Energy and Climate Change Brief

ÉNERGIE SAGUENAY by GNL QUÉBEC

Innovating locally and delivering globally

Energy is fundamental

Énergie Saguenay aims to empower citizens and regions where comparable energy sources are not accessible, reliable or affordable.

Energy is fundamental to the quality of life for people around the planet. The contribution of energy to economic development, poverty reduction, support for education and the general increase of our quality of life and that of humanity is a cornerstone of the United Nations Sustainability Goals. And yet, an estimated 1.1 billion people do not have access to electricity per the International Energy Agency (IEA) a reality faced by 14% of the global population which is often overlooked by citizens in urban centers and developed nations.

It is in this global context that the Énergie Saguenay Project is committed to providing reliable, low-greenhouse gas (GHG) emitting energy to meet the world's growing energy demand as populations expand, economies grow, and prosperity increases in developing countries. Énergie Saguenay aims to empower citizens and regions where comparable energy sources are not accessible, reliable or affordable.

Quebec and Énergie Saguenay

Innovating locally and delivering globally

Quebec can be part of the global energy solution and has a special opportunity to become a leader in fighting climate change, reducing global GHG emissions, and reducing pollution by leveraging its unique attributes.

Competitive advantage

- Surplus renewable hydroelectricity;
- Cold ambient temperatures;
- Significant existing infrastructure;
- Talented workforce; and,
- Proximity to Montreal's technology and innovation hub.

Quebec is innovating locally through the Énergie Saguenay project and will be a global leader in delivering lower GHG emitting energy to meet the planet's growing energy needs.

Making a difference at home and around the world

- Quebec can export significant energy to the world and reduce global GHG emissions by 700 million tonnes over 25 years by substituting coal and oil with cleaner LNG. This global emissions reduction estimate equates to 9 times Quebec's current annual GHG emissions.
- The Énergie Saguenay project will be the greenest LNG export facility in the world due to its use of hydroelectricity to power the facility and will emit 84% fewer emissions than typical North American LNG facilities.
- Énergie Saguenay and its sponsors have committed to strive for a carbon neutral project footprint in Quebec.

This commitment is unprecedented for any energy infrastructure of this magnitude and truly differentiates Énergie Saguenay from any other LNG project in the world. GNL Québec is moving a step further by putting sustainability at the core of its company mission, showing that economic growth and sustainability can be mutually reinforcing.

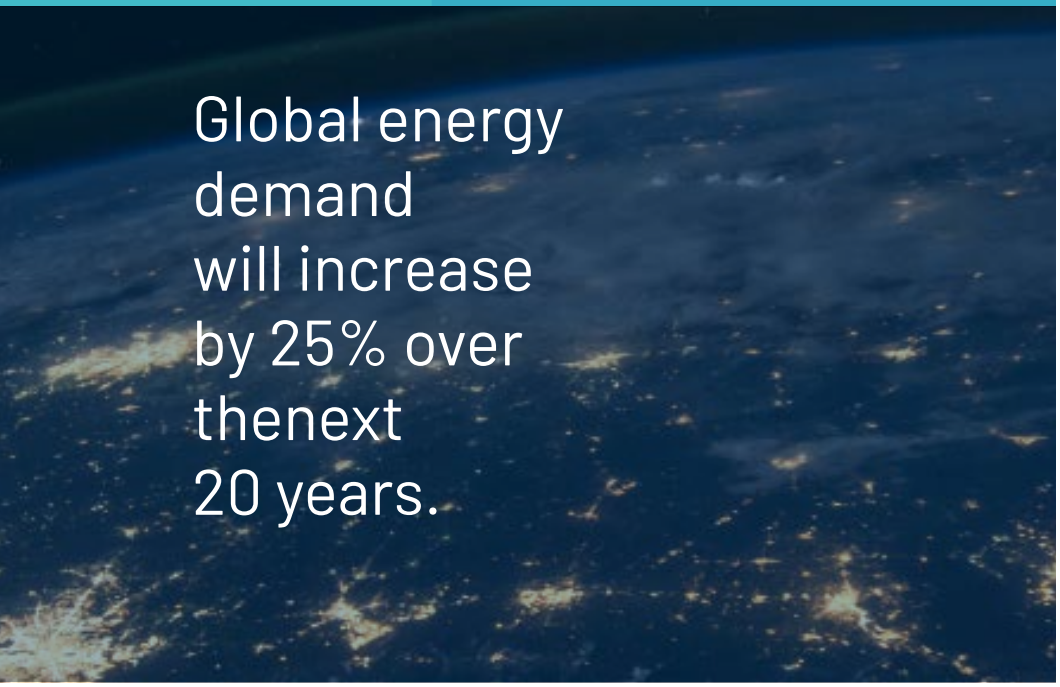
In addition, the project will be a catalyzing leader in the energy industry by implementing artificial intelligence (AI) and machine learning to further enhance environmental and economic performance along the entire value chain. LNG exports through the Énergie Saguenay project are, in effect, Quebec's best opportunity to export its clean renewable hydropower and reduce global emissions. A true win-win-win project.

