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OBR

ONTARIO BUSINESS REPORT

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A SUNNY FUTURE WITH SILICON

It's second only to oxygen
as the most abundant element
on Earth, and it may be the
key to a clean energy future.

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INTERVIEW WITH PAOLO MACCARIO OF 6N SILICON INC., MISSISSAUGA

As the primary material used to manufacture photovoltaic cells, silicon in its purest form is the power behind solar energy. The solar energy industry is on the verge of overcoming the final obstacle to its widespread use: an economical supply of solar grade silicon.

6N Silicon Inc. in Mississauga, Ontario has developed a revolutionary method to produce purified silicon using raw material (feedstock) and processing it specifically for use in the solar energy industry. The company's proprietary process offers substantial improvements in scale-up-speed and reduces capital and operational costs.

6N Silicon (the name refers to the six digit 99.9999-per-cent purity of its silicon) is a leader in an increasingly competitive sector. The company recently received an \$8 million grant from Ontario's Next Generation of Jobs Fund, and has secured a \$1.5 million investment from the Ontario Ministry of Research and Innovation's Innovation Demonstration Fund and \$4.5 million in financing from the federal government's Sustainable Development Technology Canada.

6N Silicon CEO Paolo Maccario is a veteran of the metallurgical industry, most recently as CEO of the world's largest supplier of magnesium castings to the automotive industry. Ontario Business Report (OBR) interviewed him at the company's headquarters in Mississauga.

OBR: Why is a metallurgical engineer the CEO of a solar energy supplier?

Paolo Maccario: For the same reason that 6N is headquartered in the Greater Toronto Area: this is the heart of Canada's metal processing industry, and we are surrounded by some very impressive metal processing expertise. We need that expertise to produce purified silicon,

which is the key to solar panels. 6N's founder, Scott Nichol, is a serial entrepreneur who's also a metallurgical engineer, with many patents to his credit. His training at McMaster University and his metallurgical experience gained in Ontario contributed directly to the invention of the 6N technology.

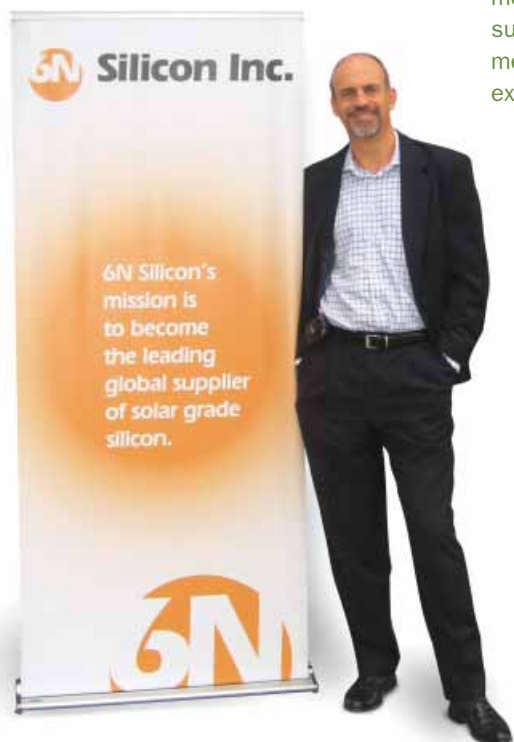
OBR: What's been holding solar energy back? It seems like it's been on the edge of success for a long time.

Paolo Maccario: That success is just starting, and just watch what will happen in the very near future. The solar industry has grown at 45 per cent per year on average for the past nine years, and demand is skyrocketing. The technology to produce solar energy efficiently is well-established. But with this tremendous solar industry growth, the supply of purified silicon is now the *critical* industry issue. That's where 6N comes in. Our process offers big improvements in scale-up-speed, and it cuts the capital and operational costs for solar energy. We are confident that we will become the leading global supplier of solar grade silicon to the industry.

OBR: Can you outline your EOS project in layman's terms?

Paolo Maccario: Well, the first thing that you should know is that we chose the name "EOS" for its symbolism because EOS was the goddess of the dawn in Greek mythology, who rose each morning to greet her brother Helios, the sun. Our EOS project is a multi-year program to develop the 6N Silicon process for purifying true solar grade silicon. The project is focusing on finding a low-cost solution to meet the purity requirements of all crystalline silicon solar cells. These cells currently make up about 95 per cent of the photovoltaic market. We're going to address the silicon shortage by helping capacity keep pace with the rapid growth of the solar energy industry. By reducing the cost of purified silicon and by allowing the industry to keep its break-neck pace, we'll help make solar power competitive with standard forms of power generation.

