



The Power to Innovate

As the evidence mounts that our dwindling supply of traditional fossil fuels is the major cause of global warming, the need for alternative energy solutions has never been greater.

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"In the 21st century, innovation is my job. It is the most important thing I do for my organization. What I need to do is to take my organization away from where it is now and move it to a place of higher value."

The speaker is Nick Donofrio, IBM's executive vice president for innovation and technology, and his words reflect in no uncertain terms where his company is heading. As it happens, they also reflect how most of the 765 leaders who took part in IBM's 2006 global CEO survey see their job.

Beset by persistently high prices, insecure supplies, and the threat of global warming, businesses across the globe are asking their CEOs to stand up and be counted on many issues, but none more so than energy. Many are meeting the challenge. Think of the 1997 Stanford University speech by Lord John Browne, CEO of BP, when he dared to acknowledge a link between fossil fuels and climate change. "Today these words seem relatively non-contentious," says Tony Meggs, BP's group vice president for technology. "We've become used to heads of global corporations calling for action on climate change. But at the time they caused ripples in our industry and beyond."

The success of the movie *An Inconvenient Truth*, narrated by Al Gore—not to mention *The*

Day After Tomorrow, a 2004 Hollywood thriller in which New York city ends up frozen in a new Ice Age after the Gulf Stream is disrupted by the melting of the polar ice caps—is clear evidence that climate has moved to the top of popular consciousness. Meggs is convinced we can't sit around waiting for inspiration to strike. Decisive action and unprecedented levels of innovation are needed to provide for the energy needs of the future, he says, while also keeping a lid on the carbon dioxide emissions believed to cause climate change.

Times Are Changing

Meggs and Donofrio were keynote speakers during a panel discussion about the energy crisis moderated by FORTUNE's Asia Editor at "Innovation Japan 2006 Forum: Innovating the Future," a major event held in Tokyo Sept. 13–15. The forum—designed to explore how business, government, and academia can work together to confront today's technological and environmental challenges—was co-hosted by the New Energy and Industrial Technology Development Organization

(NEDO) and the Japan Science and Technology Agency (JSTA).

Opening the three-day event, Iwao Matsuda, Japan's former Minister for Science and Technology, defined innovation as multidisciplinary, collaborative, and global. The prowess of Japan's manufacturing sector did not stop him from declaring that the ideal economy is no longer based on traditional factories, but on "brainpower factories"—his description of the United States. "Innovation is about smashing the status quo," proclaimed Matsuda, quoting approvingly from a participant in the IBM survey.

A Japanese government minister bent on radical change? Incredible. But we live in unusual times. After all, back in April it was quite a surprise to hear a Texas oil man named George W. Bush telling the Renewable Fuels Association that "ethanol's good for drivers" and that it "will replace gasoline consumption."

What it all means is that the debate on alternative energies has moved well beyond the old scenario of "Big Oil vs. The Tree-Huggers." One thing on

which all parties agree: With no single miracle solution in sight, a pragmatic approach is crucial. "There is no silver bullet," is the way Meggs put it. "It's important to work on many fronts." David Pimentel, professor of ecology and agriculture at Cornell University, agrees. In a recent interview with the BBC, Dr. Pimentel estimated that turning 100% of the corn produced in the U.S. into ethanol for use as fuel for cars would still only be equivalent to a mere 16% of the country's current petroleum consumption.



The Green Movement

Recognizing the urgent need to support the green movement, corporate stewards are investing in alternative energy research and development. Virgin Group chairman Sir Richard Branson made headlines at September's Clinton Global Initiative when he pledged that all profits from his air and rail companies for the next ten years would be invested in the fight against global warming. While Branson's move goes far beyond the norm, more and more companies are rising to the challenge.

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This comes hot on the heels of many alternative energy initiatives that companies—like BP—have been working on for years. This includes research and development in a host of areas, ranging from solar and wind power to hydrogen power stations. At the same time, BP is also making a \$500 million investment to study the application of biology in energy technology. “Fundamentally, fossil fuels are made from carbon,” explained Meggs, “which is actually fossilized forms of life.”

General Electric—one of

the world's leading manufacturers of large jet engines and capital equipment for the global oil and gas industry—is also pledging resources and manpower to develop alternative energy solutions. It is a major player in the global market for wind turbines, which explains why it undertook “to provide imaginative answers to the mounting challenges to our ecosystem” with its May 2005 Ecomagination commitment to double its investment in cleaner technologies. Sharp, a Japanese company best known

for its Aquos LCD televisions and pocket calculators, is also the world's No. 1 manufacturer of solar cells, with nearly as much production capacity as the three next largest manufacturers combined.

Probably the most visible attempt to grapple with the energy challenges confronting the 21st century is being made by Toyota. Its Prius, the world's first commercially produced gas-electric hybrid car, was originally seen as a plaything of the rich and famous; drivers include Hollywood heartthrob

Leonardo DiCaprio and Britain's Prince Charles. Things have changed, however, and Toyota is now selling almost 400,000 hybrids a year. Purists may argue that the Prius only reduces gasoline consumption, when eliminating it entirely would be better. But Toyota's research and development philosophy, captured in its slogan "Today for Tomorrow," is not based on wishful thinking. Rather, it's on analyzing what's needed to make our future better, and then taking the necessary, practical steps right now.

In addition to finding favor with celebrities, the Prius has received a slew of awards from the auto

industry. It's also been acclaimed in other ways. In London, for example, the authorities have classified Toyota's eco-car as a Super Ultra Low Emission Vehicle (SULEV) and exempted Prius drivers from the congestion charge levied on people who enter the city center on weekdays. The aim, of course, is to encourage drivers to switch to cleaner forms of transport. Government incentives of this kind will play a major role in the development of new energies and energy efficiencies.

