Interviews: Dimas, Piebalgs, Pöttering | Acciona, IBM, Philips, Q-Cells, UTC

Business, Politics & Culture

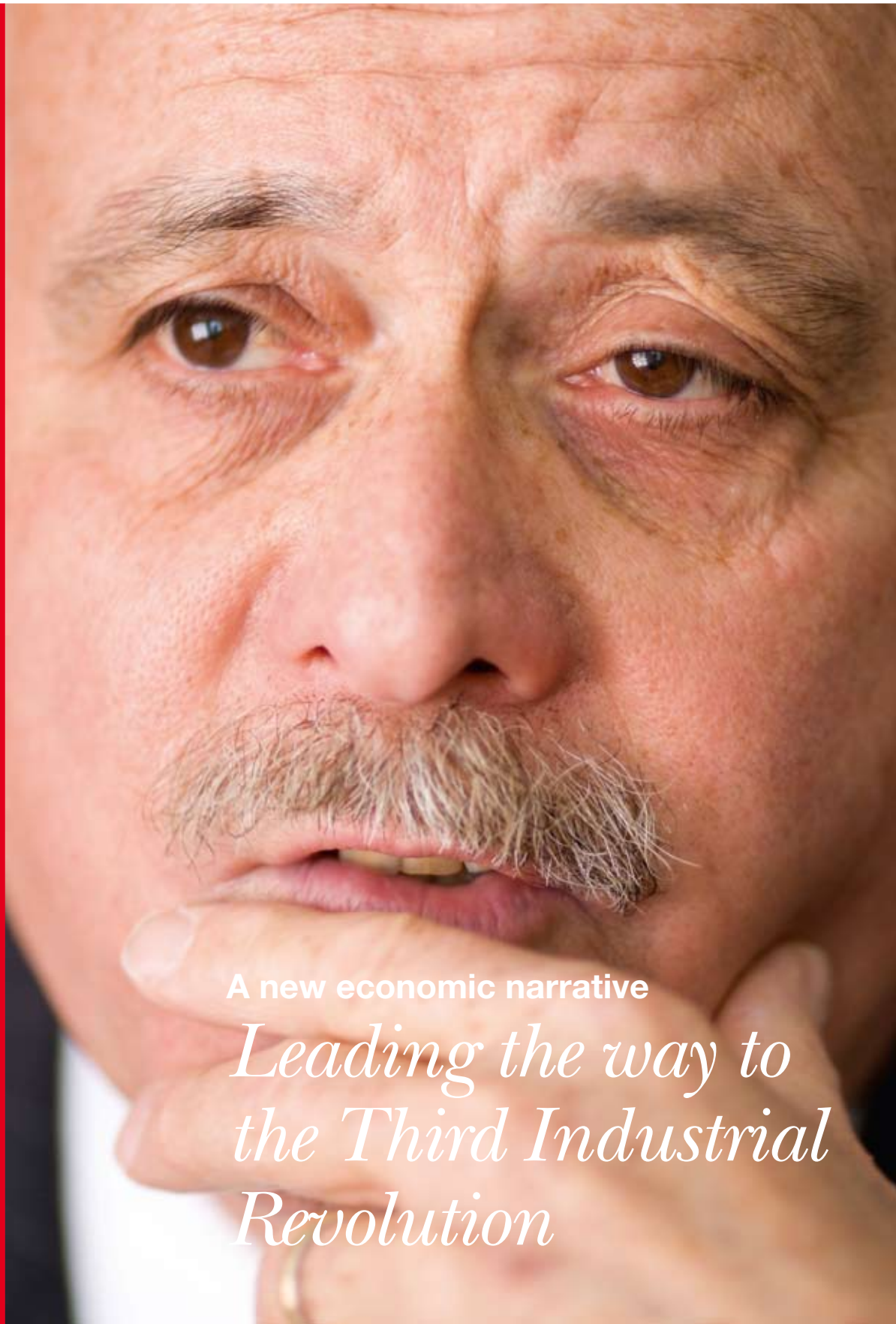
EUROPEAN ENERGY REVIEW

Europe's energy magazine for decision-makers

Special edition December 2008

Special mini-edition

United Nations Climate Change Conference
1 – 12 December 2008



A new economic narrative

Leading the way to the Third Industrial Revolution

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Cover picture by Thierry Monasse

1 year of European Energy Review

With this mini-edition, European Energy Review – Europe's new energy magazine – celebrates its first birthday.
European Energy Review is in many ways a unique magazine. It is truly European, written by journalists and experts from all over Europe. It covers the energy market in all its breadth and complexity – from oil, gas, coal and nuclear to the whole spectrum of renewables. And it features in-depth, independent stories and reports.
Above all, however, European Energy Review has set itself the mission to serve as a trusted guide in the multiform energy transition Europe is faced with today. As you know, the energy market is going through a far-reaching transition – from a high CO_2 to a low CO_2 energy mix, from dependency to self-sufficiency and diversification, from national markets to an integrated market, from a western-dominated to a multipolar world. This is where we are trying to lead our readers as well.