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NEXT GENERATION OF JOBS FUND: HELPING INNOVATIVE COMPANIES GROW

When the Ontario government launched the Next Generation of Jobs Fund in March 2008, the message to companies around the world was clear: if you've got a project that will grow your business and create jobs, we'll make it happen in Ontario.

The five-year, \$1.15-billion program, the largest in Ontario's history, is aimed at companies that make everything from advanced health products to Academy-Award-winning special effects technologies.



Modelled after the government's successful Ontario Automotive Investment Strategy, which leveraged over \$7 billion in new auto investments, the Next Generation of Jobs Fund supports projects that are globally competitive, creating and protecting high-value jobs in key sectors, including IT and digital media, biotechnology and green technologies.

And it moves at the speed of business, working with companies to process applications and make decisions in 45-days, a first for an Ontario government business program.

There are a number of applications in the works, with two approved so far.

GTA-based 6N Silicon, a supplier of true solar grade silicon for the photovoltaic industry, has received \$8 million, over five years, to help build a new \$50-million manufacturing facility that will help to secure the company's reputation as a leader in the emerging green economy.

Sanofi Pasteur, which specializes in new vaccinations, is receiving \$13.9 million to help it with a \$101.5-million expansion including a new research centre that will improve existing vaccines and bring new products to market.

The Next Generation of Jobs Fund has three component programs, each with a different focus and application process.

The Jobs and Investment Program (JIP) helps companies in a wide range of sectors to expand in Ontario and develop



innovative products for global markets. Projects must either create or retain at least 100 jobs, or invest \$25 million over five years. JIP can provide grants up to 15 per cent of eligible project costs.

The Biopharmaceutical Investment Program (BIP) supports pharmaceutical and biotechnology firms expanding their research and advanced manufacturing activities. The program provides grants, loans, forgivable-interest loans and funds for building infrastructure, research and training.

The Strategic Opportunities Program (SOP) supports industry-led public-private collaborations focused on increasing Ontario's innovation expertise in three key sectors: the bio-economy and clean technologies, advanced health technologies and creative industries such as digital media and information and communications technologies (ICT).

Companies interested in finding out more about the Next Generation of Jobs Fund and how to apply can contact the ministry at 1-800-819-8701 or by e-mail at info@2ontario.com.

MAKING WISE ADVANCES IN SUSTAINABLE ENERGY

It's a given that strong and progressive economies need energy.

It's also a given that global concerns about ever increasing energy demand, greenhouse gas emissions and climate change have launched a worldwide movement to meet this need in a clean, green and sustainable way. The Waterloo Institute for Sustainable Energy (WISE) is at the forefront of this movement and is a North American leader in advancing sustainable energy use.

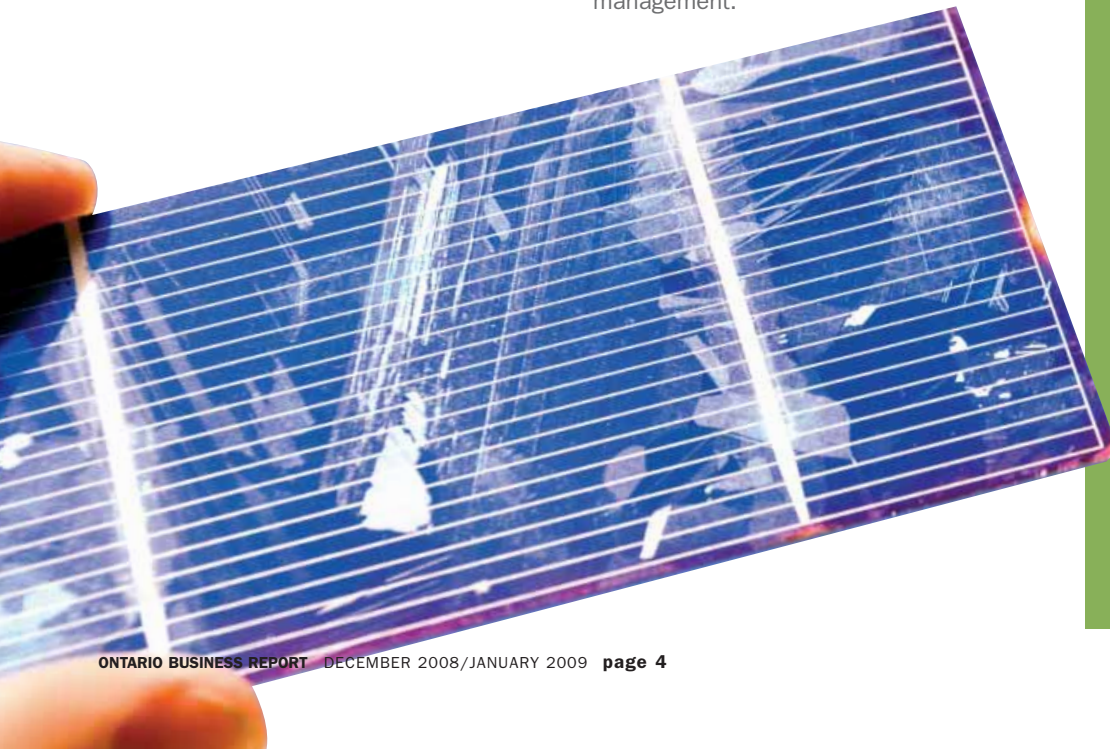
Based at Ontario's University of Waterloo, WISE is operating at full steam. More than 60 faculty members are leading research teams in areas that include solar and wind energy, bioenergy, fuel cells and greenhouse gas mitigation, as well as policy research to support energy conservation, efficiency and demand management.