Where There's a Will...

At the moment, most forms of alternative energy remain significantly more expensive than their fossil-fuel counterparts. That's why governments have a crucial role to play in shepherding these promising technologies through the so-called "valley of death," the difficult and uncertain stage between R&D and the market. It was support from Japan's New Energy and Industrial Technology Development Organization (NEDO) that helped Sharp in its long struggle to develop solar cells, while tax credits provided by the U.S. and other governments have contributed enormously

to the recent interest in wind power. Some critics argue that such interference distorts the market, and that different forms of energy, new and old, should battle it out on a level playing field. But even with old energy, pricing is not what it might be. What if the price of coal included the medical bills of the miners who contracted lung disease from long years in the mines? And what, as Vaclav Smil asks in his book *Energy at the Crossroads*, if the external costs of the first Gulf War had been factored into oil prices?

"The important thing is to ask oneself: 'What is the real cost of fossil fuels if one takes into account the environmental impacts?'" said BP's Meggs. "If a tax on carbon were implemented, then all these alternative energies would become very competitive."

Only governments can impose taxes, of course, but the choices we make, as individuals will ultimately change the way energy is consumed around the world. Do we need such large, heavy, gas-guzzling cars for popping down to the supermarket? Why haven't we replaced our incandescent lightbulbs with compact fluorescent lights?

This was just one of many points made during the panel discussion entitled "Can We Innovate Our Way Out of the Energy Crisis?" at the forum. Noting that the

ostentatious use of energy is one of the conspicuous wealth indicators of our times, BP's Meggs—quoting David Fisk, professor of engineering for sustainable development at Imperial College London—suggested that, should the evidence continue to mount that global warming is caused by greenhouse gases, unnecessary energy use may well end up becoming as socially unacceptable and unfashionable as fur coats.

But it was Robert Gleitz, general manager of GE's wind business, who was most eloquent in expressing the urgent need for a combination of political leadership and individual responsibility to address our energy problems. "As a society, we do not have the right to go in a direction we know is a dead end," he said. "We do not have the right to say, 'Let's use all the fossil fuels and pollute the planet and leave the mess for our kids and future generations.' That's how politicians should spin things to get the interest of the people. If we continue acting as we are now, we are going to end up with air we'll not be able to breathe and with high temperatures. If we don't act now, it will be insane."

The urgency of this global problem is undeniable. That's why companies and public research organizations must work hand in hand to preserve the planet for future generations.



Engines of Change

Conscious of the environmental challenges we face in the 21st century, Toyota is exploring a range of technologies in its quest for sustainable mobility.

Automobiles enrich our lives by enabling us to go where we please, when we please. But this freedom of movement comes at a price. By emitting carbon dioxide, contributing to atmospheric pollution, and using up scarce fossil fuels, cars have a negative impact on the environment.

Far from denying the existence of such issues, Toyota president Katsuaki Watanabe accepts that his company has a responsibility to find a balance between the needs of people and the planet to achieve what he calls "sustainable mobility." Toyota has been taking these issues seriously for a long time. "We established the Toyota Earth Charter in 1992 and launched the Eco-Project Campaign in 1997 so we could have an open dialogue on this topic," said Watanabe in his speech at the Fifth Toyota Environment Forum on Powertrain Technology held in Tokyo in June this year. "We're always asking: 'What can we do for tomorrow, today?'"

The Prius, the world's first mass-produced gas-electric hybrid car, was Toyota's concrete answer to that question. Launched in Japan in 1997, worldwide sales of the Prius—its name comes from the Latin word for "to pioneer"—passed the 500,000 mark in April this year. Watanabe plans to double the number of hybrid models by the early 2010s, and is targeting annual sales of one million units by around the same time. To achieve these goals, Watanabe is working to miniaturize system components by as much as 50% in the next-generation model.

Toyota is convinced that hybrid technology will be a core technology for helping solve the environmental and energy issues of the 21st century, and the company is determined to take a lead role in driving its evolution. It's also pushing ahead with research into "plug-in hybrid vehicles," which can drastically curb fuel consumption by recharging from an external source. "This technology is just now coming into focus," Watanabe declares. "It's expected to have a significant effect on reducing carbon dioxide and atmospheric pollution."

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Toyota president Katsuaki Watanabe at the Fifth Toyota Environment Forum

Hybrid technology may be the best known, but it is by no means the only environmental technology that Toyota is exploring. Watanabe believes that a multi-pronged approach—offering the right vehicle in the right place at the right time—is the secret to sustainable mobility, and that combining new technologies, like hybrid technology, with improvements in the internal combustion engine is the most practical way to deliver rapid environmental gains.

That's why Toyota regards its development of better engine and transmission technology—collectively called the powertrain—as among its most significant environmental efforts. "Petroleum will remain the main fuel for automobiles for the foreseeable future," explains Watanabe. "So we want to use that precious resource as sparingly as we can, by improving the powertrain to achieve higher fuel efficiency and cleaner exhaust emissions."

Toyota is busy revamping its entire powertrain lineup by 2010. The new engines achieve better fuel efficiency through reduced friction and the use of ultra-light parts. Inside Japan, Japanese automakers have improved their fuel efficiency by 23% over the last 10 years, and Toyota itself achieved the Japanese government's 2010 fuel efficiency standards for all vehicle categories in 2005.

