

# The Straits of Mackinac crossing and Line 5

What is  
Line 5?

Built  
to last

Staying  
safe

Enbridge in  
Michigan

Benefits for  
Michigan

Questions  
and answers



The Straits of Mackinac are a truly special place. The health and the protection of these waters are essential to the vitality, the sustainability, and the economic prosperity of the region.

We understand how important the Straits and the Great Lakes are to Michigan residents—because, for more than 60 years, we've been part of the Michigan community. Since 1953, Enbridge's employees and contractors have lived and worked across the state as colleagues, neighbors, and friends.

Safety is at the very foundation of our business. It's one of our core company values, and our people live it every day. Our Line 5 Straits of Mackinac crossing has never experienced a leak in more than six decades of operation—and we're working diligently to keep it that way. We believe all pipeline incidents can be prevented, and we back up that belief with vigilance and hard work.

In this brochure, we present an overview of Line 5—its extraordinary design and construction, which still exceed today's industry standards; the ongoing measures we take, including 24/7/365 monitoring, to promote its continued safe operations and protect the environment; and its role in heating homes and businesses, fueling vehicles, and powering industry in the state of Michigan.



Being a good neighbor is our goal. Staying safe is our highest priority.

More information on Line 5 is available at [enbridge.com/line5](https://enbridge.com/line5), while greater detail on our Michigan operations can be found at [enbridge.com/michigan](https://enbridge.com/michigan). Our Facebook and LinkedIn channels feature regular updates on our operations in Michigan, and elsewhere.

Thank you.

A handwritten signature in black ink, appearing to read 'Brad Shamla', written in a cursive style.

**Brad Shamla**  
Vice President,  
U.S. Pipeline Operations

Line 5 is an Enbridge pipeline that was built in 1953. The line runs for 645 miles from Wisconsin, under the Straits of Mackinac, through Michigan to Sarnia, Ontario. It was built to high safety standards, and Enbridge maintains Line 5 with regular inspections, and the introduction of new measures that help ensure the line continues to safely transport the light crude oil and natural gas liquids that help to fuel quality of life for people in Michigan.





## Line 5 at a glance



### Inspection

The pipeline is regularly examined using state-of-the-art inspection tools.



### Safety

Line 5, along with the rest of our pipeline system, is monitored 24 hours a day.



### Pipeline Contents

Line 5 transports natural gas liquids (NGLs) and light crude oil. It does not carry, and has never carried, heavy oil.



### Operations

The line is operated at less than 25% of maximum pressure capacity for enhanced safety.



# 540,000

barrels of NGLs, including propane, and light crude moved per day on Line 5

# 65%

of Upper Peninsula homes are heated by the propane carried on Line 5

# 24/7/365

Line 5 is monitored around the clock by both human and automated resources

Enbridge's Line 5 Straits of Mackinac crossing was built for an underwater environment, and still exceeds today's standards for pipeline safety. In 1953, it was built to extraordinary standards, using the finest engineering expertise from across the United States. The twin pipelines under the Straits have not experienced any leaks in six decades of operation—a testament to their design, construction, and maintenance regimen.

The Bechtel Corporation, the University of Michigan's Department of Naval Architecture and Marine Studies, and Columbia University's Civil Engineering Department were involved in the engineering, design, and construction process. To promote the safety and integrity of the crossing, support anchors have been constructed and placed along the section of Line 5 that runs beneath the Straits of Mackinac. While federal regulations allow for a span of up to 140 feet between underwater support anchors, Enbridge committed to further enhancing the safety of the crossing by placing additional anchors beneath the Straits crossing. Today, the Line 5 Straits crossing has 128 support anchors, none of which are more than 75 feet apart.



The Straits crossing is comprised of two 20-inch parallel pipelines which are secured deep underwater.

Hydrographic surveys, test boring and echo soundings of the area were used to find the safest location for the pipes.

The pipes are heavier-walled (a minimum of 0.812 inches), the thickest in our North America-wide system, and still exceed today's regulatory requirements.

The pipes consist of specially manufactured steel—the same steel used to build the iconic Mackinac Bridge.