This mini-edition is especially appropriate to our purpose. It features a visionary essay, written by the famous American author Jeremy Rifkin, in collaboration with Rifkin's associate Angelo Consoli and with Professor Maria da Graça Carvalho, former Portuguese Minister of Science, and Matteo Bonifacio, who both work for the Bureau of European Policy Advisers (BEPA) and are consultants to European Commission President José Manuel Barroso.
In addition, we have interviewed EU Commissioners Andris Piebalgs and Stavros Dimas, President of the European Parliament Hans-Gert Pöttering and five representatives from international corporations (IBM, Philips, UTC, Acciona and Q-Cells) about the "Rifkin vision". You will find their comments interspersed in the article. The full interviews can be found on our website: www.europeanenergyreview.eu, where you can also subscribe to EER.

We hope you will enjoy reading this editon – and will join us to become part of the great European energy transition!

Karel Beckman editor-in-chief

Addressing the Triple Threat of the Global Financial Crisis, Energy Crisis, and Climate Change

Leading the Way to the Third Industrial Revolution




By:
Jeremy Rifkin (President, The Foundation on Economic Trends)

Maria da Graça Carvalho (Principal Adviser, Bureau of European Policy Advisers – BEPA)*

Angelo Consoli (European Director, The Foundation on Economic Trends)

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* *The opinions presented in this article are personal to the authors and do not necessarily reflect the views of the European Commission*

We are at a precarious point in history. We are facing the real prospect of an economic meltdown on the scale of the Great Depression. The credit crisis is compounded by the global energy crisis and the climate change crisis, creating a potential cataclysm for civilization. There is a way out: we need to radically overhaul the way we use energy in our society.

There is a wide consensus that 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 remain high 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, with ominous consequences for the future of human civilization and the ecosystems of the earth.

The triple threat of the global credit crisis, the global energy crisis, and the global climate change crisis are interwoven and feed off of each other. Addressing the triple threat to our way of life will require a new economic story that can remake civilization along sustainable lines.

The European Union 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 across Europe begin to lay the groundwork for a post-carbon Third Industrial Revolution.

As the European Union prepares for the 14th Climate Change Conference in Poznan, Poland in December 2008, and the 15th Climate Change Conference in Copenhagen, Denmark in 2009, it is critical that we reframe the 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 Poznan and Copenhagen Climate Conferences will not achieve their full potential.