Among alternatives to petroleum, biofuels have started to attract the attention of the U.S. political establishment. Spring 2007 will see Toyota launch "flex-fuel vehicles" (FFVs), able to run on 100% bio-ethanol, in Brazil, with the United States—depending on how government policy develops—as the next potential market for FFVs.

Whether improving internal combustion engines and hybrid technology, or utilizing biofuels, everything that Toyota does is driven by its commitment to environmental preservation. "Our mission is to continue offering cars our customers can drive not just with pleasure," concludes Watanabe, "but with pride as part of the sustainable mobility community." ■



Above: Prius, Toyota's best-selling hybrid car; Right: Hybrid Synergy Drive, the symbol of Toyota hybrid vehicles.



A Bright Prognosis

Through strategic alliances and internal synergies, Olympus Corp.'s Life Science Group is bringing next-generation medicine out of the lab and to the patient.

Imagine that your family doctor told you during a routine checkup that you were going to develop lung cancer sometime in the future. What would you do? Presented with the evidence, you might request further tests or start investigating preemptive treatments for the disease. You might change your diet and your lifestyle to avoid accelerating its advance, and then stop to re-think your priorities.

Considering the direction and speed with which biotechnology is pushing medical science, this scenario is not as far off as you might think. In fact, elements of "predictive medicine" exist in clinical practice today. At the cutting edge of this new frontier is global precision technology leader Olympus.

A Microscopic Past

To many consumers, Olympus is known as an innovative camera maker. It may be surprising to hear the name associated with medical science. However, long before the company turned its hand to cameras, Olympus established its identity by producing affordable, high-quality microscopes. "Microscopy has continued to be at the core of our business for almost 90 years," says Olympus president Tsuyoshi Kikukawa. "It is part of our DNA."

Although Olympus is still the world's leading microscope manufacturer, with 30% to 40% of the global market, today the company's primary revenue pillars are its medical systems and its camera and imaging business. Rapid advances in medical science and biotechnology, however, are creating macro-opportunities for the microscope business.

"There is an ongoing shift in the emphasis of medicine from treatment to prevention, and it is becoming possible to diagnose illnesses at an early stage through speedy and highly precise testing such as clinical analysis," says Kikukawa. "The early detection of illness, especially the early diagnosis of cancer, has become an issue of global importance."

In response to these trends, Olympus undertook a restructuring of its Medical Systems Group in 2003, intended to reinvigorate its endoscope business

Rapid advances in medical science and biotechnology are creating opportunities for the microscope business.



*Tsuyoshi Kikukawa,
President of
Olympus Corp.*

Hisayoshi Osawa

(Olympus has approximately 70% of the global market for gastrointestinal endoscopes). The company also took the opportunity to establish a division dedicated to developing new business in the field of life sciences. "New business that leverages synergies between genomic medicine and our traditional microscope and clinical analyzer businesses," explains Life Science Group president Kazuhisa Yanagisawa.

Olympus is banking on the new group becoming a huge profit center. According to biotech business information provider BioSpectrum, the global life-sciences industry is estimated to be worth about \$2 trillion, with health-care services accounting for approximately half of this.

Microscope and analyzer technologies currently comprise the Life Science Group's core businesses.

Olympus plans to expand the group's operations into biotechnology, entering the genetics field within three years, and the drug discovery and molecular pathology industries within the next three to five years.

"Though biotechnology is new territory for Olympus, we can utilize the great know-how we have gained from

our expertise in the highly competitive blood testing industry," says president Kikukawa.

Kikukawa envisages Olympus' life science business becoming the company's third revenue pillar, along with medical systems and imaging. Last fiscal year, the Life Science Group contributed 11%, \$940 million (108 billion yen) of Olympus' total \$8.5 billion (980 billion yen) in sales, a 35% increase from the previous year.

From Diversity to Synergy

At first glance, it may seem that the Life Science Group's two core businesses have no direct relation to one another. Microscopes are used for basic research, pathology, and education, whereas diagnostic systems are used in hospital labs.

However, Yanagisawa believes that in the not-too-distant future these two fields will overlap, and the businesses will accordingly merge. The Life Science Group puts Olympus in the perfect position to take advantage of this worldwide trend toward "translational research," which takes technology out of the researcher's hands and gives it to the doctor.

Olympus has already announced plans to accelerate the commercialization of its range of instruments for genome and protein analysis. To fast-track this effort, Olympus has been collaborating with Cangen Biotechnologies, a U.S. biotech firm that specializes in noninvasive diagnostic tests for cancer.

The companies teamed up in May 2005 with the goal of developing a blood-based molecular diagnostic test for use in the early detection of lung cancer. Cangen recruits patients for a clinical study in Asia and manages the study from its office in Seoul. For its part, Olympus provides funding to support the ongoing research and clinical development efforts. The companies aim to have the test approved by the FDA within two years.

Many other amazing applications for Olympus' life science products are gaining attention. Recently, in Japan, there has been a growing interest in a novel consumer product, "DNA Slim," produced by Olympus subsidiary NovusGene and Hiroshima-based EBS, that identifies lifestyle-related diseases via genetic

analysis of fingernails. The service utilizes Olympus products to assess a person's predisposition to weight gain, and then offers advice on diet and exercise specific to the kind of lifestyle-related disease the person is susceptible to.

"As of 2004, the market for genetic testing was some 150 billion yen (\$1.3 billion) worldwide and growing at an annual rate of 20%, so it would be probably worth 200 billion yen (\$1.74 billion) today," says Yanagisawa. "And as the number of testing targets increases, so does the market size."

