers, and by 2002 was also selling detailed school and career advice. As it moved into designing and outfitting complete houses for its customers from 2005 on - an expansion it understood in alliance with IKEA and a major Hong Kong based firm - it was only natural for it to directly supply energy services for these homes as well.

"Wal-Mart became one of the most powerful of the new competitors."

People were comfortable with that customized bundling of services, for it matched deep currents in their ordinary lives. Vows of serial monogamy had surpassed marriage registrations in Sweden by 2004, and had achieved parity even in strait-laced Ontario by 2010. (It was also increasingly accepted in China, in response to the over-abundance of single males, left over from the one-child policy of the Communist government decades before.) The habit of preparing for constantly shifting portfolio careers made people even more ready to expect customized services in the rest of their life. They were used to shifting away from long-term links, and getting a personally tailored mix of what they wanted at the moment.

"Vows of serial monogamy had surpassed marriage registrations in Sweden by 2004, and had achieved parity even in strait-laced Ontario by 2010."

Commodities...and Escape

The energy that was supplied in these bundling deals was not of course actually 'free'. But because it was contracted for earlier in the price chain, firms which remained as traditional producers were forced down to wholesale prices; no longer able to sell at retail. Such snipping away at value chains had happened before, when powerful supermarkets had taken over much of the profits from lucrative food and hygiene

"The energy that was supplied in these bundling deals was not of course actually 'free'."

brands, forcing them into lower profit in-house brands. (It had passed under the radar of energy-company executives however, since the travails of baked beans and napkins seemed far removed from their concerns.)

The more nimble energy firms managed to fight back. Sometimes the solution was obvious. If the margin on supplying a building's energy was 6 percent, but the markup for improving the operation of the building was 25 percent, it was a straightforward choice to move along with the money. Sometimes the shifts were more ingenious. A number of countries spent more servicing their debt to international funders than they did on schools and clean water. In three cases in Africa, energy firms that took over that debt, or helped refinance it, were rewarded with preferential access to the country's markets.

"It had passed under the radar of energy-company executives ."

The ultimate danger was to be maneuvered out entirely. Here too there had been some isolated examples years before. One OECD electricity company regularly 'paid' a construction firm to offer lower-than-usual prices on homes, so long as gas mains were kept away. The way they did this was not to transfer money to the construction firm, but to guarantee lower than usual electricity rates for anyone moving in. The construction company sold them more easily, and the electricity company got a captive market. Only the gas company was left out. In 2010, with deregulation firmly in place, quick switches like that were coming faster.

"One OECD electricity company regularly 'paid' a construction firm to offer lower-than-usual prices on homes, so long as gas mains were kept away."

III. ENERGY INDUSTRY TRANSFORMED - PRODUCTION AND FINANCE

Early-curve Technologies

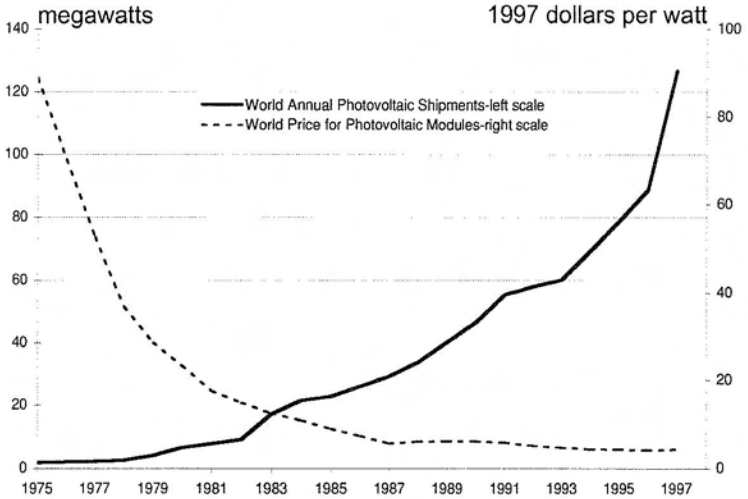
The lure of new markets brought shifts in other areas, well upstream from that of final consumer choices. Coal-fired generators were near the end of a century-long development cycle. Since they were close to their thermodynamic limits, additional improvements were slow, and few outsiders were pulled to them as a possible growth area.

Renewables however were different. Several were just near the beginning of a long, upward-stretching improvement curve.

As deregulation continued these effects became ever clearer, since subsidies went down for nuclear power, as well as for the free road construction and maintenance which had boosted petroleum sales.

One large natural gas firm had recognized this was happening, and invested heavily in wind power back in the 1990s, though management problems and the difficulties of keeping staff had led to slower than expected growth for them. Two of the major oil multinationals however profited mightily from their early positioning here, and by 2012 the massive wind generators they had in place on modified offshore rigs had forced the closure of many conventional, land-based generating stations that could not compete. There were no watching regulators to please: It was an innovation driven by simple profit.

As the price goes down, shipments rise, and price goes down...



Source: Vital Signs 1998, Worldwatch Institute

Wherever demand shifts, products that had seemed perfectly good will be abruptly dropped. Clipper ships had been dropped, not because they were suddenly worse than they had been before - if anything, the last models produced were better than any previous vessel. Rather, steam had made them unnecessary. Similarly for electric typewriters, or mighty Clydesdale horses. It was the same thing as happened

"Wherever demand shifts, products that had seemed perfectly good will be abruptly dropped."

to one highly developed 'old-style' energy technology after another now. They all were undercut, despite having achieved what - till just a moment before - would have seemed extraordinary efficiencies.

"Clipper ships had been dropped because steam had made them unnecessary."

Biotech

Change feeds on itself, for once people see that one assumption they have depended on need not be true, they realize there is no reason to keep from questioning their other long-standing assumptions as well. This is why dictators allow no dissent - one slight crack, and they know everything can crash. It is also why the first oil multinationals' successes with alternate fuels led other firms, now including ones from very different fields, to examine ways of going further. Since exploitable oil was running low in the North Sea, and high quality reserves were becoming hard to get even in Venezuela, what profits would be available for new competitors if oil could be created at will?

"Change feeds on itself."

Ethanol had long been popular in Brazil, but the biotechnology revolution allowed an even more fundamental approach. Early in 2011, working in secrecy, the high-quality biotechnology institutes which Castro had left in Cuba began an expensive joint project with a chemical giant. Scientists in the previous century had known that many of the primitive plants called algae could increase their numbers 30 times within a day, doubling every five hours. They had also known that other species of algae transformed half of their mass into oil. What they had not been able to do was genetically combine those two traits.

The first joint results overcoming this were announced in a paper in Nature, in May, 2016, but progress ceased almost immediately after that. Technical problems showed their first predictions to be over-optimistic, and the two groups also fell out over the division of future royalties. The collaboration broke up. While Cuba's industry looked for new partners in Latin America, BASF quickly set up a further research unit with Merck pharmaceuticals, to utilize that firm's expertise in the self-cleansing of microbial batches. BASF had a special reason to keep the collaborations going. It was a direct industrial descendent of the firm which had produced the first artificial indigo - a feat of biosynthesis which had made Britain's indigo plantations in India useless virtually overnight, and also opened the way for the growth of the

"To have a Merck/BASF alliance force upstream oil operations into bankruptcy was simply more of the same."

German chemical industry. To have a "Merck/BASF" alliance force upstream oil operations into bankruptcy was simply more of the same.

Innovation

The new business forms, now widespread in the 2010s, encouraged many such fresh developments. New alliances brought in fresh ideas, for each newly arrived firm was switching on a searchlight from its own area of expertise, and then aiming it, bright and sharp, onto a fresh area of the world or of the market. What was out there was lit up afresh, as with those biotech firms seeing possibilities which a drilling firm would never have considered.

The increased dealing with customers helped as well. Each time there was a new point of interface with a customer - new product lines, or new demands for customization - then a part of the firm was now 'open', in contact with the outside, and no longer submerged within as before. That produced a vast new surface area, allowing for ever more innovation and fresh products.

A low-tech example had been the way that blue jeans came into existence when a German immigrant (Levi Strauss), mixed a French material (sailcloth from Nimes, known as 'de Nimes'), with an Italian style (Genoese sailor trousers), all with an eye on a new market (the American West). The insights from four hitherto separate developments had to be joined for that new product to appear. A higher tech example was the way that the old Bell Labs had exploded its output once it was moved away from the stifling hand of AT&T. Within two years of the separation, in contact with numerous fresh areas to work on and learn from, it was pouring out fresh patents at the rate of 3.5 each day. Now, in the 2010s, such efflorescences were happening all over.

"A low-tech example had been the way that blue jeans came into existence when a German immigrant, mixed a French material, with an Italian style, all with an eye on a new market and created jeans."

Arbitrage and Free Income

The only obstacle with implementing the rush of potential new projects, was that funding was often difficult, especially in the years till the Consortium Accords of 2023. Lenders had little experience with the new areas that were opening up. As a

result, energy developments which provided their own funding became especially attractive.

The funding possibilities were there because of the constant arbitrage differences which uneven technological advance was opening up. Early experiments with this system had occurred under the auspices of the European Bank for Reconstruction and Development, in the 1990s, when the sudden collapse of Communism had first laid bare such gaping differences.

"The funding possibilities were there because of the constant arbitrage differences which uneven technological advance was opening up."

In a typical contract, a French or German engineering firm would contact a Russian hospital or other large municipal building, and offer to take over their heating systems. The hospital did not have to pay anything, and was even guaranteed a lower fuel bill in the process. It seemed like money for nothing, but the economics was impeccable. Where a civic building spent $1 million on fuel, it often wasted $600,000 of that, because its pipes were not insulated, and its boilers were set on high 24 hours a day. (Such outcomes were typical of the lack of market incentives Communism provided.) The French firm simply had to put in the latest insulation and timers, or replace parts of the boiler. Waste was easily cut by $500,000, and the firm and the hospital split the savings. The generation of savings from that future income stream was what paid for the initial investment.

"It seemed like money for nothing, but the economics was impeccable."

The groups which first did this had been called ESCo's - for Energy Saving Companies. By 2015 there were dozens of them, scurrying the globe in hunt of these self-funding differentials. Older coal-fired power plants were converted to higher efficiency; housing stock was retrofitted with insulation. Where electricity was sold to offices and homes on tariffs that varied from minute to minute, ESCo's helped install the computerized auction controls which allowed users to select their optimal mix. There were profitable markets in monitoring systems; in reducing down-time in power plants; in controlling transmission losses. All forecasts for the growth of ESCo's were favorable at this point, since the problems that arose in 2020 - the waves of popular dissatisfaction that arose against deregulation - were, as yet, utterly unforeseen.