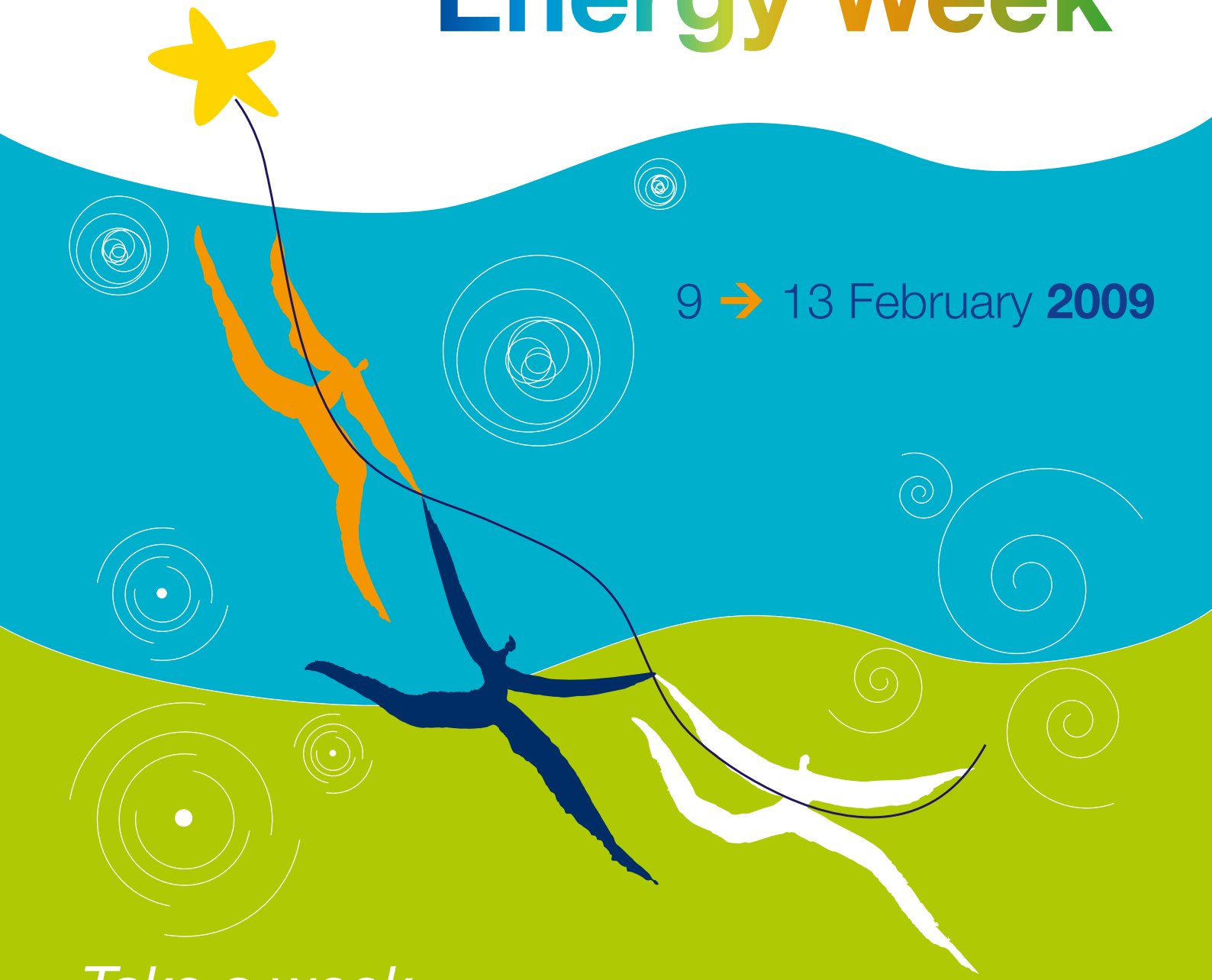
The key is to lay out a compelling "social vision" to accompany the new economic vision. The Third Industrial Revolution provides the framework for the birth of a "New Social Europe" in the first half of the 21st Century. Just as the distributed Information Technology and internet communication revolutions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

Carmen Becerril is Managing Director Corporate Resources and Public Affairs of energy and building group Acciona, one of the largest producers of renewable energy in Spain

'The model based on fossil fuels is unsustainable'

'The traditional energy model, based on fossil fuels, is unsustainable. The need to evolve to a more sustainable model is much more a structural problem than the credit crisis, which will be overcome in a reasonable time. Renewable energy activities will be affected by the crisis since they require large capital investments. I believe that if the people in charge of our energy policy convey messages of confidence and security, this will provide vital support for access to credit in these difficult times. The EU is working in the right direction, although policies could be applied with more determination. Some aspects such as adapting the grid to sustainable energies should get more priority. The success of wind power in Spain and Germany shows what can be achieved with a good regulatory framework. An exciting aspect of Jeremy Rifkin's scheme is the idea of buildings as generators of energy. That is now possible. Acciona Solar's headquarters in Pamplona is a zero-emissions building; it uses half the energy consumed by a conventional building and covers the remainder with renewables, such as biodiesel, solar PV and solar thermal energy. It also uses demand management systems to optimise energy consumption. It actually exports electricity to the grid. We must find ways to extend this concept to both new and existing buildings.'

European Union Sustainable Energy Week



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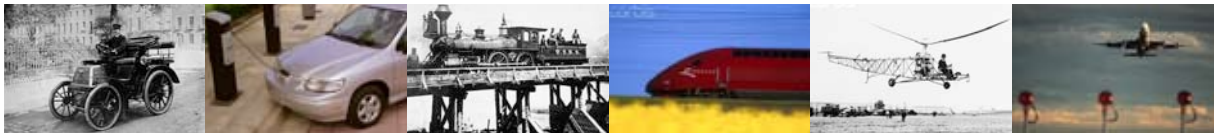


Post-Carbon Society and the Third Industrial Revolution |

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 awareness that we are entering a twilight period where the full costs of our fossil fuel addiction are beginning to act as a drag on the world economy. During this twilight era, the 27 EU member states are making every effort 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. These efforts fall in line with the EU mandate that the member states increase energy efficiency 20 percent by 2020 and reduce their global warming emissions 20 percent by 2020, based on 1990 levels, and as much as 30 percent if an international agreement is achieved.

But, greater efficiencies in the use of fossil fuels and mandated global warming gas reductions, by themselves, are not enough to address the unprecedented crisis of global warming and global peak oil and gas production. The G8 nations have already agreed that overall global emissions of greenhouse gases will need to be cut by 50 percent by 2050, which will require that the industrial nations cut their emissions by 80 to 90 percent. Looking to the future, every government will need to explore new energy paths and establish new economic models with the goal of reducing global warming emissions. The industrial nations will need to achieve as close to zero carbon emissions as possible.

