Leading the Way to the Third Industrial Revolution and a New Distributed Social Vision for the World in the 21st Century

By Jeremy Rifkin

Introduction

We are approaching the sunset of the oil era in the first half of the 21st century. The price of oil on global markets continues to climb and peak global oil is within sight in the coming decades. At the same time, the dramatic rise in carbon dioxide emissions from the burning of fossil fuels is raising the earth's temperature and threatening an unprecedented change in the chemistry of the planet and global climate, with ominous consequences for the future of human civilization and the ecosystems of the earth.

The world community needs a powerful new economic narrative that will push the discussion and the agenda around climate change and peak oil from fear to hope and from economic constraints to economic possibilities. That narrative is just now emerging as industries begin to lay the groundwork for a post-carbon Third Industrial Revolution.

The need for a new economic vision takes on an even greater urgency in light of the just released report issued by the leading U.S. climatologist James Hansen, head of the NASA Goddard Institute for Space Studies, and co-authored with eight other leading scientists. Hansen and his colleagues say that the EU CO_2 target, the most rigorous of any government, needs to be slashed to 350 ppm if "humanity wishes to preserve a planet similar to that on which civilization developed" and to which life on earth has adapted. According to Hansen, "what we have found is that the target we have all been aiming for is a disaster- a guaranteed disaster". The new findings, extrapolated from core samples taken from the bottom of the ocean, suggests that if CO_2 levels were to rise to 550 ppm, the planet's temperature would rise to 6° Celsius – previous estimate suggests a 3° Celsius rise in the temperature on earth by the end the of the century- with catastrophic results to life on earth. [i]

As the nations of the world prepare for the Copenhagen Climate Summit in 2009, it is critical that we reframe the global discussion on climate change and energy security to the mission of making the transition from the second industrial revolution to a Third Industrial Revolution. If we do not succeed in reorienting the climate change and energy agenda from

burden-sharing to commercial opportunities, it is likely that the Copenhagen Climate Summit will not achieve its full potential, with untold consequences to civilization.

The key, for every nation, is to lay out a compelling "social vision" to accompany the new economic vision. The Third Industrial Revolution provides the framework for the birth of a new "Distributed Social Vision" in the first half of the 21st Century. Just as the distributed IT and internet communication revolutions dramatically changed the economic parameters of doing business, as well as the social context, a distributed renewable energy revolution will have a similar impact on the world.

A new Distributed Social Vision flows directly from the coming together of distributed communication and information technology and distributed renewable energies. We are on the cusp of a new energy era and a new economic paradigm that will literally "empower" hundreds of millions of human beings to create their own energy and share their surpluses with neighbors across regions, nations and continents. The democratization of energy gives rise to a new Distributed Social Vision in the 21st century that will change our economic, cultural and political institutions as dramatically as the Enlightenment vision that accompanied the first industrial revolution two centuries ago.

Leading the Way to a Post-Carbon Society and the Third Industrial Revolution

While oil, coal, and natural gas will continue to provide a substantial portion of the world's and the European Union's energy well into the 21st century, there is a growing consensus that we are entering a twilight period where the full costs of our fossil fuel addiction is beginning to act as a drag on the world economy. 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 energy technologies to limit carbon dioxide emissions in the burning of conventional fuels. The EU, in particular, is mandating that the member states increase energy efficiency 20 percent by 2020 and reduce their global warming emissions 20 percent (based on 1990 levels), again by 2020. But, greater efficiencies in the use of fossil fuels and mandated global warming gas reductions, by themselves, are not enough to adequately address the unprecedented crisis of global warming and global peak oil and gas production. 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.

The Great Economic Revolutions in History: The Convergence of New Energy and Communication Regimes

The great pivotal economic changes in world history have occurred when new energy regimes converge with new communication regimes. When that convergence happens, society is restructured in wholly new ways. For example, the first hydraulic agricultural societies—Mesopotamia, Egypt, China, India—invented writing to manage the cultivation, storage, and distribution of grain. Surpluses of stored grain allowed for an expansion of population and the feeding of a slave labor force which, in turn, provided the "man power" to run the economy. The convergence of written communication and stored energy in the form of surplus grain, ushered in the agricultural revolution, and gave rise to civilization itself.

