DISCUSSION PAPERS

LEADING THE WAY TO A THIRD INDUSTRIAL REVOLUTION AND A NEW SOCIAL VISION FOR THE WORLD

Addressing the Triple Threat of the Global Economic Slowdown, Energy Security and Climate Change

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1 Introduction

In 1956, the U.S. Congress enacted the Federal-Aid Highway Act. The legislation, signed into law by President Dwight D. Eisenhower, appropriated $25 billion for the construction of 41,000 miles of interstate highways over a thirty year period, in what was at the time the biggest single public works project in U.S. history. The resulting interstate highway system joined every part of the continental United States and provided the road infrastructure for completing the Second Industrial Revolution. The oil-powered internal combustion engine was the economic engine of the 20th century economy and provided the stimulus for virtually every other industry, from steel production to tourism. Americans took for granted that “what’s good for General Motors is good for the country.” The interstate highway system created the connective infrastructure for a suburban commercial and housing construction boom that made the United States the most prosperous economy and society in the world, and Americans the wealthiest people on Earth, by the late 1980s.

2
The Long Sunset of the Second Industrial Revolution

Even while America was celebrating its unprecedented commercial success, some ominous storm clouds were brewing on the horizon, but it would be another half century before they came together to create the perfect economic storm, bringing the United States and the world economy to the brink of collapse.

At the same time that the interstate highway system was being constructed, scientists began to take note of a disturbing trend in the chemical composition of the Earth's atmosphere —the buildup of CO_2 concentrations. Scientists speculated that the burning of fossil fuels and the emission of CO_2 might be warming up the Earth's atmosphere with unimaginable consequences. By the 1960s, computer models were projecting a possible increase in the Earth's temperature of a few degrees within a century. In 1979, the U.S. National Academy of Sciences issued its first preliminary report on global-warming, suggesting that human-induced activity might be adversely affecting the temperature of the planet. The findings were tentative and highly speculative in nature, and did not so much as register a blip on the public radar screen at the time.

Although flush with oil —remember that the United States was the world's leading producer of oil in the mid-20th century— and confident of a prosperous future, other troubling signs began to appear. The 1973 Organization of the Petroleum Exporting Countries (OPEC) oil embargo and the subsequent rise in oil prices in the 1970s turned public attention to the question of whether we might one day run out of oil. But, the general consensus at the time was that the oil embargo was less about supply than about oil-producing countries flexing their economic and political muscle to exact gains in the marketplace and command respect and attention in the geopolitical arena.

What no one knew was that peak available global oil per capita —not to be confused with peak global oil production— occurred in 1979. While more oil reserves have been found since then, the growing human population means that if oil were distributed equally to every person today, each individual would have less oil available to them. This fact alone would have ominous consequences in July 2008 when oil hit a record price of 147 dollars a barrel on world markets.

The entropy bill for the Second Industrial Revolution was inexorably building up in the last half of the 20th century but was all but ignored in a world economy that was growing by leaps and bounds. By the late 1980s, the Second Industrial Revolution had matured in the United States. The suburban building boom, which had led to the largest economic expansion in U.S. history, began to cool off. The recession of 1989 to 1991, which was triggered by a downturn in suburban construction in the southern and western parts of the country, marked a milestone for the Second Industrial Revolution, although no one at the time recognized its importance.

There would be another major building boom in the last half of the 1990s and the first six years of the 21st century. However, it would be generated more by irresponsible extension of mortgage credit instruments and driven by wild speculation than by technology-driven increases in productivity and the generation of new "real" wealth. The reality is that the economic multiplier effect of establishing an interstate highway network had mostly run its course with the completion of the infrastructure and the suburban build-out.

Economic growth from the early 1990s to the crash of 2008 was led less by new technological innovations and entrepreneurial acumen, even though that was the official public explanation for the new prosperity. That's not to say that new technologies —especially the information and communication technologies (ICT) revolution— didn't play some role in the restoration of economic growth, but it was far less significant than the media, business community, and politicians led the public to believe. The fact is that the great economic growth made possible by the Second Industrial Revolution had begun to slow by then. Wages had already been stagnant in the United States for nearly a decade, and the technologies that made up the Second Industrial Revolution phalanx were now passing into their mature and even senescent stage.