"Our role is to help Ontario transition from a conventional power infrastructure to one that is less carbon intensive; develop a full range of solutions through technological innovations for a smart grid that effectively uses distributed sources of energy; create opportunities to inform energy policy choices; and teach students by involving them in practical, real-world projects," says Dr. Jatin Nathwani, Ontario Research Chair in Public Policy and Sustainable Energy Management and Executive Director of WISE.

Master's Degree in Power System Engineering

Hydro One Networks approached the University of Waterloo to help build the capacity of its working engineers so they could meet the evolving challenges of aging power infrastructure and emerging challenges in the energy business. The project's success led to the establishment at the university of an online Master's Degree in Power System Engineering, the first of its kind in North America. This program is designed to upgrade skills for professionals working in the power industry, and to develop a specialized workforce in sustainable energy.



WISE conducts the majority of its research in collaboration with industry, business or government. "We are often approached by companies looking for a solution to a specific problem, for strategic advice or to address a long-term issue," says Nathwani. Partners usually provide project funding or offer support-in-kind. The institute defines the scope of the issue and sets up multi-disciplinary research teams that cut across the faculties of engineering, science and environment. The goal is to complete research in a one- to three-year timeframe, with annual project deliverables. Projects with a greater degree of complexity may extend beyond the three-year timeframe, up to five years.

There are many benefits to Ontario of this concentration of expertise. Just recently, for example, the University was awarded funding by the Ontario Centres of Excellence (OCE) to support three major clean energy projects critical to Ontario's energy sustainability. The projects range from research and development of a renewables-based "micro-grid" for a remote community (see sidebar), to large-scale integration of solar power into the grid, to management

of energy consumption. Nathwani also stresses the potential economic benefits to the province, with WISE becoming a starting point for young innovators. "Students are keen to turn their insight and knowledge of sustainable energy into their own companies," he says.

WISE recently passed its one-year mark of operation. As for the future, Nathwani predicts that the institute will be globally recognized as a serious contributor to the complex issues of environment sustainability, energy use and economic development; and will help deliver the practical solutions that will make a difference to Ontario, the health of the planet and economies around the world.

For more information on the Waterloo Institute for Sustainable Energy and its projects, visit www.wise.uwaterloo.ca.

Wind Energy System for Extreme Northern Communities

In a \$6.4-million project supported by OCE and led by WISE, university researchers are working to reduce diesel fuel dependence in northern communities. The objective is to develop a low-carbon energy system that combines wind resources specifically designed for extreme northern climates, with a storage system that uses hydrogen and a fuel cell to generate electricity. "Power delivered by diesel is extremely expensive and polluting," says Nathwani. We've partnered with Hydro One and the Nishnawbe Aski Nation to develop a clean energy solution that will last and a solution that can also be adapted for other remote communities around the world."

