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# PARTNERSHIPS & INNOVATIONS

# HOW BIOTECHNOLOGY IS SHAPING THE FUTURE OF ONTARIO

An in-depth look at three key sectors:

**HEALTH** **ENERGY** **FORESTRY**

## The global challenge and Canadian opportunity

**Today's global population is closing in on the 7 billion mark. By 2050 it is predicted to grow to over 9 billion people. This exponential growth brings with it enormous challenges as 9 billion people will require new medicines, food, energy, and material goods.**

This growth and its corresponding demands, require more efficient and effective ways to deliver health care, grow food, and manufacture goods. Yet in this global challenge lies the enormous opportunity for Canada's biotechnology industry and the innovative solutions it represents.

### A look into all the sectors

A growing population requires food that is produced more efficiently and with greater nutritional value. A strong agricultural sector coupled with biotech innovation will position Canada and Canadian farmers to take advantage of the global opportunity. Feeding the world's growing population requires farmers to produce 70 percent more food on less land. With one in every eight Canadian jobs related to agriculture, there is huge potential for economic prosperity at the farm gate. Innovation enables Canadian farmers to remain globally competitive with crops reducing the need for fertilizers, pesticides, and water.

From a manufacturing standpoint, being competitive in the emerging bio-economy requires a re-engineering of economies and manufacturing processes in order to achieve greater efficiencies, productivity, and decreased environmental impact. Biotechnology allows for new products, processes, and improved sustainability. By way of example, a Canadian company has developed an enzyme to capture $CO_2$ emissions- a technology with obvious implications for a number of core economic industries.

With respect to human health, new diseases and illnesses are emerging and being discovered at a rapid pace. Thankfully, innovations such as the mapping of the human genome have enabled researchers to better understand diseases and develop targeted medicines to relieve, cure, and even prevent illness. Biotech innovations leading to prevention and cure hold enormous economic, health and social benefits for all economies and societies.

Preventing and curing disease, avoiding drought and pests, adding nutritional value to existing staples, improving environmental performance, enabling traditional industries such as forestry, agriculture, mining to sustainably compete and sustain hundreds of thousands of Canadian jobs are some of the core economic advantages biotech innovation delivers.

### Attracting capital

Quite clearly, within the global challenges lies a significant opportunity for Canada should it successfully bring together its natural resource advantages and long history of biotechnology innovation. Ultimately, biotechnology represents the key to Canada's ability to compete successfully in the global economy. That said, other nations recognize the importance of biotechnology to their respective economies and are correspondingly taking aim at attracting more biotech innovation and research. Innovation requires capital.

**Andrew Casey**
President and CEO,
BIOTECanada

And unlike forests, mines, and other resources, ideas are very mobile; they will go to where the capital is. So if Canada is not attracting capital, the ideas will go to where the capital is. Central to attracting capital and supporting innovation will be to ensure Canada has the public policy measures in place to nurture innovation and investment.

A long history of innovation coupled with a diverse industry with strong regional clusters, federal and provincial governments have come to recognize the strategic value that the Canadian biotechnology sector represents for the Canadian economy. Significant and strategic investments have been made by the industry and governments to grow biotech innovation and research in Canada. Leveraging these investments going forward will be key to capitalizing on the opportunity at the doorstep. Industry and governments need to continue working together to identify the gaps and to ensure Canada's policy environment is as strategic and comprehensive as it needs to be. In part this will require developing a clearly articulated vision for Canada's biotechnology industry.

The world depends on innovative solutions. Canada is positioned as a leader in developing efficient and effective ways to deliver health care, grow food, and manufacture goods. There is enormous opportunity for Canada's biotechnology industry and the solutions it represents.

**ANDREW CASEY**
editorial@mediaplaneter.com

# CHALLENGES


**CLOSER LOOK AT DNA SEQUENCING TECHNOLOGY** Genomics is the foundation of biotechnology.

## Ontario has all the ingredients needed to prosper—

a diversified economy, a world-renowned research community, a highly skilled workforce, a wealth of natural resources, and a terrific geographic location.