It's exciting and energizing.

Population Growth

The United Nations is forecasting the world's population to increase from 7.5 billion people to 11.2 billion people by 2100.

The world will need significantly more energy to meet this population growth and increase prosperity for people who have limited access to energy. Quebec can be part of the global energy solution and has a special opportunity to become a leader in fighting climate change, reducing global GHG emissions, and reducing pollution.



A Global Challenge

One of the biggest challenges of the 21st century is ho w to meet the growing global need for energy while addressing climate change and GHG emissions. In the 20th century, coal and oil were the primary energy sources that fuelled the Industrial Revolution. It is projected that global energy demand will increase by 25% over the next 20 years. Although the world's energy mix is shifting to include renewable energy sources (primarily for power generation), coal and oil are still anticipated supplying over 40% of the world's energy in 2040.

Alongside renewables, only natural gas is forecasted to proportionally grow as part of the energy mix due to both its abundance and its more environmentally enhanced attributes (compared to higher-GHG emitting and more polluting fuels such as coal and oil).

As emphasized in the UN's annual COP24 climate change conference announcements and the conclusions of the October 2018 Intergovernmental Panel on Climate Change (IPCC) report, the world must significantly reduce GHG emissions to mitigate the drastic potential impacts of climate change, including global warming, sea-level rise, ocean acidification, and expanded disease.

Improving energy efficiency, innovating with new technologies, enacting sound government policies, replacing high GHG/polluting energy sources, and changing human behaviour patterns, are all essential solutions to address the threat of climate change. Energy demand will increase due to population growth and an increase in living standards in developing countries, but it is imperative to simultaneously tackle the issue of carbon intensity per capita and provide access to cleaner energy solutions around the world.

Coal and Air Pollution

There is a worldwide consensus to act urgently to reduce the harmful effects of air pollution. A NASA-UNEuropean Commission joint research effort concluded that more than 4.2 billion people in Asia are breathing air many times more polluted than the World Health Organization's (WHO) safety limit. The residents of many European countries are exposed to unsafe levels of air pollution as well. The map to the right shows that in China, 90% of residents are exposed to pollution levels that exceed the WHO's safety limit by 300%, while in India, 40% of the population are exposed to pollution levels that exceed the WHO's safety limit by 500%. In India alone, 140 million people are breathing 10 times more air pollution than the safety limit set by the WHO.

