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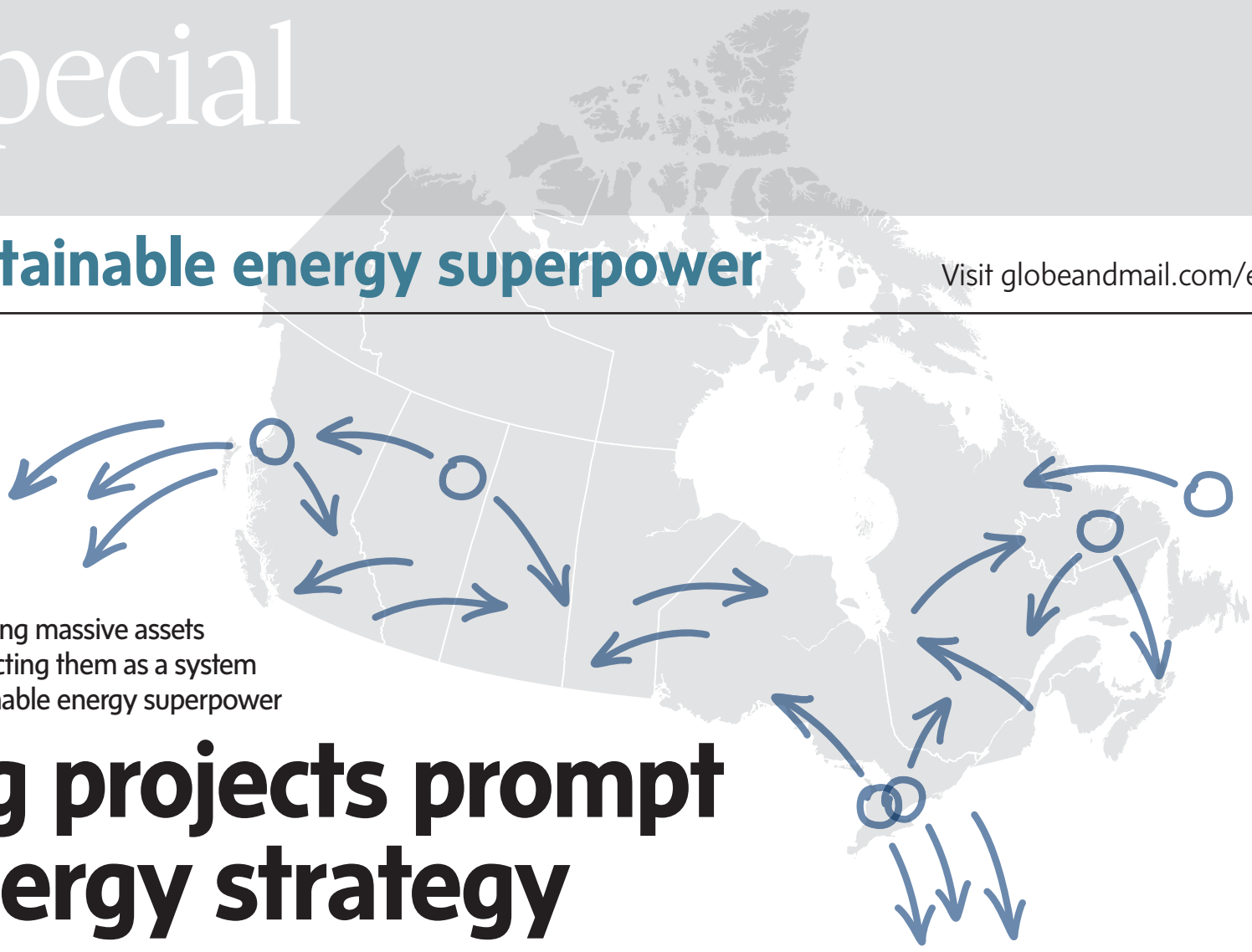

Developing massive assets
+ connecting them as a system
= sustainable energy superpower

Big projects prompt energy strategy

Humankind is facing two major challenges this century – to provide energy for the two billion people who currently have limited or no access to energy and to respond to climate change – and Canada has the potential to make a difference in both areas, say Richard J. Marceau and Clement W. Bowman, co-editors of the upcoming book *Canada: Becoming a Sustainable Energy Powerhouse*. With advantages like a wealth of resources and expertise in bringing big projects to fruition, what is needed are visionaries to point the way, and governments and industry to work together to implement the plans.

"We've built our country through big projects, massive undertakings that have stretched our resources to the limit and sometimes beyond," says Dr. Richard J. Marceau, vice-president (research) at Memorial University and president of the Canadian Academy of Engineering. As examples, he gives the Rideau Canal, the Canadian Pacific Railway, the James Bay Hydroelectric Project, the Trans-Canada Microwave Network and the CANDU nuclear reactor.

The successful completion of these immense transportation, energy and communication projects is a testament to the strength of the Canadian innovation strategy, explains Dr. Marceau, adding that big projects are at the foundation of today's prosperity. "A good recent example is the Newfoundland offshore petroleum industry," he says. "It's made Newfoundland the most exciting and dynamic Canadian province right now."