What brought the United States and the world out of the economic downturn of the late 1980s and early 1990s was the issuing of massive consumer credit, first in the United States and then in other countries. The "credit card culture" boosted purchasing power and put American companies and employees back to work in the early 1990s to produce all of the goods and services being bought on credit. For the last eighteen years, American consumers have propped up the global economy, largely by their credit driven purchases. The price for maintaining a global economy on the shoulders of increasing U.S. consumer debt however, has been the depletion of American family savings. The average family savings in 1991 was approximately 8 percent. By 2006 family savings entered the negative category. Many families were spending more than they made. The term for this is "negative income", an oxymoron that represents a failed approach to economic development.

As family savings moved into negative territory, the mortgage and banking industry created a second line of artificial credit, allowing American families to purchase homes with little or no money down, at low or nonexistent short term interest rates —subprime mortgages— with the interest rate going up and the principle coming due pushed off into the future. Millions of Americans took the bait and bought homes beyond their ability to pay in the long run, creating a housing bubble. Strapped for cash, homeowners used their homes as ATM cash machines, refinancing mortgages —sometimes two or three times— to secure needed cash. The housing bubble has now burst, with millions of Americans facing foreclosures and banks facing collapse.

The result of eighteen years of living off of extended credit is that the United States is now a failed economy. The gross liabilities of the US financial sector, which were 21 percent of gross domestic product (GDP) in 1980, have risen steadily over the past twenty-seven years, and were an incredible 116 percent of GDP by 2007. Worse still, the accumulated household consumer debt now exceeds 13.9 trillion dollars. Because the U.S., European, and Asian banking and financial communities are intimately intertwined, the credit crisis has swept out of America and engulfed the entire global economy.

What essentially happened in the past two decades is that the global economy continued to expand by depleting the accumulated American savings reaped during the forty year growth spurt of the Second Industrial Revolution that began at the end of World War II and ran its course by the late 1980s. To make matters worse, the global credit crisis escalated even further over the past two years as oil prices soared, reaching $147 per barrel on world markets in July 2008. The increasing price of oil stroked inflation, dampened consumer purchasing power, slowed production and increased unemployment, wreaking further havoc on an already debt ridden economy.

We now face a new phenomenon. It's called "peak globalization" and it occurred at around $147 per barrel. Beyond this point, inflation creates a firewall to continued economic growth, pushing the global economy back down toward zero growth. It is only with the contraction of the global economy that the price of energy falls as a result of less energy use.

The importance of "peak globalization" can't be overemphasized. The underlying assumption of globalization has been that plentiful and cheap oil allows companies to move capital to cheap labor markets, where food and manufactured goods can be produced at minimum expense and at high profit margins and then shipped around the world. This core assumption has disintegrated, with ominous consequences for the globalization process.

To understand how we got to this point, we need to go back and revisit 1979, the year that global oil per capita peaked, according to a study done by the British oil company, BP. When China and India began their dramatic economic growth in the 1990s, their demand for oil skyrocketed. Demand began to outstrip supply and the price of oil began to climb. With less oil potentially available for every human being, efforts to bring one third of the human race —the combined population of China and India— into an oil-based Second Industrial Revolution, have come up against a limited supply of oil. In other words, demand pressure of a growing human population against finite oil reserves inevitably pushes the price up, and when oil hits $147 per barrel, inflation becomes so powerful that it acts as a drag on further economic growth and the global economy contracts.

The rising price of energy is embedded in every product we make. Therefore, the increase in the price of energy impacts every aspect of production as well and makes long-haul transport by air and tanker increasingly prohibitive. Whatever marginal value companies previously enjoyed by moving production to cheap labor markets is cancelled by the increasing cost of energy across the entire supply chain. This represents the real endgame for the Second Industrial Revolution and occurs well before the point of peak global oil production.

At the same time, the effects of "real-time" climate change are further eroding the economy in regions around the world. The cost in damages just from Hurricanes Katrina, Rita, Ike, and Gustav is estimated to be in excess of $100 billion. Floods, droughts, wildfires, tornadoes, and other extreme weather events have decimated ecosystems on every continent, crippling both agricultural output and infrastructures, slowing the global economy, and displacing millions of human beings.

The United Nations' Intergovernmental Panel on Climate Change estimates that a doubling of carbon dioxide concentration in the Earth's atmosphere in the current century is likely to heat up the Earth's surface by 2 to 4.5 degrees Celsius, with 3 degrees Celsius being the most likely increase. However, the scientists caution that the Earth's temperature could rise "substantially higher" than 4.5 degrees Celsius, according to some of the forecasting models.