Hans-Gert Pöttering, a politician from the German CDU, is the President of the European Parliament

'We can't go on being dependent on imports'

'We are facing challenges that no single state or superpower can manage alone. In the European Parliament we're used to dealing with complex problems. We have developed a political system which offers many countries a platform and a voice. Even if it's not always easy we succeed in bringing forward advanced solutions and carry them out. This is why I agree with Rifkin's scenario and I think the European Parliament serves as a good example of how we can approach these challenges together. Climate change is a major threat to our lives, our health, our economy, our civilisation as such. We can't go on being dependent on foreign and especially Russian gas import and we know that one day we will run out of fossil fuels. We need to start now to find alternative ways of maintaining and improving our living standards. The economic crisis will inevitably lead to cutbacks by governments but this should not be to the detriment of climate change policy. We must not use this crisis as an excuse to give up on our climate change goals. **Let's face it: the targets of the EU climate package will not be implemented tomorrow. Linking the financial crisis with long-term ambitions is out of place.** I hope the Poznan conference will be a crucial step on the road to the Copenhagen conference in 2009 where we have a unique opportunity for reaching a global agreement to fight climate change.'

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.

In the early modern era, the coming together of coal powered steam technology and the printing 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 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, retail stores, factories and technology parks, store that energy in the form of hydrogen, and share it with each other across an 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 whether renewable energy will, in the long run, be sufficient to meet the needs of the world. 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

Harry Verhaar is Senior Director Energy & Climate Change at Philips Lighting

'We are convinced this is the future of our world'

'Almost 20% of global power consumption comes from lighting. An energy saving of 40% is possible when replacing old lighting by currently available alternatives. Offices could save over 60% of their energy consumption, homes 80%. Over €100 billion in costs could be saved annually and we could make do with 530 fewer power plants.

Installing more efficient lighting requires investments, but their payback time is only 2 to 7 years. Unfortunately, market renovation rates are too slow. In street lighting the annual renovation rate is just 3%. A third of the street lamps in Europe are mercury lamps from the 1930s. The least efficient systems can be found in schools and government office buildings. One bottleneck is financing. Often, investments processes are not attuned to efficiency criteria. We must stimulate "green" procurement schemes and introduce "green" financing schemes. Of course Philips has an interest in speeding up the efficiency revolution. Green products are already half our turnover at Philips Lighting and 100% of our growth. We are convinced that this is our future. But we are equally convinced that it is the future of the world. There is no other option. Who can believe that spending ever increasing amounts on wasting ever scarcer resources can be good for the economy, let alone the climate?



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. It should have as powerful an economic impact in the 21st century, as the convergence of 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.

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. Their falling costs make them increasingly competitive. Billions of euros 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.

In becoming the first superpower to establish a mandatory target of 20 percent renewable energy by 2020, the EU has set in motion the process of vastly enlarging the renewable energy portion of its energy mix. 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.

Second Pillar: Buildings as Positive Power Plants

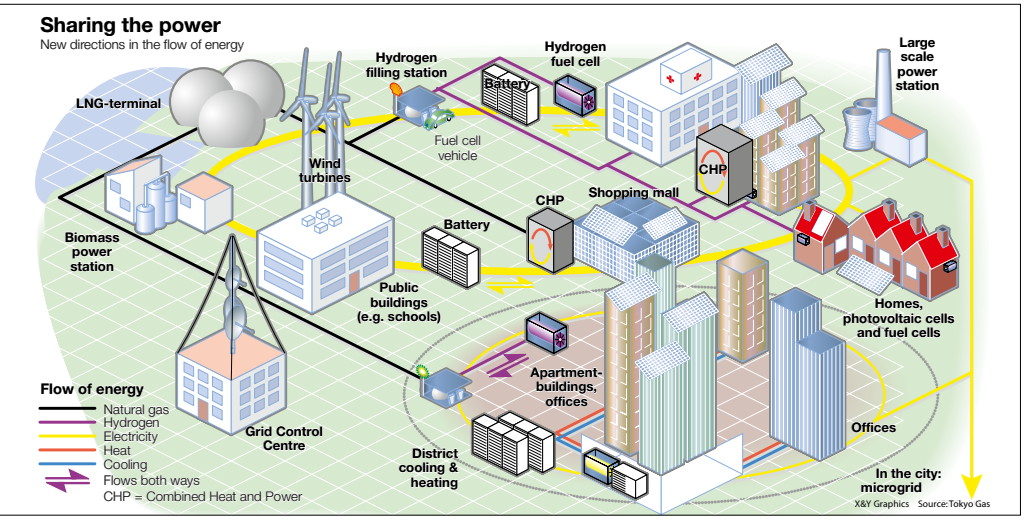
While renewable energy is found everywhere and new technologies are allowing us to harness it more cheaply and efficiently, we need infrastructure to load it. This is where the building industry steps to the fore, to lay down the second pillar of the Third Industrial Revolution.