Coming out of the confluence of natural resource potential, private-sector enterprise and investment, as well as strategic government support, the Newfoundland offshore petroleum industry is thriving in an incredibly harsh climate, Dr. Marceau says, adding that its impact is impressive. As of 2010, this still relatively new industry was responsible for approximately 33 per cent of provincial real GDP and resulted in the average personal income being 6.5 per cent higher, the unemployment rate being 1.8 per cent lower and the province's population 16,400 larger than they would have been without the industry. Future oil industry activity, and associated investments in infrastructure, education, training, R&D and businesses, is expected to deliver additional economic growth and diversification, says Dr. Marceau.

"How do we continue this nation-building?" is the question Dr. Marceau has examined. Canada has to carry on its tradition of big projects, which are "springboards for the future, creating new innovation ecosystems and releasing a torrent of entrepreneurial activity and technology that can propel capabilities and performances to new levels," he says.

Specifically, the focus should be on energy, believes Dr. Bowman, associate, Bowman Centre, Sarnia/Lambton Research Park and chair of the Canadian

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"Energy can be a principal driver of the economy as it is a sector where Canada can be a sustained leader."

Clement W. Bowman
is an associate at Bowman Centre, Sarnia/Lambton Research Park

ELECTRICITY

Capitalizing on clean energy advantage

Provided it can summon the political will and make the appropriate investment decisions, Canada is well positioned to become a sustainable energy superpower and major player in the North American electricity market over the next 30 to 40 years, a time when global energy consumption is likely to double in North America alone, says Dr. Jastin Nathwani, executive director of the Waterloo Institute for Sustainable Energy.

Although it is widely recognized that the transition from a fossil fuel to a low-carbon energy system will take decades, Canada has a "clean-energy advantage" and is abundantly rich in low-carbon energy resources, including hydro, wind, bioenergy, geothermal, and advanced nuclear. However, says Dr. Nathwani, before Canada can capitalize on its advantages, political barriers to inter-regional energy trading are going to have to come down, and further investments are going to have to be made in inter-regional and cross-border energy infrastructure.

Dr. Jastin Nathwani believes a power grid can leverage Canada's electricity potential. SUPPLIED

"Electricity generation is a high-value manufactured good that has the promise and potential of delivering large benefits through inter-regional trade enabled by transmission and interconnections," says Dr. Nathwani. But achieving such a goal will require a dramatic shift away from the "provincial self-sufficiency paradigm" to a coherent national strategy.

"Realizing the full potential of clean electricity exports from Canada to the U.S. through an expanded power grid requires provinces, U.S. states and the federal government to establish a clear policy framework and specific mechanisms to reduce barriers to investment and to the development and approval of specific projects," he says.

There are encouraging signs that this process is already underway, he adds. The federal government in particular has been supportive of infrastructure expansion across regional boundaries. "This is your Keystone, and this is your liquefied natural gas in British Columbia," he says. Over the longer term, it is logical from an investment perspective for regional energy systems, such as those that exist between Ontario and Quebec, or Newfoundland and Nova Scotia, or Alberta and British Columbia, to be expanded in order to facilitate the large scale export of energy to the U.S. and beyond.

He adds that Canada's clean energy resources even carry a price advantage as traditional fossil-fuel sources are becoming increasingly subject to carbon-emission penalties in the United States in order to speed-up the transition to a low GHG-emissions environment.

OPINION

The value-added crisis in Canada's trade

By Jim Stanford,
Economist, Unifor

You learn a lot about a country by analyzing its international trade. What does it produce that the rest of the world wants? What does it need, but can't make itself? And what is the balance between the two?

By these criteria, it's clear that Canada has a big problem, an unintended consequence of the energy boom that's dominated our economy since the turn of the century.

We now face a Jekyll-and-Hyde dichotomy in our trade performance. Sure, there's a growing trade surplus in energy products: almost $70-billion in 2013. But unfortunately, our performance in all non-energy products and services has deteriorated more rapidly than our energy exports have grown.

Until 2002, our export portfolio was diversified, and we generated trade surpluses in many different industries (value-added as well as resources). But that changed once the energy export boom kicked into high gear. We began to incur trade deficits in non-energy trade, which reached a record $76-billion in 2013. Ironically, the more energy we export, the less of everything else we export. Our trade has de-industrialized before our eyes.

Other components of our trade also deteriorated during this period. Our trade deficit in services reached $25-billion in 2013 (hurt by the overvalued loonie, another side-effect of the energy boom). And net outflows of investment income (reflecting growing foreign investment here) are another drain. Put it all together, and our balance of payments is now deep in the red: by $60-billion per year.

Once we could export both resources and value-added products to the rest of the world – and more than pay our bills in the process. But now our capacity to produce for the world has become narrowly pigeon-holed in resources (especially petroleum).

In short, no matter how fast we dig it up and export it, we need more than oil to pay our way in world trade. So how do we escape this resource-dependant trap?

Trade, Page SE 4

By the numbers

Canada's electricity supply comes from:

Almost **60%** hydroelectric power

12% nuclear power

3% non-hydro renewable sources, such as wind and solar

Close to **13%** fossil fuels, including coal, natural gas and petroleum

INSIDE

This report was produced by RandallAnthony Communications Inc. (www.randallanthony.com) in conjunction with the advertising department of The Globe and Mail. Richard Deacon, National Business Development Manager, rdeacon@globeandmail.com.