"The groups which first did this had been called ESCo's : Energy Saving Companies."

Small Power Plants

Small power plants became important, not simply because they were easier to fund than big units, but because they provided an excellent way of staying close to the market - which was just what a service-centered world demanded. Sales of small gas turbines boomed, as did modular systems in general.

Risk went down considerably. Since they were quicker to build than older style coal or nuclear stations, there was no need to 'guess' or forecast so far ahead. The advantages were much like those of the JIT systems which had long since become standard in the automotive industry. With less chance of being caught with an ill-sited production unit, or an outdated technology, financing was even easier to find.

The shift was one with deep roots in technological history, for it fit within the centuries-long move to find ways of responding even closer to what individuals chose. Coal-fired trains had to be centralized, and follow rigid schedules; smaller, individually powered automobiles, could be dispersed, and follow whatever moment to moment directions their drivers wished.

"The shift was one with deep roots in technological history."

In many areas, the home electricity market was entirely lost to traditional distributors. Even in the late 1990s, fuel cells that would turn ordinary homes into mini power stations had been prototyped in England, at reasonable cost; a one-house cogeneration system had been demonstrated in Switzerland. IT improvements made such systems easy to service. The whole movement fit within the trend for dispersed, localized sources. Where old-style electricity utilities did survive in those areas, they were mere remnants; serving as a small, risk-averaging backup.

"Where old-style electricity utilities did survive, they merely served as a small, risk-averaging backup."

IV. LOSERS...AND RESISTANCE

Losing Firms

It was easy to get it wrong, and a number of once-famous firms fell by the way. Electricity utilities were the first affected. Once it became possible to wheel electricity from one regional producer to another, then traditional cost evaluations suddenly lost all foundation. In the previous world, generating plants had a known value, but now they were more like real estate properties. Their value could suddenly plummet, the moment someone else, far away, created a product - such as lower-priced electricity, or consumer-attractive 'green' electricity - which was more desired. Soon it was similar for natural gas, for gasoline, and other products.

"When a gas station owner makes more money selling pasta than gas, the fuel for cars becomes a matter of choice, not lock-in."

It did not help that many firms had a mind-set which resisted these shifts. They had spent years thinking of their products as solid objects, with definite value, and it was hard to move away from that. This is a deeply ingrained human habit. When the airline industry had first been deregulated, back in the 1970s, one company had tried to protest that its Boeings had a particular value, and so they needed to be guaranteed the ticket prices that would pay for it. The Washington official leading the new legislation was unmoved: airplanes were just 'marginal costs with wings on', he told the firm, sharply, and the sooner the airline recognized that the better.

"Airplanes were just 'marginal costs with wings on'."

The change struck at the core of many engineers' self-definitions. Some time in the 1990s an important threshold had been passed, when the bulk of the software inside a jetliner was no longer there to run ailerons or fuel pumps or other such systems essential too flight, but simply to run the entertainment systems that were carried onboard. That was so nontraditional - so non 'macho' - that some avionics firms that could have entered into the wider airline software field did not even consider it. It was similar when supermarkets and other outlets began slicing into the gasoline retail market. Very few men had gone to engineering classes and roughed it on drilling sites and then been promoted into management of big, complex drilling or distribution systems, just so they could end up selling Twinkies. But only firms which fully accepted the need to

"That was so non-traditional that some avionics firms that could have entered into the wider airline software field did not even consider it."

concentrate on such new marketing - to accept that this could become a central, high-profit activity, every bit as productive as boring holes - managed to prosper.

Many of the firms that dabbled with ESCo's failed here. Taking true control of a user's energy costs ultimately turned into providing a mini-government for them, especially as the contracting parties soon became whole neighborhoods or towns. The successful ESco's were soon setting prices in local shops; sending out home visitors, and arranging with local governments to give them legal powers to enforce the overall contract provisions. Political scientists and administrative law specialists were hired, working side by side with the power engineers.

"It was hard for many firms to understand how strange the competition had really become."

It was hard for many firms to understand how strange the competition had really become. For the point was not that Wal-Mart or a government consultancy had become a competitor, and so Wal-Mart now had to be added to the list of opponents to watch out for. That would always keep you one jump behind the market, for other unsuspected arrivals could rush in while you were focused on Wal-Mart. The deeper skill was to understand *how* Wal-Mart and Branson and the others managed to pick out how new configurations might arise.

"The deeper skill was to understand* how *Wal-Mart and Branson and the others managed to pick out how new configurations might arise."

New Categories

One skill that was central here was to no longer be limited by old, familiar groupings. The old Fortune 500 was no longer printed, but it still prevailed in many people's minds. That was a mistake, for any such listing is simply a lock-in of the market at one moment. The futurist Stan Davis once pointed out that in the 1950s, it might have made sense to look at a 'Wages 500' - the American AFL-CIO, the British TUC, the French CGT and the like. By the 1970s and 1980s the Fortune 500 was more important, but it too was only a brief snapshot, for it simply locked in the key actors from the era just before deregulation really took off. A better way to segment the market was a 'Values 500', which would have included such powerful entities as the American Association of Retired Person (AARP): One of the most powerful lobbies in America,

"A better way to segment the market was a 'Values 500', which would have included such powerful entities as the American Association of Retired Person (AARP)."

with several million members who also often used their AARP for recommended purchases.

Successful firms in the 2010s were able to view the market in a host of such fresh ways. Overseas Chinese, for example, were estimated even in the late 1990s as having a GNP of $450 billion, which would have made them the 9th largest economy in the world. Thinking in terms of that grouping suddenly made a whole new economy 'pop' into clear focus. Profitable firms were also good at working with the detailed, local mind-sets they found when they arrived in a new area they had 'found'. If an African rural area had a layered notion of property rights - so that some people had the right to use water in an area, while others had the right to pass through but not draw water for free - then the business arrangements would take that into account.

"Overseas Chinese, for example, were estimated even in the late 1990s as having a GNP of $450 billion."

Hasty Decisions

Firms that felt themselves slipping often took frantic leaps into what they thought might be better fields. But without a calm assessment of whether they had the skills to do well in the newly proposed area, those efforts rarely ended in success. Good alliances were sought for, but not enough managers were skilled in handling them properly. It was no good finding old-fashioned industry partners to join with, even if they had a complementary geographic expertise, for all that did was strengthen each participant's grip on standard, already-established markets. And even a fruitful, new-style partner could be dangerous, since firms that were too trusting, too willing to settle in with the new partner for the long haul, were easily turned into simple commodity producers, while the partner was the one who worked their product into a bundle, and tailored it for final sale to the consumer, where the largest profit margins resided.

"Firms that felt themselves slipping often took frantic leaps into what they thought might be better fields."

It also turned out to be wrong to assume that only dispersed or ultra high-tech projects would do well. The essential point was simply to supply a need. Coal was near the end of its innovation cycle, but there was so much of it extant that distribution of modification opportunities often arose. Nuclear stations were large, and slow to build, but even in the 1990s clusters of already extant ones were being revived in Jazz-style financial deals. Although

"The essential point was simply to supply a need."

dispersed geographically, they were organized - successfully - as part of a single, horizontally-branching group.

Countries

Germany was the great surprise winner. In retrospect, the move of the German capital to Berlin was a harbinger of that success. Bonn was where you went to escape from the world, and run a slow, carefully balanced economy. Berlin was different. The quick, anti-establishment language which had long been a mark of its working classes was ideally suited to the new economy, and the willingness to critically accept new opportunities. Also, Berlin - and Germany generally - had a long tradition of welcoming energetic outsiders when a growing economy needed their power. In the late 1800s that had been ex-peasants from the German hinterland; in the 1960s it had been ex-peasants from Turkey.

"In retrospect, the move of the German capital to Berlin was a harbinger of that success."

Now, anyone with a good idea for a deal felt they would get a fair hearing there. Through the 2010s, developments in telecommuting, eco-friendly housing, new concepts in urban living and in industrial processes opened vast growth opportunities throughout Germany. The well-funded Max Planck Institutes for research played an important role. The decades of persistent high unemployment that had begun in the late 1970s were now over.

England had many of the same successes, though to a lesser degree. It too had a tradition of bringing in outsiders when needed: Irish laborers and Scottish engineers to build its cities in Victorian times; Indian and Jamaican workers in the 1960s. By the 2010s the one-time immigrants were often a conduit to the world's fastest growing economies. What slowed it was the heavy hand of regulation from Westminster, which Germany - with its tradition of more independent regional governments - managed to avoid.

Japan was the great contrast, seemingly locked into permanent decline. At first no one had expected this. After all, Japan's post-WWII growth had shown it could make alliances, give quick responses to new business environments, and accept that 'the customer is king'. But those attitudes had been carried out when Japan's population was relatively young. Now it was old, and its demography was terrible for innovation. In 2020 its average age reached 45 - making it the oldest society in the history of mankind.

"Japan was seemingly locked into permanent decline."

Japan's second problem came in the nature of those alliances. There is a big difference between hunting within your country, and hunting on the outside. Where

Germany had brought in guest workers from the 1950s, when its own manpower sources were reaching their limits, Japan had refused to do that, and rather had *exported* its manpower needs, opening up branch factories in Malaysia and other countries from the 1960s on. That difference in ethos continued. Ideas could be brought into the country - adaptation was still a Japanese strength - but yet, those ideas or business opportunities were rarely allowed to enter in their original or raw form. This wariness towards the outside, towards venturing full-heartedly into fresh ventures with foreigners, was a constant brake. There were a few successes, as with the massive wind farms established in China using Japanese capital and technology, but even here they tended to be one-off projects; slower in their follow-up than those which more open groups prepared.

The US had started out doing very well. Its entrepreneurial ethos seemed ideal for the alliance-quick, fast-changing economy that was taking shape by the 2010s. But soon it faltered, for decades of low federal investment in education, research and infrastructure - it had fallen from 2.5 percent of GDP in 1981, to 1.6 percent in 1998, and continued on down - meant that large swathes of the country were unable to take part. The aging baby boomers, with their constant demand for security, also helped hold back new advances.