In the early modern era, the coming together of coal powered steam technology and the print press gave birth to the first industrial revolution. It would have been impossible to organize the dramatic increase in the pace, speed, flow, density, and connectivity of economic activity made possible by the coal fired steam engine using the older codex and oral forms of communication. In the late nineteenth century and throughout the first two thirds of the twentieth century, first generation electrical forms of communication—the telegraph, telephone, radio, television, electric typewriters, calculators, etc.—converged with the introduction of oil and the internal combustion engine, becoming the communications command and control mechanism for organizing and marketing the second industrial revolution.

Similarly, today, the same design principles and smart technologies that made possible the internet, and vast "distributed" global communication networks, are just beginning to be used to reconfigure the world's power grids so that people can produce renewable energy and share it peer-to-peer, just like they now produce and share information, creating a new, decentralized form of energy use. We need to envision a future in which millions of individuals can collect and produce locally generated renewable energy in their homes, offices, factories, and vehicles, store that energy in the form of hydrogen, and share their power generation with each other across a continent-wide intelligent intergrid. (Hydrogen is a universal storage medium for intermittent renewable energies; just as digital is a universal storage mechanism for text, audio, video, data and other forms of media)

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 computers that exist, 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 Four Pillars of the Third Industrial Revolution

The creation of a renewable energy regime, loaded by buildings, partially stored in the form of hydrogen, and distributed via smart intergrids, opens the door to a Third Industrial Revolution and should have as powerful an economic multiplier effect in the 21st century as the convergence of mass print technology with coal and steam power technology in the 19th century, and the coming together of electrical forms of communication with oil and the internal combustion engine in the 20th century.

The First Pillar: Renewable Energy

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. Global investment in renewable energies topped $148 billion in 2007, a 60 percent increase from 2006[ii]. Global investments in renewable energies are expected to leap to €250 billion by 2020 and €460 billion by 2030.[iii] Today, renewable energy manufacturing, operations, and maintenance provide approximately two million jobs worldwide.[iv] A recent study found that the number of jobs created per euro invested (and per kilowatt-hour produced) from clean renewable energy technologies is 3 to 5 times the number of jobs created from fossil fuel based generation.[v]

By becoming the first superpower to establish a mandatory target of 20 percent renewable energy by 2020,[vi] the EU has set in motion the process of vastly enlarging the renewable energy portion of its energy mix. Reflecting the new commitment to higher

renewable energy targets, the European Investment Bank has ratcheted up its renewable energy investments and is slated to finance loans totaling more than €800 million per year.[vii] In Germany, alone, the renewable energy industry boasted an annual turnover of €21.6 billion and 214,000 workers in 2006, and the industry projects to grow to between 244,000 and 263,000 jobs by 2010, 307,000 to 354,000 jobs by 2020, and 333,000 to 415,000 jobs by 2030.[viii]

The 26 other EU member states are also creating new jobs as they bring renewable energy sources online to meet their objective of achieving a near zero carbon emission policy. Renewable energy in the EU generated €8.9 billion in earnings in 2005, and is expected to leap to 14.5 billion euros by 2010.[ix] More than 700,000 jobs are expected to be created in the EU by 2010 in the field of electricity generation from renewable energy sources.[x] By 2050, renewable energy is projected to provide nearly half the primary energy, and 70 percent of the electricity produced within the EU, and account for several million new jobs.[xi]

The Second Pillar: Buildings as Positive Power Plants

While 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.

The construction industry is the largest industrial employer in many countries. In the EU, in 2003, construction represented 10 percent of the GDP, and 7 percent of the employment in the EU-15.[xii] Buildings are the major contributor to human induced global warming. Worldwide, buildings consume 30 to 40 percent of all the energy produced and are responsible for equal percentages of all CO2 emissions.[xiii] Now, new technological breakthroughs make it possible, for the first time, to design and construct buildings that create 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 and far reaching for the real estate industry and, for that matter, the world.

In 25 years from now, millions of buildings – homes, offices, shopping malls, industrial and technology parks – will be renovated or constructed to serve as both "power plants" and habitats. These buildings will collect and generate energy locally from the sun, wind, garbage, agricultural and forestry waste, ocean waves and tides, hydro and geothermal– enough energy to provide for their own power needs as well as surplus energy that can be shared.