The construction industry is the largest industrial employer in the EU and, in 2003, represented 10 percent of GDP, and 7 percent of employment in the EU-15. 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. 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 economic implications are vast and far reaching for the real estate industry and, for that matter, Europe and the world.

> *Buildings are the major contributor to human induced global warming*

In 25 years from now, millions of buildings – homes, offices, shopping malls, industrial and technology parks – will be reconverted 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 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 for all of its own needs, and 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 their operations. There are currently a dozen office buildings in operations at the Walqa Park, and 40 more slated for construction. The facility is run almost entirely on renewable forms of energy, including wind power, hydro, and solar. The park houses leading high tech companies, including Microsoft.

> *Today's centralized, top-down flow of energy becomes increasingly obsolete*

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.

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. To maximize renewable energy and minimize cost it will be necessary to develop storage methods that facilitate the conversion of intermittent supplies of 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 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 (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 is because renewable energy is intermittent. The sun isn't always shining, the wind is not always blowing, water is not always flowing, agricultural

yields vary. When renewable energy is not available, electricity cannot be generated and economic activity grinds to a halt. But, if some of the electricity 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. In October 2007, it announced an ambitious public-private partnership to speed the commercial introduction of a hydrogen economy in the 27 member states, with the focus on producing hydrogen from renewable sources of energy.

Fourth Pillar: Smart grids 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 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 and companies to produce renewable energy locally – through solar cells, wind, small hydro, animal and agricultural waste, garbage, and so on – and use it off-grid for their own needs. Smart metering technology allows local producers to more effectively sell their energy back to the main grid, as well as accept electricity from the grid, making the flow bi-directional.

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

In the future, intelligent utility networks will also be increasingly connected to weather changes, giving the power network the ability to adjust electricity flow

Jan van Dokkum is president of UTC Power, a subsidiary of United Technologies Corp in the US, a leading producer of fuel cells and other renewable energy technologies

‘No carbon footprint, that’s what we’re driving to’

We work with all the automotive companies to get demonstrations going, to get the buses and cars on the road, to take that experience in and redesign our fuel cells for more cost-effectiveness. I would say that fuel cells by 2015 will go into early commercialisation. With stationary applications, we can already go directly to customers – with the government incentives we get in some countries – and compete against incumbent technology. I do not like the conversion of natural gas to hydrogen. That is an in-between step. I advocate “green hydrogen”, where you take wind, solar, geo-thermal energy and convert that into storable hydrogen. There is no carbon footprint. That’s where we are driving the industry to.There are already quite a few installations running on renewable hydrogen. I run my entire operation in Hartford, Connecticut, on green hydrogen out of the Niagara Falls area. The only carbon footprint I have is the truck that brings the hydrogen to Hartford. But fuel cells are only part of the offering. If I take a facility, I look at the roof space, the energy profile, I bring all possible solutions together, to find a cost-effective solution. If you just concentrate on fuel cells, you’re missing the boat. You need to look at this as a holistic system for your clients.’

> *The intergrid makes possible a broad redistribution of power*

continuously, to both external weather conditions as well as consumer demand. For example, if the grid is experiencing peak energy use and possible overload, the software can direct a homeowner's washing machine to go down by one cycle per load or change 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 information opens the door to "dynamic pricing", allowing consumers to increase or drop their energy use automatically, depending upon price. Up to the moment pricing also allows local 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 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 producers as well as consumers of energy. This is called "distributed generation."

Even electric and hydrogen- powered fuel cell plug-in 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 network, providing electricity back to the grid. Electric and fuel cell plug in vehicles thus become a way to store massive amounts of renewable energy.

In 2008, Daimler and RWE, Germany's second largest power 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

Stavros Dimas is European Commissioner for the Environment

'EU policy represents a green New Deal'

The situation is serious. We are experiencing an unprecedented crisis in financial markets and governments around the world are grappling with the question of how to avert the worst impacts of the economic downturn. There are those who question whether measures to address climate change are now a luxury. But the reality is that we do not have to make a choice between addressing the crisis, improving our energy efficiency and taking action against climate change. We can do both. Developing our response to the economic crisis represents an opportunity to set the foundations for a future low carbon economy. The EU's climate and energy package is part of this solution. It represents a green "new deal" which will put Europe firmly on the road towards a low carbon economy. Europe will benefit from first-mover advantage. The EU package will require additional investments of about 0.45% of EU GDP in 2020 or €70 billion. But these are investments rather than costs. Meeting the target of 20% renewable energy alone is forecast to lead to nearly 700,000 new jobs. The EU's competitiveness will further be strengthened by improved energy efficiency and reduced dependence on energy from abroad as a result of the decentralisation of energy production. We will cut our oil and gas import bill by €50 billion a year in 2020.

with EDF, France's largest utility, 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 producers, so that new players – especially small and medium sized 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 established a European Smart Grid Technology Platform and prepared a strategy document in 2006 for reconfiguring the power grid to make it intelligent, distributed, and interactive.