# INVESTING IN ONTARIO:

## Fueling Canada's economic engine with innovative thinking and strategic partnerships

This is an exciting time for research and innovation in Ontario: last February, Premier Kathleen Wynne re-established the Ministry of Research and Innovation because she understands how important it is to the future of our province. I couldn't agree more.

### A closer look at Ontario

Ontario's capacity to compete and win in the global knowledge-based economy depends on how well we can harness our research strengths. That is why, since 2003, our government has invested more than $3.6 billion in research and innovation and has helped foster over 10,000 industry and academic partnerships.

These investments have paid off: according to an independent report by KPMG, since 2006, we have created over 17,700 new high-value jobs in Ontario, and thousands more have been retained. Ontario is ranked alongside California, New York, and London as a top centre for innovation. We have over 900 medical technology companies that employ more than 17,000 people and generate approximately $3.9 billion in revenues annually. And with seven of the top 10 Canadian research hospitals, Ontario is the fourth-largest biomedical research centre in North America.

These statistics are not only incredible; they also hold the promise of a bright future for this sector in Ontario.

### A joint collaboration

There is still work to be done and to ensure that we continue to compete and win in the global economy, we need to put innovation at the centre of everything we do. We need everyone working together to help our researchers and entrepreneurs take their ideas from concept to commerce.

In terms of collaboration, the Ontario government is seeing great success with programs like Excellence in Clinical Innovation Technology Evaluation (EXCITE) and the Health Technology Exchange (HTX), and at institutions like the Ontario Brain Institute (OBI).

EXCITE provides pre-market evaluation of medical technologies, enabling innovations to get to market faster. We are supporting the EXCITE program with $1.25 million in funding over two years. I am pleased to say that the EXCITE approach to navigating the required approvals, adoption and uptake is gaining worldwide attention.

**Hon. Reza Moridi**
MPP Richmond Hill and Minister of Research and Innovation

HTX helps Ontario scientists, engineers, and entrepreneurs commercialize their ideas into innovative medical and assistive technology products that can be marketed to the world. Since 2010, HTX has approved 26 projects for funding, invested $9.8 million into public-private commercialization projects worth $46 million, and created over 140 high-quality jobs in Ontario.

Our government is also proud to support the OBI, which provides strategic direction for brain research in Ontario. Our initial $15-million investment, combined with funds from industry and the federal government, have led to over 20 projects that address medical imaging, diagnostics, brain training software, brain stimulation, and many other medical devices, diagnostics and prosthetics. This early success, international recognition and strong support from industry, with relatively few dollars, is the reason Ontario has increased OBI funding to $100 million over the next five years.

### Bringing Ontario to the forefront

Clinical Trials, HTX, OBI and EXCITE are all excellent examples of the success that can be achieved when government partners with industry, academia, researchers, and entrepreneurs. The Ontario government is committed to supporting innovative ways to collaborate and create new products and services. Together, we can turn our promising capacity for innovation into new businesses, good jobs, and a better quality of life for Ontarians.

**HON. REZA MORIDI**
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WE RECOMMEND

**Canada's biofuel strategy**
Transitioning away from fossil-based to bio-based resources
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"As Canadians, we should encourage our government to put in place the structural conditions and flexible policies required to take full advantage of these evolving opportunities"



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THE ONTARIO ADVANTAGE

- World leading R&D cost reductions through tax incentives
- Highly educated and skilled workforce
- Research powerhouse supported by significant infrastructure investment
- Easy access to a massive North American supply chain and market
- Global scientific research connections and collaborations

**SOURCE: MINISTRY OF RESEARCH AND INNOVATION**
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INSIGHT

FACT 1

ONTARIO IS THE 4TH LARGEST BIOMEDICAL RESEARCH CENTRE IN NORTH AMERICA

# Making a knowledge-based economy a reality in Ontario

Imagine a world with clean water, plenty of food, efficient health care, and green energy. Dare to imagine a knowledge-based economy in Ontario where small, medium and large companies are thriving by embracing new technologies in engineering and biotechnology that will: produce healthier and cheaper food; ensure our most important natural resource, water, is clean and safe; guarantee that we pollute less and live in a harmonious way with our environment; and provide a health care system that is sustainable and promotes prevention while addressing some of society's cruelest maladies, cancer, Alzheimer's and addiction.

