



THE MILLENNIUM
TECHNOLOGY
PRIZE

Photo: Randy Lamb, UCSB



Photo: Scampix



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Photo: Scampix

A full spectrum of benefits

Millennium Technology Prize winner Shuji Nakamura's inventions will save energy and lives.

When Shuji Nakamura invented the blue light-emitting diode in 1990, he opened the door to everything from energy-efficient lighting and water purification to higher-density data storage on DVDs.

In recognition of the significance of his work, which also includes inventing green and white LEDs and the blue diode laser, he will receive the EUR 1 million Millennium Technology Prize in Helsinki, Finland, on September 8.

Light-emitting diodes, better known as LEDs, have actually been around for fifty years. However, until Mr Nakamura's breakthrough, they had a significant blind spot. While red and yellow were available, blue and green were missing, except at low brightness. As a result, it wasn't practical to use LEDs

for home and office lighting, since the way to produce white light involves combining red, yellow and blue wavelengths.

That was a pity, since LEDs are ten times more efficient than incandescent light bulbs, which convert only 5% of the energy they use into light. The rest is turned into heat, which increases cooling needs in summer months, wasting still more energy.

But tailoring colours of LEDs is not easy. Working at Nichia Chemical Industries in Japan, Mr Nakamura succeeded through a painstaking process of trying out new LED materials one after another, developing new methods and building much of his own equipment along the way.

After trying out new materials

12 hours a day, seven days a week for more than a decade, a process that he admits drove him to despair many times, Nakamura finally managed to produce a blue LED inside a crystal of gallium nitride in 1990. A few years later, he also developed green and white LEDs, as well as the blue diode laser.

Mr Nakamura, now a professor at the University of California, Santa Barbara, predicts that the efficiency of white LEDs that use blue LEDs will approach 100% and says that conventional lighting, such as incandescent bulbs, fluorescent lamps, and others, could be replaced with white LEDs. In the US, this would save up to USD 98 billion by 2020, according to US Department of Energy estimates.

Also, thanks to their high efficiency and low voltage operation, these white LEDs could be operated by a battery powered by

a solar cell in the daytime, a near-perfect solution for remote areas of developing countries.

Data storage and transfer using light generated by blue lasers brings significant benefits. For example, the amount of data stored on CDs or DVDs can be increased by about five times compared to current techniques. This technology is already reaching consumers in the latest high-density DVDs and DVD players.

One of the most significant future applications for Mr Nakamura's work, however, is the sterilisation of drinking water, since the use of ultraviolet LEDs instead of conventional lights makes the water purification process both cheaper and more efficient. Systems based on this technology are expected to improve the lives and health of tens of millions of people around the world. ■

For the benefit of mankind

The Finnish Millennium Technology Prize of EUR 1 million is the world's largest technology prize. It aims to reward people who develop new technologies that improve the quality of life and well-being.

Says Jaakko Ihamuotila, chairman of the Millennium Foundation: "Through the prize, the foundation

wishes to highlight the potential of technology. It was initiated to help the general public and decision-makers understand that there are still questions which can only be answered by new technology.

"Encouraging innovations and new technology is one of the keys to improving quality of life for people all over the planet."

The first Millennium Technology Prize went to Tim Berners-Lee

in 2004. Inventor of the World Wide Web, he had not until then actually made any real money out of his contribution to what is now part of the fabric of everyday life for many people. "If I had tried to make



money out of the web, it wouldn't have had the same impact," he says philosophically.

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Coming to a petrol station near you

Anyone driving on diesel looking for a truly environmentally-friendly way of filling the tank has a hard time. That is about to change.

Clean exhaust, good combustion properties and a renewable source have been the goals of many rounds of legislation and directives concerning fuels, but there has been no realistic way of combining all three. However, a new generation of biodiesel fuel called NExBTL will become available next year.

The crucial advantage of NExBTL, which is produced through a patented, high-pressure process by the Finnish company Neste Oil, is that it is a hydrocarbon, unlike conventional biodiesels, which are methyl esters. The latter contain oxygen, which makes them react with moisture, and need to be blended with 80 or even 95% petro-diesel in order to work well in unmodified engines. Such modifications inevitably lead to higher emissions, especially of nitrogen oxides. Neste Oil's process, on the other hand, takes out oxygen and adds hydrogen.