OPINION

Wake up, Canada: seize the opportunity for super-sized value-added projects

By Clement W. Bowman, Associate, Bowman Centre, Sarnia/Lambton Research Park, and Surindar Singh, Executive Director, Renewables & Emerging Technologies, Alberta Innovates: Energy and Environment Solutions

There was once a time when it made eminent sense to send all our oil and gas south. It no longer does. And it's not just because of the XL pipeline. It's because Canadians are losing billions of dollars a year by being too slow and complacent about finding new markets.

Consider the past decade. The Australians exported Liquefied Natural Gas (LNG) to China and Japan at parity with crude oil prices – around $16 per million cubic feet (MCF). Canada annually exported around three trillion cubic feet (TCF) of its natural gas to the United States only, often at prices below $3 per MCF. The lost revenues were around $13 per MCF. If one TCF per year had been sent to Asia, this would have generated an additional $13-billion each year. This would have easily paid for all the necessary pipelines and LNG terminals, as well as other massive infrastructure projects – and created high-paying jobs and immense wealth across Canada. Natural gas royalty revenues would have increased – and Alberta would not have had any deficits.

A similar situation exists with our bitumen exports. Compared to the refining of conventional crude oil, it takes a refiner around $15 per barrel more to refine bitumen to transportation fuels. When the differential between world crude oil price and bitumen price exceeds $15 per barrel, then it becomes more profitable for U.S. refiners to refine bitumen – but Canadians lose. For example, if the differential is $25 per barrel and one million barrels of bitumen are being refined in the United States, Canadians "lose" $10-million per day or $3.65-billion per year. Don Wood's team at the Bowman Centre has estimated that a 100,000-barrel-per-day bitumen refinery in the Sarnia-Lambton region would cost $10-billion. If bitumen is diverted to this refinery and the differential is maintained at $15 per barrel, the capital cost of this refinery would pay for itself in less than three years. Lower differentials mean higher royalties – the Alberta government revenues would be increased significantly.

Canada needs to diversify its energy markets by building infrastructure both east and west of Alberta. And Canadian governments have always done so – the TransCanada railways in the 19th century, the extensive oil and gas pipeline networks in the 20th century. Now, it's time once more to make a strategic decision on building the energy infrastructure for the 21st century. This would pay for itself within a few years. For governments, it would mean more revenues; for industry, it would mean better market access and therefore greater profits; to Eastern Canada, it would mean better energy security; for all Canadians, it would mean more high-paying jobs and wealth generation.

The delegates at the May 2013 conference titled *Bitumen - Adding Value: Canada's National Opportunity* concluded that failure to expand our market reach has resulted in "value destruction on a scale never witnessed before in this country." Now is the time for national action to capture the true value of our energy resources. It's in our own best interests.

Crude oil and bitumen don't yield the same returns as value-added petroleum products and diversifying exports could lead to a significant increase in revenues. ISTOCKPHOTO.COM

INFRASTRUCTURE

BITUMEN UPGRADING PROJECT'S BUSINESS CASE SEEN AS SOLID

Job creation, energy security and economic gains are some of the arguments for moving the Sarnia/Lambton bitumen upgrading project forward, says Don Wood, an associate of the Sarnia-based Bowman Centre and former Polysar vice-president.

Mr. Wood is part of a team of executives with petroleum industry experience who are currently looking for a corporate champion (or champions) for the $10-billion oil sands bitumen upgrader and refinery in Chemical Valley.

"Canada stands to gain a significant increase in export revenue, and Alberta interests will have access to a new market for bitumen at more stable prices," says Mr. Wood, adding that the local economy in the Sarnia/Lambton region will also see significant stimuli.

Part of the infrastructure is already in place, Mr. Wood explains, as the two pipelines that are currently coming into Sarnia can carry diluted bitumen and increasing their capacity is feasible. And if the new upgrader is built to produce gasoline, diesel and other value-added petroleum products, an acceptable return on investment can be achieved.

There are three existing refineries and two petrochemical plants as well as unused refinery and upgrader-suitable plants available, in addition to land, pipelines and other related infrastructure. Taking the existing assets into account, Mr. Wood estimates that infrastructure development would pay for itself within a few years.

"We have pipelines, local infrastructure and surplus skilled construction labour, all strategically located in the centre of the North American market, with access to international markets through the St. Lawrence Seaway," says Mr. Wood, adding that additional benefits include production costs equivalent to those in the U.S. Gulf Coast and lower than in Europe and Asia, making the facility globally competitive.

"Ours is a welcoming community with over a century of experience hosting oil and gas industry projects," Mr. Wood says. "Since we will use the latest technologies to eliminate or minimize emissions, and will consult with all local stakeholders, approvals to build are expected to be obtainable.

"The only losers would be the refineries abroad that would have to find their feedstock elsewhere," says Mr. Wood, adding that the new 150,000-barrel-a-day upgrader and refinery in Sarnia would allow Canada to capture $2.5-billion annually in added value. If the bitumen is not processed locally, that opportunity would be lost, or sent south.

ENERGY ANALYSIS

Primary energy production in Canada increased 3.3 per cent between 2011 and 2012 to 17,335 petajoules. This followed a 3.6 per cent increase between 2010 and 2011.