Instead, the 2010s and 2020s were becoming Latin America's era, as well as that of several parts of Asia, and Africa. It had been a long-promised awakening. Argentina in the 1930s had per capita incomes comparable with Australia and Sweden; Kenya and Ghana and Nigeria in the 1950s had seemed poised for continued growth as well. Now, with oppressive governments finally gone, those countries' natural vitality was finally allowed to come out. Their populations and that of their neighbors were young, and energetic; strong family groupings meant entrepreneurs usually had a first access to pooled capital; fast communications now meant their talents could be hooked into further capital sources anywhere on the planet. Joint energy projects in particular flourished, since border tensions now seemed archaic in the era of sustained growth. Miami became a financial powerhouse, serving as the portal through which successful Latin American businesses served the increasingly slowing US South.

"The 2010s and 2020s were becoming Latin America's era, as well as that of several parts of Asia, and Africa."

Resistance

At first the economic shifts had gone ahead without much political concern. They seemed to take place in a world of their own; as a layer on *top* of the usual political activities inside a country. By the late 2010s though their consequences were being attacked directly. Many people even in prosperous countries were left out; small firms had been squeezed aside by new international competition; the focus on money and

profit seemed cold even to many who were a part of the new system, or living well within an enlarged ESCo. As Machiavelli wrote, in 1513: 'Those who stand to profit by the preservation of the old order of things will dislike the new...'.

Sometimes the problems were more direct. Many of the ESCo's were not benevolent at all. Their funding was basically that of leveraged buy-outs - they received credit now, from savings in the future - and in one particularly unpleasant incident in Indonesia, those savings were enforced in unduly harsh ways. The raw Jazz approach had little formal restraint. While most firms were content to seek out new opportunities, a few others tried to control the market for opportunities, and put up barriers to anyone else entering their domain. The period 2019-2021 was a tumultuous one, with riots and parliamentary shifts in many countries, and a number of opposition groups came to power.

"It must be remembered that there is nothing more difficult to plan, more uncertain of success, nor more dangerous to manage than the creation of a new order of things."

Machiavelli, The Prince (1513)

But how to resist? Old-style command economies were discredited, especially after Russia's failed attempt to reinstall one during its troubles in 2005. Strict anti-business slogans would not work either, since the boundaries between business and local communities was increasingly unclear, as many local interest groups were now part of the spreading networks. It was a Chinese parliamentarian who came up with the dissenting slogan that finally took off: The new business forms were destroying our green world. Since they were aimed solely for profit, all the rest of us - all the world's citizens; all the world's resources in land and water and education - were being left behind.

It was a popular slogan - this call for the greening of the new economy - and it swept the globe. All the dispossessed could feel united under it. They also now had powerful tools to share this feeling, using the Internet and other fast communications. Governments in northern China, the US, France, and several regional administrations in Latin America quickly locked on to the popular unrest. It was, finally, an allowable way for them to get back their sovereignty which had been slipping away.

"It was a popular slogan - this call for the greening of the new economy."

Unitary Taxation

The mechanism they used against the quick-changing alliances and entrepreneurs - against the locality-gripping ESCo's as well - was based on what had hap-

pened in an earlier epoch of popular resistance to a new business form. This was the period when joint-stock railroads had been opening up the American West.

Rail firms of that time had often refused to pay taxes on the goods they transported, and were only willing to be assessed on the value of the wood and metal of the tracks that happened to be within a given state. What the Western states had done to get around this was to estimate each firm's total profits, then estimate how much of its business took place within a given geographical area, and simply divide the two, to work out what the 'true' tax should be.

"It was called unitary taxation, and had made regular reappearances over the years."

It was called unitary taxation, and had made regular reappearances over the years. Now it came back with a vengeance, spreading from its heartland in the US West; imposed at levels harsh enough to slow the new business deals almost to a halt. The great number of links across the Pacific - from families that spanned both sides; from the decades-long accumulation of university and other links - meant it quickly started spreading throughout Asia as well.

V. A CAUTIOUS EXTENSION: THE GREENING OF JAZZ

Voluntary Greening

The outcome was in the balance for several years, with the new business style held back even in its Latin America, central European and overseas Chinese strongholds. Several firms that had benefited in the 2010s wanted to fight the green opposition directly, but wherever they did it simply provoked public resentment even more.

There was no single accord that resolved it, for authority was too dispersed. By late 2023 however, a substantial number of what came to be called Consortium Accords had been outlined. These set out guidelines for how firms were to act on environmental and other sustainability issues. It was a voluntary 'greening' of the main business actors.

"It was a voluntary 'greening' of the main business actors."

A few cynical firms tried to backslide from the provisions, pointing out that they were under no legal obligation to follow them. But the opposition groups that had coalesced in 2019-2021 were increasingly skilled at using the Internet to keep an eye on what firms were doing. It was hard to hide, since the transactions that allowed new deals depended on highly transparent information sharing, which watchdogs could just as easily tap. The power of sheer publicity on changing behavior had been demonstrated years before, when the Toxic Release Inventory requirements of the US government in 1986 had made firms publicize the amounts of their chemical emissions. Within four years then - and entirely without added punitive laws - overall chemical industry emissions went down 35 percent, with one of the largest firms dropping its emissions by 69 percent.

"The power of sheer publicity on changing behavior had been demonstrated years before."

Now, by late 2023, it was difficult for any firm or new alliance to get insurance unless it could show that it had systems in place to guarantee compliance with the most respected Accords. It was simple self interest: the insurance companies had no desire to become linked to firms that would suffer from substantial environmental criticism. Consumer choice was so easily exercised that even if a disliked firm was not hampered legally, buyers would simply shift - and quickly - to a competitor that showed it was following the voluntary Accords.

Huge shifts in the attitudes businesses take for granted are rare, but when they do come about, the shift is likely to be very fast. The last

"Huge shifts in the attitudes businesses take for granted are rare, but when they do come about, the shift is very fast."

one on the scale of this voluntary greening had been two generations before. In the '50s of the last century almost all large firms had been unembarrassed about practicing racial and religious discrimination when it came to promotion to their higher ranks. By the late '60s of that century however, there had been a once and for all shift, and such attitudes were considered abhorrent; something that was rarely aimed at even when laws did not explicitly guard against. It was similar here, with the greening of the new 'Jazz' business world.

Trust Authorities

The new business form had one more major lacking it had to overcome before its renewed spread could continue. In previous decades it had been easy enough to find out if a potential partner was trustworthy. Either you were in the same industry, and knew each other directly, or you had contacts in common who could vouch for the other one; if there was not such direct knowledge, you still were likely to be under the sway of an agreed legal system.

With fresh and quick-changing alliances all over the world, those traditional establishments were not enough. The positive mood which the 2023 Accords had produced finally led, two years later, to a protocol on informal 'trust' authorities. These were a new sort of entity, neither business nor government nor strictly judicial, which however served as a mechanism to vouch for the trustworthiness of the various partners considering a coalition. Each TVS (Trust Validation System) publicized its track record, and the criteria which it used. Ones which were easily manipulated or misled were soon left behind, as firms gravitated towards the ones which showed they facilitated deals which held.

"Each TVS (Trust Validation System) publicized its track record, and the criteria which it used."

Transport and Acceptance

With the TVS's established in this way, the new business forms continued their earlier growth. By the end of the 2020s, the turmoil that decade had begun with was nearly forgotten. The new Jazz business forms were no longer considered 'new'. They had simply become the accepted way of doing business. Partly this was because they delivered wealth on a scale which no predecessor had, even if this was not always spread

"TVS's also matched society so well: the move towards serial monogamy; the belief in portfolio careers."

smoothly. They also matched society so well: the move towards serial monogamy; the belief in portfolio careers.

Above all, people came to accept as second nature the links between once-disparate firms which only the new business forms allowed. In transport, for example, you paid for 'getting there', and not for the particular vehicles that were used along the way. For a business trip to a distant city, a transport consortium would book your plane ticket, arrange for a rental car of the quality you expected to be waiting, and of course have a parking spot reserved at your final destination. (The primitive 20th century system where parking places were either found by chance, or 'bartered' as a reward within a company, were now long gone.) It was not the end of cars - on the contrary, a user-friendly world liked cars more than ever - but rather an attitude that cars were just one part of the mix you used, towards the ultimate purpose of getting to your destination.

"The primitive 20th century system where parking places were either found by chance, or 'bartered' as a reward within a company, were now long gone."

Any service that was desired was now something to be bought. It was thought as odd to bother about who provided your electricity or your gasoline as it once had been to bother about which make of bolts or nails were used in your house. What was desired - and paid for - was the maintenance of a given comfort level of temperature and humidity, but the decisions about how to do that were made by the contracting firm. To delve into those details was left to the rare enthusiast, similar to the individuals who had once built their own radios out of personally chosen crystals, wires & dry cell batteries.

Politicians who accepted this and promised to lead these seemingly inevitable currents were brought to power. Often they were very young. In a previous era of worldwide fast change - the late 18th century, where the world's great empires were being transformed - even the majestic British empire had turned to a 24 year old youngster to serve at its Prime Minister, and guide it through the turmoil. In the 2030s, India, Belarus and Argentina now also elected charismatic leaders of that young age.

Happy viruses: Hunting social software

Where resistances remained, the new business forms had the ability to leap-frog over them. Each business opportunity - a new distribution system for energy; a fresh mix of services fulfilling basic transport or shelter needs - was, after all, something that could usually be created on a smaller than national scale. If Alberta had a 60 percent majority still supporting punitive unitary taxation, but Quebec had a majority

that was willing to encourage the new business forms, then it was towards Quebec that the investments would now turn.

"In the 2030s, investors spent more time hunting out regions where good social institutions - where good social 'software' - could be found in place."

Investors in the 20th century had often been attracted to the hard physical resources of a country: pools of hydrocarbon, or potentialities of water power. In the 2030s, investors spent more time hunting out regions where good social institutions - where good social 'software' - could be found in place. Transparent legal systems, functioning democracy, a well-educated population: That was the necessary raw material to make the new ventures work.

It worked like a 'happy virus'. Where the invigorating business deals took hold, neighboring regions often tried to introduce the social software that would attract this beneficence to themselves. There was nothing new in this. In the latter quarter of the 20th century, Hong Kong, Taiwan and to some extent Thailand had made similar decisions to improve their social software, so that the value-rich Japanese investments of the time would land in their territory, rather than elsewhere. Now, new technology and open trade often made small regions economically viable, and instead of civil war, they simply informally, gradually, began separating from the larger nation from which they differed.

"It worked like a 'happy virus'."

But Yet...