## Genomics to lead the way

If Ontario's life science community sets a goal of providing no less than 30,000 new private sector jobs and a contributing more than $1 billion in federal and provincial taxes in the next ten years, this knowledge-based economy will establish a new ecosystem of economic prosperity within Ontario and Canada.

These are not pipe dreams. Life science and biotechnology, driven by genomics, is leading the way and Ontario is well positioned to make this future a reality. Boston, San Francisco, and North Carolina's Research Triangle Park are excellent examples of thriving economies using this approach.

Ontario currently has intellectually competitive universities that are among the top producers of new knowledge internationally. Canada's natural resources provide us with great wealth, and an opportunity to be global leaders in innovation. We lack not the capacity, but the ability to connect new knowledge to the needs of industry and financial resources.


**Dr. Mark Poznansky**
President and CEO,
Ontario Genomics Institute

## New innovation strategy

So how do we turn this vision into a reality? Ontario needs a coordinated innovation strategy that enables strong relationships between academia, government, industry, and venture capital. These players are essential to a healthy ecosystem that drives economic growth.

This innovation strategy would need: governments that support fundamental discovery research, the basis of the innovation pipeline; universities to recognize that in addition to their role as creators of knowledge, they are drivers of the knowledge-based economy; a strong and flexible intellectual property environment that allows for the efficient transfer of technologies; serial entrepreneurs from industry who are experienced in converting ideas into products in the marketplace; an education system that continues to support the development of highly qualified personnel in the life sciences, and the intersection between life science and business; a holistic finance system where government (through proof-of-concept grants), industry (through true academia/industry partnerships) and venture capital all participate to support the passage of a product through the development pipeline; strong regulatory and public policy as well as an efficient tax system that provides incentives for companies to thrive in Ontario, and procurement policies where, in a reasonable way, a "Buy Ontario" culture is promoted.

We are on the cusp of this revolution. Life science and genomics have a crucial role to play creating jobs and wealth in Ontario and across Canada. When knowledge and innovation drive our economy, everyone wins.

**DR. MARK POZNANSKY**
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# Biotechnology paves the way for identifying and treating rare diseases

As a parent of two children with congenital conditions (my son was born with a congenital heart defect and my daughter with hypotonia, aka, "floppy baby syndrome" of unknown origin and an inherited blood disorder that surfaced later), it has always been tempting to try to learn whether there are genetic causes. At the time (they are both in their 20's now and doing very well), it wasn't feasible. Ontario was screening newborns for only three conditions. Today, thanks to strenuous parent and physician advocacy, Ontario screens for 27 newborn conditions, using just a drop of blood from the infant's heel. In most cases, diet modifications or replacement therapies have allowed parents to avoid severe physical damage, cognitive impairments, developmental delays, and early death.

But this still leaves undiagnosed some 5,000 genetically-based rare disorders as well as limitless genetic mutations linked to sub-types of common diseases including cancers, neuromuscular diseases, pulmonary conditions, and even adverse reactions to medicines such as warfarin. Many of these could be treated much more effectively with a "personalized" diagnosis. But there are many barriers to obtaining useful genetic information. The causative gene may not yet be identified. The gene is known but the tests are difficult, time-consuming and/or expensive. We have isolated the gene but we are not sure what it does or how it causes the disease or symptoms.

**Durhane Wong-Rieger**
President,
Canadian Organization for Rare Diseases (CORD)

## The future is looking up

But innovations in genetic research are pouring forth at speeds that defy even "instantaneous" social media communications. Parents today can "purchase" a map of their child's entire DNA. Before the end of the decade they may easily (and inexpensively) access an interpreted blueprint of their personal genome showing potential risks for a myriad of diseases, allergic reactions, and even late onset disorders. And because Canadian laboratories and clinics are among the world's leaders in genetics research, Canadians could be among the first to benefit from those services.