One petajoule equals roughly the amount of energy required to operate the Montréal subway system for one year.

Crude oil accounted for the largest proportion of primary energy production in Canada in 2012, at 42.9 per cent. This was followed by natural gas (34.9 per cent), primary electricity (9.9 per cent), coal (8.6 per cent) and gas plant natural gas liquids (3.6 per cent).

EXPORTS AND IMPORTS
Just over 58 per cent of primary energy produced in Canada is destined for export markets, primarily the U.S.

Exports of Canadian energy and energy products increased 5.3 per cent in 2012 to 11,234 petajoules.

Canada exported 73.5 per cent of its crude oil production, 56.5 per cent of its marketable natural gas and 23.3 per cent of its refined petroleum products.

Imports of energy decreased 0.8 per cent from 2011 to 3,709 petajoules in 2012.

Crude oil accounted for 44.6 per cent of imports, followed by natural gas (32.7 per cent), refined petroleum products (13.4 per cent) and coal (7.4 per cent). Together, these products and commodities made up 98.1 per cent of energy-related imports.

ENERGY CONSUMPTION
Canada's energy consumption decreased 0.6 per cent to 8,179 petajoules in 2012, following a 7.5 per cent increase in 2011.

Energy consumption increased in total mining and oil and gas extraction (+13.3 per cent) and the construction sector (+3.6 per cent). All other sectors showed decreases in energy consumption.

Refined petroleum products (38.1 per cent) were the main source of energy consumed in Canada in 2012, followed by natural gas (30.8 per cent) and primary electricity (22.5 per cent).

Source: Statistics Canada

HYDROELECTRICITY

Potential for renewable energy for generations

By any measure, Newfoundland and Labrador's Muskrat Falls hydroelectric scheme is a mega-project. The 560,000 cubic metres of concrete for the power house and spillway alone would be more than enough to pave a one-metre wide and 10-centimetres thick path from St. John's to Vancouver.

But it's the $7.7-billion project's contribution to Canada's sustainable energy inventory that really sets it apart.

Muskrat Falls is phase one of the Lower Churchill Project. It includes an 824 megawatt hydroelectric generating facility, the Labrador-Island Link that will transmit power from Muskrat Falls to Soldiers Pond on the Avalon Peninsula, and the Maritime Link, being constructed by Emera of Nova Scotia, connecting Newfoundland and Nova Scotia. Construction of the major component is underway and expected to take five years to complete.

Muskrat Falls and Gull Island – the second phase of the project – are considered the best undeveloped hydroelectric sources in North America. Together, they have a combined capacity of more than 3,000 megawatts.

Nalcor Energy, Newfoundland public energy corporation, says Muskrat Falls will power homes and businesses across Newfoundland and Labrador with clean, renewable energy for generations.

The aerial view of Muskrat Falls looking downstream conveys a sense of the project's vast potential – it will power homes and businesses across Newfoundland and Labrador. SUPPLIED

Gilbert Bennett, Nalcor's vice president for the Lower Churchill Project, says now that major construction activities are underway, the challenge will be to keep the massive project on track by monitoring the progress of the main contractors and carefully managing labour supply.

"There are several other big infrastructure projects underway in the province that are drawing from the labour pool," he says. "On top of that, many Newfoundlanders and Labradorians have left to work on major projects in other parts of the country, and we want them to come back home to work for us."

The success of Muskrat Falls is an inspiration to proponents of other potential sustainable energy schemes such as the concept for a massive hydroelectric project that proposes harnessing the Mackenzie River in the Northwest Territories to produce 13,000 megawatts of power, with seven low dams to avoid land submersion.

The concept was developed by industrial engineer Pierre Gingras, an associate researcher with the Montreal Economic Institute and specialist in the construction of hydroelectric projects. His proposal, based on research completed last December and published this year by the Canadian Academy of Engineering in the book *Canada: Winning as a Sustainable Energy Superpower*, suggests a project that would include an upstream water control structure, six downstream powerhouses, and 10,000 kilometres of transmission lines to take the power to Edmonton. The complex could produce power equivalent to 525,000 barrels of fuel per day and help Alberta and Saskatchewan transition away from high-carbon-footprint thermal generating stations.

Mr. Gingras wonders if the electricity might also be used to replace steam with electric heating elements in oil sands operations, which would eliminate water use and reduce air emissions from fossil fuel used to generate steam.

"The priority is to build awareness of the Mackenzie River's hydroelectric potential and attract the interest of policymakers," says Mr. Gingras. "This is a project as big as the James Bay complex, and it could make a major contribution to Canada becoming a sustainable energy superpower."

FROM PAGE SE 1

Strategy: Driving the economy and lowering GHG emissions

Academy of Engineering Energy Pathways Task Force. "We started nine years ago with an understanding that an energy system is important to the country. That understanding has now turned us into believers."

Energy can be a principal driver of the economy as it is a sector where Canada can be a sustained leader, says Dr. Bowman, and a number of initiatives involving electricity could also help North America meet climate change targets.

"We have the capability to generate enormous quantities of electricity, way beyond our own needs," he explains, adding that Canada currently only utilizes about a third of its resources for hydroelectric power and could increase nuclear energy production by a factor of 10. "Both sources have very low greenhouse gas emissions," Dr. Bowman says.