Despite the successes, there was something unsettling about the new business forms' energetic advances. So much depended on private loans, that often only relatively low price hurdles were jumped. Giant liquefied natural gas terminals had taken a long time to build up, and then once they were in operation, there was little incentive to plan ahead, for what might happen if those reserves finally did run out. Spot markets were now long established in electricity, since computerized switching systems allowed instantaneous auctions. But this meant that the future price of electricity was impossible to plan for, which again slowed down investment. And while some regional separations went ahead peacefully, in other areas resentful central powers tried to keep dominance by force.

"There was a nagging concern that although great swirl of new business operations was powerful, was it really the best which the science of the 2040s could produce?"

The future seemed to be left to its own devices. There was a nagging concern that although great swirl of new business operations was powerful, was it really the best which the sci-

ence of the 2040s could produce? Research and development was costly, and for long-term projects it was costlier still. In the 20th century the foundations left over from the era of heavy industry - the Rockefeller Foundation, the Ford foundation - had provided important funds for long-term research, but that had always depended on major universities which, ultimately, received most of their money from the state. In the 2040s, the foundations which the late, great Silicon Valley billionaires had left behind - the Melissa Gates Memorial Foundation; the Larry Ellison Foundation - were pouring out tremendous amounts, but there was so little other funding for long term research that everything was slower than before; again, more short-term. And since so many deals were in the form of alliances, it could be hard to get funding: any one participant could only promise a small percent of control over how the invested funds would be handled.

"Most of all, it was odd to feel that no one was in control."

Most of all, it was odd to feel that no one was in control. Traditional governments were weaker than ever; increasingly sidestepped. Already there had been a few terrifying oscillations in the economic system, admittedly for only brief periods, but of a sort which had left several leading chaoticians quietly worried. Dematerialization proved not to be the unmitigated wonder it had once seemed either: highly available cars led to even more dispersed housing in once-scenic areas; light-weight appliances were more easily thrown away, which meant constant attention had to be paid to selecting and buying replacements. And although the new business style was locally clean, who was looking out for its overall effects?

Many people - the old especially - felt a great nostalgia for the past, when life had seemed slower, and day to day changes had been more manageable; easier to comprehend. For the young though - and especially in the fast-spreading cities of Asia, Latin America and parts of Africa - fast change was all they were used to. Their world was wide open.

"Their world was wide open."

And they were confident that the future would turn out for the best.

Appendices

Plausibility

If anything like these stories are likely to come true, then firms will need to begin basic policy shifts. That is such a major undertaking, that it is only natural to want to be very sure about the evidence backing it all up.

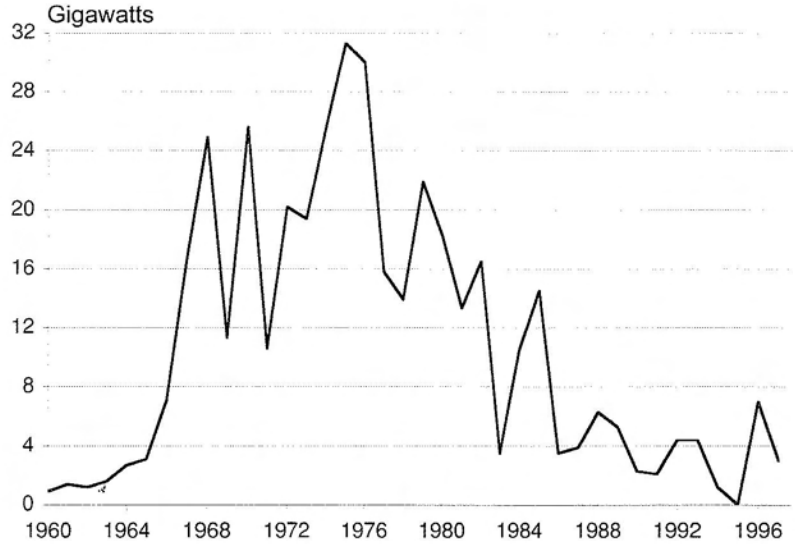
What I'll do in this section is simply list much of that evidence. Some of it has appeared already, spread through the various stories or summaries you have now seen; some will be added afresh.

"A cynic would interrupt, and ask why we need to bother with this at all. After all, will not there always be a market for low-priced oil, and low-priced electricity?"

A cynic would interrupt, and ask why we need to bother with this at all. After all, will not there always be a market for low-priced oil, and low-priced electricity? (That is the actual question one of our participants recounted a suspicious colleague asking.)

It sounds sensible, until you start looking at some historical comparisons. IBM executives reassured each other, in the 1960s and 1970s, that there would always be a market for low-cost computing power. They were right in that, but missed the fact that it would not have to be supplied via the mainframes they were expert in. The personal computer revolution took away their market.

World Nuclear Reactor Construction Starts



Source: Vital Signs 1997, Worldwatch Institute

Nuclear electricity executives of the time also reassured themselves that there would always be a market for low price electricity. Again, they were only partially wrong: there was such a market, but other forces - a mass consumer resistance they had not foreseen - acted against their products, almost entirely stopping their growth.

The point is that trends rarely continue forward in straight lines. The 1950s were a time of great social stability in many countries, but it was followed, with many a pause, by the great upsets of the 1960s. Bill Gates in 1994 was con-

vinced personal computers were the inevitable victors in the computer wars - and in that pride almost entirely missed the growth of the Internet.

"At one time, quality was considered too costly, too complicated, and too 'foreign' a concept to be important for customers."

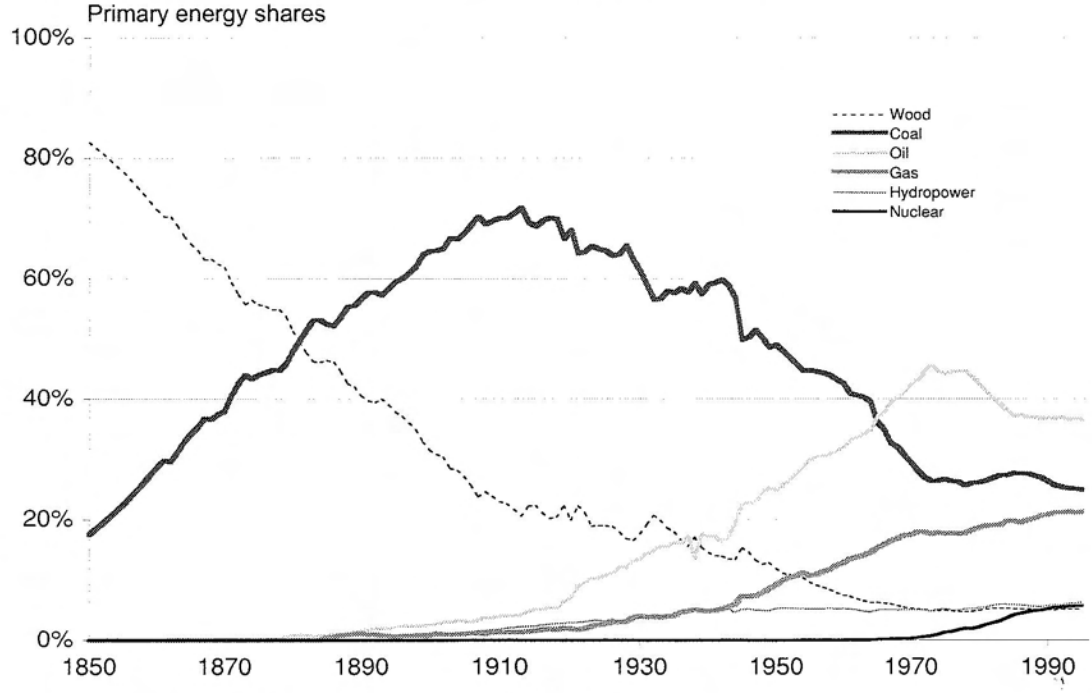
The energy field has repeatedly gone through such shifts.

Also, many tasks that seem onerous or unnecessary can quickly come to be taken as second nature. At one time, quality was considered too costly, too complicated, and too 'foreign' a concept to be important for customers. At other times, lean manufacturing was similarly waved aside.

So how to answer our cynic? His question is almost certain to end up being rephrased. The point is not that people 'always want low-cost gasoline'. Rather, they always want 'something to help them conveniently complete their journeys'. It might be gasoline, but it might be batteries, or odd new rental consortia (where the gasoline providers are simply low-profit commodity suppliers). What scenarios can do is help prepare us, for whichever one of these - or other possibilities - it turns out to be.

"What scenarios can do is help prepare us, for whichever one of these - or other possibilities - it turns out to be."

The relative share of energy carriers has shifted before



Source: Technology & Global Change, Arnulf Grübler, pg 250 Fig 6.19

Plausibility: F.R.O.G.

"The basic assumption of F.R.O.G. is one that almost all historical evidence backs up."

The basic assumption of F.R.O.G. - that attitudes continue pretty much as they are into the near future - is one that almost all historical evidence backs up. Intellectuals and strategists like to insist that society is at a great turning point, and that momentous shifts are about to take place. But how right have they been most of the time? Social trends that seem of dire importance today, have a way of fading away, with little notice, surprisingly soon thereafter. The world has a great amount of inertia.

The triggering event moving the F.R.O.G. scenario forward - its unexpected jolt, so to say - is that the developing nations undergo a major change, and that this impinges on the rest of the world. Such a development would also be consistent with past experience. Wealthy countries have regularly entered new markets, wherever free trade has allowed it in the last century, and this has changed the nations on the receiving end considerably. Japan was once a poor, barely developing nation, with its exports a byword for shoddiness. That certainly has changed. More recently, China's telephone switching industry, which was 'backward' and seemed an easy export market for outmoded western products at the start of the 1990s, was, by the end of the decade, successfully competing in a number of sectors with the most advanced good from outside. Education and skills easily shift, as noted on page 15 (of the main scenario). Aside from various small university towns, Seoul has one of the highest densities of Ph.D.s, per capita, in the world.

"The world has a great amount of inertia."

Even aside from those advances, developing nations cannot be counted on to become our engines of growth. The expectation that they would do this is a very old one, going back to the foundation of European colonial empires. But simple economic downturns there have repeatedly led to disappointments. In 1981, for example, when OECD countries were going through a recession, oil companies were convinced that developing nations would maintain high enough demand to keep oil prices high. But when commodity prices crashed, and the debt crisis struck, this hoped-for salvation faded away.

"Developing nations cannot be counted on to become our engines of growth."

Without regulation or major shifts in habits now, sustainability pressures would emerge. Water use has gone from 2.6 cubic kilometers to 4.2 cubic kilometers in

the past quarter century, and there just is not that much more fresh water available. City air is often unpleasant in many Asian and African cities, yet this is when only 8 percent of the world population has cars.