A new generation of commercial and residential buildings as power plants is going up now. In the United States, Frito-Lay is retooling its Casa Grande plant, running it primarily on renewable energy and recycled water. The concept is called “net-zero”. The factory will generate all of its energy on-site by installing solar roofs and by recycling the waste from its production processes and converting it into energy. In France, Bouygues, the giant French construction company is taking the process a step further, putting up a state-of-the-art commercial office complex this year in the Paris suburbs that collects enough solar energy to provide not only for all of its own needs, but even generates surplus energy as well.

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 their operations. There are currently a dozen office buildings in operations at the Walqa Park, and 40 more already slated for construction. The facility is run entirely by renewable forms of energy, including wind power, hydro, and solar. The park houses leading high tech companies, including Microsoft and other IT companies, renewable energy companies, etc.

The GM factory in Aragon, Spain, the largest GM production facility in Europe, has just installed a 10 Megawatt (MW) solar plant on its factory roof at a cost of $78 million. The power station produces enough electricity for the factory as well as 4,600 homes. The initial investment will be paid back in less than 10 years, after which the generation of electricity will be virtually free, except for the maintenance costs.

The Third Pillar: Hydrogen Storage

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 reliable assets. Batteries, differentiated water pumping, and other media, can provide limited storage capacity. There is, however, one storage medium that is widely available and can be 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 30 years.

Here is how hydrogen works. Renewable sources of energy—solar cells, wind, hydro, geothermal, ocean waves—are used to produce electricity. That electricity, in turn, can be used, in 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—so called 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 use, society will have a continuous supply of power. Hydrogen can also be extracted from biomass and similarly stored.

The European Commission recognizes that increasing reliance on renewable forms of energy would be greatly facilitated by the development of hydrogen fuel cell storage capacity and, in 2003, established the Hydrogen Technology Platform, a massive research and development effort to move Europe to the forefront of the race to a hydrogen future.[xiv] Regions and national governments across Europe have already begun to establish hydrogen research and development programs and are in the early stages of introducing hydrogen technologies into the marketplace.

In 2006, the Federal Republic of Germany committed €500 million to hydrogen research and development and began readying plans to create a nationwide hydrogen roadmap, with the stated goal of leading Europe and the world into the hydrogen era by 2020.[xv] Chancellor Angela Merkel and members of her cabinet called for a Third Industrial Revolution in public addresses in 2007.[xvi]

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 27 member states of the EU, with the primary focus on producing hydrogen from renewable sources of energy.

The Fourth Pillar: Smartgrids and Plug-in Vehicles

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 European 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 smart intergrid is made up of three critical components. Minigrids allow homeowners, small and medium size enterprises (SMEs), and large scale economic enterprises to produce renewable energy locally—through solar cells, wind, small hydro, animal and agricultural waste, garbage, etc.—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 bi-directional.

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 to moment weather changes—recording wind changes, solar flux, ambient temperature, etc.- giving the power network the ability to adjust electricity flow continuously, to both external weather conditions as well as 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 24 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 also create 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—so-called "distributed generation."

Even electric plug in and hydrogen- powered fuel cell vehicles are "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, they can be plugged in, during non-use hours, to the home, office, or the 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.

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 hundreds of thousands of battery charging points in Israel, Denmark and Portugal. The distributed electric power charging stations will be used to service Renault's all electric Mégane car. Toyota has joined with EDF, France's largest power and utility company, to build charging points in France and other countries, for its plug-in electric cars. By 2030, charging points for plug-in electric vehicles and hydrogen fuel cell vehicles will be installed virtually everywhere—along roads, in homes, commercial buildings, factories, parking lots and garages, providing a seamless distributed infrastructure for sending electricity both from and to the main electricity grid. If just 25 percent of drivers used their vehicles as power plants to sell energy back to the intergrid, all of the power plants in the US and the EU could be eliminated.

IBM and other global 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. Centerpoint Utility in Houston, Texas, Xcel Utility in Boulder, Colorado, and Sempra and Southern ConEdison in California are laying down parts of the Smart Grid this year, connecting thousands of residential and commercial buildings.

The new EU energy plan is preparing the way for the intergrid, with the demand that the power grid be unbundled, or at least made increasingly independent of the power companies that also produce the power, so that new players—especially small and medium size enterprises and

homeowners—have the opportunity to produce and sell power back to the grid with the same ease and transparency as they now enjoy in producing and sharing information on the internet. The European Commission has also established a European Smart Grid Technology Platform and prepared a long-term vision and strategy document in 2006 for reconfiguring the European power grid to make it intelligent, distributed, and interactive. [xvii]

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The central question that every nation needs to ask is where they want their country to be in twenty five years from now: In the sunset energies and industries of the second industrial revolution or the sunrise energies and industries of the Third Industrial Revolution. The Third Industrial Revolution is the end-game that takes the world out of the old carbon and uranium-based energies and into a non-polluting, sustainable future for the human race.