Key safety, design and operation features help to ensure Line 5's ongoing integrity.

The pipes are coated from the outside with waterproof enamel, then made even stronger with a fiber wrapping.

The pipes never operate at maximum pressure. Less than 25% of the pipe's capacity is used to ensure safety.

Bechtel Corporation, which built the Hoover Dam, managed the engineering, procurement, and construction of the pipeline.

The line is regularly inspected by divers, Remote Operated Vehicles (ROVs), Autonomous Underwater Vehicles (AUVs), and in-line inspection tools.

Safety is important to everyone—especially the people who live, work, and play along pipeline routes.

We place the highest priority on the safety and reliability of our pipelines, including Line 5, through industry-leading operations, monitoring programs and technology.

### Harnessing technology

As we do with all our pipelines, we work hard to operate, inspect, and maintain Line 5, so we can fix potential issues before they happen. We've invested millions of dollars into the best monitoring and inspection practices. We've also partnered with Michigan Technological University's Great Lakes Research Center to test and enhance a state-of-the-art Autonomous Underwater Vehicle that maps the bottom of the Straits, using sonar technology to ensure the terrain near Line 5 is hazard-free.

Knowing how important the Great Lakes are, we pay special attention to the Straits of Mackinac. While the likelihood of a leak in the Straits is extremely low, we understand that the consequences would be significant. We rely on both human resources and technology to constantly monitor the continued safe operation of Line 5.

### 24/7/365 monitoring

In 2011, Enbridge opened a new, modernized Control Center. The center is specifically designed to enhance the safety and reliability of pipeline operations. How? By using the latest in computer modelling technology and by creating the best conditions to support our operators as they conduct critical around-the-clock operations.

### Passing hydrotests

In June 2017, we completed successful hydrostatic testing on the twin pipes that cross under the Straits.

### Staying prepared

While prevention is key, Enbridge also maintains a significant focus on emergency response and preparedness. In the case of the Line 5 Straits crossing, we've developed a Tactical Response Plan working with the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA). This plan has been tested through a full-scale emergency response exercise.

To learn more about how we work, visit [enbridge.com/line5](http://enbridge.com/line5)

**\$60 million**

invested in company-wide training and incident response equipment since 2012

**315**

company-wide emergency response exercises, drills, and equipment deployment events held in 2018





► In August 2015, Enbridge sponsored the deployment of a monitoring buoy, in partnership with Michigan Tech, that measures water conditions, currents and other weather information to provide real-time data regarding the Straits of Mackinac.

### What else are we doing to stay safe?



Increasing the frequency of our inspections



Reducing the average underwater span lengths to no more than 75 feet



Developing a water current modeling study to examine the effect of currents on the pipelines





We've had a presence in Michigan for nearly as long as Enbridge has been in existence.

Since 1953, Enbridge's employees and contractors have lived and worked in communities throughout Michigan as colleagues, neighbors, and friends.

Our Line 5 pipeline transports petroleum products, such as natural gas liquids (NGLs) and light crude oil, that are refined into fuels vital to everyone who lives and works in Michigan.

We work hard to live up to that "good neighbor" status in a variety of ways—economically, socially, and culturally. As a company, and as individuals who

live and work in communities across Michigan, we want to make our communities safer, healthier, smarter, greener, more enriching, and more inspiring.

Enbridge is committed to enriching the communities near our projects and operations. From investing in the conservation of local trails to donating our retired fleet vehicles to fire departments, search-and-rescue teams, and EMS providers across Michigan, we know that being a good neighbor means being essential to the fabric of a community.

We adhere to a strong set of values—integrity, safety and respect—that reflect what is truly important to us. Enbridge has been part of Michigan life for over 60 years—and with nearly 100 employees and contractors, we hope to be a part of it for many more.



Line 5 has the capacity to transport **540,000 BARRELS PER DAY** of crude oil and natural gas liquids (NGLs) that are refined into the gasoline, diesel fuels, and propane which are vital to all who live and work in Michigan communities.