But even a rise in temperature of 3 degrees Celsius, which some scientists say is overly conservative given the potential positive feedback effects that have yet to be anticipated, would take us back to the temperature on Earth three million years ago during the Pliocene era. That was a very different world than the one we experience today.

Even more frightening, the panel estimates that a 1.5 to 3.5 degree Celsius or more rise in temperature in less than one hundred years threatens the potential extinction of between one fifth and upward of 70 percent of all species assessed so far. To put the magnitude of this in perspective, we need to bear in mind that there have been five waves of mass biological extinctions in the 3.5 billion years that life has existed on Earth, and every time there was a biological wipeout, it took approximately ten million years to recover the biodiversity lost. In a very real sense, the human race has yet to grasp the enormity of the changes taking place on Earth as the temperature on the planet continues to rise.

The convergence of the global credit crisis, the energy crisis, and real-time impacts of climate change have brought the world economy to the brink of collapse. Oil, coal, and natural gas will provide a decreasing portion of the world's energy in the 21st century. It has become clear to most observers that we are approaching the end of the fossil-fuel era. During this twilight era, nations are making efforts to ensure that the remaining stock of fossil fuels is used more efficiently and are experimenting with clean technologies to limit carbon dioxide emissions in the burning of conventional fuels. The European Union in particular is mandating that its member states increase energy efficiency by 20 percent by 2020 and reduce their global-warming emissions by 20 percent (based on 1990 levels), again by 2020.

But greater efficiencies in the use of fossil fuels and mandated global-warming gas reductions alone are not going to be enough to adequately address the unprecedented crisis of global peak oil and gas production and global-warming. Looking to the future, every government will need to explore new energy paths and establish new economic models with the goal of achieving as close to zero carbon emissions as possible.

3
The Rise of the Third Industrial Revolution

Even as the Second Industrial Revolution is entering into its endgame, a new Third Industrial Revolution is looming on the horizon. Whether it will come on line quickly enough to mitigate the long-term entropic impact that has built up over the two hundred year time span that marks the fossil fuel era and the first two industrial revolutions is still an open question.

The great economic changes in history occur when new communications revolutions converge with new energy regimes to create wholly new living environments. We are on the cusp of just such a convergence —the coming together of the distributed ICT revolution of the past two decades with the distributed energy regime of the 21st century. The use of distributed information and communications technology as the command and control mechanism to organize and manage distributed energy ushers in a powerful Third Industrial Revolution with an economic multiplier effect that should extend well into the second half of the 21st century and beyond.

Distributed energies are energies that are found in the backyard. The sun shines all over the world. The wind blows across the Earth every day. We all generate garbage. People living in rural areas have access to agriculture and forestry waste. People living in coastal areas have the energy generated from the incoming tides. Geothermal energy lies beneath the Earth and water provides hydropower. We call these energies distributed because unlike the conventional elite energies —coal, oil, natural gas, and uranium— that are only found in limited geographic regions, the renewable energies are found in various proportions everywhere.

Today the information and communications technologies that gave rise to the Internet are being used to reconfigure the world's power grids, enabling millions of people to collect and produce their own renewable energy in their homes, offices, retail stores, factories, and technology parks and share it peer to peer, across smart grids, just like they now produce and share their own information in cyberspace. Companies are already beginning to establish the beginnings of an infrastructure and market for what business leaders call "distributed capitalism."

Renewable forms of energy —solar, wind, hydro, geothermal, ocean waves, and biomass— make up the first of the four pillars of the Third Industrial Revolution. While these sunrise energies still account for a small percentage of the global energy mix, they are growing rapidly as governments mandate targets and benchmarks for their widespread introduction into the market and their falling costs make them increasingly competitive. Billions of dollars of public and private capital are pouring into research, development, and market penetration, as businesses and homeowners seek to reduce their carbon footprint and become more energy efficient and independent.

Although renewable energy is found everywhere and new technologies are allowing us to harness it more cheaply and efficiently, we need infrastructure to load it. This is where the building industry steps to the fore, to lay down the second pillar of the Third Industrial Revolution.

Buildings are the major contributor to human induced global-warming and consume 30 to 40 percent of all the energy produced and are responsible for equal percentages of all CO_2 emissions. Now, new technological breakthroughs make it possible, for the first time, to convert existing buildings and design new ones that can create some, or even all, of their own energy from locally available renewable energy sources, allowing us to reconceptualize the future of buildings as “power plants.” The commercial and economic implications are vast for the real estate industry and, for that matter, the world.