Partners for Life

In order to keep pace with the rapid evolution of the life science industry and the complexity of the technology involved, strategic alliances that boost efficiency and speed have become more important than ever. In addition to its corporate partners, such as those mentioned here, Olympus has forged partnerships with prestigious academic institutions to help develop, test, and refine its life science technologies.

One such collaboration, with Japan's Energy and

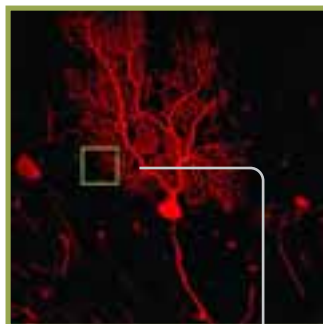
Industrial Technology Development Organization (NEDO), required that the Life Science Group partner with Olympus' own medical systems company and its R&D division responsible for developing MEMS (Micro Electro Mechanical Systems). The NEDO-funded research program resulted in the development of the world's smallest ultra-slim microscopic probe.

Yanagisawa believes that adroit management of Olympus' innovations and partnerships, especially across divisions within

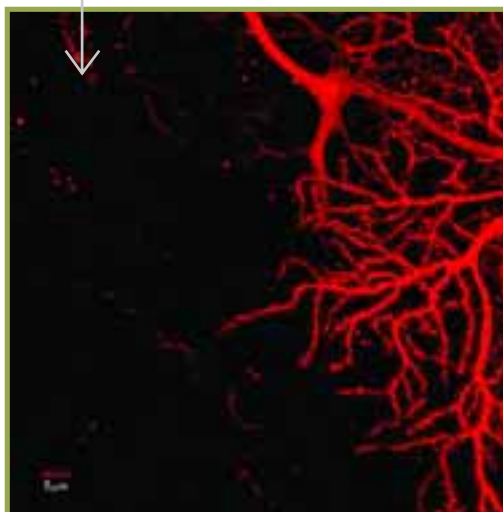
the company, will generate new business opportunities at an exponential rate.

More impressively, the company's continued growth and advances in life science hold steadfastly true to Olympus' corporate mission as stated by President Kikukawa: "to contribute to a life of quality, while envisioning a better future for everyone, everywhere, all the time."

— Campbell Hanley



An Olympus microscope zooms in on a brain cell, showing details less than a micrometer in size.



Innovating Our Way Out of the Energy Crisis

As the world ponders how to stop global warming and save the planet, government research institutions, corporations, scientists, and other innovators are scrambling to develop alternative energy sources that can turn the tide. To find out how some public and private organizations are tackling the issue, FORTUNE assembled a panel of leading experts to answer the question: Can we innovate our way out of the energy crisis? The panel was part of the Innovation Japan 2006 Forum held in Tokyo. Experts from Europe, Japan, and the U.S. gave their views and discussed new alternative energy technologies. The panel included: Itaru Yasui, vice rector, United Nations University; Tony Meggs, group vice president, technology, BP; Shinzo Kobuki, managing officer, Toyota Motor; Robert Gleitz, GE wind general manager, GE Energy; Takashi Tomita, corporate executive director and group general manager of the Solar Systems Group, Sharp; and Kazuaki Koizawa, executive director, New Energy and Industrial Technology Development Organization (NEDO). Below are edited excerpts from their discussion.

Thanks to the movie "An Inconvenient Truth," narrated by Al Gore, the topic of global warming is getting more attention in the United States. How do the Japanese feel about this issue?

Yasui: It looks as though the majority of Japanese companies believe in global warming, but whether they actually have a strategy to deal with it is another matter. Industrial groups are worried about the possibility of some sort of environment tax that would handicap them in competing with China. Naturally enough, companies that use a lot of energy—cement manufacturers, say, or steelmakers—tend to be very hostile toward an environment tax. Compared to America, though, the overall attitude in Japan is rather mild.

There are various projections about global warming, but we don't really know what's going to happen. But in my opinion, the fact that we don't know does not mean we should sit on our hands. We should expect the worst and deal with things on that basis. We need to accept that there is no simple, one-size-fits-all solution. With all these types of new energy, there's always a trade-off between technology and the environment.

Take biofuels versus food as an example. The world population is likely to peak at somewhere around eight billion before 2050, so we'll have to increase the global food supply proportionately. Obviously, this will end up limiting our ability to make biofuels. It's the same with wind power. In Japan, for example, we just don't have much wind. I think it's



important to stay aware of all the problems and not be overly optimistic.

Nonetheless, we can do a lot about global warming with the technology we have. But we need policies. It will cost money, and industry is against paying. We paid to clean up pollution because we felt the effects of pollution in our everyday lives. Global warming, however, is in the future, with the real problems a hundred or more years down the line. Technology is not the problem. We have the technology. The problem

is cost. The question is: Are we willing to pay taxes to solve the problem? Half of the responsibility lies with the individual citizen. We need a society-wide change in our "habits of mind."

How is BP responding to high oil prices? Is the company using its capital to spend more on oil and gas exploration, or to develop new technologies?

Meggs: Higher oil prices give us the opportunity to





Toyota's hybrid vehicles have shown that a vehicle integral to people's everyday lives can make dramatic gains in energy efficiency. But skeptics say the cars are not economical because you cannot recover their higher cost despite the fuel you save. How do you respond to such critics?

Kobuki: We see oil hitting its peak in 20 or 40 years, but many other forms of energy—coal, biofuels, nuclear power—have their own problems, too. Liquid fuel is the most efficient kind of fuel for vehicles because of its density. That being the case, we need to use that liquid fuel but use it as sparingly as we can. There are two ways to do that. One is to improve the efficiency of diesel and gasoline engines. The other is to use energy efficiently by recovering any energy that would otherwise be wasted. That's what hybrid cars do. They employ a mechanism that captures and recycles the energy generated by braking and accelerating.