FORGE (Finding of Rare Disease Genes) Canada, a national consortium of clinicians and scientists using "next generation" exome sequencing, has set an ambitious goal of identifying the genes responsible for 200 rare pediatric-onset disorders. They have already returned diagnoses to many families. The technique analyzes a person's entire genetic code (about 22,000 genes) within a few days at reasonable cost).

And herein lie both the blessing and the curse. Do you really want to know? If your child had an unidentified and progressive condition, the correct diagnosis may be nothing short of a life-changing miracle. But there are many other possibilities. What if there were no preventive measures or treatments? What if the gene were linked to a late-onset condition?

## The need for continual investment

The Canadian Institute of Child Health (CICH) is leading the discussion on important issues related to the ethics of genetic testing in children. The core principle is that all genetic tests or screening be guided by the best interests of the child, but this requires access to appropriate healthcare professionals who are able to discuss not only about the clinical implications but also social, ethical and legal issues. According to CICH, there are only 80 geneticists and 250 genetic counsellors in Canada and most are located in major cities. We are fortunate to have the genetic research capacity in Canada and should continue to support these but it is critical that we insist that Canada also invest in the necessary health and community infra structure to insure that new genetic knowledge will be supported by the necessary education, medical and social services, and community support.

**RARE DISEASES**
Defined as those that affect fewer than one in two thousand Canadians.

Personally, these issues are of even greater relevance to our family since both of our children are adopted, so we have virtually no family medical history to draw upon. But the decision for genetic testing is no longer mine, but theirs.

**DURHANE WONG-RIEGER**
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NEWS

**FACT 2**

THE CANADIAN BIOFUELS INDUSTRY HAS SEEN $3 BILLION IN ECONOMIC ACTIVITY FROM CONSTRUCTION OF BIOFUEL FACILITIES

# Renewable biomass resources: an attractive investment

**WOOD CHIPS LOADING INTO A BIOMASS BOILER**
Biofuel technologies produce cleaner fuels from wheat, wood chips and other forest by-products.

## Biotechnology milestones

**1919** The word **"BIOTECHNOLOGY"** is used for the first time.

**1922** **Dr. Frederick Banting** and his assistant Charles Best discover insulin as a treatment for diabetes.

**1983** The **petunia** becomes the first whole plant grown from a biotechnology process.

**1988** **Vaccines** for the prevention of bacterial meningitis decrease the incidence of cases in children by 97%.

**1990** Canadian physician **Dr. Lap-Chee Tsui** discovers the defective gene causing Cystic Fibrosis at the Hospital for Sick Children in Toronto.

**1992** Canada's **human genome** project is announced.

**1995** Canada becomes the first country in the world to grow **commercial biotech crops.**

**1998** Canada introduces the first public immunization program for **chickenpox.**

**2003** Canadian researchers become the first to sequence the **SARS genome** and release their findings on the Internet to help in the development of a potential treatment and possible vaccine.

**2005** The Government of Canada announces a donation of $160 Million to the **Global Alliance for Vaccines and Immunization (GAVI).**

**2012** Agrisoma Biosciences' oil seed crop helps power first **biofuel flight.**

SOURCE: BIOTECanada
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Around the world and here at home, economies are adjusting to respond to a number of global challenges including population growth, climate change, and other environmental concerns. One of the most significant steps being taken to address these challenges is the transition away from a fossil-based to a bio-based economy.

In Canada this transition has been taking place for a number of years, and was accelerated with the introduction of the Government of Canada's biofuels strategy including the ecoENERGY for Biofuels program and its associated renewable fuel regulations that mandate 5 percent renewable content in Canadian gasoline.