In twenty-five years from now, millions of buildings —homes, offices, shopping malls, factories, industrial and technology parks— will be renovated or constructed to serve as “power plants” as well as habitats. These buildings will collect and generate energy locally from the sun, wind, garbage, agricultural and forestry waste, ocean waves and tides, hydropower and geothermal-power sources —enough energy to provide for their own power needs as well as surplus energy that can be shared.

The GM factory in Aragon, Spain, the largest GM production facility in Europe, has just installed a 10 mega-watt solar plant on its factory roof for the cost of 78 million USD. The power station is able to produce enough electricity for the factory or provide electricity for 4,600 homes. The initial investment is paid back in less than 10 years, after which the generation of electricity is virtually free, except for the maintenance of the solar facility.

In France, the giant French construction company, Bouygues is putting up a state-of-the-art commercial office complex in the Paris suburbs that collects enough solar energy to provide not only for all of its own needs but even generates surplus energy.

The Walqa Technology Park in Huesca, Spain, is nestled in a valley in the Pyrenees and is among a new genre of technology parks that produce their own renewable energy on-site to power virtually all of their operations. There are currently a dozen office buildings in operations at the Walqa Park, and forty more already slated for construction. The facility is run almost entirely by renewable forms of energy, including wind power, hydropower, and solar-power. The park houses leading high-tech companies, including Microsoft and other ICT and renewable energy companies.

The introduction of the first two pillars of the Third Industrial Revolution —renewable energy and “buildings as power plants”— requires the simultaneous introduction of the third pillar of the Third Industrial Revolution. To maximize renewable energy and to minimize cost, it will be necessary to develop storage methods that facilitate the conversion of intermittent supplies of these energy sources into dependable assets. Batteries, differentiated water pumping, and other media can provide limited storage capacity. There is, however, one storage medium that is widely available and relatively efficient. Hydrogen is the universal medium that '"stores" all forms of renewable energy to assure that a stable and reliable supply is available for power generation and, equally important, for transport.

Hydrogen is the lightest and most abundant element in the universe, and when used as an energy source, the only by-products are pure water and heat. Our spaceships have been powered by high-tech hydrogen fuel-cells for more than thirty years. Here is how hydrogen works: Renewable sources of energy —solar, windpower, hydropower, geothermal power, ocean waves— are used to produce electricity. That electricity, in turn, can be used, through a process called electrolysis, to split water into hydrogen and oxygen. Hydrogen can also be extracted directly from energy crops, animal and forestry waste, and organic garbage —biomass— without going through the electrolysis process.

The important point to emphasize is that a renewable energy society becomes viable to the extent that part of that energy can be stored in the form of hydrogen. That's because renewable energy is intermittent. The sun isn't always shining, the wind isn't always blowing, water isn't always flowing when there's a drought, and agricultural yields vary. When renewable energy isn't available, electricity can't be generated and economic activity grinds to a halt. But if some of the electricity being generated when renewable energy is abundant can be used to extract hydrogen from water, which can then be stored for later conversion back to electricity, society will have a continuous supply of power.

In 2008, the European Commission announced a Joint Technology Initiative (JTI), an ambitious public/private partnership to speed the commercial introduction of a hydrogen economy in the twenty-seven member States of the EU, with the primary focus on producing hydrogen from renewable sources of energy.

By benchmarking a shift to renewable energy, advancing the notion of buildings as power plants and funding an aggressive hydrogen fuel-cell technology R & D program, the EU has erected the first three pillars of the Third Industrial Revolution. The fourth pillar, the reconfiguration of the power grid along the lines of the Internet, allowing businesses and homeowners to produce their own energy and share it with each other, is just now being tested by power companies in Europe, the United States, Japan, China, and other countries.

The smart intergrid is made up of three critical components. Minigrids allow homeowners, small and medium-sized enterprises (SMEs), and large-scale economic enterprises to produce renewable energy locally —through solar cells, windpower, small hydropower, animal and agricultural waste, and garbage— and use it off-grid for their own electricity needs. Smart metering technology allows local producers to more effectively sell their energy back to the main power grid, as well as accept electricity from the grid, making the flow of electricity bidirectional.

The next phase in smart grid technology is embedding sensing devices and chips throughout the grid system, connecting every electrical appliance. Software allows the entire power grid to know how much energy is being used, at any time, anywhere on the grid. This interconnectivity can be used to redirect energy uses and flows during peaks and lulls, and even to adjust to the price changes of electricity from moment-to-moment.