"Water use has gone from 2.6 cubic kms to 4.2 cubic kms in the past century, and there just is not much more fresh water available."

Even if birth control becomes much more widespread than it is now, there will be an inevitable bulge of population as the current generation of children reach adulthood, and start having children of their own. China's total population, for example, will reach 1.3 billion in 20 years - even if it continues its very small family size - and this is greater than the whole industrial world today. Educational systems will be hard put to keep up. At the moment, some 40 percent of the world's population lives in about 200 river basins shared by more than two countries. As those populations become denser, historical experience does not suggest this will encourage harmonious and polite agreements on sharing. In 1998 alone, Egypt has threatened military action against Ethiopia if it takes more water from the Nile; Syria has threatened Turkey, because of its dams and irrigation systems on the Euphrates; Kazakhstan and Uzbekistan are engaged in often bitter negotiations over the Aral Sea.

"China's total population, will reach 1.3 billion in 20 years and this is greater than the whole industrial world today."

Such effects could easily be large enough to spread. You do not need famine to produce large emigrations. A steady slow-down in jobs available for growing families in the past has sent many millions of energetic but untrained individuals towards OECD borders, be it from Mexico, Algeria, Romania, or the like. Air pollution spreads easily in earth's atmosphere; squabbles over fishing rights and in some areas over timber reserves have already begun. Fast growth almost always produces financial world-wide financial instability at some point. Corruption is almost inevitable when economies enlarge quickly, and funds get misplaced - which can be hidden for a while, but will always be recognized when the returns which those funds were to produce do not come about. It happened repeatedly as the US was industrializing in the 1800s, almost bringing down several of the largest UK banks of the time; there have of course been signs of it from the currently developing nations more recently.

The next stage in the F.R.O.G. scenario - that ecologically-triggered tensions can lead to local barriers being raised - is also quite plausible. In the past, even the threat of wars or economic problems has often led to countries or ethnic groups turning inwards; looking unkindly on dissent. Shortly after Saddam Hussein invaded Kuwait, opinion polls in Britain and America showed that there were a large number of 'undecideds', when it came to choosing what course of action was best. Once the Allied

forces were in place and near war-footing though, the number of 'undecideds' fell almost to zero.

The reflex of major economic blocs putting up trade barriers has happened before, most notably in the early years of the worldwide 1930s Depression. It is a reflex that is turned to whenever there is a feeling of danger somewhere in the outside world. Strongly nationalist leaders in all countries can often get support by picking up on a mood of resentment; by charging that the other nations, out there, are not doing their part, and that it is their fault we are suffering now.

"The reflex of major economic blocs putting up trade barriers has happened before, most notably in the early years of the worldwide 1930s Depression."

Already at treaty conferences, mutual recrimination is common when issues of the environment or international trade come up. Representatives of developing countries can be heard saying that OECD countries are very wasteful, so why should we be picked on. 'There are those who are unwilling to see China progress,' wrote the China Daily, in 1997, 'and who are trying to contain its development by pointing their fingers at the world's environmental problems.' There is a lot of residual hostility here. Malaysia's Prime Minister famously told one German environmentalist: 'Stop being arrogant and thinking that it is the white man's burden to decide the fate of the peoples of the world.' Many politicians back in the wealthier countries are quite willing to return the recriminations, charging that the problems of unemployment, or acid rain, or over-fished waters are due to unreasonable foreigners as well.

Within the changed world that develops in the F.R.O.G. scenario, liability and litigation can quickly close down innovation. The halt in nuclear power plant construction in numerous countries outside Japan and France due to incessant litigation is well-known, and could easily spread to other energy sources. A suspicious mood easily feeds on itself. In 1998, Dow Corning had to pay over $3 billion to settle personal injury claims from its breast implants - even though epidemiological studies subsequently showed they had produced no real injury at all. The private airplane industry was almost forced to close in the US due to a few enormous liability cases in the 1980s. As stresses continue, it would only be natural for such suspicion to spread. Fierce nationalism could also cut back the number of scholarships and visas given to foreign

"Within the changed world that develops in the F.R.O.G. scenario, liability and litigation can quickly close down innovation."

"A suspicious mood easily feeds on itself."

students at American and European universities, with cascading effects as noted for Korean science postgraduates on page 22-23.

Partial oligarchies easily return, as page 30 of the frog scenario text showed occurred after previous deregulations, in the airline industry in the 1970s, and in the oil industry in the 1920s. The latter example is especially relevant to the F.R.O.G. scenario. Before WWI, when the international environment was harmonious, there was great indulgence in the US for stakeholders lobbying against centralized oil firms. In the turmoil of that war and its aftermath though, such indulgence abruptly ended.

"Partial oligarchies easily return."

That massive energy shifts regularly arise when risk is too great was recounted on page 25, with the examples of supertankers replacing pipelines, oil replacing coal, and investments (temporarily) leaving developing countries - all because of sudden bouts of risk. Such jumps can be surprisingly fast, as with the example of Europe moving from overwhelmingly coal use to overwhelmingly oil use in the 15 years from the late 1950s. With today's more advanced technology, a risk-induced shift back to coal could be even faster.

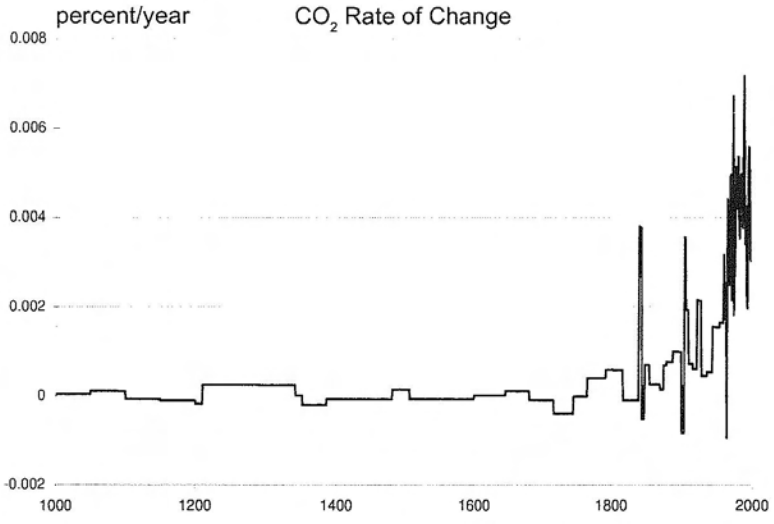
"With today's more advanced technology, a risk-induced shift back to coal could be even faster."

If times get really rough, international trade can easily be threatened. A few dozen primitive US submarines destroyed almost all Japanese shipping in World War II. Just one or two rogue modern submarines, if not guarded against by the very few countries that have worldwide naval capacity, could easily raise insurance costs to impossible heights. Even the brief assaults on international shipping near the end of the Iran/Iraq war had grave insurance effects. In a F.R.O.G. world, there would be no international coalition bringing that to a halt.

Plausibility: GEO*polity*

Eco-shocks already seem to be occurring at a greater rate than a decade ago, as evidenced by records kept by the major insurance companies. Even the slightest of further sea-level rises would have grave effects in the low-lying - yet densely populated - regions of the Nile, Ganges and Mekong deltas. Crop losses would be hard to replace, since world grain reserves are now at their lowest point in more than four decades. This is not a matter of temporary fluctuations, or land kept out of use, since 1996 and 1997 saw bumper harvests, and American set-asides have been almost ended. Rather, rising populations took up those gains.

CO_2 levels DO rise



Source: State of the World 1999, Worldwatch Institute

Scientists would easily attribute storms or rising sea levels to global warming. Ice core samples from the Antarctic, published in Nature, show earth's air temperature rising and falling in close accord with atmospheric CO_2 concentrations throughout the period from 160,000 BC till now. CO_2 levels are now higher than at any point in that period, and temperatures - according to the most conservative models - are rising at about three times the rate which occurred during the great melting at the end of the last Ice Age.

The distinctive assumption of the GEO*polity* scenario is that after such crises - or simply after the media have given the impression of such crises - a series of new, globally powered institutions could be set up, to shift world-wide practices so they would be less likely to happen again. If that response seems implausible, then all the rest of the GEO*polity* scenario - all the details in the full text we have seen - will not really matter. It is worth looking, accordingly, at what possible reasons there might be for thinking it could come to pass.

"It is not that surprising to have powerful new international organizations set up, or for prior ones to get their agendas shifted to deal with new problems. It has happened plenty of times before."

First of all, it is not that surprising to have powerful new international organizations set up, or for prior ones to

get their agendas shifted to deal with new problems. It has happened plenty of times before, and indeed usually after the periods of great stress that GEO*polity* is imagining. After the decades of Napoleon's wars, Western Europe's leaders set up institutions to resolve future conflicts by peaceful means. Aside from three brief exceptions in the 1860s, it was an agreement - an attitude - that held for almost exactly 100 years, until the guns of August, in 1914. After the 1930s Depression and World War Two, the Bretton Woods agreements establishing an international monetary system were accepted, and strictly bided by, for 30 years. (They are still loosely abided by even today.)

Voters can easily accept a bureaucracy that reins in the free market. Strong sentiment against free-trade has always been around. Most university students cannot quote the standard economic arguments about free-trade being to the advantage of both sides. This is not due to an especial dullness on campuses. It seems only logical, in the popular mind, to believe that one party must gain, and another lose, whenever there is a transaction. If the eco-shocks that set off the Geo*polity* scenario are seen as being linked to such free market economics, then that waiting sentiment could be brought to the fore. The financial turmoil of 1998 - and the calls for international control on unregulated markets which it led to - are but the most recent example of such feelings.

"Most university students cannot quote the standard economic arguments about free-trade being to the advantage of both sides."

People are used to governing institutions telling energy companies what to do. As we saw in all the ex-Communist countries it is simply the default assumption: what had been assumed as the only way to proceed for decades. That is especially the case in Asia, where traditions of deference to authority run deep. Even in ostensibly 'free market' parts of OECD economies though, rural electrification has many favorable memories. The Tennessee Valley Authority in the U.S. is perhaps the largest example of a respected energy-directing organization that was neither government nor business, but a new-style hybrid of both.

"People are used to governing institutions telling energy companies what to do."