In the near future, as battery technology evolves, we expect to create a plug-in hybrid that can be charged and run off electricity. Plug-in hybrids will definitely save oil resources, reduce carbon-dioxide emissions, and make for a cleaner atmosphere. Of course,

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do two things. One is to increase the recovery from our existing resources. High oil prices promote technological and capital investment in incremental recovery mechanisms. On average, oil fields around the world recover only 40% of the oil in place, so there's a big opportunity to make that figure a lot higher. At BP we have also chosen to commit a great deal of money to alternative forms of energy. We think it's both prudent as businesspeople as well as a part of the solution we offer. Currently we've allocated \$8 billion—15% of our total investment—to

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alternative energies like solar, wind, and hydrogen power stations over the next five years.

We're also in the first stages of creating a half-billion-dollar investment to do research into the application of biology to the problems of energy. I'm confident that there's a huge opportunity with biofuels. For a number of years, biology and bioscience have been—and will be—the most rapidly expanding branch of science. New discoveries are being made all the time and the pace of progress is rapid. But almost all biological research has gone

into medicine—and a little bit into agriculture—over the last 15 or 20 years.

If we could just take a small proportion of that resource and have it address the issue of energy, I think it would make an incredible difference. Fundamentally, fossil fuels are made of carbon—forms of life that are fossilized. There are some very big challenges, the biggest one being to convert the woody material in plants, the parts no one eats, into fuel. It's a very big challenge, but the possibility for breakthrough is very large indeed, and it would make a very material impact.

A Comprehensive Approach

Ricoh dominates the market for multifunction devices for small- and medium-sized enterprises. Now its Global Business Services division is targeting major global companies.

It's a company that has \$17 billion in revenues, and over one million units of its products are distributed to customers every year. It is among the top three players in its field in every major market. Awarded the highest rating for corporate social responsibility in the office electronics category by Germany's Oekom Research in 2004, it topped the tables in a recent survey on corporate IT usage in *Nikkei Computer*, a highly regarded periodical published by Japan's leading information provider.

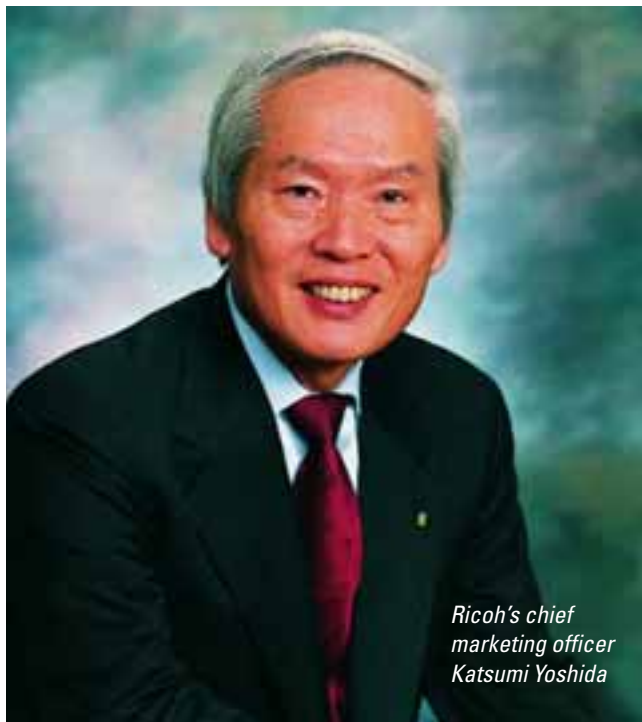
Katsumi Yoshida, chief marketing officer at document solutions provider Ricoh, may have plenty of reasons to be cheerful—but he's nonetheless still far from satisfied. Originally a manufacturer of copiers, Ricoh started to produce networked multifunction digital devices (machines that combine printing, copying, scanning, and faxing functions) in the mid-1990s. These proved an immediate hit with small- and medium-sized enterprises, and Yoshida now wants to increase the number of global companies on Ricoh's client list. To do this, he is relying on a new division, Ricoh Global Business Services.

The last few years have seen a transformation in the needs of global corporations who now want low-cost, standardized, and secure IT solutions. "Document management used to be done country by country, but now it's all about secure worldwide networks," says Yoshida. "Ricoh has switched from powerful analog to powerful networked digital devices, so this change represents a major opportunity for us."

Strength on the Ground

Ricoh has a host of strengths. Most important is its network of wholly-owned subsidiaries in 45 countries that enables the company to have direct contact with its customers and provides insights unavailable to companies content to farm out sales and service to local dealers. This broad reach means Ricoh can handle global projects with one standardized process and a single point of contact. This is a strategic advantage for corporations keen on applying governance over global IT operations.

What are the advantages of this approach? In the world of document solutions, the first step of any project is an "on-site assessment." That is when the client's workflow is examined



*Ricoh's chief marketing officer
Katsumi Yoshida*

and suggestions for productivity improvements are made. Having a local network allows Ricoh to dispatch staff to the client's site for an entire month to obtain accurate data, instead of relying on remote monitoring software, as competitors do. "No other company in the industry does such a thorough job of going after the facts," Yoshida says proudly.