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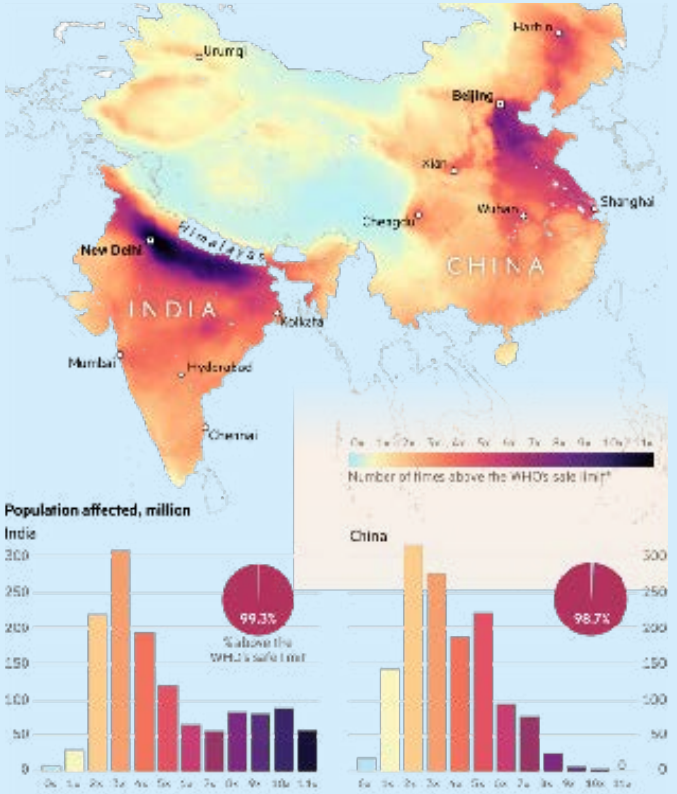
A recent study has shown that mortality caused by air pollution has been largely underestimated and that it could cause 8 million deaths globally each year while simultaneously reducing life expectancy by approximately 2 years[1]. According to The Lancet[2], air pollution in India could be the cause of 1.2 million deaths per year and a life expectancy reduction of more than 5 years for the resident population.cause of 1.2 million deaths per year and a life expectancy reduction of more than 5 years for the resident population.

About 60% of India's and 72% of China's electricity are produced by coal-fired power plants. In addition, coal is likely to dominate both India's and China's energy mix for decades to come. In India, the majority of coal is "unwashed" to keep costs low, leading to 30-50% ash content and higher pollution levels. Other East Asian and South-East Asian countries like Japan, Thailand and Vietnam rely on coal for 20-34% of their energy needs. Over the past thirty years, coal demand across Asia has increased 3.5-fold[3].

Thailand[4] is the clear leader in solar capacity in SE Asia; However, it still produces more than 20% of its power from coal today. The IEA expects installed power generation capacity in South-East Asia to increase by more than 565 gigawatts (GW) by 2040, from 240 GW today.

1 Air Pollution Reduces Life Expectancy by Nearly 2 Years
2 The impact of air pollution on deaths, disease burden, and life expectancy across the states of India
3 Asia's coal addiction puts chokehold on its air-polluted cities
4 Balance of power tilts towards renewables in Asia Pacific

India's air quality is now far worse than China's ever was.

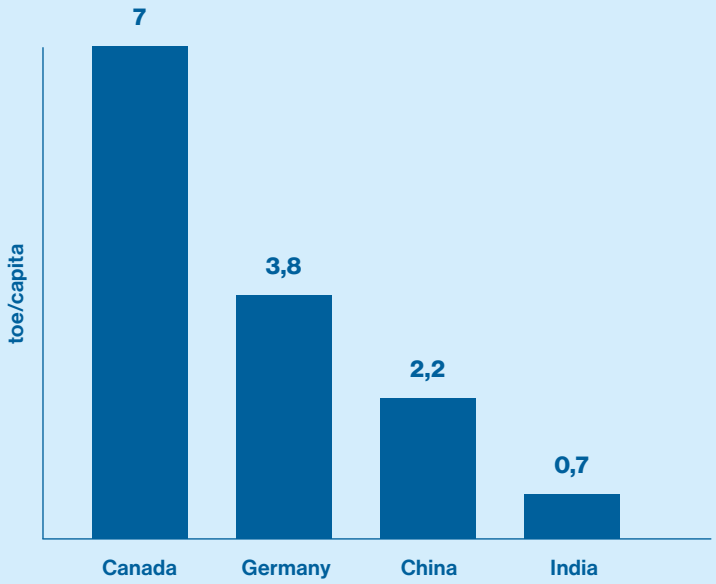


The burden and impacts of air pollution and climate change are not Asia's alone to bear – climate change impacts every country in every continent.

In Europe, for example, countries like Germany (21%), Turkey (28%), Poland (48%) use coal for a significant proportion of their energy needs.