In the future, intelligent utility networks will also be increasingly connected to moment weather changes —recording wind changes, solar flux, and ambient temperature— giving the power network the ability to adjust electricity flow continuously, to both external weather conditions and consumer demand. For example, if the power grid is experiencing peak energy use and possible overload because of too much demand, the software can direct a homeowner's washing machine to go down by one cycle per load or reduce the air conditioning by one degree. Consumers who agree to slight adjustments in their electricity use receive credits on their bills. Since the true price of electricity on the grid varies during any twenty-four hour period, moment-to-moment energy information opens the door to "dynamic pricing," allowing consumers to increase or drop their energy use automatically depending upon the price of electricity on the grid. Up-to-the-moment pricing also allows local minigrid producers of energy to either automatically sell energy back to the grid or go off the grid altogether. The smart intergrid will not only give end users more power over their energy choices, but it also creates significant new energy efficiencies in the distribution of electricity.

The intergrid makes possible a broad redistribution of power. Today's centralized, top-down flow of energy becomes increasingly obsolete. In the new era, businesses, municipalities, and homeowners become the producers as well as the consumers of their own energy —what is referred to as "distributed generation."

The distributed smart grid also provides the essential infrastructure for making the transition from the oil-powered internal combustion engine to electric and hydrogen fuel-cell plug-in vehicles. Electric plug-in and hydrogen-powered fuel-cell vehicles are also "power stations on wheels" with a generating capacity of twenty or more kilowatts. Since the average car, bus, and truck is parked much of the time, it can be plugged in during nonuse hours to the home, office, or main interactive electricity network, providing premium electricity back to the grid. Electric and fuel-cell plug-in vehicles thus become a way to store massive amounts of renewable energy that can be sent back in the form of electricity to the main power grid.

The introduction of the internal combustion engine and the auto highway infrastructure marked the beginning of the oil era and the Second Industrial Revolution in the 20th century, just as the introduction of the steam engine, the locomotive, and the rail bed infrastructure marked the beginning of the coal era and the First Industrial Revolution in the 19th century.

Transport revolutions are always embedded in larger infrastructure revolutions. The coal-powered steam engine revolution required vast changes in infrastructure, including a shift in transport from waterways to railbeds, and the ceding of public land for the development of new towns and cities along critical rail links and junctions. Similarly, the introduction of the gasoline-powered internal combustion engine required the building of a national road system, the laying down of oil pipelines, and the construction of new suburban commercial and residential corridors along the interstate highway system.

The shift from the internal combustion engine to electric and hydrogen fuel-cell plug-in vehicles requires a comparable new commitment to a Third Industrial Revolution infrastructure. In 2008, Daimler and RWE, Germany's second-largest power and utility company, launched a project in Berlin to establish recharging points for electric Smart and Mercedes cars around the German capital. Renault-Nissan is readying a similar plan to provide a network of battery-charging points in Israel, Denmark, and Portugal. The distributed electric power-charging stations will be used to service Renault's all-electric Megane car. By 2030, charging points for plug-in electric vehicles and hydrogen fuel-cell vehicles will be installed virtually everywhere —along roads and in homes, commercial buildings, factories, parking lots and garages, providing a seamless distributed infrastructure for both sending electricity to the main electricity grid as well as receiving electricity from it.

IBM, General Electric, Siemens, and other global information technology (IT) companies are just now entering the smart power market, working with utility companies to transform the power grid to intergrids, so that building owners can produce their own energy and share it with each other. CPS Energy in San Antonio, Texas; Centerpoint Utility in Houston, Texas; Xcel Energy in Boulder, Colorado; and Sempra Energy and Southern CalEdison in California are beginning to lay down parts of the smart grid, connecting thousands of residential and commercial buildings.

The question is often asked as to whether renewable energy, in the long run, can provide enough power to run a national or global economy. Just as second-generation information-systems grid technologies allow businesses to connect thousands of desktop computers, creating far more distributed computing power than even the most powerful centralized supercomputers, millions of local producers of renewable energy, with access to intelligent utility networks, can potentially produce and share far more distributed power than the older centralized forms of energy —oil, coal, natural gas, and nuclear— that we currently rely on.

The transition to the Third Industrial Revolution will require a wholesale reconfiguration of the entire economic infrastructure of each country, creating millions of jobs and countless new goods and services. Nations will need to invest in renewable energy technology on a massive scale, convert millions of buildings, transforming them into power plants, embed hydrogen and other storage technology throughout the national infrastructure, transform the automobile from the internal combustion engine to electric plug-in and fuel-cell cars, and lay down an intelligent utility network across every nation.