### Renewable fuels

As a result of the government's commitment to new renewable fuels industrial platforms, ethanol production facilities were built out across the country. These first generation "biorefineries" will serve as excellent building blocks for the on-going development of Canada's bioeconomy. Leading edge conversion technologies, many of which are designed in Canada, can be integrated into these facilities to produce a range of cost-competitive alternatives to petro-based products like polymers, chemicals, and fibres.

Taking full advantage of these opportunities will depend on the government making smart policy decisions. In Canada, simplified regulatory frameworks, unhindered trade in agricultural and forestry commodities, and focused public investment in research, development, and demonstration are areas which government and industry can address together to ensure Canada takes advantage of its biomass advantages.

### New investment opportunities

Industry is increasingly viewing chemical and polymer production from renewable biomass resources as an attractive area for investment. This is good news for Canada as it will help stimulate regional and rural development, diversify farm incomes, help build more robust primary industries, like forestry, and provide pragmatic solutions to some of our most pressing domestic environmental challenges.

As Canadians we should be excited by the real economic and environmental opportunity that biotechnologies offer and we should collectively encourage our governments to put in place the structural conditions and flexible policies required to take full advantage of these evolving opportunities.

ANDREW CASEY
PRESIDENT AND CEO, BIOTECanada
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# How genomics research is impacting various biotechnology sectors

**Energy and water consumption are high, pollution is being poorly monitored in our environment, and Canadian taxpayers have spent seven billion dollars to treat adverse drug reactions.**

Fortunately, genomics research is playing a role in turning all that around.

### Understanding genomics

In ten years, we've gone from spending one billion dollars over ten years to sequence a human genome, down to a few thousand dollars in only a few days, and that's just the beginning of the many advancements in genomic research.

"DNA is the code of life for every living thing; genomics is all about being able to understand DNA and the functionality of that code," says Pierre Meulien, president of Genome Canada, a not-for-profit organization that invests in genomics research and, with co-funders, has invested more than two billion since the year 2000.

### Progress in the industry

Needless to say we have come quite far, not only in the speed at which we use the technology but also in the diverse uses of the data. Canadian Genomics research has played a major role in recent innovations related to agriculture, environment, forestry, mining, energy, aquaculture, and health, but Meulien believes we're just getting started.

"I think we're right at the beginning, not at the end of something," says Meulien. "Now we can start to really make advances in areas such as crop breeding, breeding of livestock and aquaculture, among other things."

Outside of using genetic research to determine your likelihood of carrying a disease or helping you decide whether to take preventative health measures, genomics has worked in the environment sector to help develop a commercially available microbial product that cleans up pulp and paper sites contaminated with solvents. This project was run out of Ontario from the laboratory of Dr. Elizabeth Edwards at the University of Toronto.

Thanks to Canadian research that has demonstrated some women have a genetic variant that converts codeine into morphine twice as fast than normal, mothers are now better informed about the potentially fatal use of codeine while breastfeeding.

### The future of Genomics and Biotechnology

"Genomics is the basis of biotechnology," says Meulien. "I think you're going to see a huge number of companies using this technology, and a lot of new diagnostic products coming out that are going to help manage chronic diseases better and more cost-effectively."

Meulien also believes we're going to see the growth of companies in other sectors such as environmental monitoring and livestock and crop genomics. "Genomics is the foundation of what we're calling the future bio-economy in Canada, which involves all of this nation's economic activity that results from the life sciences," he adds.

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INSIGHT

FACT 3

FORESTRY PROVIDES 900,000 DIRECT AND INDIRECT JOBS AND 3% OF CANADA'S GNP

# Forest product innovation through education for commercialization

**Universities are a natural hub for innovation and ideas. They act as a catalyst for new ideas and knowledge sharing. Progress in forest product transformation is being made through education and the high value jobs being created as the industry expands into new markets.**

As the industry adapts to changing market demands, the need for highly skilled and research focused individuals is changing as well. Yingjie (Phoebe) Li, a PhD student at the Materials Engineering Department at the University of British Columbia and a member of the Lignoworks Network has connected with Canada's leading development networks in forestry innovations. "I believe that my educational background and research experience for innovation make me a qualified and valuable candidate for a high value job in a research and development position," says Ms. Li.