Énergie Saguenay, through the displacement of coal in Europe and Asia, will have a direct impact on mitigating global pollution as the consumption of natural gas essentially does not generate PM2.5 particles and natural gas produces 50% less greenhouse gas emissions than coal.

Energy Intensity Trends (2016)



toe = ton of oil equivalent (Source: International Energy Agency)

Developing Countries & Energy Intensity Trends

Providing low-GHG emitting energy to developing countries will be essential to allow them to improve their quality of life while developed countries reduce their energy intensity.

The availability of energy is essential to countless parts of our modern existence. We rarely stop to think how much energy is required to sustain our quality or life or from where that energy comes. There is a substantial difference in energy intensity (energy use per capita) between developed and developing countries. As economies grow in developing countries, so do their energy needs.

Despite this growth – which is necessary to help developing nations eventually achieve a similar quality of life enjoyed in developed countries – most developing countries are still using a fraction of the energy per capita compared to the high average quality of living in North America. For example, India consumes 10 times less energy per capita than Canada and China consume approximately 3 times less energy per capita than Canada.

Improving energy efficiency, decreasing energy intensity, and switching to lower GHG emission fuels in developed countries, particularly in North America, is vital in reducing global GHG emissions. Even still, these efforts will be overshadowed by significant increases in energy usage in developing countries in line with the need to improve the quality of living, education and health around the world.

In the global energy transition over the next 50 years, intermittent renewable energy sources will need to be complemented by low GHG emitting energy sources like natural gas as the world strives for a low-carbon energy mix. Énergie Saguenay will provide one of the best solutions to enable developing countries to meet their growing energy needs by providing hydroelectric-driven, low-GHG emitting LNG.

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3,7 %

Average annual global LNG growth expected, 2018 - 2035 (320 million ton per annum (mtpa) to 612 mtpa)

20 %

of global LNG demand will be in Europe

75 %

of global LNG demand will be in Asia (with an 80% increase in demand expected India and China by 2035)

GHG Emissions & Climate Change

Energie Saguenay's project alone will displace 33% of Quebec's yearly GHG emissions.

On a global climate change basis, the continued increasing global demand for oil and the use of coal in China, India, South-Eastern Asia, Europe and North America has created two GHG climate change fallouts for the planet. The first fallout is, the production and emissions of CO2 from burning coal and fuel oil to fuel the world with energy. CO2 emissions have a direct impact on climate change, which has accelerated in the last decade.

The second is emissions stemming from leaks or unintended release in coal mines, called fugitive emissions – which is correlated to the growing needs of primary energy. As an example, China's coal mining fugitive emissions alone have grown at a rate of 1.0 to 1.2 million tons/year of methane.

On a yearly basis, methane fugitive emission from coal mines alone in China accounts for at least 20 MT/ year, which is 7 times the emissions in US coal mines. There is no indication that this trend will stop.

Replacing coal with natural gas reduces GHG emissions by more than 50% through efficient, established and well-known technology and well-enforced environmental standards – during production, transportation and during final consumption to generate electricity or heat.

Replacing coal with natural gas, reduces GHG emissions by more than 50%

Natural Gas in the Energy Mix

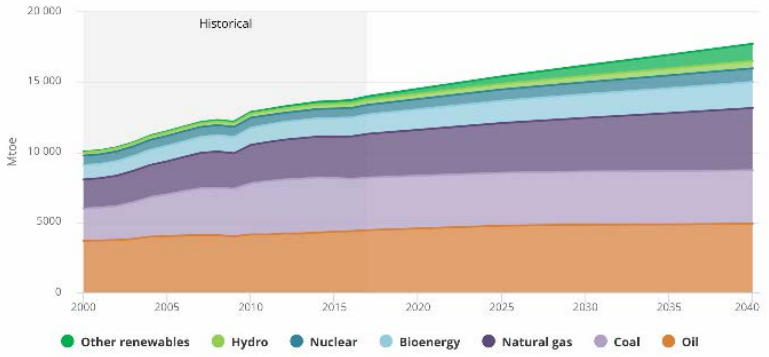
Natural gas will continue to be a very important fuel as the world strives to transition to a lower carbon energy mix.