The remaking of each nation's infrastructure and the retooling of industries is going to require a massive retraining of workers on a scale matching the vocational and professional training at the onset of the First and Second Industrial Revolutions. The new high-tech workforce of the Third Industrial Revolution will need to be skilled in renewable energy technologies, green construction, IT and embedded computing, nanotechnology, sustainable chemistry, fuel-cell development, digital power grid management, hybrid electric and hydrogen-powered transport, and hundreds of other technical fields.

Entrepreneurs and managers will need to be educated to take advantage of cutting-edge businesses models, including open-source and networked commerce, distributed and collaborative research and development strategies, and sustainable low carbon logistics and supply-chain

management. The skill levels and managerial styles of the Third Industrial Revolution workforce will be qualitatively different from those of the workforce of the Second Industrial Revolution.
A fully integrated intelligent intergrid allows each country to both produce its own energy and share any surpluses with neighboring countries in a “network” approach to assuring global energy security. When any given region enjoys a temporary surge or surplus in its renewable energy, that energy can be shared with regions that are facing a temporary lull or deficit.

The Third Industrial Revolution leads to a new social vision where power itself is broadly distributed, encouraging unprecedented new levels of collaboration among peoples and nations. Just as the distributed communications revolution of the last decade spawned network ways of thinking, open-source sharing and the democratization of communications, the Third Industrial Revolution follows suit with the democratization of energy. We began to envision a world where hundreds of millions of people are empowered, both literally and figuratively, with significant implications for social and political life.

4
A New Social Vision

The democratization of energy becomes a rallying point of a new distributed social vision. Access to power becomes an inalienable social right in the Third Industrial Revolution era. The 20th century saw the extension of the political franchise and the broadening of educational and economic opportunities to millions of people around the world. In the 21st century, individual access to energy also becomes a social and human right. Every human being should have the right and the opportunity to create his or her own energy locally and share it with others across regional, national and continental intergrids. For a younger generation that is growing up in a less hierarchical and more networked society, the ability to share and produce their own energy in an open-access intergrid will be regarded as a fundamental right and responsibility.

The half-century transition from the Second to the Third Industrial Revolution is going to dramatically change the globalization process. The most significant impact is likely to be on developing nations. Lack of access to electricity is a key factor in perpetuating poverty around the world. Conversely, access to energy means more economic opportunity. If millions of individuals in communities around the world were to become producers of their own energy, the result would be a profound shift in the configuration of power. Local peoples would be less subject to the will of far-off centers of power. Communities would be able to produce goods and services locally and sell them globally. This is the essence of the politics of sustainable development and reglobalization from the bottom up. The developed nations, working with industries and civil-society organizations, can help facilitate the next phase of sustainable globalization by reorienting development aid, leveraging macro- and microfinancing and credit, and providing favored-nation trade status in order to help developing nations establish a Third Industrial Revolution.

The shift from elite fossil fuels and uranium-based energies to distributed renewable energies takes the world out of the "geopolitics" that characterized the 20th century, and into the ''biosphere politics" of the 21st century. Much of the geopolitical struggles of the last century centered on gaining military and political access to coal, oil, natural gas, and uranium deposits. Wars were fought and countless lives lost, as nations vied with each other in the pursuit of fossil fuels and uranium security. The ushering in of the Third Industrial Revolution will go a long way toward diffusing the growing tensions over access to evermore limited supplies of fossil fuels and uranium and help facilitate biosphere politics based on a collective sense of responsibility for safeguarding the Earth's ecosystems.

The new emphasis on Biosphere politics is being accompanied by a shift in personal dreams. For a long time, the American dream, with its emphasis on personal opportunity and material success, was the gold standard to which much of the world looked for inspiration and guidance. In the 21st century, the emerging European dream of quality of life is beginning to attract the Net generation. Although the American dream is still the standard for many, it has lost some of its hegemony as young people turn their attention to tackling global climate change, restoring the health of the biosphere, protecting the Earth's other species, maintaining safe communities, providing universal access to health care, ensuring a high-quality and affordable universal education, living a less materialistic and more experiential lifestyle, and creating communities rich in cultural diversity. While still a minority vision, held largely by a younger generation of middle-class Europeans and an increasing number of young Americans, the dream of quality of life is gaining currency among young people around the world.