"We have the resources and expertise to produce something that the world continues to need. It's an opportunity not just for economic growth, but also for bringing greater unity of spirit, thought and action to our country."

Richard J. Marceau
is vice-president (research) at Memorial University and president of the Canadian Academy of Engineering

"If we combine them with a national grid that connects from east to west across Canada and is linked to the U.S., we could provide electricity to the States." Replacing some of the coal power generation in the U.S. could have a substantial impact on GHG emissions, he adds.

Big projects have a large impact, but most take years to accomplish and require substantial investments at a time when economic benefits are far off, says Dr. Bowman, who believes they are not jobs for single companies or a single set of shareholders. They are national projects, serving a long-term national interest.

They also have the potential to strengthen Canada's economic and social fabric, says Dr. Marceau. "We have the resources and expertise to produce something that the world continues to need. It's an opportunity not just for economic growth, but also for bringing greater unity of spirit, thought and action to our country," he says.

For Dr. Marceau, this is an example where the sum can be greater than its parts. "By developing these massive assets with the view of connecting them as a system, we can leverage them for greater impact," he says, adding that the combined strength would provide a solid foundation for research and financial backing for "developing game-changing technology with the potential to reduce the accumulation of carbon in the atmosphere."

Canada: Becoming a Sustainable Energy Powerhouse will be launched on June 26 at the AGM of the Canadian Academy of Engineering and will be available at www.cae-acg.ca/publications-of-the-academy/.

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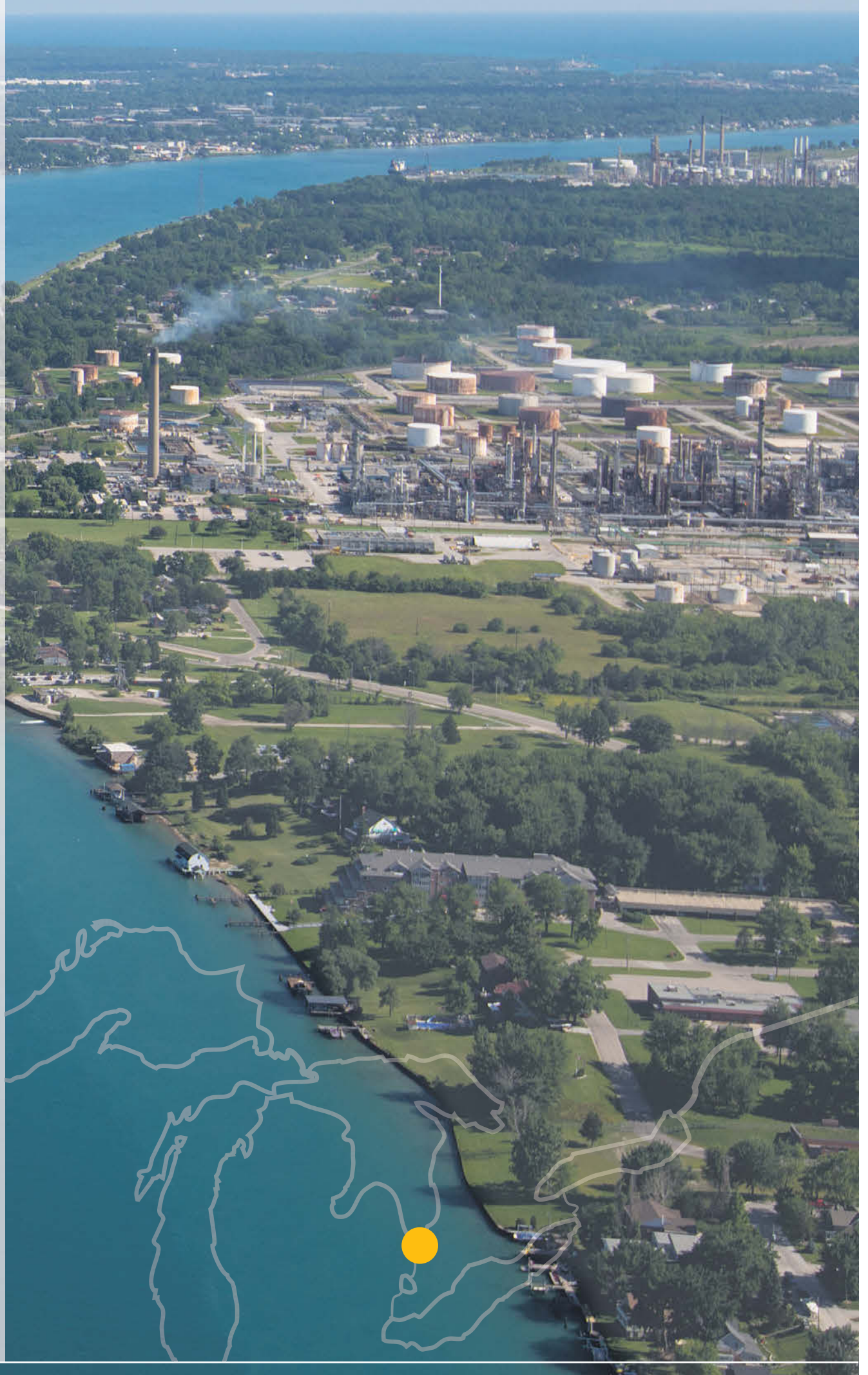

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ENGAGEMENT

LNG project brings 'sense of optimism' to northern community

Nation-building takes many forms. In the late 19th century, the completion of a railroad linking Eastern and Western Canada helped transform Canada from a concept to a fact. Similarly at the onset of the 21st century, the completion of pipelines and export terminals allowing liquefied natural gas (LNG) to be exported to Asia and around the world is viewed as a significant act of nation-building.