Anders Røj, a fuel expert at Volvo Technology and chairman of the ACEA Working Group on Fuels and Lubricants, explains that traditional biofuels also have a low cetane number—diesel's equivalent of an octane number, another reason they have to be blended with a lot of petro-diesel. The opposite is true for NExBTL, which has between 85 and 100, well above the diesel sold at petrol stations, which has a cetane number of between 52 and 55.

In addition, drivers don't need to worry about cold weather, as is the case with some diesel blends. The cold properties of NExBTL can be tailored to be used at temperatures as low as -30°C. "NExBTL is a plain hydrocarbon, which gets rid



Photo: Bildarkiv.se

The road ahead? The next generation of biodiesel will be able to use locally grown oil crops and waste animal fats.

of some problems," says Anders Røj.

Further, the quality of current biodiesels has been dependent on the type of vegetable oil used, usually rapeseed oil, which has caused relatively expensive production and large transport needs. NExBTL, however, can be made out of whatever vegetable oils, animal fats or waste frying oils happen to be around. Regardless of the raw material, the refining process—technically a hydrogenation of fatty acids—yields the same fuel.

Finally, NExBTL is a very homogenic and clean fuel. Exhaust and combustion tests show that it performs better in emissions tests than conventional biodiesels.

The German vehicle producer MAN is one of the companies that have tested the new biodiesel. A report summarising its results states that NExBTL has the same

or superior properties to the best existing diesel fuels. "We think that NExBTL is a very good fuel," says Dieter Rothe, who tested the fuel for MAN, and confirms that there are fewer by-products in production and lower emissions, especially nitrogen oxides, when it is burned. Also, you avoid dissolving dirt in engines which might get stuck in fuel filters. "You don't have the catalyst poison in the fuel as with earlier generations of biodiesel." ■



Photo: Scanpix

He can't halt air pollution by himself.

Investment fueled by confidence

Next summer, Finland's Neste Oil will know if the EUR 100 million bet it made two years before was a good one.

That's when its new plant in the town of Porvoo will begin producing up to 170,000 tonnes per year of NExBTL, a biofuel derived from renewable resources.

With the aid of tax incentives, a push from the EU—which has directed that 5.75% of overall gasoline and diesel usage should be bio-based by 2006—and rising crude oil



prices, the prospects look brighter all the time. "With the current

high crude prices and the relative competitiveness of biodiesel—and the biodiesel technology that we have in particular—the overall outlook is becoming even more encouraging," says Petri Pentti, the company's CFO. "At the same time, we have seen the various national bodies implementing policies supporting the overall growth in the renewable market, so we are very encouraged by the opportunities."

The new plant has the potential to enable Finland to meet the biofuel goals set by the EU for 2010 three years early, in 2007.

"This biodiesel production plant is proof that Finnish engineering and technology is world class," says Neste Oil CEO Risto Rinne, adding that the technology has made Neste Oil an interesting partner for a number of leading oil companies. "We are already planning joint biodiesel production with Total in France and OMV in Austria and others might come along later."

REFINING THE FUTURE

"...One of the tools by which the Community can reduce its dependence on imported energy."

White paper on NExBTL biodiesel
(SAE International)

MAN: "The same or superior properties"

"NExBTL is a diesel derived from biological origins but with the same or superior properties to the best existing diesel fuels."

Dieter Rothe, MAN



Photo: MAN

NESTE OIL

Neste Oil is a leading independent oil refining and marketing company focusing on high-quality traffic fuels with reduced environmental impact. Neste Oil is a corporate partner of the Millennium Prize Foundation.

www.nesteoil.com

ENCORE in the Baltics

Milk separators, ball bearings and telephone switchboards turned Sweden from a poor and neglected country on the outskirts of Europe into a dynamic economy with internationally renowned companies

SEB, the bank that played a crucial role, has helped lay the foundations of a repeat miracle in the Baltic countries, starting with helping to build their banking infrastructures.