Quality of life is a shared dream that can only be realized collaboratively and collectively. It is impossible to enjoy quality of life in isolation.The older American dream and the newer European dream reflect two very different ideas about human nature. The American dream puts a premium on individual autonomy and opportunity and emphasizes material self-interest as a means to secure both personal freedom and happiness. While the European dream doesn't discount personal initiative and opportunity, it tends to put equal weight on advancing the quality of life of the entire society. The dream is an acknowledgement that one doesn't thrive alone in autonomous isolation but, rather, flourishes in deep relationship to others in a shared social space. Quality of life emphasizes the common good as an important means to securing the happiness of each individual member of the community.

Quality of life of late has become a significant factor in rethinking many of the central assumptions of 20th century economic theory. At the top of the list is the near obsession with recording the gross domestic product, or GDP. It has long been the compass for judging the well-being of America and countries around the world.

GDP was created by the U.S. Department of Commerce in the 1930s, to provide a gauge for assessing the economy's recovery from the Depression. The problem with GDP is that it only measures the value of the sum total of economic goods and services generated over a twelve month period. It does not, however, distinguish between economic activity that actually improves the quality of life of the society and negative economic activity that takes away from it. Every type of economic activity is calculated in the GDP, including the building of more prisons, enlarging the police force, military spending, spending for cleaning up pollution, increased health-care costs resulting from cigarette smoking, alcohol and obesity, as well as the advertising spent to convince people to smoke and drink more or eat processed and fatty fast food.

A number of attempts have been made over the years to come up with a suitable alternative to GDP. The Index of Sustainable Economic Welfare (ISEW), the Genuine Progress Indicator (GPI), the Fordham Index of Social Health (FISH), the UN's Human Development Index (HDI), and the Index of Economic Well-Being (IEWB) are among the more popular indicators. They each attempt to determine "real" economic improvement in human welfare.

The earliest effort at establishing an alternative index was the ISEW, created by then World Bank economist Herman Daly and theologian John Cobb in 1989. Their index begins with personal consumption spending and then adds unpaid domestic labor. Then they subtract activity that is primarily designed to mitigate losses, like money spent on crime, pollution, and accidents. The ISEW also adjusts for income disparity and depletion of natural resources. The GPI includes many of the same criteria but adds the value of voluntary work in the community and subtracts the loss of leisure time. The FISH measures sixteen social-economic indicators, including infant mortality, child abuse, childhood poverty, teen suicide, drug abuse, high school dropout rates, average weekly earnings, unemployment, health insurance coverage, poverty among the elderly, homicides, housing, and income inequality. The IEWB takes into account such things as the family savings rate and the accumulation of tangible capital such as housing stocks, which measure one's sense of future security.

Both the French government and the European Commission are working on high-level studies to create quality-of-life indexes to judge the real health and well-being of the economy and the citizenry. The fact that governments are now pursuing the idea of an alternative way of measuring economic success is a good indicator of the broader social changes taking place as quality of life becomes as important as mere production output in assessing economic performance.

5
The Role of Social and Public Capital

Promoting a quality of life society requires a collaborative commitment at two levels: civic minded engagement in the community and a willingness to have one's tax money used to promote public initiatives and services that advance the well-being of everyone in the society. Resurrecting social capital in the civil society and revitalizing public capital in the governance sector will be essential for achieving the dream of quality-of-life in every country.

Civil society is where we establish fraternal and affectionate bonds, create culture, and contribute to the social capital of the community. It is where we engage in both light and deep play with one another for the sheer joy of companionship and with the desire to make a difference in the life of others and the well-being of the community. We volunteer our time willingly and enthusiastically, and the reward comes in the form of strengthening affiliation and intimacy. Participation in sports clubs, pursuit of the arts, assisting others in need, preserving the natural environment, mentoring the young, caring for the old, as well as promoting public works projects and initiatives are all ways we take part in the civic and cultural life of the community.

Although traditional civic engagement in fraternal organizations like the Lions Club, Kiwanis, Ruritan, and the Elks has withered with the passing of the World War II generation, there has been a surge in civic engagement in self-help groups and in collaborative types of activity in cyberspace.

While sometimes referred to as the third sector, as if to suggest that it is of less relevance than the marketplace or government, in fact, the civil society is the primary sector. It's where people create the narratives that define their lives and the life of the society. These narratives create the cultural common ground that allow people to create emotional bonds of affection and trust which are the mother's milk of empathic extension.