A New Distributed Social Vision in the 21st Century

The Third Industrial Revolution makes possible a new Distributed Social Vision in the 21st century. Most citizens of the world, when asked what they most hope for, say they envision a good "quality of life". The dream of quality of life emphasizes individual opportunity, social and human rights, balancing the social and market models, and building bridges of cooperation and peace. Underlying this expansive new 21st century social vision is the commitment that millions of people share to create a just and sustainable society for their children and future generations.

The dream of a good quality of life is now endangered by the dramatic rise of oil and gas prices on the world market, and the real time impacts of climate change on communities and ecosystems across the continent.

Without a well-thought-out plan to usher in a Third Industrial Revolution, the hope of a new Distributed Social Vision will begin to fade. The Third Industrial Revolution, therefore, is the beginning point for a new Distributed Social Vision. Indeed, a new Distributed Social Vision flows inexorably from the Third Industrial Revolution narrative and is impossible to achieve without it. Together, the Third Industrial Revolution and a new Distributed Social Vision offer a compelling gameplan for the next 50 years of global development.

What is needed now is a strong political vision capable of joining the two together. By articulating a clear political agenda to advance the Third Industrial Revolution and the

accompanying programs for a new Distributed Social Vision, today's political leaders will set the stage for the next phase of human development, and, in the process, bequeath a powerful legacy for future generations. The new politics will also serve as a beacon of hope for the rest of the world in the 21st Century.

The new Distributed Social Vision is made up of 10 key building blocks, each erected on top of a Third Industrial Revolution framework:

1) A Sustainable Standard of Living: The long term rise in the price of oil on world markets and the increasing real time effects of climate change on commercial sectors ranging from agriculture to tourism are already having a dramatic impact on the standard of living of millions of people. Food prices are sky rocketing as well as the price of consumer products and services and home heating and petrol cost, threatening the economic well being of families around the world. These conditions are only going to worsen in the years ahead, imperiling the dream of advancing a quality of life society. Government, the business community and civil society need to join together in an unprecedented mobilization to turn the corner on the sunset energies and industries of the second industrial revolution and usher in a renewable energy regime if the human race is to enjoy a sustainable standard of living in the 21st century.

2) The Economic Multiplier Effect: 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, with an economic multiplier effect that will stretch to the second half of the 21st century. We will need to invest in renewable energy technology on a massive scale; redesign millions of buildings, transforming them into positive power plants, embed hydrogen and other storage technology throughout the national infrastructures, transform the automobile from the internal combustion engine to the fuel cell car, and lay down an intelligent utility network across every nation.

3) New Jobs and Business Models for the 21st Century: The wholesale 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, nano technology, 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 that of the workforce of the second industrial revolution.

4) Advancing Energy Security: In the next 50 years, every nation will need to create a self-sufficient, distributed renewable energy regime to ensure energy independence and the ushering in of a post carbon future. 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.

5) Empowering the People: The Third Industrial Revolution leads to a new Distributed Social Vision where power, itself, is broadly distributed, encouraging unprecedented new levels of collaboration among peoples and nations. In the new era, businesses, municipalities and homeowners become the producers as well as the consumers of their own energy—so-called "distributed generation." Just as the distributed communication 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 far reaching implications for social and political life. 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 their 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 world, the ability to share and produce their own energy in

an open-access intergrid, like they produce and share their own information on the internet, will seem natural and commonplace.

6) Education for the 21st Century: The first and second Industrial Revolutions were accompanied by vast changes in the educational system. The Third Industrial Revolution will require equally innovative educational reforms if we are to prepare future generations to work and live in a post-carbon world. The new curriculum will focus increasingly on advanced information, bio and nano technologies, the earth sciences, ecology, systems theory, collaborative and distributive education, open-source learning models, and social capital. We will need to educate our children to think as global citizens and prepare them for the historic transition from 20th century conventional geopolitics to 21st century global Biosphere politics. Education will increasingly focus on both global responsibility to preserve the health of the planet's Biosphere and local responsibility to steward regional ecosystems. Living sustainably will become the anchor of 21st century learning environments.