As a result, the Baltic countries were equipped with one of the most modern bank infrastructures in the world in an astonishingly short period of time. "It is fundamental for economic development to have a trustworthy and well-functioning banking system," observes financial analyst Andreas Håkansson of Swiss investment bank UBS. "The involvement of Scandinavian banks like SEB has been quite advantageous for the Baltic states."

High usage of Internet bank services

The first credit card in the Baltics was launched in 1994. Two years later, a stock exchange and Internet banking were launched. By 1998, 96% of all transactions were electronic. Today, penetration of Internet bank services is higher in the Baltics than in Sweden.

"They skipped the cheque phase and went directly to Internet banking," says Gunilla Åkerblom, who is responsible for SEB's corporate communications in the Baltics.



Artwork: Joakim Forsberg

For 150 years, business bank SEB has financed innovative technology, resulting in dozens of successful companies.

Innovation, faith and capital

Turning ideas into businesses takes money and time. What's next for a bank that has given Swedish entrepreneurs plenty of both?

One fine day in 1969, Hans Öberg walked into a bank to borrow SEK 3,500 (about EUR 370) to buy a motion picture camera. He was turned away.

"They didn't even want to meet me. The bank clerk took one look at me and told me that I needn't come in. Luckily, I went to SEB as well. They said: 'How much do you need?'"

Today, Mr Öberg's Prisma Outside Broadcast is one of Europe's leading players in live broadcasting, covering events such as the Olympic Games, Wimbledon, Tour de France and the Eurovision Song Contest.

Stories like this are commonplace for the northern European bank SEB, founded 150 years ago by Swedish entrepreneur André Oscar Wallenberg. In fact, think of a successful international company with roots in the Nordic countries (any at all, except perhaps IKEA). Chances are that it has been aided by SEB at some time or other.

Aided by the financial acumen and famous patience of the Wallenberg family (one Wallenberg patriarch was fond of saying that it takes 38 years to turn around a difficult company) several inventions of the late 1800s and early 1900s became the foundation of some of the world's most successful corporations. The list includes Ericsson, ABB, SKF, Electrolux, Saab, Astra Zeneca, Nobel, Alfa Laval, Atlas Copco and TetraPak.

What business opportunities would André Oscar Wallenberg see today? Sure enough, SEB

and the Wallenberg Group are heavily engaged in the newest technology through 3, a mobile communications company, along with Hong Kong-based Hutchinson Whampoa.

Recently, SEB has been adding a wider perspective to its long-term one, expanding operations to more than 20 countries. In the Baltics the bank provides a single point of access for clients like DHL, Ruukki

and The Linde Group and the same kind of access to capital to promising young companies as helped to establish its reputation in Sweden. Latvian Z-Light, for example, specialises in sophisticated optical fibre and instruments that guide light in medical lasers.

"We knew that we had the knowledge to produce really superior products, but we didn't have the financial means and our business plan involved technology that no one seemed to understand," says Aldis Vanags, who is a member of the company's management board. "So it was great to find a bank that understood and believed in us." ■

Supporting research

The SEB group is one of the corporate partners of The Millennium Prize Foundation. This is not the only way in which SEB and the Wallenberg sphere support research and new technology. The Stockholm School of Economics was financed with Wallenberg donations and every year, the Knut and Alice Wallenberg Foundation supports outstanding research.

INNOVATION THEN, INNOVATION NOW



Photo: SEB

Women in banking

In 1864, SEB hired Alida Rossander, making her the first female bank employee in the world.

1856

Scandinavian business bank SEB

has been around for 150 successful years.

Single entry point

SEB offers customers a single point of entry to the Baltics. This has proved convenient for, among others, DHL and The Linde Group.

SEB

The SEB Group is a north European financial group for corporate customers, institutions and private individuals. SEB has 5 million customers, of whom about 2 million bank via the Internet. SEB is a corporate partner of the Millennium Prize Foundation.

www.sebgroup.com

RFID: Looks good on paper

By blending information technology with techniques for producing paper, a Finnish paper company reveals a surprisingly unbiased view of the future.

Clearly, if the old manufacturers of paper from Europe's deep forests want to stay in business, they have some serious product development to do.