Without culture it would be impossible to engage in either commerce and trade or governance. The other two sectors require a continuous infusion of social trust to function. Indeed, it's fair to say that the market and government sectors feed off social trust and wither or collapse if it is withdrawn. That's why there are no examples in history in which either markets or governments preceded culture or exist in its absence. Markets and governments are extensions of culture and never the reverse. They have always been and will always be secondary rather than primary institutions in the affairs of humanity because culture creates the empathic cloak of sociability that allows people to confidently engage each other either in the market place or government sphere.

Civil society organizations (CSOs), also know as nongovernmental organizations (NGOs) or not-for-profit organizations (NPOs) are proliferating in countries around the world. In the developed nations, where postmaterialist self-expression values are becoming a more dominant lifestyle orientation, CSOs appeal to a younger generation committed to advancing the quality of life of the community. But, even in developing countries a new generation of activists are creating CSOs to further their dream of promoting a quality of life society. Where once young idealistic youth flocked to political parties, they now are more likely to find their way to civil society organizations, believing that building social capital —which is another way to describe a sense of collective shared empathy— precedes building political capital.

The American public school system has leaped ahead of their counterparts in other countries by initiating a critical reform in the educational system, whose purpose is to better prepare future generations for the responsibilities attendant to creating social capital.

In the past fifteen years, American secondary schools and colleges have introduced service learning programs into the school curriculum —a revolutionary change that has significantly altered the educational experience for millions of young people. As part of the requirement for graduation, students are expected to volunteer in neighborhood non-profit organizations and in community initiatives designed to help those in need, and to improve the well-being of the communities in which they live.

The exposure to diverse people from various walks of life has spurred an empathic surge among many of the nation's young people. Studies indicate that many —but not all— students experience, for the first time, a deep maturing of empathic sensibility by being thrust into unfamiliar environments where they are called upon to reach out and assist others. These experiences are often life-changing, affecting their sense of what gives their life meaning. And because service learning is an exercise in social engagement designed to advance the well-being of others and the community, it is collaborative in nature and strengthens and reinforces the collaborative emotional and cognitive skills that young people are developing and using in other parts of their life.

Service learning, as pedagogy and practice, is just beginning to spread to other countries and promises to significantly affect the emotional and social intelligence of millions of young people in ensuing decades. Creating quality-of-life requires not only a commitment of social capital but also a commitment to invest public capital to promote the common good. Europeans have long shown a willingness to tax personal incomes —in some countries as much as 45 to 50 percent to advance the quality of life of everyone in the community. That's why in Europe, health-care is a public good, and as a result, infant mortality rates are lower and life expectancy is longer than in the United States. European countries also spend more public funds on assisting the poor and have lower rates of childhood poverty than the United States. Europeans also enjoy safer communities, have far lower homicide rates, and have far fewer incarcerated people. The public transport system is among the best in the world. Europeans also have the most stringent regulations in the world regarding environmental safeguards.

Until recently, Americans have not expressed the same willingness to be taxed to promote the public good of the society. The recent economic downturn, however, has undermined public confidence in the business community and opened up a new dialogue about the government's role in creating a quality-of-life society for every American. Barack Obama's presidential campaign emphasized the need for universal health care, more public funds to advance public education, and more rigorous protection of the environment, among other public goods.

A quality-of-life society promotes both the market and social models simultaneously by emphasizing personal economic opportunity along with a sense of collective commitment to create a sustainable society for every citizen. In the Third Industrial Revolution, "distributive power" becomes the technological means to greatly expand entrepreneurial initiative while establishing a collaborative approach to secure the well-being of society. Empowering hundreds of millions and eventually billions of people to produce their own energy, makes everyone a potential entrepreneur in a vastly extended global marketplace, but this time reconfigured from the bottom up rather than from the top down. Millions of small and medium size enterprises and producer cooperatives will expand commercial opportunities on a lateral scale never before experienced.

Billions of people sharing energy will require new governing arrangements at the local, regional, national and transnational levels to ensure universal access to power generation and distribution and equitable dispensation of the commercial fruits of the Third Industrial Revolution. It is only by encouraging both individual entrepreneurial initiative in the distributive energy market and seamless collaboration between neighborhoods, communities, municipalities, regions and nations in the marshalling, storing, and delivering of energy that we can create a sustainable global economy in the coming century. Streamlining the market and social models to accommodate a distributed and collaborative Third Industrial Revolution will be the pressing political agenda for the next half-century as governments transition to a new dream of creating a quality-of-life society in a Biosphere world.

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LEADING THE WAY TO A THIRD INDUSTRIAL REVOLUTION AND A NEW SOCIAL VISION FOR THE WORLD

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