7) A Quality of life society: In the new Distributed Social Vision of the 21st century, individual economic opportunity becomes part of a more expansive social vision of creating a quality of life society. The conventional 20th century economic indicators that emphasize gross domestic product and per capita income are now being accompanied by equally important quality of life indicators that measure a good economy in terms of a commitment to social and human rights, an educated citizenry, a healthy population, safe communities, a proper balance of work and leisure, and a clean and sustainable environment. A quality of life economy promotes both the social and market models simultaneously by emphasizing personal economic opportunity along with a sense of social commitment to create a sustainable society for every citizen. In the Third Industrial Revolution, distributive power and sustainable communities provide the essential framework for creating a quality of life society.

8) Rethinking Globalization from the Bottom-up: 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. Incredibly, over half of the human population has never made a telephone call and a third of the human race has no access to electricity. 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 and

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 re-globalization from the bottom up. The developed nations, working with industries and civil-society organizations, can help facilitate the next phase of sustainable globalization by re-orienting development aid, promoting clean development mechanism projects under the Emissions Trading system, leveraging macro and micro-financing and credit, and providing favored-nation trade status in order to help developing nations establish a Third Industrial Revolution.

9) The European Union's Special Role in Spearheading a Third Industrial Revolution: European industry has the scientific, technological, and financial know-how to spearhead the shift to renewable energies, positive power buildings, a hydrogen economy, and an intelligent power grid and, by so doing, lead the world into a new economic era. The EU's world class automotive industry, chemical industry, engineering industry, construction industry, software, computer and communication industries, and banking and insurance industries, give it a leg up in the race to the Third Industrial Revolution. The EU also boasts one of the world's largest solar markets and is the world's leading producer of wind energy. The next stage of European integration is establishing a distributed energy regime that will allow Europe to complete the creation of a unified single market. While the EU is potentially the largest internal commercial market in the world, with 500 million consumers and an additional 500 million consumers in its associated regions stretching into the Mediterranean and North Africa, it has not yet created a seamless logistical infrastructure, with a common transport grid, communication grid, and power grid. Integrating the logistical infrastructure so that the billion plus people in the EU region can engage in commerce and trade with efficiency and ease, and with a low carbon dioxide footprint, is the critical unfinished business of the EU.

10) The Millennial Generation's Legacy: A Sustainable Planet: In 1960, President Kennedy challenged the baby-boom generation in the United States to join him in putting a man on the moon within the decade and exploring the far reaches of outer space. The sequel, in the 21st century, is for the millennial generation to lead the world in saving the Biosphere of the earth.

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 ever more 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.

Political parties and governments need to turn their attention to stewarding the Biosphere. At the same time, they need to communicate this mission across the world with the goal of unleashing the vast creative potential of the millennial generation to the task of preserving and renewing the planet.

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The shift from the Second Industrial Revolution to the Third Industrial Revolution is going to require a carefully constructed long term transition plan. The EU understands this, and has committed itself to pursuing a two-track process: Track one, increasing the energy efficiency and reducing the carbon footprint by 20 percent, respectively, by the year 2020, in order to clean up the mature fossil fuel energies of the Second Industrial Revolution; track two, aggressively pursuing a 20 percent renewable energy target and laying down the foundation for a Third Industrial Revolution during the first half of the 21st century. Every nation needs to aggressively pursue both tracks simultaneously if we are to ease the transition to a post-carbon era.

In 2007, the EU Parliament became the first legislature in the world to pass a written declaration in support of the two-track approach to making the transition into a Third Industrial Revolution and a post-carbon energy era.

The story of a Third Industrial Revolution and a new Distributed Social Vision is powerful and provides the narrative we so desperately need at this critical point in history if we are to address climate change and peak oil and reheal the Biosphere of the planet.