Taxes designed to shift fuel use can readily be accepted. Sweden, Denmark and the Netherlands already have a range of energy taxes in place, to wide public acceptance, and of course it was a plank in Schroder's electoral campaign in Germany. Even during Margaret Thatcher's strongly pro-capitalist government of the mid 1980s, the UK Treasury supported a policy

"Sweden, Denmark and the Netherlands already have a range of energy taxes in place, to wide public acceptance."

of sharply higher taxes on non-leaded gasoline, with the explicit intention of shifting consumer demand.

"Such strict directives are likely to work at first."

The Geo*polity* bureaucracy is likely to be pressured to start with powerful measures, aimed to quickly solve the worst problems. Such strict directives are likely to work at first. CO_2 emissions dropped swiftly in the early 1990s throughout Russia and Eastern Europe, when the end of the Soviet empire stopped subsidies for fossil fuels there; CO_2 slowed considerably at Chinese power stations in the late 1990, through efficiency gains forced by policy-driven cuts in state subsidies for coal as well. Page 39 looked at further examples, for car emissions, and CFCs.

"It is easy to pick the wrong project to back."

As to the likelihood that an international organization of this sort would eventually have to change - as suggested in the switch to NEW GEO*polity* within the scenario - this too is only to be expected. It is easy to pick the wrong project to back. France's Grande Ecole elites wasted billions on one wrong turn after another in the computer industry; South Africa's synthetic fuel program did not stop, even after costings showed it was impractical, and the easing of sanctions made it unnecessary Britain's industrial policy-makers constantly got the semiconductor business wrong; on page 48 we saw the Japanese MITI lock-in on irrelevant mainframe computers as well. The problem is not that governments are inherently worse than private firms in choosing winners. Both sides have a track record of some successes, and many failures.

"Large governmental bureaucracies find it exceptionally hard to admit they were wrong, and so disengage from a failed policy."

Rather, large governmental bureaucracies find it exceptionally hard to admit they were wrong, and so disengage from a failed policy.

An eco-shocked world would likely have rushed GEO*polity* into its first policy choices, and this would simply make it worse. Hasty decisions are rarely optimal. The US, for example, locked onto light-water reactors for its commercial nuclear program in the depths of the Cold War, simply because they were already available on submarines. Their lackings in safety, and cost-effectiveness, were recognized later. Corruption could easily make all such decisions worse, as the experience of the UN has made only too well known.

"Details of NEW GEOpolity are of course speculative, but they pick up on ideas emerging from current think tanks, which have a habit of preceding action by many years."

Details of NEW GEO*polity* are of course speculative, but they pick up on ideas emerging from current think tanks, which have a habit of preceding action by many

years. In a few cases, the suggested practices have only just begun. NEW GEO*polity*'s use of mortgages, for example, is based on two new practices in the 1990s. One is the way the US Department of Energy experimented with pushing a few large financial institutions to give loans for retrofitting housing stock. The loans were not given directly, but rather to the small number of firms which the multitude of homeowners then dealt with. It meant retrofits were widely available, yet with minimal bureaucratic oversight. The other is the way which 'Fannie Mae', the large US secondary mortgage provider, has been giving easier mortgage terms to individuals with more energy efficient homes. The savings in utility bills leave them more money - and so make them a better risk - in paying back the mortgage. All of the Pacific Gas and Electric examples, on page 53, are based on the actual company of that name. The favorable consequences associated with widespread raising of electrical usage, on page 55, are based on extensive correlation studies by Barbara Heinzen, member of the project core team.

"The hoarding of tradable permits has already been experienced in the New Zealand fisheries industry."

As to the unintended consequences of NEW GEO*polity*'s proposed actions, current experience has been carried far enough for a few of those to be seen as well. The hoarding of tradable permits has already been experienced in the New Zealand fisheries industry; some of the problems with reforestation have been researched by John Moncrieff at the University of Edinburgh, and further outlined by Nigel Dudley and others at the World Wide Fund for Nature.

Perhaps the most powerful 'plausibility' is that we are already living within substantial parts of the GEO*polity* scenario, even without recognizing it. It is a common occurrence. Reagan left office convinced he presided over a pure capitalist society, even though, when he was a young man, the 1980s America which had social security, unemployment benefits, an income tax and state funding of universities would have been considered a socialist's utopian dream. Similarly here. Opinion polls today would probably show little detailed public knowledge of the Montreal Protocols on CFCs, even though ordinary appliances have been refabricated in accord with them. Preferential taxes for lead-free gasoline have come to be accepted as a fact of nature, as have fishery quotas of some sort. Further taxes on engine size, on carbon emissions, on non-insulated homes - or almost anything else a powerful authority might come up with - could easily come to be thought of in the same way.

"We are already living within substantial parts of the GEOpolity scenario, even without recognizing it."

Plausibility: JAZZ

The central assumption of Jazz is that a new business style can quickly spread. It is an enormous assumption, and all one can say is that it has happened before, in the first industrial revolution, when steam engines and centralized mass production were the stunning new techniques that transformed the globe. It helps when no great obstacles are in the way. During the first industrial revolution this was because old-style mercantilism and aristocracy were fading; in the spread of Silicon Valley-style operations, the end of regulated markets played that role.

"The central assumption of Jazz is that a new business style can quickly spread."

It also helps when the new technique is more powerful - and profitable - than what was in place before. The great power of the steam engine swept everything before it, as commentators from Adam Smith on up have described. Firms which have embraced the latest deregulated and computer-linked techniques have also acquired great strength. The Central Electricity Generating Board once dominated the UK electrical industry. Its main successor firms, following the new style, have barely a third of the staff levels, yet far greater output, and correspondingly greater profits.

"Today's new style will often lead to standard customers being 'stolen' by new-comers."

Today's new style will often lead to standard customers being 'stolen' by new-comers. This can occur in adjacent fields, as with gas firms now selling electricity, and vice-versa. Increasingly though, it arises from further afield. The main players in the UK insurance market were thrown when Richard Branson - known for his music stores and airline - suddenly established a large firm to sell their product by phone. Before they could parry this, almost half of their customers had left them.

A common technique used will be giving away of 'free' energy. The mortgage firm referred to on page 63 is the very large Alliance & Leicester Building Society, which in late 1998 began offering to pay the electricity and gas bills of any new customer who switched to their discount mortgage, so long as the customer agreed to stay with the firm for five years.

"'Giving away' is increasingly common in the economy."

'Giving away' is increasingly common in the economy. Home improvement firms give away 'free' loans for their work (where they pay the interest, not

the customer); computer retailers give 'free' insurance; airlines give 'free' limousine rental for first class passengers. It also has deep roots. In the US, for example, TV programs had long been paid for by advertisers, and given away 'free'; in many countries, newspapers were just a vehicle which advertisers ran to better distribute their ads as well. It is simply the application of this technique to new areas - which deregulation and IT allows in the energy field - which is striking.

"Giving products away also has deep roots."

In the world of the Jazz scenario, there will be time for these developments to take place, before any sustainability limits are hit. The main evidence here is what is often called the reverse Kuznets curve.

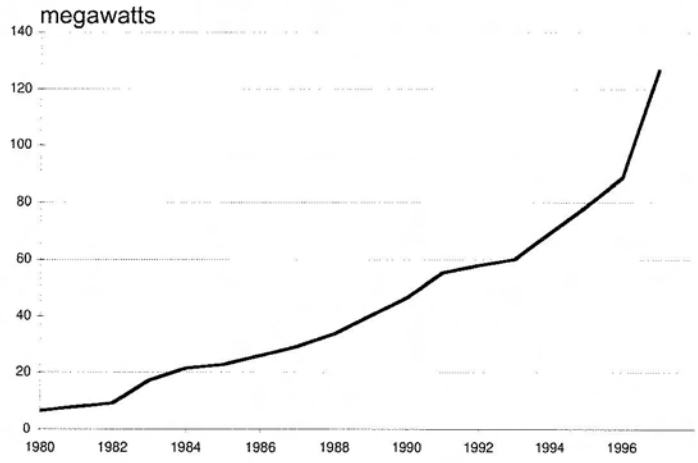
"But that is only a limit faced with current techniques."

From numerous regression studies, it has been found that sulfur dioxide, particulate emissions and several other indicators of pollution rise quickly as a region first industrializes, but then goes down, as it shifts away from heavy industry, and as it becomes wealthy enough to afford control measures.

The possibilities that food limits will be hit in the near future could also be circumvented. World grain reserves have been going down in the 1990s - as noted in the 'Geo*polity*' plausibilities - but that is only a limit faced with current techniques. What the biotech revolution does remains to be seen. If it raises output as much as the green revolution of the 1970s, then a breathing space lasting a decade or more could result. Economic growth, so long as it is spread evenly - and especially to women - has often slowed population growth. If that occurs, the breathing space offered by biotech and other enhanced technologies would not quickly be used up.

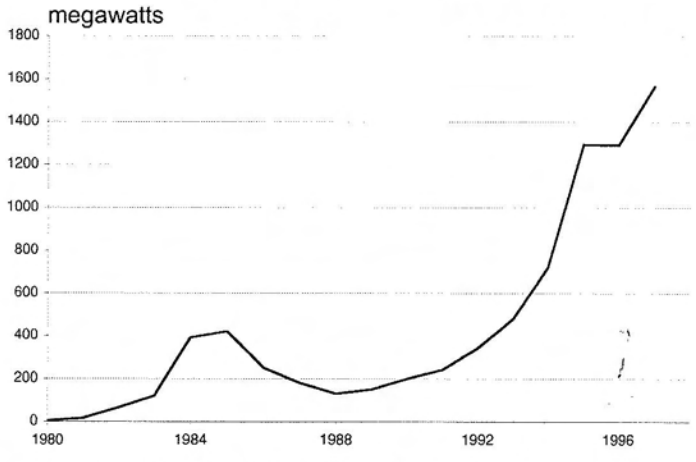
In this changed world, a push towards renewables is likely, for the reasons noted on page 65: they are technologies at an early stage of their

World Photovoltaic Annual Shipments 1950-97



Source: Vital Signs 1998, Worldwatch Institute

World Wind Energy Annual Additions 1950-97



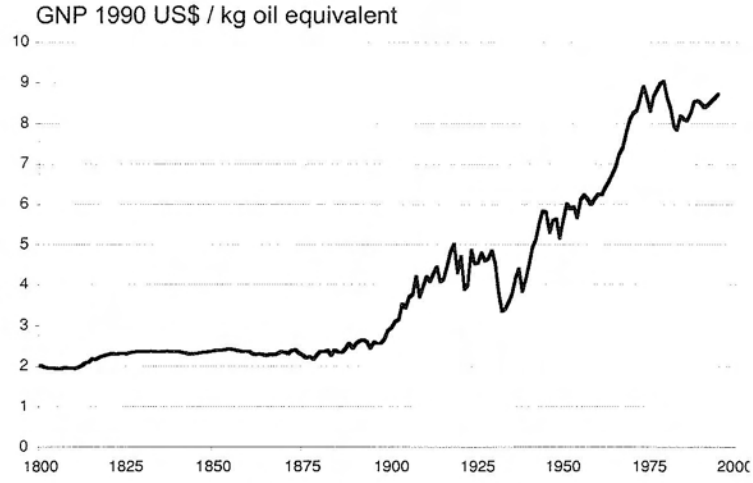
Source: State of the World 1998, Worldwatch Institute

"Modular and dispersed energy systems will spread."

growth, which gives great space for profits as they are further advanced. They are already growing quickly, as the accompanying charts show on the previous page.