A New Social Europe in the 21st Century

Up to now, the energy and climate change challenges have been seen as constraints rather than opportunities. Policies and actions to address them have been perceived as potential threats to our capacity to generate wealth and maintain our social models. Addressing climate change, especially during a period of global economic slowdown, has been seen as a "luxury" that collides with other compelling priorities such as the need to build sustainable social security systems, as well as support the welfare of low income groups, communities and nations. This is especially true for Europe, which has placed the need

to preserve a social model based on solidarity, access and opportunity at the heart of its policies and values. The vision of the Third Industrial Revolution, however, makes it possible to reframe the energy and climate change challenges as economic opportunities, not just to foster a wealthier society, but also a more equitable and sustainable one.

The European social tradition

At the core of social Europe is the effort to promote both individual freedom and social responsibility. These key principles have been translated into market initiatives and social models with the aim of ensuring economic growth, as well as broad access, social cohesion and solidarity. The vision of a new Social Europe emphasizes not only individual opportunities but also the quality of life of society. Indeed, the two objectives are inseparable – each requires the other.

The conventional 20th century economic indicators that emphasize GDP and per capita income are now being accompanied by equally important quality of life indicators that measure an 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 market and social models simultaneously by emphasizing personal economic opportunity along with a sense of social commitment to create a sustainable society for every citizen.

> *The democratization of energy becomes a rallying point of a New Social Europe*

Energy and climate change challenge as opportunities

The long term rise in the price of oil and the increasing real 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 European citizens. Prices of food, consumer products and services, home heating and petrol are going up, threatening the economic well being of families. It is virtually certain that these circumstances will worsen in the years ahead, endangering the vision of a wealthier and more equitable society. For this reason, reducing our dependence on fossil fuels and containing, as much as possible, energy driven inflation, is a first step to preserve equity in the distribution of wealth.

Energy is one of the major sources of wealth in every society, and both availability and the configuration of the energy system have been critical in shaping the availability and distribution of wealth. In our energy regime, dominated by fossil fuels, the location of sources as much as the processes and technologies through which energy is collected, stored and distributed, has an obvious influence on who will benefit the most from its utilization.

Now that the fossil fuels energy paradigm is approaching its sunset, the question is how will the new sunrise energies impact or reshape the European social model.

The "empowered" generation

Unlike fossil fuels, which are only found in a few places, renewable energies are "distributed" everywhere. With the proper technologies, each building can collect, produce and store renewable energies locally to provide for its own power needs as well as provide surplus energy that can be shared. And, thanks to technological developments, we can create intelligent power grids to distribute energy from the places where there is a surplus to where there is a demand.

In the future, millions of people, businesses, and other institutions will have the opportunity to play an active role in renewable energy production and benefit from its value. Distributed energy means distributed wealth. The Third Industrial Revolution can pave the way for a New Social Europe where power itself is broadly distributed, encouraging unprecedented new levels of collaboration among its 500 million citizens. 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 can begin to envision a Europe where 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 Social Europe and access to power becomes an inalienable social right.

The 20th century saw the extension of the political franchise and the broadening of educational and economic opportunities to millions of Europeans. In the 21st century, individual access to energy also becomes a social and human right. Every European should have the right and the opportunity to create their own energy locally and share it with others across the intergrid. 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.

Reshaping globalization

A continent-wide, integrated, intelligent intergrid could allow each EU member country to both produce its own energy and share any surpluses with the rest of Europe in a "network" approach to assuring energy security. When any given region enjoys a temporary surge or surplus in its renewable energy, that energy can be shared with regions facing a temporary deficit. The new energy paradigm also holds great implications for the distribution of power outside Europe. 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. The reason the poor are "powerless" is literal. They lack "power." Incredibly, nearly half of the human population has never made a telephone call and a third of the human race has no access to electricity. The latter 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 EU, working with industries and civil-society organizations, can help facilitate the next phase of sustainable globalization by re-orienting development aid, supplying financing and credit, and providing favored-nation trade status in order to help developing nations establish a Third Industrial Revolution.