Natural gas is one solution for reducing global GHG emissions due to its environmental attributes. For example, burning natural gas creates at least 50% fewer GHGs than burning coal and 25% fewer GHGs than burning oil. In addition, natural gas has a significant environmental advantage over coal, bunker fuel, diesel and oil because gas does not contribute to SOx, NOx and fine particulate pollution – which are major contributors to the air quality challenges experienced in many Asian and European countries today. These less well-known forms of pollution have significant negative effects on life expectancy, human health and quality of life around the world and, in particular, for citizens of countries that burn significant quantities of coal.

The global expansion of natural gas is benefitting from the flexibility and growth in the LNG industry. There were 35 countries importing LNG in 2010 and that number is projected to increase to 60 countries by 2030. Natural gas will continue to be a very important fuel as the world strives to transition to a lower carbon energy mix.

Énergie Saguenay is projected to reduce global GHG emissions by 700 million tons over 25 years.

Energy Demand



Source: International Energy Agency/World Energy Outlook 2018

Artificial Intelligence / Machine Learning in Quebec

Artificial Intelligence (AI) has recently garnered significant interest across a variety of industries and has become a core expertise within Quebec's technology community. Quebec-based companies and academic institutions have focused on applying AI and machine learning (ML) to identify and solve major global challenges in diverse areas such as climate change and healthcare. After a slow start, the energy industry is starting to adopt digital technology and AI to improve environmental performance, reduce costs and improve efficiency.

As a benchmark, innovative LNG development, Énergie Saguenay will be employing AI across a variety of areas including optimizing operations across the value chain. This would include plant operations, trading, shipping, weather conditions analysis, procurement planning, turnaround planning, and environmental performance for the development.

AI development is flourishing in Montreal. The city is currently home to 1,000 AI researchers, a concentration unrivalled elsewhere in Canada.

The city recently hosted a significant global AI forum and is well positioned to become Canada's Silicon Valley for AI. Montreal boasts an exceptionally high concentration of expertise in the area of AI, thanks in part to Quebec-based pioneers in the area of deep learning movement and the research performed at the Montréal Institute for Learning Algorithms (MILA). McGill University and Université de Montréal have more than 250 researchers and doctoral students in related fields, forming the largest AI academic community in the world today.

Énergie Saguenay, which will be the lowest GHG emission LNG facility in the world due to its use of hydroelectricity, is committed to deploying game-changing AI/ML solutions during the LNG project's next phase of development. The company will collaborate with its contractors, suppliers, and Quebec's AI community to help make Énergie Saguenay the most innovative LNG facility in the world.