Converting Sunlight Directly into Electricity

Through the university's new Centre for Advanced Photovoltaic Devices and Systems, which was built with support from the Ontario Research Fund Infrastructure Program, researchers are working to advance photovoltaic technology – converting sunlight directly into electricity – as one of the more important forms of renewable energy technology. One goal is to make this renewable source of energy an affordable source of energy. Breaking the cost barrier will not only have widespread implications for poorer nations of the world – it will be a driver for sustainable energy use.

INTERVIEW WITH PAOLO MACCARIO OF 6N SILICON INC., MISSISSAUGA

OBR: How will you measure the project's success?

Paolo Maccario: We've designed the EOS project with a series of goals and milestones, with input from potential and actual customers and partners. The goals start from launching the pilot production line right through to refinement of a stand-alone product. There is ongoing consultation, material trials and direct feedback throughout the project.

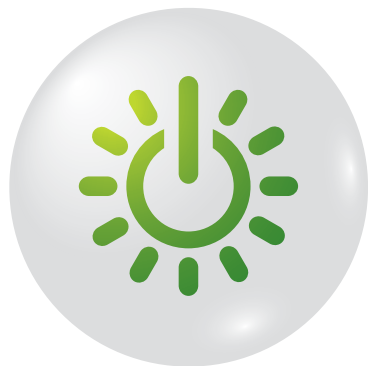
OBR: So there is solar power in our future?

Paolo Maccario: Definitely. Look at where venture capital is going. Venture capitalists like solar because it offers great potential, and it has a lot of opportunities for new intellectual property and fundamental industry advancement. There has been a steady improvement in reducing costs and boosting efficiencies in solar. The world's energy markets are enormous, and are begging for a 'clean' alternative. It won't be long before you'll see solar panels on your roof and in large-scale sites on buildings and solar farms. We're addressing the near-term materials challenge with our technology. We are also involved in a number of solar-related partnerships that are very promising. It is a cliché, but the solar industry has a very bright future.

website: www.6nsilicon.com



ENSURING ONTARIO'S CLEAN ENERGY FUTURE



The Ontario Centres of Excellence have partnered with academia and industry to invest a total of \$28 million to fund research and development for six new clean energy projects across the province.

The projects offer an exciting glimpse into our energy future and promise to keep Ontario at the forefront of clean energy technology.

"These projects give Ontario a good chance to become a world leader in clean energy," says Dan McGillivray, Managing Director of the Centre for Energy at Ontario Centres of Excellence (OCE) Inc. "There's a buzz of activity here that we haven't seen before, and it started last year when we first asked for ideas at a series of public workshops. Ontarians are actively developing new ways to generate clean energy. Hundreds of people attended, and we received more than 100 quality ideas."



Ontario Centres of
Excellence
Where Next Happens

OCE requested 16 formal proposals from the initial group and selected the final six on the recommendations of a panel of leading energy experts. The proposals were evaluated with criteria that included the technology's market impact, "clean energy" potential, the strength of the research team and the potential return on investment. The projects selected are expected to lead to breakthrough technologies in solar power, hydrogen and energy conservation and demand management.

The new technologies will shrink Ontario's carbon footprint and deliver multiple economic benefits, including new export sales. The research projects are underway at universities across the province (see sidebar).

"We're accelerating the innovation process and subsequently the investment process," says McGillivray. "These projects have all had their profile heightened because of the OCE investment, and the angel and venture capital community moves much more quickly when a project has a higher profile. We've already had additional private sector investment in several of these projects and there is more on the way."

For detailed information on these projects, visit the Ontario Centres of Excellence website: www.oce-ontario.org.

The six projects funded by the Ontario Centres of Excellence are diverse, but share common clean energy goals that are sought around the world:

- The Energy Hub Management System is a "smart" web-based tool that gives consumers control of the way they use energy, such as switching off the central energy grid at peak times and moving to on-site alternatives like solar and wind energy.
- The Solar Venture will create a recyclable, flexible hybrid-organic thin film for solar panels that will reduce the full costs associated with solar generation and ensure high performance.
- A pilot installation in Mississauga will demonstrate a high-capacity fuel cell system that provides low-cost, efficient, environmentally friendly power and heating in one package.
- McMaster University and ARISE Technologies are introducing a novel way to manufacture solar cells, using a proprietary silicon technology that aims to be more than twice as efficient and less costly to manufacture than existing solar cells.
- Another partnership will develop a low-carbon community energy system that combines wind turbines (designed for extreme northern climates) with a storage system that uses hydrogen and a fuel cell to generate electricity.
- A project in western Ontario will develop technologies to efficiently connect large-scale solar farms to the existing energy grid, thus encouraging utilities to adopt solar energy as a viable part of their generated power.