"It's the new frontier," says LNG Canada's director of external affairs Susannah Pierce. "The proposed LNG projects provide a new market for the energy industry – in this case natural gas – which has the potential to be a significant revenue generator and job creator, benefiting all Canadians."

Independent studies commissioned by the Government of British Columbia indicate that if five LNG facilities were operating in B.C. by 2020, it could mean more than $98-billion in new capital investment, 75,000 permanent new jobs, more than 39,000 average annual jobs over the construction period, and generate more than $100-billion in new government revenues over a 30-year period. All this is possible, says Ms. Pierce, because of the move away from a closed domestic and North American market to an international one where energy prices can be significantly higher.

The LNG Canada project is also significant in the high "social licence fee" the company is willing to pay to ensure that human and environmental needs are addressed during both the building and operational phases of the project.

LNG Canada has built a good rapport with community members, says Mary-Ellen Proctor, LNG Canada's community liaison officer. SUPPLIED

"As much as possible, the plant is being built incorporating the comments and interests of the people who are potentially affected," she says. In Kitimat, where the LNG export facility is proposed, Haisla Nation Chief Ellis Ross says the company has been as good as its word, preferring consultation to confrontation and extending economic development opportunities to the Haisla people.

"They've been very upfront about the impacts and don't apply for permits without consulting with us first," he says, adding that the project offers so many benefits to his people that it has the potential to move the Haisla Nation away from dependence in economic matters. "If this isn't the perfect example of reconciliation at work, then I don't know what is," he says.

In Kitimat, mayor Joanne Monaghan says the arrival of LNG Canada has transformed the community, renewing hope and reversing a long economic slide. "We were in a situation of doom, and now we're having a boom," she says. "We're building new houses and renovating old ones, which is enhancing our neighbourhoods. We were down to two children on our street a few years ago, now we're up to 20. There's a renewed sense of optimism." She adds that she has an extremely good rapport with LNG Canada. "I have their cell numbers. They always talk to me, they listen to our concerns and they're always polite."

Typically taking the call from people like Mayor Monaghan and other concerned citizens is Mary-Ellen Proctor, LNG Canada's community liaison officer. Born and bred in the North, Ms. Proctor says she views the project as a kind of salvation for towns like Kitimat, one that will keep families and communities together by providing opportunity. "At LNG Canada, we like to think of ourselves as new neighbours," she says. "We like what we're doing, but we want people in the community to like it as well, so we've set up a system where people can come to us with their concerns."

The LNG industry is still in an embryonic stage, and there are many hurdles to pass, but the way in which it has already been successful in building communities and renewing hope in the North speaks well of its ambition to be a positive force in nation-building in the years to come.

"The proposed LNG projects provide a new market for the energy industry – in this case natural gas – which has the potential to be a significant revenue generator and job creator."

Susannah Pierce
is LNG Canada's director of external affairs

TECHNOLOGY

Intelligent energy conservation solutions

Businesses represent the next major opportunity for energy efficiency, according to David Helliwell, co-founder and CEO of Pulse Energy. Commercial buildings in North America use $200-billion in energy each year, yet have been often overlooked by traditional conservation efforts. Mr. Helliwell's company has combined energy expertise and software analysis to tackle this problem.

"Our mission is to make the world's businesses more energy-efficient," Mr. Helliwell says, explaining that the company pairs that objective with a unique approach to cost-effectively delivering savings.

"We partner with utilities and analyze energy data from their customers," Mr. Helliwell says, with Pulse Energy's energy intelligence software identifying anomalous power use and highlighting areas to improve. Sometimes it's as simple as changing operating schedules or turning off appliances overnight to deliver meaningful cost and energy savings."