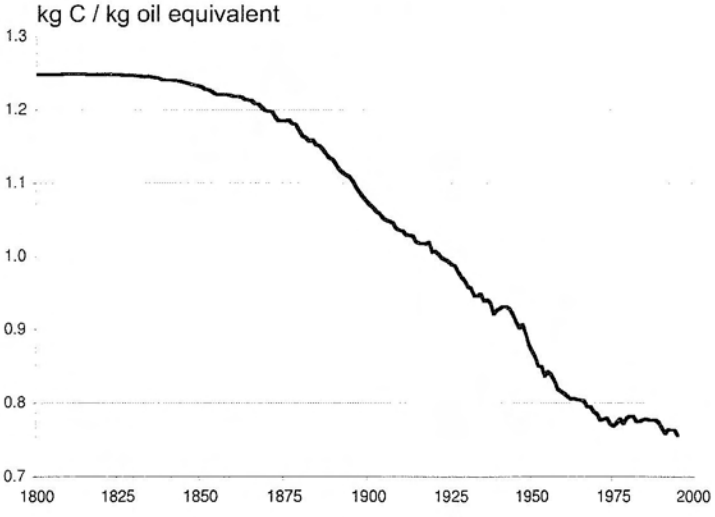
Modular and dispersed energy systems will spread, and not just by the analogy to cars replacing trains. They are part of a deeper trend. There is been a steady move over time towards energy that is been more mobile, and denser in calories released. You can measure the sequence in terms of the hydrogen/carbon ratio: it moves up from wood, to charcoal, to coal, to oil, to natural gas. Each step makes it more user-friendly - it is a closer match to the final use required. (Even the plastics industry fits neatly in that sequence. Instead of burning hydrocarbons, you turn them into dispersed, finely-targeted goods.) Small-scale units for final use is simply more of the same.

Global Energy Intensity



Source: Technology & Global Change, Arnulf Grübler, pg 287 Fig 6.32

Global Energy Carbon Intensity



Source: Technology & Global Change, Arnulf Grübler, pg 287 Fig 6.32

The dematerialization all this depends on is a deeply-rooted trend as well, even beyond the recent items noted on page 58. The real weight per dollar of US imports started going down swiftly as early as 1970, and has been shrinking by an average 4 percent in almost every year since then.

The further innovation that emerges could be immense. The vast population pools that can be drawn on from the developing countries was referred to on page 79. It has happened before. In the interwar period, the Lower East Side of New York was decried by respectable critics as a useless agglomeration of backward Irish, Italian, Jewish and

"The dematerialization all this depends on is a deeply-rooted trend as well."

Greek immigrants. Within a generation - and funneled through the publicly funded education system in New York - those 'backward' groups produced one of the highest density of Nobel Laureates the world has seen. With modern communications, there will no longer be need for that physical concentration. The talent base of the entire planet can be hooked up.

"The further innovation that emerges could be immense."

The 'stress' which occurs in developing countries can be especially useful. Engineering skills are often honed when operating under constraints. The gas turbines now used in power generation were first developed in the airplane industry, where weight - and so maximum efficiency - was at a premium. Similar constraints in developing countries - in water scarcity; in temperature extremes - can only be expected to boost creativity as well. (There is more on creativity from developing countries on page 15, where it made an abortive appearance in the early stages of the F.R.O.G. scenario.)

"It has happened before."

In countries rich and poor, the multiple openings which a Jazz world offers give a further boost to new products. We saw this briefly on page 67 with the example of the old Bell Labs in the 1990s. It is a basic pattern. Even the modern petroleum industry depended on a similar 'opening'. Thermal cracking - which could double the amount of usable gasoline from each barrel of oil - had been invented by an in-house scientist at Standard Oil. But when John D. Rockefeller controlled the firm as a monolith, his executives refused to let the new process be used. Only when Standard was shattered apart, by a previous wave of deregulation, in the 1910s, did thermal cracking find a fresh company that would use it. Mass growth in car ownership would have been considerably slowed if that had not happened.

"Engineering skills are often honed when operating under constraints."

Seemingly stagnant economies revitalize, when such new business forms unleash their power. Germany's proposed resurgence has good precedent. Early in this century, France had seemed doomed to permanent stagnation. Starting in the mid 1950s, however, it entered a 20 year boom, as an entire new wave of technology was introduced: The latest dams (and the financing instruments to back them); the infrastructure for new-style airports; entire new industries to support greatly increased car ownership.

"Seemingly stagnant economies revitalize, when such new business forms unleash their power."

The fact that many established companies handle the transformation poorly is only to be expected. As seen on page 72, whenever the world's changing quickly, and there is a fear you might be the one slipping behind, cautious judgment is easily forgotten. Rolls-Royce raced to get contracts for a new jet engine in the 1970s, without engag-

ing in the testing which would have shown it was vulnerable to sudden fracture; Exxon, famously, wasted over one billion dollars in just two years on a shale oil project, on the Western Slopes of the Rockies, in a decision it raced into as well. Firms become desperate to recapture an established market, rather than genuinely develop the capacity to enter into a new one.

"Firms become desperate to recapture an established market, rather than genuinely develop the capacity to enter into a new one."

It is especially easy to miss the role of services. The avionics case on page 59 is one example; another is the way that Detroit's first response to rising imports of Japanese cars was to feel it had to compete on price. Years passed before the American auto industry realized that customers were deserting it on grounds of superior reliability and service, instead.

"It is especially easy to miss the role of services."

There will be deep obstacles to all these advances, as there have been with previous large-scale shifts in the world's economic patterns. The industrial revolution even in its milder locales, led to unions and company taxes; in its rougher outpourings, it led to riots, punitive taxation, and uncompensated nationalizations. Jazz would no doubt provoke some range of analogous resistances, as noted on page 70: from the regions which are left out; from the firms which see themselves being marginalized. In the worst cases, Jazz's lack of central authority could lead to a situation like Russia of the late 1990s, where new alliances and entrepreneurs were universally despised.

"Jazz would no doubt provoke some range of analogous resistances."

The self-repair capacities in a Jazz world, however, could easily be strong enough to overcome that. As noted on page 77, Jazz lives by the Internet and fast communication, and that can be used by watchdogs to help keep it on the straight and narrow. In the Brent Spar episode of the early 1990s, when Shell was criticized for its method for disposing of an off-shore oil storage unit, consumers in Germany easily followed calls to boycott the firm. Although that particular criticism was based on an erroneous analysis - calmer evaluation, later, showed Shell's disposal method was fine - insurance companies increasingly began to demand that firms 'prove' they were following the most-desired standards of action. Giant timber firms, such as Canada's MacMillan Bloedel, agreed to follow sustainable timber codes of conduct. Nike signed up for codes of good manufacturing conduct.

"Jazz lives by the Internet and fast communication."

That suggests the greatest strength, and likelihood of Jazz surviving. When DuPont announced that it, unilaterally, was going to get out of producing CFCs, how

could its competitors keep any public respect by saying that they were not? That option was closed off. Precedent and the availability of alternatives makes it hard to slip away. A market that lacks central organization does not have to descend into chaos. It is a point backed by Adam Smith no less - that notably successful theorist of the first industrial revolution. So long as firms engage in a minimum amount of self-policing - which could be easy enough in Jazz, as suggested above and on page 78 - there is every reason to expect their output to be impressively superior to the more regulated, bureaucratically controlled system which came before.

"A market that lacks central organization does not have to descend into chaos."

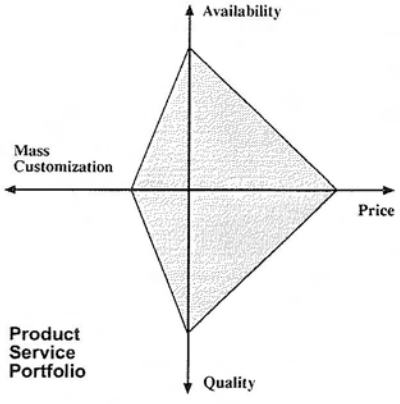
Plausibility: Sustainability

It used to be that the energy business was simply a matter of competing on availability. There were natural monopolies of distribution, universal service, high entry costs - the whole situation we took for granted not so long ago.

"It used to be that the energy business was simply a matter of competing on availability."

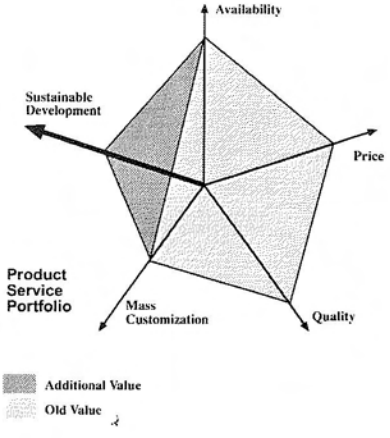
That is changed. Competing on price has not taken up the slack, and we rarely see a successful strategy based on being cheaper than the next supplier. Nor has quality succeeded as a determining characteristic.

The latest trend has been to compete on mass customization. We try to give clear brand images to what we offer, and convince the customers that they are who we are in business to serve. But even that has not worked very well. Margins are thin, and have been falling - which is a sure sign that we have become commoditized.



Those problems have led to a wave of mergers, downsizing and general cost reductions. At times it can seem to be the only alternative, but it is relentlessly difficult, and hard to maintain for long.

What our industry needs is a new dimension of value - something that goes beyond simple availability, or price, or quality, or mass customization. It needs to be something more than a fad as well, for otherwise it will not help us for more than a short while.



In our judgment, sustainability can be this lasting new dimension of value. It is a common enough view - as demonstrated not least by the large number of companies that have joined the WBCSD. But there are reasons to think it is more than just a good guess.