Ricoh is also a leader in technology, customizing software to fit clients' unique needs at technology centers in Asia Pacific, Europe, Japan, China, and North America. It stands at the forefront of environmentally-friendly innovations such as the use of recycled components, double-sided printing, and energy-saving "sleep" mode. Green technology, Yoshida points out, is not just good for helping clients achieve their CO₂ reduction goals—it's also good for their bottom line.

The Opportunity to Grow

More and more global corporations are waking up to the appeal of what Ricoh has to offer. Consumer-goods giant Unilever awarded the company a managed printing services contract that now covers 15 European nations. And this September, Volkswagen, Europe's largest carmaker, selected Ricoh as the exclusive supplier of document-production equipment for its automobile manufacturing sites worldwide.

"The competition is tough," says Yoshida when asked about the future of Ricoh Global Services. "But we already have business on a regional basis with about 70% of the Global Fortune 500 companies, and worldwide contracts with 30 of them, so we definitely have a foot in the door." ■

Ricoh is a leader in technology, customizing software to fit clients' unique needs at IT centers around the world.

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we'll need an infrastructure of electric stations, like present-day gas stations, not to mention things like standardized plugs and so on.

Now let me address some of the negatives you mentioned. First of all, the major criticism about hybrids is that they're expensive. Well, the battery and its components are developing technologically, and the engine's being improved, too. Costs are coming down. Our hope is that by the middle of the next decade, we'll have a hybrid vehicle that will pay for its higher sticker price over the life of the car. And we do believe that hybrids will become mainstream in the near future. This fiscal year we're aiming to sell 400,000 hybrid cars—about 5% of our company's production. We've announced that we want to sell a million units a year by the early 2010s. That would be over 10% of the total.



How much does wind power account for in terms of total energy demand, and how far do you think it could go?

Gleitz: Only 1% of the electricity generated today comes from renewables like wind, so the contribution is quite small on a worldwide basis. But look at the growth rates and it's a completely different story. The future growth rates of renewables are showing figures around 25%. That's almost 40% of the total annual investment in power generation. These enormous figures are the result of targets set by governments. The U.S. is talking about getting 20% of its electricity from wind. China is aiming for 30 gigawatts of wind power by 2020. Europe has a target of 12% of renewables in 2010. Japan has a target of three gigawatts of wind by 2010. The demand is there.

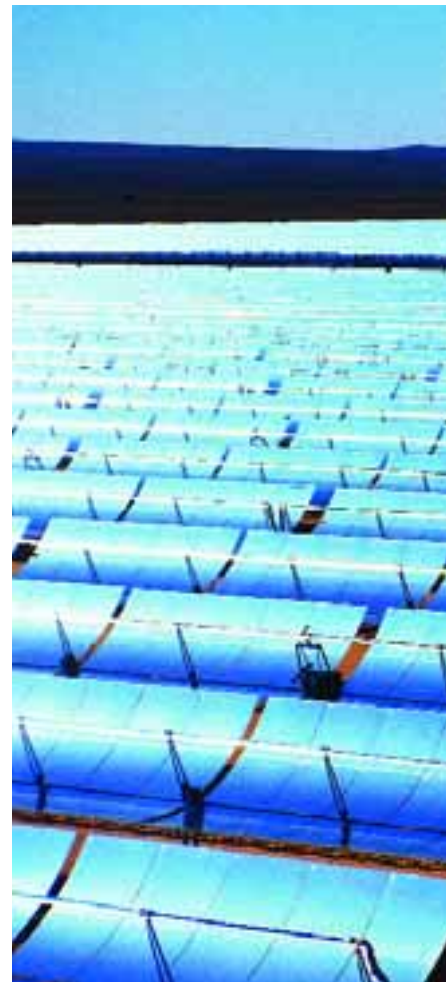
Wind represented more than 50% of the growth of installed capacity in 2005, meaning that more than 12 gigawatts of wind were installed that year. In the coming decades, we expect 15 to 20 gigawatts to be installed every year. This is because wind is nearing the mainstream in terms of cost. It's now possible to generate wind electricity at about seven cents per kilowatt-hour. That explains why wind is growing so fast and why the demand is much larger than the production capacity.

In the wind industry in

the past, policies were on and off. This climate of uncertainty has not encouraged the necessary investment, so the industry is now unable to deliver the huge number of turbines necessary. We haven't invested enough, but it's not too late. We are investing with our suppliers and we are ramping up. I think in the coming years we'll see more and more wind turbines. Denmark has more than 20% of its electricity generated by wind and Germany around 16%. These are large figures that show what's possible when you have the support.

What are the prospects for solar energy? Which countries are leaders in solar technology and why?

Tomita: Statistics show that solar produced one gigawatt of power in 2005. This figure may rise to 10 gigawatts by 2010. In the OECD countries, solar power accounts for only about 1/10,000th, or 0.01%, of total energy produced. We can look at this as an opportunity to grow—and in fact, the growth rate for solar is around 130% per year. The main drivers are Japan and Germany. But just recently, Italy, Spain, and the U.S. have announced new solar programs, so the target countries are starting to change. Solar has the same problems that wind power has, in not being able to predict what kind of



policies governments will choose and what kind of investments will be made.

The reason Japan and Germany are ahead of the curve in solar power has nothing to do with the fact that they have sunny climates. As you know, Japan has no energy resources of its own, so as a country we've been pushing ahead with the development of solar energy ever since the oil shock of 1973. Several hundred thousand households in Japan now use solar cells. And in Germany the government has started to buy electricity derived from solar sources at a more expensive rate, something that obviously encourages significant investment. Germany is not double Japan, but capacity



is being introduced at a rate of about 500 megawatts per year. Energy created through innovative means is undoubtedly more expensive, but with a solar cell you can use it for a long time, which certainly helps to bring costs down.