Lisbon agenda

Finally, the new energy paradigm represents a dramatic change in the European policies aimed at creating more and better jobs. The transition to the Third Industrial Revolution will require a wholesale reconfiguration of the European infrastructure, creating millions of jobs, and countless new goods and services, with

Guido Bartels is General Manager of IBM's Global Energy & Utilities Industry and a leader of the Global Intelligent Utility Network Coalition set up IBM

'We are looking at a whole new growth engine'

'Jeremy Rifkin designates the smart grid as one of the four "pillars" of his "Third Industrial Revolution". There is good reason for this. The development of the smart grid is essential for our future economic growth. If we don't adopt this technology, the transformation that is needed to save the world will not come about. If you listen to the political debates in the US, you will hear talk of all sorts of marvellous new developments, such as electric cars or solar energy. What most people don't realise is that these represent an enormous challenge for utility companies. The power grid as we know it is not designed to handle these new technologies. If Thomas Edison came back to earth today, he would recognise the power grid as something that is basically what it was in his time. We cannot combat climate change and enter a new energy era without an overhaul of the networks. Countries that adopt this technology are looking at a whole new growth engine. A whole set of new technologies will be possible. That is why some people compare this to the internet revolution. But we still have to overcome many institutional limitations. The business model of many utilities, for example, is based on kilowatts sold. This does not work in a world of climate change.'

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 the continent's millions of buildings, transforming them into positive power plants, embed hydrogen and other storage technology throughout the infrastructure, transform the automobile from the internal combustion engine to electric and hydrogen fuel cell plug-in vehicles, and lay down an intelligent utility network across the continent.

With the Third Industrial Revolution looming on the horizon, the Lisbon Agenda acquires a new and greater significance. Knowledge will be key in fostering the Third Industrial Revolution and ensuring a smooth transition. The remaking of the infrastructure and the retooling of industries is going to require a massive retraining of workers. 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, electric and hydrogen powered transport, and hundreds of other technical fields.

Entrepreneurs and managers will need to be educated to take advantage of new 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.

Just as 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 nanotechnologies, 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

Andris Piebalgs is European Commissioner for Energy

'This will trigger a new industrial revolution'

'We face huge challenges, but these may also turn into opportunities. There is growing awareness that our fossil-fuel based societies are not sustainable. I agree with Mr. Rifkin that we have to move to a low carbon economy and that this change is going to trigger a newtechnology-based industrial revolution. In terms of specific policies, e.g. regarding renewables, smart grids and buildings as power plants, I believe that they differ in their importance and level of maturity. Buildings as power plants are as yet feasible only for very high performance buildings. With regard to nuclear energy, this is a matter to be decided at the national level, but the Commission encourages member states to consider carefully the option of nuclear energy. Nuclear has an important role to play in the fight against climate change. Renewable energy and energy efficiency measures are by no means sufficient to substitute for a phasing out of nuclear plants. Coal-fired power with carbon capture and storage (CCS) can and should fit in the model of a sustainable future. CCS is one of the EU's strategic energy technologies. Experts agree that the technology for wide-scale application of CCS in power plants can be commercially feasible in 2020. In the short- and medium-term renewables will not provide enough energy for continued economic growth.'

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.

More research will also be needed to develop the technologies necessary to advance renewable energies, reconfigure existing buildings, construct new ones, establish hydrogen storage technologies, create intelligent utility networks, and create a new generation of electric and hydrogen fuel-cell vehicles, as well as support all of the other ancillary industries and services that accompany the Third Industrial Revolution.

Given the limited availability of public resources, private resources must be mobilized to invest more in research and education. A new pact should be made between the business and research communities that can overcome the traditional barriers that have long separated these two sectors. This will require a profound rethinking of the research endeavor, with emphasis on a more interdisciplinary approach. We need to ensure that both basic and applied research are innovation driven, and that fragmented resources across organizations are pooled together to achieve needed critical mass.

To advance these goals, the Commission is bringing forward a series of initiatives to make the Lisbon Strategy a concrete pillar of the new post-carbon society. The European Institute of Innovation and Technology will be a laboratory to pursue new educational programmes, provide needed skills, as well as create strategic partnerships between the business community and the research and education communities to advance the new energy paradigm. In 2009, the European Institute of Technology will kick off its activities with two of its three priorities being renewable energy and climate change.

The Institute aims at inspiring and driving the changes and reforms needed by knowledge-intensive organizations to fully contribute and benefit from the Third Industrial Revolution.

Conclusions

The Third Industrial Revolution makes possible a New Social Europe in the 21st century. The European dream, which lies at the very heart of this, emphasizes social and human rights, balancing the social and market models, and building bridges of cooperation and peace. Underlying this expansive new dream of a 21st century social Europe is the commitment that millions of Europeans share to create a just and sustainable society for their children and future generations.