On the purely physical side, there is all the evidence we have now seen that direct effects of climate change or other environmental shifts might reach levels that will impinge on future events. But sustainability goes beyond that, which is why limits being hit - or avoided - in matters of education, political participation and fi-

nances entered so naturally into the main stories as well. We are moving from a material constrained world to a meaning-constrained one.

It is not the sort of thing you can ever prove in advance. The point is a different one. *If* sustainability turns out to be an important factor in the future - and this seems likely enough - then exploring what happens within its constraints will have been wise.

It is true that some people are leery, and want to stay away from it as a determining strategy, simply because it opens up so many ambiguous possibilities. But think how inadequately one would have strategized about the future without its insights in the stories we have just seen! Sustainability really can be a 'lens', to help a firm look at current and future reality, and end up seeing more powerful strategic opportunities than its competitors. Standard approaches simply set you fighting over a few market share points. Sustainability however - when properly used - is the sort of insight that can end up determining who owns an entire market.

"Sustainability's signals are often pretty weak."

Sustainability's signals are often pretty weak, and this is a further reason they are sometimes left aside. For weak signals are hard to interpret. Sometimes they mark something which is objectively weak - which will never amount to anything. But sometimes they are weak merely because they are the beginning of a tidal wave, which merely happens to be some way off. Only in the next decade will we be able to select the right answer to our dominating question: "Sustainability is...

- Nothing?
- A tidal wave?
- The birth of a new surfing industry?"

"... we are the first species to become a geophysical force, altering Earth's climate, a role previously reserved for tectonics, sun flares and glacial cycles."

E.O. Wilson

About Scenarios

Forecasting is not enough

Old-fashioned forecasting works fine in the short term. You can often accurately predict how much sales will rise or fall in different areas, and make your plans accordingly. The problems come when you want to move beyond the short-term, or when your world is changing quickly.

"Problems come when you want to move beyond the short-term, or when your world is changing quickly."

One common response is to hedge your predictions, and prepare for high/medium/low alternatives. But even this is not as good as it seems. An army, for example, might suspect that an attack by enemy soldiers is most likely from the east, but just to be sure, it might hedge its bets, and position a few troops to the north, just in case there is an attack from that direction. But what happens if instead of an attack by soldiers from the north, or the east, or indeed from any other compass direction, it now suddenly finds itself disabled by a cyber-attack, where its computers have been hacked and taken out of action? As James Webb, the long-time NASA chief executive put it: 'It is the risks that you do not consider that get you'.

"But what happens if instead of an attack by soldiers from the north, or the east, or indeed from any other compass direction, it now suddenly finds itself disabled by a cyber-attack?"

The problem has arisen often enough in the history of energy. The precursor of the European community prepared a large study around 1950 to forecast Europe's energy situation a half-century hence. They concentrated on working out what the mix would be between coal and nuclear. They were even sensible enough to say that they had to hedge the exact details. But what they utterly missed, in their detailed calculations, was the great popular reaction against nuclear energy. Many planning departments in the 1980s missed the consequences of deregulation.

"But what they utterly missed, in their detailed calculations, was the great popular reaction against nuclear energy."

Going beyond forecasting is not pure guesswork

This problem does not mean that you cannot plan ahead. Clearly we would like planning departments in the 1990s to do better. You just have to go about it differently. A good scenario exercise shifts the question away from 'Whether x will happen', to 'What would we do if it *did* happen'.

What helps in this process is that many *aspects* of what is liable to occur in the future are already around. In the early 1970s, for example, no mainstream political commentator was predicting Thatcherism. (Even Thatcher was not: her speeches then still supported the old, middle-line consensus.) But a keen observer would have noted that there were a number of small think-tanks appearing, in Britain and in America, which were outlining a new approach to government. The think-tanks were talking about such strange, unheard-of concepts as privatization, and tax incentives for privately-funded pensions, and much of the rest of what ten years later really did become the new Reagan/Thatcher consensus. It would have been foolish for an observer to have insisted that the rumblings from those think-tanks would definitely become policy a decade down the line. But it certainly would have been useful for them to imagine what would happen *if* those proposals did start getting introduced.

"A good scenario exercise shifts the question away from 'Whether x will happen', to 'What would we do if it* did *happen'."

It happens in technologies as well. Dominant technologies have often been around for a long time, in simpler or experimental form, and in theory they could have been looked over for their possibilities back then. The Internet seems 'new', but it had been used by academic scientists, for emails and chat rooms, in some forms at least since the early 1960s. Even something as ultra-modern as the Stealth fighter, is actually built up from a 1960s mathematical idea, using 1970s software, and with hydraulics put in by a designer following techniques he had learned in the 1940s.

"The Internet seems 'new', but it had been used by academic scientists, for emails and chat rooms, in some forms at least since the early 1960s."

Good choices

The trick is to find *which* aspects of things around now are the ones that are likely to become more important in the future. It is never easy to pick out these right precursors. Sometimes what seems a powerful trend quickly fades away (remember when Japan's economy was 'inherently' more dynamic

"The trick is to find* which *aspects of things around now are the ones that are likely to become more important in the future."

than America's?) Sometimes dormant technologies that seem about to take off prove to be non-starters - think of the proposed new media technologies in the mid '90s that did not make it.

"Some firms will use the scenarios to stress test their current strategies, seeing how robust they are in different settings."

That is why scenarios work best if instead of picking just one possibility, we imagine two or three quite different ones. (And of course although the future often builds up on selected aspects of the past, utterly new factors often have to be envisaged as entering in as well.) To do this well of course entails a great deal of groundwork. There is no advantage if your choices are simply built on personal guesswork, or chance.

When it works it is great. One's no longer stumbling through a jungle at night; fearfully guessing what might be in store. Instead we have infrared night-vision goggles on, and can see what is lying in wait. Some firms will use the scenarios to stress test their current strategies, seeing how robust they are in different settings. Others will be opening in-house discussions to create new strategic options. Whatever final use is made will have to be customized for each firm's own needs - which is why the main report only gave overall indicators of strategy within each scenario.

"Others will be opening in-house discussions to create new strategic options."

'Levels' of innovation

Scenarios have to tread a fine line between being exciting, yet also being sensible. If you are going to bet several hundred million dollars on a fresh strategic choice, you want there to be good reason for it. But they are also not worth bothering with unless they do surprise you, stretching your mind to new ways of thinking. One way of doing this is to look at central topics in more than just their usual way.

"In these energy scenarios, for example, innovation was constantly examined along two levels."

In these energy scenarios, for example, innovation was constantly examined along *two* levels. There was innovation in physical products, but also there was innovation in organization. It is the difference between hardware, and software. Knowing the state of a country's roads and telecoms is important, but knowing how well it observes contracts, and what its educa-

tional level is, is important as well. The first is a country's hardware, but the second is the software needed to make that hardware work.

The importance of keeping an eye on that organizational 'software' is clear if you imagine someone 20 years ago having been granted a glimpse ahead into the firms that later became ABB, the immensely successful Swedish-Swiss engineering firm. To have been able to see the particular technical products they ended up building would certainly have been useful, especially if the viewer was trying to make electrical generating equipment of his own. But to have seen how much ABB was shifting its operations out of Europe would have been equally interesting, while to have glimpsed the new and highly flattened management structure which one then unknown young man named Percy Barnevik was soon to put into effect - when he subsequently became CEO - could have been the most important insight of all.

One part at a time

As we mentioned earlier, it is virtually certain that no one of the scenarios presented here will be entirely true. The Nobel Laureate Peter Medawar pointed out at least one basic reason for this. The future depends very much on what happens in science, yet even the world's top scientists cannot say precisely what will be found - if they could, they would no longer be in their labs, but would be publishing their final results.

What we are really doing is a bit like boosting the gain on different sections of an electric circuit, to examine how its different parts work. In the first scenario we focused in full detail on one possible aspect of what might arise, and then, when we had finished that, we shifted in the next scenario to focusing on another possible aspect. Real life is always going to be a mix. But a good way to prepare for it, is by understanding how those core components are likely to work.

"What we are really doing is a bit like boosting the gain on different sections of an electric circuit, to examine how its different parts work."

People

Interviewees

Anova Holding

Frank Bosshardt

Ken McCready

Stephan Schmidheiny

BG plc

Chris Rose

Jackie Henshaw

Mike Patterson

Peter Schwarz

Steve Copley

Steve Lucas

General Motors

Bill Blatt

Denny Minano

Jim Pasek

Mustafa Mohatarem

Remy Schosmann

Terry Pritchett

Tom Marx

Norsk Hydro ASA

Bjørn Sund

Bjørn Tretvoll

Kjell Øren

Sigurd Andenæs

Trygve Refvem

Ontario Hydro

Anda Kuksis Kalvins

Bob Ferguson

Gerry O' Hearn

Helen Howes

Ontario Hydro(cont)

Ian london

Mike Della Rossa

Pat McNeil

Rod Taylor

PowerGen plc.

Carol Wood

David Parry

Kelvin Beer

Mike Gibbons

Mike Lewis

Tom Hainey

Tony Cocker

Rocky Mountain Institute

Amory Lovins

Hunter Lovins

SHV Holdings N.V.

A.J. Rijnvis

A.M. van Vlissingen

J. Visser

J.S. Harris

P.C. Claver

W. Peek

W.IJ. Baan

Statoil

Arve Thorvik

Eldar Saethre

Geir Pettersen

Martin Bekkeheien

Stig Bergseth

Suncor Energy Inc.

Arnie Godin

Barry Stewart

Earle McVicar

Eric Axford

Gordon Lambert

Rick George

Tom Ryley

Tepco

Johannes Waltz

Kazunori Yumoto

The Wuppertal Institute for Climate, Environment & Energy

Ernst von Weizäcker

UBS

Boris Spycher

Bruno Bebié

Inge Schumacher

Vattenfall AB

Bengt Hanell

Carl-Erik Nyquist

Inger Holmström Lindgren

Kerstin Frenning

Staffan Nordin

Ulf Boman

Workshop Participants

Arie F. Brand, SHV Holdings N.V.

Bjørn Sund, Norsk Hydro ASA

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Bibliography

Of all the books about energy and change, there are three you should read:

Smil, Vaclav, 1993, *Energy in World History*, Boulder, Westview.

Grübler, Arnulf, 1998, *Technology and Global Change*, Cambridge University Press.

Pine II, Joseph and Gilmore, James, 1999, *The Experience Economy*, Cambridge, Harvard Business Press.

The best data source is *www.worldwatch.org*, which can also lead you elsewhere.