UPM, a Finnish company with the usual blend of history, forests and paper production, has taken a radical approach. UPM's labelstock business, UPM Raflatac, has gone in for mass production of Radio Frequency Identification (RFID) tags. These combine computer chips for individual identification of items with small antennas, using radio waves for communication.

Intelligent technology

There are basically two different kinds of RFID tags. Active tags have their own source of energy, which enables them to conduct radio communication. Passive or sleeping tags spring into life only when they come in contact with a reader whose electromagnetic fields provide the energy necessary. The intelligence of the RFID system lies in the host system, usually not in the tags, whose task simply is to identify themselves.

UPM is banking on the idea that attaching the layers of an RFID tag isn't any tougher than adding coatings to paper at high speed and at tolerances measured in microns or making laminated labels. It also reckons that its experience with large-volume production is a plus when it comes to economies of scale.

Is there any reason to believe that RFID might be ready for a prominent role now? Yes, probably. RFID seems to fit into today's



Photo: UPM

What you buy says a lot and will soon say even more.

global information networks as a kind of missing link. Also, the technology finally seems stable and cheap enough for mass use.

The Wal-Mart effect

Some influential retail chains such as Metro, Tesco and Wal-Mart are already pressuring their suppliers to adopt the technology. Since Wal-Mart managed the same trick before with the bar code, the odds are they will do it again.

These days, Wal-Mart's 200 top suppliers are required to put RFID tags on pallets and cases bound for its shops. Tests in 1000 American Wal-Mart shops show some definite gains: out-of-stock items have been reduced by between 30 and 66%. Tagged items are also replenished three times faster than ordinary goods.

The cost and security of RFID tags are, of course, still question marks. Still, UPM's move seems like the perfect marriage of Finland's two main industries: IT and paper. And perhaps RFID technology can benefit from being in the hands of a company that comes at the challenges of mass production from a completely different angle from that of a typical IT company. ■

▶ Did you know that...

While RFID is very much the buzzword of the moment, Radio Frequency Identification, believed to have been first invented by Léon Theremin for Soviet espionage in 1945, is not exactly a new technology. A similar technology was used by the Allies during World War II as a means of identifying friendly aeroplanes. Similar technologies have also featured in James Bond movies.

But is it the real thing?

For high-value products, RFID tags could not only keep track of items during transportation but guarantee customers that they are buying the real thing. Nokia has started to tag its products to fight counterfeiters.



Tracking your luggage

Luggage and air freight could be tracked more securely and efficiently with RFID. DHL has endorsed the technology and several airlines are expected to implement it.

Phoney drug wars



Already useful in pharmaceutical testing and development, RFID tags could act as an antidote to counterfeit drugs, which account for an estimated 10% of the European market.

Smarter shopping

RFID could help keep inventories up to date and solve various logistics problems even better than bar codes. Eventually, shoppers could bypass checkout counters completely and be billed automatically. Incorporating RFID tags into garments is a tool for brand owners in fighting grey market imports.



Yes, it's rocket science

Producing high-quality paper is harder than it looks. The control room of a paper plant is more complicated than a nuclear power plant and the logistics of production approach rocket science.



Not so different Labels and radio tags share production techniques

The technique used to make RFID tags starts with high-precision etching of an antenna of the desired size on a plastic film, to which a memory chip smaller than a pinhead is added. Then the whole thing is attached to a surface.

Long experience of extremely precise and sophisticated pressure-

sensitive printing techniques on a massive scale has made UPM keen on the RFID printing business.

"UPM is a technology-oriented company and it is easy for us to see opportunities in new technology," says the company's executive vice president of business development, Pauli Hänninen. "Paper is an ex-

cellent information carrier, but today's world needs additional high-tech information carriers.

"Our involvement in RFID development originates from our laminating technology know-how and involvement in logistics chain management."



UPM is one of the world's leading producers of printing papers and pressure-sensitive label stock. UPM Raflatac is at the global forefront in the development and high-volume production of RFID tags and inlays. UPM is a corporate partner of the Millennium Prize Foundation www.upmraflatac.com