> *Entrepreneurs and managers will need to be educated to take advantage of new businesses models*

It is becoming increasingly clear that the consumption of oil and gas fuels is not sustainable in the medium term and that the impact of climate change on communities and ecosystems endangers our vision for a social Europe in the long run. Without a well-thought-out plan to usher in a Third Industrial Revolution, the hope of a New Social Europe will begin to fade, putting the European experiment in jeopardy. The Third Industrial Revolution, therefore, is the base upon which a New Social Europe can be built. Together, the Third Industrial Revolution and a New Social Europe offer a compelling narrative for the next 50 years of European integration.

European industry has the scientific, technological, and financial know-how to spearhead the shift to

renewable energies, positive power buildings, a hydrogen economy, an intelligent power grid, and plug-in transportation, 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 sectors, 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 will be based on the establishment of 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, 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 endeavor of the EU.

What is needed to move European integration forward is a strong political vision capable of joining the Third Industrial Revolution and a New Social Europe together. By articulating a clear political agenda to advance the Third Industrial Revolution and the accompanying programs for a New Social Europe, the European Commission will help take the European project to the next stage of its development, and, in the process, bequeath a powerful legacy for future generations in Europe. The new politics provides the EU with an opportunity to become a beacon of hope for the rest of the world in the 21st Century.

In 1960, President Kennedy challenged the baby-boom generation in the United States to join him in putting a man on the moon and exploring the far reaches of outer space. The sequel, in the 21st century, is for the EU to lead the world in saving the biosphere of the earth. The European Commission and the member states need to communicate this mission across Europe with the goal of unleashing the vast creative potential of the European people to the task of renewing the planet.

Anton Milner is ceo of Q-Cells in Germany, one of the two largest producers of solar cells in the world

'Politicians are not brave enough'

'We are facing a triple crisis and the only way out is through a restructuring of our economy – a Third Industrial Revolution. Politicians know this. But they do not like to talk about it. There are some hard choices to be made, but they are not brave enough to face up to them. They are more concerned with short-term issues.'

'The climate policy of the EU is too little, too late. We believe that the potential of renewable energy is much higher than 20% in 2020. Photovoltaics alone can provide 12% of power supply in 2020. The regulatory environment will have to steer investments in the right direction. At this moment, governments are only starting to play with these instruments. There is still too much conflict of interest between centralised and decentralised producers. The financial crisis shows the urgency of creating a new energy system. Now, if we use oil and gas, the proceeds go to other parts of the world. If we invest in renewables, the money will stay here and employment will grow. I want to say to the participants of the Poznan-conference: think about how you can achieve a step-change in the way society is organised. It will have major consequences, but if and when climate change comes to bear the consequences will be much greater.'

Friends of Europe Les amis de l'Europe

Friends of Europe is an independent Brussels-based think-tank that fosters debate and new thinking on the issues facing Europe's citizens. It reaches out far beyond Brussels by using innovative technologies and communication techniques.

Its activities span almost all the issues on the European agenda but concentrate on these six areas in particular:

- **Energy and the environment**
- **Europe's social challenges**
- **EU institutional reform**
- **EU external relations**
- **Development policy**
- **EU communication with citizens**

Friends of Europe attracts policymakers and stakeholders from a wide range of sectors from all over Europe. They include EU and national policymakers, business and civil society leaders, NGO representatives, leading academics and the international media. We ensure that all sides of the debate are represented.

ENERGY AND THE ENVIRONMENT

Energy security and the global challenge of climate change are today both on top of Europe's political agenda. They also feature prominently in *Friends of Europe*'s calendar and we are proud to make a substantial contribution to the debate on Europe's energy and environment. In addition to our regular evening debates, annual policy summits and reports on both water and energy issues, we also hold each year a special environment conference as part of the European Commission's Green Week.

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Austrian Ministry of the Economy

Helge Lund
CEO of StatoilHydro

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Opportunity seized?

Sustainability performance arouses as much interest and passion in stakeholders as the traditional flashpoints of financial performance. However, is the same business challenge being applied? Just reporting on sustainability is not enough – it needs to be integrated into your business strategy so that you look beyond managing risks to focus on optimizing opportunities and improving business value. Striking the right balance between risk and opportunity isn't easy given today's uncertainties. Ernst & Young's Climate Change and Sustainability Services provide global advice that help you confidently navigate your climate change and sustainability journey – from understanding business and regulatory threats and opportunities, to exploring and executing commercial transactions, monitoring performance and adding rigor to public disclosures on progress. Each step focused on enhancing confidence as your organization balances risks, takes advantage of opportunities and achieves full potential in a transformed world.

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