At NEDO you're involved in a variety of innovations related to energy. What can government do to speed up the development of alternative energies? Can you give us examples of successful partnerships that NEDO is involved in?

Koizawa: We've been talking about the role of government in developing alternative energies, and www.fortune.com/sections

"We've been working on solar cells for over 30 years, but it took 20 years before it started blooming as a business."

one thing that we're doing at NEDO is conducting basic research. As Mr. Tomita of Sharp mentioned just now, we've been working on solar cells for over 30 years since the first oil shock, but it took a good 20 years before solar started blooming as a business. Truth be told, it's really only in the last few years that it turned the

corner. And compared to other sources of electricity, the performance of solar cells still leaves something to be desired. It's necessary to investigate the possibility of making the thin film used in solar cells from some completely different material, or possibly coming up with cells that work on quite different principles, so NEDO is

teaming up with universities and companies to do research on this issue.

Governments should also establish incentives—a system of subsidies, really—and a regulatory framework to encourage the adoption of new energy technologies. This sort of government action has been extremely effective in encouraging the take-up of solar modules in private houses in Japan. We also have targets designed to encourage power-generation companies to introduce wind and solar power. All in all, the role of government is enormously important.

As regards collaboration with other countries, energy security is a major theme in Asia. At NEDO we're involved in a variety of cooperative programs to help distribute Japan's excellent technology throughout the region. A good example is the model solar-power system we set up in the Xinjiang Uygur region in China. We are doing a lot in Southeast Asia. As yet we're not doing that much in India but it will become a very important country for us in the future. With the high price of oil, China and many other countries have started to take energy conservation very seriously and set targets. Japan has very advanced energy conservation technology and disseminating this technology to other Asian countries to address regional energy security concerns is a strategic priority. ■

Digital Ties That Bind

The Internet has enabled us to collaborate on a global scale, revolutionizing the way we work.

What a difference a generation makes. Twenty years ago, who could have imagined that business would be completely transformed by the Internet and the technologies it has helped spawn? Nowadays, companies are able to instantly access information, collaborate with partners across oceans and time zones, and buy and sell products with just the click of a mouse. For large corporations, the paradigm shift has been huge. Suddenly, they have become dispersed organizations with customer support, production, and R&D stretched out all over the globe. In this new Digital Era, a company's sprawling functions are largely automated, and employees can collaborate in so many ways. For example, design teams in India, Mexico, and the U.S. can work in tandem to develop a new product, while tailoring it to the nuances of their own unique local marketplaces. At the same time, this trend has revolutionized the supply chain. Examples of this phenomenon abound—just look at the Apple iPod. It may have been designed in California, but it was assembled in China from components made by a host of companies all across Asia.

To discuss the trend, a group of corporate executives was assembled for a TIME panel entitled "Digital Collaboration: Toward a Better World for Everyone" at the Innovation Japan 2006 Forum held in Tokyo in September. The participants were Daniel Ling, corporate vice president for research, Microsoft; Koichi Takiguchi, senior vice president, Fuji Xerox; Tsutomu Nakamura, senior vice president and member of the board, NEC; Toshiaki Ikoma, director general for the Center of Social Development, Japan Science and Technology Agency; Yasuharu Suematsu, director general of the National Institute of Informatics; and Vinton Cerf, vice president and chief Internet evangelist, Google. Here are excerpts:

How do you see collaboration and communication developing, and products spreading into new markets?

Nakamura: Next year will mark 30 years since NEC adopted the slogan "C&C" to proclaim the integration of computers and communications—something that's been steadily building momentum that we promote globally. To do this properly, companies need to understand the differing

needs of both developed and developing countries. What we see is the evolution of PC usage. It is not just a tool that individuals and corporations can use to access information. It can also help ensure the safety of organizations and society, and aid in education. What kind of PC is needed in developing countries? First, it must be very cheap. Second, it has to be wireless and hand-powered, since many users will be in places without communications, or electric



Global brain trust: Leading scientific experts and corporate executives give their views on digital innovation.

power infrastructure. In addition, it should be equipped with anti-virus software, and have some sort of retina or fingerprint recognition system that can restrict access for children so they won't be exposed to unsuitable things on the Internet.

Google's mission is to make the world's information accessible and useful. What happens when you share information in ways that have not been done before?

Cerf: The Internet is all about people working together. Even putting a hyperlink on your site that directs someone somewhere else is a kind of implicit collaboration. One of our applications, Google Earth, is an example. This 3D interface of the planet allows users to view satellite images of

neighborhoods, terrain, and buildings, and to retrieve maps and directions for travel. It also binds geographically-indexed information to those images so people have some idea about what is actually there and what you can do in that location. Geographical indexing is one of the most powerful organizing paradigms, because the correlation of things that

Japanese companies are busy fostering knowledge sharing and innovation.

happen in a certain place is very powerful. So what we're trying to do with Google Earth is expose an interface that allows other people to inject what they know about what's happening in certain places. The scientific community has made use of Google Earth in some pretty interesting ways because they correlate information about things happening in a given place by sharing their information and knowledge about that. So we find the

general public and scientific community using tools like Google Earth as a way of directly correlating and sharing their information, and thereby collaborating. I find this a strong indication of how powerful information sharing can be if it's properly organized.

Give me a sense of what collaborative technology Microsoft is dreaming of for global society?