250

RESEARCHERS IN AI AND DEEP LEARNING

9 000

UNIVERSITY STUDENTS IN RELATED PROGRAMS

Source: www.montrealinternational.com

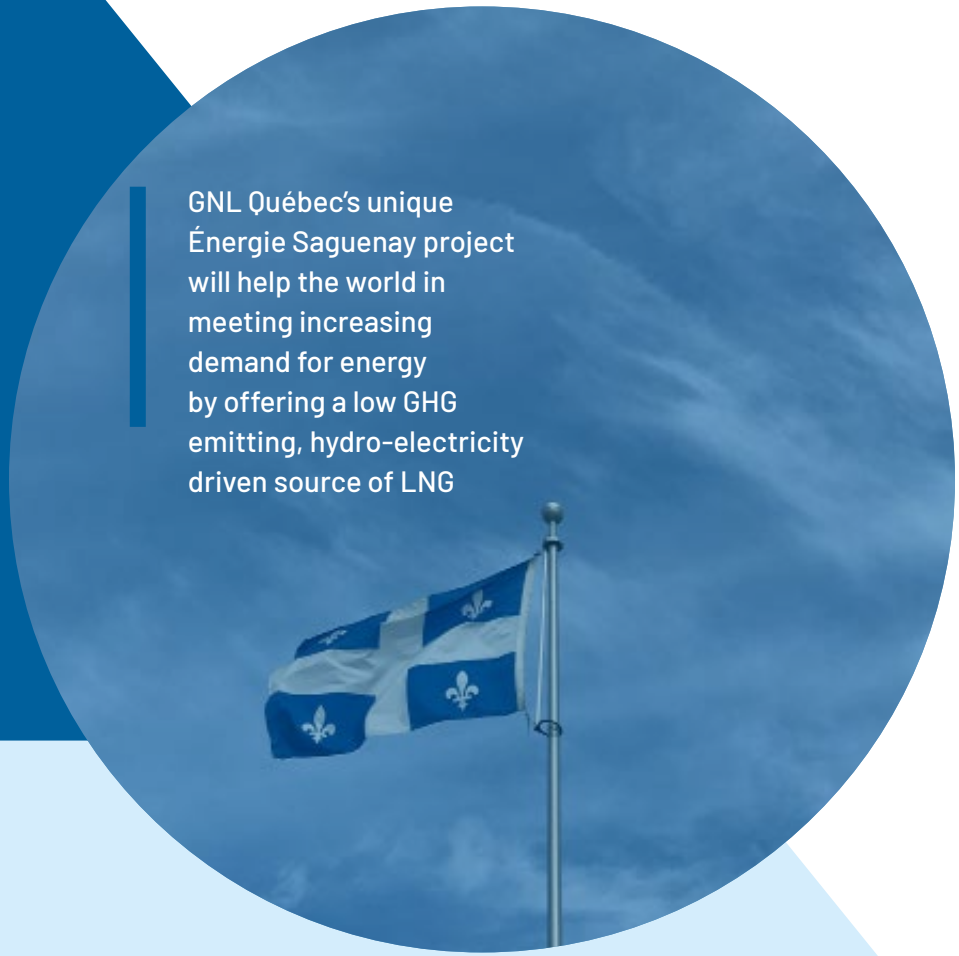
Internationally, the Énergie Saguenay Project will contribute to the United Nations Sustainable Development Goals by:

- Promoting the delivery of affordable and clean energy (SDG#7)
- Promoting sustainable industrialization through the use of hydroelectricity & Énergie Saguenay's target of carbon-neutral plant operations (SDG#9)
- Acting on climate change through displacement of coal and oil by providing low GHG emitting and hydro-electricity driven LNG (SDG#13).

Locally, the project is addressing the Province's 16 Sustainable Development Principals in several ways, including the promotion of:

- Engagement and participation of stakeholders, even in the early stages of development
- Environment protection through a thorough evaluation of environmental impacts and working on a) avoidance, b) minimization and c) mitigation of those impacts
- Responsible production using available/installed renewable hydro-electricity capacity from Quebec's existing grid

Énergie Saguenay will emit 84% fewer GHG emissions than typical LNG Plants.



GNL Québec's unique Énergie Saguenay project will help the world in meeting increasing demand for energy by offering a low GHG emitting, hydro-electricity driven source of LNG

Quebec and the World Stage

Governments around the world and major international organizations, such as the United Nations Framework Convention on Climate Change (UNFCCC), recognize that the use of energy is inseparable from social & economic development and climate change. The contributing role of greenhouse gases in climate change is well established. As a result, the reduction of GHG emissions has become a very important theme for Quebec, for Canada, and for the international community. In Quebec, two major approaches have been highly supported: the reduction of GHG emissions and implementation of renewable energy sources. In this context, Énergie Saguenay's goal is to lead an exemplary project with limited local impacts while significantly reducing global GHG emissions.

In the context of an energy transition towards a less carbon-reliant global economy, GNL Québec's primary mission is to make natural gas available to meet the world's growing energy demand by building an LNG liquefaction and export facility at the port Saguenay-Quebec. This facility will generate substantial economic and social benefits for the national, provincial and regional economies, and will be an industry benchmark facility in reducing global GHG emissions.

In addition to delivering on its primary mission, GNL Québec is aligned with the intentions expressed in the most recent Energy Policy of the Government of Quebec and will implement solutions to support the Policy as a sustainable energy project that enables the Quebec Province to transition to a lower GHG-emitting economy.

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