### Highly skilled workforce

Ms. Li was a part of the Otto Maass Student Poster Competition at the recent FIBRE (Forest Innovation for Research and Education) conference and was honored with a third place win. "My innovation came about by adding novel functionality to lignin through advanced nanotechnology techniques. It is motivated by the demand for providing additional value to the abundantly available and renewable lignin. Lignin is a major by-product which is removed from wood through the pulping process in the paper-making industry. However, only a small amount is currently used for commercial products, and 98 percent of lignin is being burnt as fuel."

> "The training and research being supported within these support networks are creating a highly skilled and trained workforce."

There is a national priority for the eight forest research networks with in the forest sector to provide training and development opportunities for highly qualified personnel (HQP). HQP are individuals with university degrees at the bachelors' level and above. The training and research being supported within these support networks are creating a highly skilled and trained workforce with a focus on innovation and commercialization.

### Growing the green economy

The networks are in place to work cohesively with academia, industry and government to invigorate what is now the new forest industry. "Standing on the shoulder of this large industry, I am thrilled to contribute through sustainable lignin innovation," says Ms. Li. "Canada is at a cross-roads and needs to make a strong move to have a sustainable and growing forestry industry. I strongly believe that the growth of Canada's green economy is not mutually exclusive, and innovation is at the forefront of this movement."

FIBRE unites eight of the country's state forest-sector, university-based research networks. The intention is to advance the transformation and competitiveness of the Canadian forest industry by creating innovative products.

**JANET LANE**
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# Stimulating the forest economy through partnerships

Canada has seen an exciting shift in the forest sector in the past few years. The economic struggles of America's economy began affecting the demand of Canada's $80 billion a year forest industry. Forestry saw one of the biggest downturns hitting hardest in Ontario, Quebec, and BC. Many companies and organizations came together to revitalize the industry that has taken a financial hit during the past few years. "If you look at 2008 and the pulp, paper and wood product markets, there was a major crisis," says Pierre Lapointe, President and CEO of FPInnovations. Creating partnerships between the forest industry and government, and accessing new markets such as oil and gas were essential for recovery. "The use of newsprint reduced by 50 percent in a few years. When you are in a situation like that, you get pressure from the provincial and federal governments asking what should we do?" With government and industry seeing the need for change, the forest industry saw a resurgence of economic viability through the use of scientific and commercial capital.

### Coming together

"We have a new approach as to how we view new markets. We have defined a national forestry strategy," says Mr. Lapointe. Partnering with industry leaders to create Canada's first cellulose nanocrystalline production plant, it was important for the forest industry to come together, rather than apart. Through partnership, there has been renewed stimulus surrounding Canada's forest economy. Building on value added products and scientific innovation, Canada is now at the forefront of innovative forest technologies. "You have to have an extremely good understanding of the market and products you will produce. The first sale of nanocellulose went to the oil and gas industry. You really have to understand the market to enable you to knock on the right door," says Mr. Lapointe. R&D to economic feasibility is not an easy task and requires a large undertaking of joint ventures built on trust. Expanding Canada's markets has breathed new life into an industry that has adapted to the changing global market.

**Pierre Lapointe**
President and CEO, FPInnovations

### Diversifying the market

"Forestry is an industry that has had problems," says Pierre. "However, it has chosen to diversify its markets. BC used to sell most of its wood to the US and now they sell more to China than they ever sold to the US." Mr. Lapointe knows this is a very exciting time for Canada. "The future is extremely bright because there has been a shift towards new products and new processes. We now produce a much greener product and one that is more environmentally friendly than cement or steel. We can now construct 6-storey apartment buildings with wood and are envisioning the day when wooden skyscrapers will be possible. This information has allowed us to open new markets, new partnerships, and new clients. It's just the beginning."