Ling: We're very interested in helping parts of the socioeconomic spectrum that we've traditionally been unable to get to. At our research lab in Bangalore, India, we have been looking at rural village schools with classes of 20 students, but only one computer. We attached multiple mice to one computer so that five or six students could feel as though they were in control of something, rather than just watch one person using

the computer. We've developed a number of learning games that multiple students can participate in at the same time. We've also looked at how to provide IT services to the illiterate. The challenge was whether we could develop an interface simple enough so that even illiterate domestic workers could use it to help them find a job, which would obviously lead to their economic improvement. ■

Innovation 101

IBM is a company that both innovates and studies the process of innovation. As part of "Innovation Japan 2006 Forum: Innovating the Future," Nick Donofrio, vice president for innovation and technology at IBM, shared insights into innovation gleaned from IBM's 2006 Global Innovation Outlook and Global CEO Study.

What is innovation?

In the 21st century innovation seeks that value that is locked at the deep intersections of industrial, societal, governmental, and academic knowledge and technology.

Why does innovation matter?

Because it spurs productivity which in turn spurs economic growth and higher standards of living.

What is the right environment for innovation?

The environment for innovation must be open, collaborative, multidisciplinary, and global.

How has innovation changed?

In the 20th century the invention itself could be the innovation. But in the 21st century, invention is no longer the necessary and sufficient con-

dition for innovation. There's a new equation: Invention + deep insights into societal/business/government/academic issues = Innovation.

Any hints for thinking in an innovative way?

Try flipping the equation and looking at things from a different perspective. London and Stockholm had a problem with snarled-up traffic. Did they build more roads and bridges? No. They worked the problem from a different perspective and introduced road charging, and congestion is down 25% to 30%. Now everybody's happy.

Can you learn innovation?

In advanced economies like the U.S. and Japan over 70% of the economy is service-based, but you never meet anyone with a degree in services. That's why IBM is putting together a curriculum in SSME or Services Science, Management, and Engineering. People need to be trained differently to come up with the insights needed to innovate.

What do CEOs think about innovation?

In IBM's 2006 CEO survey, the majority of the 765 respondents said that in the 21st century "leading innovation was the most important thing they do for their organization."

What do CEOs want to innovate?

CEOs don't want to innovate one thing or another. They want to innovate everything—products, processes, and their business model. It's Innovation with a big "I."

The Energy-Efficient Family

More and more Japanese households are using solar and wind power to meet their energy needs, thanks to the research and development efforts of the New Energy and Industrial Technology Development Organization (NEDO).

With almost 30 million inhabitants and a frenetic pace of life, Tokyo could easily lay claim to the title of the world's most stressful city. But help is now at hand for Tokyoites who feel their energy levels have become dangerously depleted. The centrally situated Royal Park Hotel has two rooms where the lighting, the temperature, and the music all work in concert to send guests off into a deep, revitalizing sleep.

It's no surprise to find that the rooms are fully booked. What is startling is the fact that the technology behind this system originated with research on sleep quality-measuring sensors funded by Japan's New Energy and Industrial Technology Development Organization (NEDO). Established in 1980, after the second oil shock, NEDO's original mission was to promote research into alternative energy and reduce Japan's dependency on imported oil. Since 1988, NEDO has been promoting international joint research, through grants of over \$100 million for some 160 plus projects.

Solar technology is one field where NEDO's backing has made a clear difference. Of the world's top five manufacturers of solar panels, four are Japanese, and Japan installed more solar cells than Germany and the U.S.A. each year from 1997 to 2004, with a total of almost 200,000 Japanese households now using them. In 2005 Japan generated 1.42 gigawatts of electricity from solar power—equivalent to burning 348,000 kiloliters of oil. Not only is solar clean, but a whole industry has sprung up to produce the technology and materials for solar cells.

There have also been some unexpected spin-off effects. "An amorphous solar cell is basically a layer of silicon spread over a sheet of glass, and similar procedures can be applied with liquid crystal display TVs," says Masamichi Hashiguchi, NEDO's director general of R&D promotion. "Then there's wire saw technology. Originally created to slice the silicon used in solar cells, it's now used in the semiconductor production process."

With giant turbines being constructed around the world, wind is one of the hottest new energy options,



In Ota City in Japan's Gunma Prefecture, 550 households get a proportion of their energy needs from solar power.

but Japan faces a unique set of problems. "The majority of wind turbines are made in Europe," explains Hashiguchi. "And weather

conditions there are different from Asia. Here we have not just typhoons, but lightning storms."

So rather than fund wind-turbine research, a technology which has already been successfully commercialized, NEDO is developing standards to help adapt wind turbines to Asia's unique climatic needs. It's also researching better battery storage and improved grid connections—both essential with an energy source as inherently unstable as wind.

Together with Kyushu University and Torishima Pump Manufacturing, NEDO is working on a promising

new source of wind power: wind lens microturbines, so-called because they gather wind as a lens collects and focuses light. Although much smaller than giant turbines, wind lenses have the benefit of being able to swivel to face the wind, and produce none of the noise that is so stressful for people living near wind farms. "The number of suitable places—empty spaces with strong winds—where large-scale turbines can be installed is limited," explains Hashiguchi. "So the wind lens is about to come into its own.

It's small and can be used in cities where wind turbines are out of the question."

Producing one kilowatt of energy (the average family uses four kilowatts), measuring about a meter across, and costing around \$9,000, Hashiguchi sees wind lenses—in combination with solar cells—supplying the energy needs of the household of the future.

As our supply of fossil fuels dwindles, we can all sleep that much sounder knowing that NEDO is working on practicable energy solutions for the 21st century. ■



Unlike conventional wind turbines, the wind lens is small and quiet so it can be placed in densely inhabited areas.