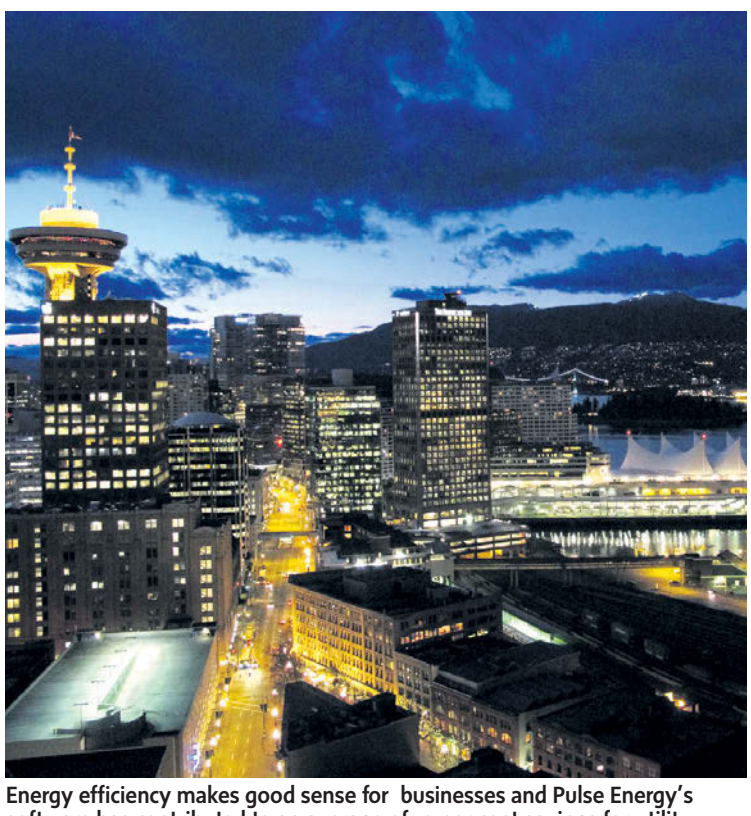
Since it started working with BC Hydro in 2009, Pulse Energy has built up an impressive track record. "[BC Hydro] rolled out our software to hundreds of their largest commercial customers as part of a continuous optimization program that has delivered around 10 per cent savings on average," Mr. Helliwell says, adding that the operational efficiency of the buildings has been improved by a combination of the software and energy managers. He emphasizes that those percentages have been achieved through low- or no-cost measures with short payback periods.

Pulse Energy now works with leading utilities across three continents, and is on track to analyze over two million businesses by the end of 2014. These generate an immense amount of data on how commercial customers – dry cleaners, shoe stores, offices, elementary schools, universities and others – interact with their energy use, which feeds back into constantly improving the software.

This innovation has come to the attention of British Gas Business, the commercial division of the United Kingdom's largest energy company. In a recently announced deal, Pulse Energy's technology will improve the energy performance of British Gas's entire commercial customer base at over 900,000 locations.

British Gas was attracted by Pulse Energy's commercial expertise and ability to improve customer relationships. "Our primary role is to help them better engage with their customers so they can provide better services," Mr. Helliwell says, adding that energy savings lead to lower bills, an important part in attracting and retaining customers. "It's a virtuous circle we're proud to be a part of."

Energy intelligence also plays an important role as more renewables are coming on board, says Mr. Helliwell. Bringing more intelligence into the system and encouraging people to tailor their energy use to its availability can ease the pressure on the grid and reduce the need for storage.



Energy efficiency makes good sense for businesses and Pulse Energy's software has contributed to an average of 10 per cent savings for utility companies' commercial clients. LORI BAMBER

Located in the municipality of Clarington in Durham Region, 70 kilometres east of Toronto, Darlington is Ontario Power Generation's newest CANDU nuclear generating station. It provides approximately 20 per cent of Ontario's electricity needs, enough to serve a city of two million people. SUPPLIED

SOLUTIONS

Courage and safe design key to nuclear potential

For more than a century, Canada has been a leader in nuclear engineering. Today, the country has the potential to assume a key position in nuclear energy, with the uranium and materials necessary to generate an endless, sustainable supply of power, says Dan Meneley, professor of nuclear plant safety at the University of Ontario Institute of Technology.

"It's inexhaustible," says Dr. Meneley, former chief engineer at Atomic Energy of Canada Ltd., noting that nuclear energy has an important – albeit controversial – role in making Canada a sustainable energy superpower. "We have an embarrassment of riches, but only if we have the courage to use it."

Canada's nuclear expertise originated around 1900 with the Nobel Prize-winning research of Ernest Rutherford, a New Zealand-born physicist working at McGill University. He became known as the father of nuclear physics.

It continued with W.B. Lewis's groundbreaking research on nuclear power following the Second World War, especially the development of the CANDU reactor. Dr. Meneley calls this "our bird in the hand," and notes that more than half of Ontario's electricity is now generated by these reactors.

"Oil is looking weaker every day," he comments, but Canada has a supply of uranium that could last thousands of years, as well as the raw materials to build as many reactors as we want.

"It can be done all within our own economy," he says, although it's important to have "political gumption" and to design reactors for safety. "Our children and our grandchildren will accept it, but only on one condition: that we manage the energy correctly."

Now is the time to begin, Dr. Meneley stresses. "The later we do it, the higher the price of oil will be. We can, if we wish, be off oil in 50 years, there's no question about it."

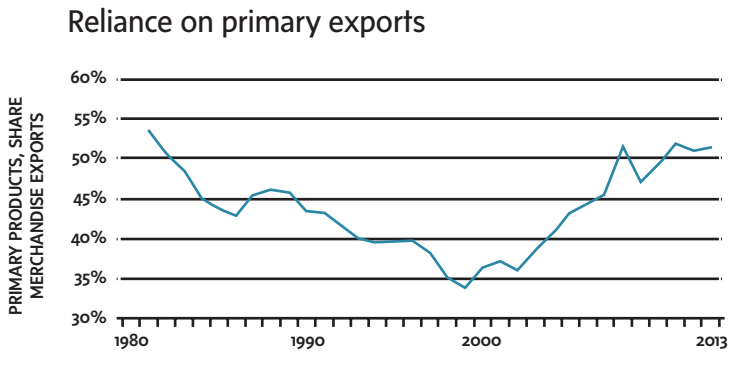
FROM PAGE SE 1

Trade: Strategies for adding value

Two key strategies are needed:

1. Canada must defend its capacity to produce and export value-added products, not just resources. We must be able to produce higher-value products (and services, too) that the rest of the world will buy. This will require conscious industrial strategies to support investment and innovation in manufacturing and tradable services.
2. An obvious place to start is by maximizing value-added possibilities directly connected to our resource base. Instead of exporting bulk unprocessed commodities, we should upgrade, refine and process our petroleum (into refined products and petrochemicals). It's shocking that we now import almost as much refined petroleum product as we export – shameful for a major petroleum power. Upstream, too, we could do much better at leveraging Canadian-made inputs (like high-value machinery and capital equipment) for our mines and wells, instead of importing them all from the rest of the world.

Canada will never become a truly developed and successful trading nation unless we rebuild our collective capacity to add value to our own resource wealth. We can and must become more than hewers of wood, drawers of water – and scrapers of tar.



We made progress in reducing the precentage of primary exports over a 20-year period and then blew it over the past 10 years. INTERPRETATION BY CLEM BOWMAN









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LNG Canada is proposing to build and operate an LNG export facility near Kitimat, British Columbia – but we can't do it alone. We are working with First Nations, the public, and all levels of government to share information and ask for input on our plans. While there is still much work to be done, LNG Canada is building strong relationships with the community now, in anticipation of these relationships lasting well into the future.

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INFRASTRUCTURE

Making cities more resilient by integrating flexible, local fuel sources

Small-scale projects that produce energy and use it more efficiently at the community level are critical to securing Canada's energy future, experts say.

With energy use by cities accounting for more than two-thirds of global demand, local urban solutions are instrumental to curbing energy consumption and the resulting environmental consequences, says independent consultant Mary Ellen Richardson.

"If Canada is to become a sustainable energy superpower, Canadian cities will need to be as focused on resource stewardship and efficient management as they are on resource extraction and transport," says Ms. Richardson, whose career in the oil, natural gas and electricity industries spans 30 years. "We have to rethink how we develop our urban spaces and take advantage of the energy we have there."

Energy use by cities accounted for 67 per cent of global demand in 2006, a figure that is expected to increase to 73 per cent by 2030, according to the International Energy Agency.

Ms. Richardson notes that cities in northern Europe, which have similar climates to ours, have built "district energy" systems, with small-scale "combined heat and power" facilities that produce thermal and electrical energy for local use or to sell to the electrical grid. Few communities in Canada are exploiting such opportunities to turn natural gas or local fuel feedstocks such as wood biomass, solid waste and biogas into energy, she laments. "Literally, we waste our waste."

Many Canadian provinces focus their energy policies on distant, large-scale electricity plants rather than community energy systems, she says, adding that a bigger focus on efficiently meeting the heating and cooling energy needs of cities is critical.

Michael Harcourt, the former mayor of Vancouver and premier of British Columbia, who has served on a number of organizations dealing with urban sustainability, says that communities must make energy an integral part of their strategies.

District energy systems have been implemented, for example, in Oujé-Bougoumou, Quebec (top right), and Strathcona County, Alberta (bottom right). Their infrastructure is expensive to build, but if prices of high-grade energy sources – such as electricity, natural gas or oil – were to spike unexpectedly, these systems would allow central energy plants to switch fuel sources to renewables with much less overhead and still deliver reliable services, according to Ms. Richardson and her team members Terri Chu and Marlene Rogowska. FVB ENERGY

"We can dramatically reduce costs and reduce consumption and create livable, sustainable solutions."

Michael Harcourt
is chair of Quality Urban Energy Systems for Tomorrow

"We have to change the way we live," says Mr. Harcourt, chair of Quality Urban Energy Systems for Tomorrow, a collaborative network focused on urban integrated energy initiatives.

He points out that Guelph, Ontario, has a 25-year community energy initiative that requires it to reduce greenhouse gas emissions by 60 per cent and per-capita energy consumption by 50 per cent. "That means making the right choices."

For example, water storage, treatment and delivery accounts for 17 per cent of a municipal government's energy bill, he says. People could significantly reduce their water consumption if the "grey" water resulting from washing and showering were recirculated in their homes for other purposes.

"We can dramatically reduce costs and reduce consumption and create livable, sustainable solutions," Mr. Harcourt says.

Ms. Richardson acknowledges that the capital costs of the infrastructure needed to pipe thermal energy throughout a community would be significant, but it really is no different than installing sewers, water systems and other critical infrastructure needed to meet basic needs.

Vision is critical, as "conventional land-use planning approaches tackle energy at the end of the planning process, with energy considerations presently appearing secondary to building or community design," she says. "This approach misses the opportunity for increased efficiencies, the use of local energy fuels and the application of other energy stewardship concepts."

A "reactive" approach locks communities into long-term, less-adaptable energy scenarios, Ms. Richardson says, while one based on flexible, local fuel sources is less vulnerable to supply interruptions from severe weather and grid failures, and it helps communities focus on energy conservation.

"Cities are at the crux of the climate challenge," she says, although "this scale of a problem requires multi-government co-operation and intervention of city planners working in tandem with the community, technical experts and policy-makers."