**JANET LANE**
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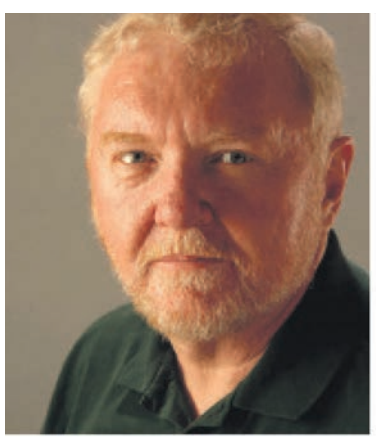
# It's Time to Refocus Ontario's Energy Plan



**By Don MacKinnon**
President
Power Workers' Union

Ontario recently announced a six-month review of its Long-Term Energy Plan (LTEP), initially released in 2010. This review provides a timely opportunity to stop the current upheaval in the electricity sector and refocus the LTEP on Ontario's energy advantages.

Key elements of the LTEP include the renewal of aging electricity infrastructure, two new nuclear generation units at Darlington, the creation of a new green energy economy and the reduction of greenhouse gas (GHG) emissions.

Several forces– the global recession, new wind, solar and natural gas generation along with the refurbishment of two Bruce Power nuclear reactors – have converged to create an increase in temporary power surpluses. Emboldened by this situation, proponents of more wind, solar and natural gas generation have attacked the planned refurbishment of Ontario's remaining nuclear reactors and the construction of new ones, even with the looming loss of 3,000 megawatts of GHG emission-free base-load capacity when the Pickering Nuclear Generating Station closes in 2020.

In today's world, an affordable, reliable, low-carbon electricity supply underpins our economic prosperity. Historically, Ontario's low-cost hydroelectric and nuclear generation has helped keep our economy competitive and growing. This competitive advantage is under threat.

Ontario's electricity prices will soon be among the highest in North America. Consumers face further increases as a result of the billions of dollars in hidden costs for the integration and management of intermittent wind and solar generation as well as for backup from natural gas generation when the wind isn't blowing or the sun isn't shining. The province's growing reliance on imported natural gas exposes Ontario consumers to electricity price volatility and increased GHG emissions.

The green jobs promised in the Green Energy Act remain elusive and billions of dollars in ratepayer-supported subsidies to big multinational wind and solar developers are flowing out of Ontario.

By comparison, refurbishing Ontario's nuclear reactors, building new reactors, and recycling coal stations to utilize renewable carbon-neutral biomass and natural gas for peak supply needs offers a more sensible path. Besides producing lower-cost, lower GHG emission electricity, this approach utilizes existing electricity generation sites that already have valuable transmission line connections and supportive host communities. The ongoing controversy surrounding the cancelled and relocated Mississauga and Oakville natural gas generation station underscores the importance of welcoming host communities.

Ontario's more than 150 nuclear supply-chain companies would benefit and tens of thousands of new high-value jobs would be created in engineering, construction, research and development, forestry, agricultural, biomass processing and transportation.

Besides providing long-term price stability and energy security, investing in Ontario's energy advantages and existing electricity assets is the most effective way to reduce GHG emissions. Ironically, increased reliance on intermittent wind and solar power means greater dependence on imported shale gas to fuel back-up generation and higher GHG emissions. In Ontario, wind turbines operate about 30 percent of the time. In 2011 the entire wind fleet output dropped below 10 percent of rated capacity 20 times for 24 hours or more and once for 72 hours.

Based on a full life cycle analysis, nuclear power emits 16 grams of carbon dioxide equivalent per kilowatt hour compared to 12 to 46 grams for renewable sources (depending on the type) and 469 grams for natural gas. Ontario's Environment Commissioner recently flagged the province's growing reliance on natural gas generation as a major threat to meeting future GHG emission targets. Such significant backsliding would make a shambles of Ontario's climate change plan.

Billions of people around the world are striving for the standard of living we have come to enjoy and that means increased competition for energy resources. Ontario already has some of the best energy resources in the world. It's time to refocus the LTEP before we squander our natural competitive advantages.