Line 5 meets increasing demand from Michigan, Ohio, and Ontario refineries for light crude oil

Enbridge has nearly **100 EMPLOYEES AND CONTRACTORS** in Michigan



**LINE 5 ALSO DELIVERS NATURAL GAS LIQUIDS**, including propane, which are used to heat homes, make vehicles and tires for Michigan's renowned auto industry, and produce consumer goods like computers, clothing, and medical equipment

**ENBRIDGE TAXES IN 2018 ACROSS MICHIGAN**

**\$60.4 million**

Property tax

**\$33K**

Sales-and-use taxes



Tax revenue that is used for schools, transportation, community projects, and other services that help sustain our quality of life

**65%**  
homes

65% of homes in the Upper Peninsula get their propane from the NGLs transported on Line 5.

**55%**

Line 5 also meets 55% of statewide propane demand in Michigan, one of the largest propane consumers in the U.S.

**14,000**  
barrels  
each day

Since 1999, Enbridge's Line 5 has transported nearly 80 million barrels of Michigan-produced crude oil. That works out to an average of approximately 14,000 barrels each day.

Here are answers to the most common inquiries about Line 5.

As part of Enbridge's ongoing Line 5 public outreach program, we engage with residents from communities in the Upper and Lower Peninsulas in a variety of ways, such as Open Houses and equipment demonstrations. At these events, residents have raised some great questions and concerns that we wanted to share more widely throughout the state. We're thankful for this feedback, and we hope this information is helpful to others in Michigan who value the Great Lakes and want to know that Enbridge is operating Line 5 safely.

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### *What does Enbridge do to ensure the safety of Line 5?*

A dedicated team monitors the line constantly. Enbridge also conducts internal inspections via an MRI-like tool known as a "pig" that travels the line recording data on the pipe's thickness and looking for cracks, dents or signs of corrosion. We keep an eye on the outside of the pipeline with the help of divers and, in partnership with Michigan Tech, use an Autonomous Underwater Vehicle to visually inspect the line. We perform these inspections twice as often as federal pipeline regulations require.

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### *Is Line 5 deteriorating?*

Line 5 was built for the underwater environment, with nearly one-inch-thick steel walls and fiber-reinforced enamel coating. It was built by Merritt-Chapman & Scott, the same company that built the Mackinac Bridge, using the same kind of steel. Like the bridge, the intention has always been to operate and maintain it carefully to maximize its lifespan. Recent inspection reports show that Line 5, from an engineering and integrity perspective, is like new and in excellent condition.

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### *How can you convince me that you care about Michigan?*

Safety is one of our core values. The people who live near our pipelines expect us to operate safely, and the protection of the public and the environment is our highest priority. More than 100 Michigan residents are employed or contracted with Enbridge, and they all play an important role in maintaining the safety and reliability of our pipelines and facilities.

***Enbridge is the same company that caused a giant spill in Marshall. Why would this be any different?***

We regret the spill in the summer of 2010 that caused oil to flow into the Kalamazoo River. Those were the darkest days in our company's history and we will never forget the lessons of Marshall. Since then, Enbridge has transformed its approach to safety, investing heavily in enhanced monitoring, safer pipelines, and more staff to keep operations safe.

***How do you know the Line 5 Straits crossing is safe?***

In addition to our regular high-tech tool inspections, we successfully completed hydrostatic testing of the twin pipes that cross under the Straits in June 2017.

The 4.5-mile segments travelling under the Straits were emptied, filled with water and pressure tested to 1,200 pounds per square inch (PSI).

This very significant test of Line 5 confirmed, once again, that the line is in excellent health and fit for service.

***Does Line 5 transport heavy crude oil?***

Line 5 carries light crude oil and natural gas liquids, including propane, which power manufacturing, heat homes, and fuel our cars. It does not carry, and has never carried, heavy oil.

***Line 5 transports products that benefits other states or countries. Does it benefit Michigan?***

Line 5 meets 65 % of propane demand in the Upper Peninsula, and 55 % of statewide propane demand. It also transports as much as 14,000 barrels per day of crude oil produced in Michigan. A significant amount of crude carried by Line 5 stays in the region, where it's refined into the gas, diesel, and other products that fuel everyone's quality of life. Enbridge paid more than \$60 million in property and sales-and-use taxes in Michigan in 2018.