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[i] Hansen, J.; Sato, M.; Kharecha, P.; Beerling, D.; Masson-Delmotte, V.; Pagani, M. et al. (2008, April 7). Target atmospheric CO2: Where should humanity aim? Retrieved April 7, 2008 from http://arxiv.org/ftp/arxiv/papers/0804/0804.1126.pdf

[ii] Blair, T. (2008, May 29). Leading on Climate Change: How Action in Congress can Move the World. The Washington Post. Retrieved on June 2, 2008 from http://washingtonpost.com

[iii] German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. (June 2006). *Renewable Energy: Employment Effects: Impact of the Expansion of Renewable Energy on the German Labour Market*. Retrieved from http://www.bmu.de/files/pdfs/allgemein/application/pdf/employment_effects_061211.pdf

[iv] Worldwatch Institute and Center for American Progress. (September 2006). *American Energy: The Renewable Path to Energy Security*. Retrieved from http://images1.americanprogress.org/il80web20037/americanenergynow/AmericanEnergy.pdf

[v] Daniel M. Kammen, Kamal Kapadia, Matthias Fripp (2004). *"Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?"* A Report of the Renewable and Appropriate Energy Laboratory, University of California, Berkeley. Retrieved from http://rael.berkeley.edu/publications

[vi] Council of the European Union. (2007, May 2). *Brussels European Council, 8/9 March 2007. Presidency Conclusions*. (Publication No. 7224/1/07 REV 1). P. 21. Retrieved from http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/93135.pdf

[vii] European Investment Bank. (29 January 2007). *Corporate Operational Plan 2007-2009*. Retrieved from http://www.eib.org/cms/htm/en/eib.org/attachments/strategies/cop_2007_en.pdf

[viii] German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. (21 February 2007). *Development of Renewable Energies in 2006 in Germany*. Retrieved from http://www.erneuerbare-energien.de/files/pdfs/allgemein/application/pdf/hintergrund_zahlen2006_eng.pdf

German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. (June 2006). *Renewable Energy: Employment Effects: Impact of the Expansion of Renewable Energy on the German Labour Market*. Retrieved from http://www.bmu.de/files/pdfs/allgemein/application/pdf/employment_effects_061211.pdf

[ix] PR Newswire (14 November 2006). *European Renewable Energy Revenues Expected to Double Market Boosted by Government Support and Global Warming*. Citing Frost & Sullivan report "European Renewable Energy Market- Investment Analysis and Growth Opportunities", October 2005. Retrieved from LexisNexis Academic.

[x] Greenpeace International. (September 2005). *Energy Revolution: A Sustainable Pathway to a Clean Energy Future for Europe*. Retrieved from http://www.greenpeace.org/raw/content/international/press/reports/energy-revolution-a-sustainab.pdf

[xi] *Ibid*. European Renewable Energy Council. (2007). *Renewable Energy Technology Roadmap Up to 2020*. Retrieved from http://www.erec-renewables.org/fileadmin/erec_docs/Documents/Publications/EREC-Technoloy_Roadmap_def1.pdf

[xii] European Commission, Enterprise and Industry. (10 June 2006). *Construction: Overview*. Retrieved from http://ec.europa.eu/enterprise/construction/index_en.htm

[xiii] United Nations Environment Programme. (2007). *Buildings and Climate Change: Status, Challenges, and Opportunities*. Retrieved from http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=502&ArticleID=5545&l=en;

For OECD countries only, see Organization for Economic Cooperation and Development, Environment Directorate, Environment Policy Committee. (13 June 2002). "Working Party on National Environmental Policy: Design of Sustainable Building Policies: Scope for Improvement and Barriers". Retrieved from http://www.olis.oecd.org/olis/2001doc.nsf/43bb6130e5e86e5fc12569fa005d004c/203e895174de4e56c1256bd7003be835/$FILE/JT00128164.PDF

[xiv] Advisory Council of the Hydrogen and Fuel Cells Technology Platform, Implementation Panel. (March 2007). *European Hydrogen and Fuel Cell Technology Platform. "Implementation Plan- Status 2006"*. Retrieved from https://www.hfpeurope.org/uploads/2097/HFP_IP06_FINAL_20APR2007.pdf

[xv] Wasserstoff Strategierat Brennstoffzellen. (30 April 2007). *National Development Plan, Version 2.1. "Hydrogen and Fuel Cell Technology Innovation Programme"*. Preamble. Retrieved from http://www.hyweb.de/gazette-e/NIP_Programm_2-1_EN.pdf

[xvi] Allianz Group. Interview with Hans Joachim Schellnhuber. (26 January 2007). Retrieved from http://knowledge.allianz.com/nopi_downloads/downloads/Schellnhuber_Interview_von%20druck.pdf

[xvii] European Commission Directorate-General for Research. (2006). *European SmartGrids Technology Platform: Vision and Strategy for Europe's Electricity Networks of the Future*. Retrieved from http://ec.europa.eu/research/energy/pdf/smartgrids_en.pdf