DMI: POWERING THE FUTURE

DMI Industries calls itself a “towering force in wind energy” and it’s an apt description of the West Fargo, North Dakota-based manufacturer.

DMI makes wind towers – those massive steel structures topped with blades that stand about nine stories high and dot the countryside, providing clean energy. And the company is poised to have the largest wind tower manufacturing capacity in North America, thanks in part to its Fort Erie, Ontario facility.

“Fort Erie is strategically important for us,” says DMI President Stefan Nilsson. “Without it, we wouldn’t be considered for business opportunities in the northeast.”

Back in 2004 when DMI was looking for a site from which it could grow its market as well as improve service and lower costs for its customers in the northeast United States and Canada, it scouted 28 locations, finally settling on Fort Erie.

The border city offered the company almost instant access to a 100,000-square foot manufacturing facility, an available skilled workforce and proximity to the market.

A helpful local economic development office and supportive Ontario and Canadian government policies clinched the deal.



“While a great deal of our business as in the U.S. at the time, we anticipated a growing market in Canada and that has since proved to be the case,” say Nilsson.

DMI took possession of the plant in October 2005 and immediately began renovating and modernizing it for state-of-the-art heavy steel wind tower fabrication. The company also hired the first wave of local workers and trained them at its West Fargo facility.

Just nine months later, in May 2006, tower manufacturing began, making DMI’s Fort Erie facility the first of its kind in Ontario. Initial annual capacity was 400–500 wind tower sections, but with the potential to at least double that.

Less than a year later, with demand for wind power growing rapidly, the Fort Erie facility began a two-phase expansion that

increased the plant’s production capacity and allowed for the manufacture of larger tower sections.

Today, with a workforce double the original size, DMI’s Fort Erie plant is running four production shifts and operating at full capacity, turning out tower sections for major players in the wind energy industry, including GE Wind Energy, Lagerway, Siemens Wind Power and Vestas.

“We’re continuing to invest in the Fort Erie location both in terms of personnel and equipment with a view to continuing to improve productivity and expand sales,” says Nilsson.

website: www.dmiindustries.com

RENEWABLE ENERGY BOOSTS ONTARIO'S ECONOMY, FIGHTS CLIMATE CHANGE

Renewable energy is crucial to our energy future. As jurisdictions and individuals reduce their reliance on fossil fuels and seek cleaner, greener alternatives and as governments and industry invest in research while innovators develop leading-edge energy technologies, the sector is surging forward with unlimited potential.

Renewable energy relies on wind, sun, falling water and biomass (e.g., wood chips and crop residues), as opposed to fossil fuels – coal, oil or gas. Renewable energy technologies are clean (non-polluting), and can help to drastically reduce pollution and greenhouse gas emissions.

They also benefit the economy, creating business growth and new jobs. The global market for clean energy is vast. Ontario alone, plans to replace all its coal-fired generation with clean alternatives, making a long-term \$18-billion investment in renewable energy. Ontario Economic Development Minister Michael Bryant says: "Industry, researchers and government are all innovating and collaborating to ensure Ontario and its talented workforce can take full advantage of all the economic opportunities available in alternative energy and a cleaner, greener environment."

This can be seen in wind power, where, in 2003, fewer than 15 megawatts of Ontario's electricity came from wind power, compared with today where 500 megawatts are on line, with about 790 megawatts of new projects in



progress. Prince Wind Energy Farm in Sault Ste. Marie, completed in 2006, for instance, is the largest wind farm in Canada with 126 turbines generating up to 189 megawatts – enough to power nearly 40,000 homes. Ontario is increasingly attracting manufacturers of wind turbines and related components, service providers and project developers.

Ontario's solar energy industry is also a power house, growing on average about 45 per cent per year for the past nine years. Businesses like Ottawa-based Menova Energy Inc. that developed an innovative solar technology that reduces typical energy bills by up to 60 per cent and has zero gas emissions continue to propel the sector. The Ontario government recently invested \$3 million in Menova.

Research and development is a priority. Twelve research centres across Ontario are dedicated to alternative energy R&D, including McMaster Institute for Energy Studies and the Waterloo Institute for Sustainable Energy. The Ontario Centre of Excellence for Energy was established in 2005.

And through Ontario's \$1.15 billion Next Generation of Jobs Fund and other programs, the government helps businesses advance "new-economy," environmentally friendly projects.