***Some have called for Enbridge to permanently remove Line 5. Why hasn't it been done?***

A lot of people and businesses depend on the light crude oil and natural gas liquids delivered by Line 5. Without it, the state's access to affordable, secure energy would be compromised.

***What would happen if there were a leak or spill?***

If there is a change in pressure or flow, Enbridge can remotely shut off flow in three minutes and activate trained responders. A response plan, which reflects input from the U.S. Coast Guard and Environmental Protection Agency, is in place, and local emergency responders are trained on it and prepared to respond if an incident were to happen.

For more information on Line 5, go to **[enbridge.com/line5](http://enbridge.com/line5)** We hope that these important questions and answers will be the beginning of a larger dialogue throughout the state.

Enbridge helps to provide a secure, sustainable and reliable supply of energy to Michigan, and across the U.S. and Canada.

Millions of North Americans count on the energy we deliver daily. Providing safe and reliable infrastructure is the very foundation of our business. That's why our top priority is the protection of people and the environment. Our strategic investments in infrastructure upgrades help ensure the reliability and safety standards that all communities expect.

Enbridge transports, distributes and generates energy. We play a central role in providing heat and light for homes, offices and factories; fuel for vehicles and airplanes; and many other essential products and services that support prosperity and quality of life for millions of people.

## **Energy transportation**

Enbridge operates the world's longest crude oil and liquids transportation system. We safely deliver more than 3 million barrels of crude oil and liquids a day—or 25% of the crude produced in North America. We're also a North American leader in natural gas gathering, transportation, processing and storage, moving about 20% of the natural gas consumed in the U.S.

## **Energy distribution**

Through our affiliates Union Gas and Enbridge Gas Distribution, we have about 3.7 million retail customers.

## **Energy generation**

We've committed more than \$6 billion in renewable energy and power transmission projects. These projects, including wind, solar, geothermal and waste heat recovery, have the capacity to generate nearly 1,750 megawatts (MW) net of zero-emission energy, based on projects in operation or under construction. That's enough to meet the electricity needs of nearly 700,000 homes, based on net generation figures.

We believe that working towards lower-impact energy solutions is in everyone's best interest. Our portfolio of renewable energy projects is diversified and growing.

## **A North American company**

Enbridge has a workforce of 13,600 people, primarily in the U.S. and Canada. Enbridge was named to the Thomson Reuters Top 100 Global Energy Leaders in 2018, and we were selected to Bloomberg's 2019 Gender Equality Index.

## **Enbridge in Michigan**

We've had a presence in Michigan for almost as long as Enbridge has been in existence, with our roots in the Great Lakes State stretching back to 1953. Today, Enbridge's six wholly owned or operated pipelines that travel through Michigan—Line 5, Line 6B, Line 17, Line 79, NEXUS, and Vector Pipeline—carry oil, natural gas, and NGLs (including propane), and provide significant economic benefits to the state. Enbridge paid more than \$60 million in property and sales-and-use taxes in Michigan in 2018.





**1** Enbridge Inc. and Enbridge Income Fund Holdings Inc. Headquarters, Calgary, Alberta, Canada

**2** Enbridge Energy Partners, L.P. and Midcoast Energy Partners, L.P. Headquarters, Houston, Texas, USA

**3** Enbridge Gas Distribution Headquarters Toronto, Ontario, Canada

- Liquids Pipeline
- - - Liquids Pipeline (proposed)
- Natural Gas Transmission Pipeline
- Natural Gas Gathering Pipeline
- Natural Gas Liquids Pipeline
- Crude Storage or Terminal
- Gas Storage Facility
- NGL Storage Facility
- △ Gas Processing Plant
- Gas Distribution Service Territory
- Affiliated Gas Distribution Territory

- ▼ LNG Facility
- ⊞ Rail
- Propane Terminal
- Power Transmission
- ⚡ Renewable Energy

## We want to hear from you

We want to address any concerns that you may have. You can get in touch with us at any time.

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Here's how:

Call us, toll free:  
**1-855-869-8209**

Email us:  
**[line5info@enbridge.com](mailto:line5info@enbridge.com)**

