SPECIAL ADVERTISING SUPPLEMENT

A MIGHTY WIND

Rapid change follows rapid growth in the wind power industry. Here's how logistics providers are working to go any way the wind blows.

As the picturesque windmills of Dutch fame grow increasingly rare, the sleek, modern wind turbines used for electric power generation have experienced explosive growth. Wind turbines, which can top 400 feet in height, are cropping up in rural wind farms in large numbers, and even dot the landscape as an occasional lone, urban power source.

About seven years ago, The Port of Houston Authority provided the first direct handling of the hubs, blades, nacelles, and towers that make up the wind turbine, loading them directly onto railcars and shipping as a unit train. Since then, the port has handled hundreds of wind power units moving from Houston to Sacramento, Iowa, Illinois, and other U.S. destinations.

Lars Buchwardt's experience with wind turbines dates back considerably earlier than that. The regional director for logistics service provider IJS Global recalls fitting an entire wind turbine, blades and all, into a 40-foot ocean container. That's a far cry from the massive size of today's single wind turbine.

There has been a drop in the volume of wind turbines moving through the Port of Houston, in part because of the economic downturn. But the commercial and economic reasons for the shift run deeper.

As recently as 2008, wind power was experiencing dramatic growth, according to Pat O'Malley, co-COO of Landstar System, a Jacksonville, Fla.-based third-party logistics provider. Alternative energy tax credits were set to expire at the end of the year, focusing some of the demand.

But credit markets were extremely liberal, and the combination of available capital and incentives was driving new construction. Government initiatives intended to aid U.S. economic recovery, while improving air quality, led a number of organizations to concentrate resources on wind power.

The Georgia Ports Authority, for instance, has identified wind energy equipment as a target commodity for its breakbulk teams. IJS Global has targeted wind power as a strategic market that offers growth and sustainability.

IS WIND DYING DOWN?

Predictions earlier in the year had been for a drastic reduction in wind power development. Concerns grew that, as an energy source, wind had died down. However, the U.S. wind energy market (installed capacity) actually grew by nearly 40 percent in 2009 and now powers approximately 8.4 million homes, making wind one of the leading sources of newly installed electricity-generating capacity, according to the DHL Global Forwarding Renewable Energy Team.

"Nearly all renewable energy generation techniques are more expensive at face value than traditional and nuclear sources," says DHL. "The only way investments in wind power are currently feasible is through government subsidies."

Whenever a government decides to offer feed-in-tariffs (FITs) – a guaranteed minimum price over a certain amount of time for selling electricity back to the grid – it becomes an interesting deal for developers and the demand for turbines ramps up. Among the focus countries for 2010-2012 are the United States, Germany, Italy, Turkey, the United Kingdom (mainly off-shore), China, India, and parts of Latin America.

For many years, Europe was the main producer and consumer of wind turbines. But this is changing. The United States, China, and India have all become key manufacturing markets for wind turbine components that satisfy domestic demand and are shipped globally.

Current wind turbines average 1.7 megawatts (MW), but vary widely, with larger units in the West, and somewhat smaller units in the East. Their average height is 262 feet and weight is approximately 200 tons (not including foundation).

And the major parts, including towers, are getting bigger. Wind turbines used to be 1.5 MW units and towers came in three sections. Now, they are 2.5 MW and come in four sections, along with bigger and more complex components. This helps account for some of the distortion in growth figures. The power industry measures growth in output, while those who look at the units shipped would see at least some leveling as fewer, but larger, units are needed to produce the same amount of energy.

A typical wind farm will source an array of components–ranging from gearboxes, bearings, and generators to 131-foot rotor-blades–from 30 or more locations. For shipments of that size and complexity, sequencing becomes an important function.

The "knowledge-heavy" components, such as rotor-blades, are being moved to low-cost countries, says DHL. The components requiring less know-how, such as towers, are being produced closer to the anticipated installation site. A major driver is that these low-tech, bulky, and heavy components account for nearly 50 percent of the transportation cost.

John Fricker, general manager of RoRo/Special Projects Europe for Atlantic Container Line (ACL), suggests even the rotor blades are being sourced closer to destination, while the technology-rich mechanical components are produced at the manufacturer's plant. ACL has moved the

Wind turbine blades used to move on ocean vessels primarily to Europe. Today, China, India, and the United States are key markets for these components.

tower sections and blades, and more recently, has moved some of the blade molds to U.S. plants, where they could be produced closer to the point of consumption.

Landstar's O'Malley points to the area of the United States nicknamed the Wind Corridor, which stretches from Texas to the Midwest. Here, sustained winds are sufficient to produce power using wind turbines. Manufacturers have followed the demand and located plants closer to the regions where the wind farms are being erected.

A lot more logistics know-how is required for the long-haul shipment of "high-tech" components, says the DHL team. At least that's the medium-term strategy. But for the long term, major manufacturers plan to produce regionally for regional consumption and minimize transportation, which accounts for up to 20 percent of total landed cost, according to DHL estimates.

In addition to being highly engineered and sensitive, wind turbine blades are matched and balanced, and must be delivered to the job site in sets.

While he still sees stacks of tower sections and wind turbine blades at breakbulk ports, Scott Mager, operations manager for BNSF Logistics, says U.S. manufacturing is, in fact, increasing. And, he adds, many manufacturers of the turbines themselves have begun fabrication or plan to fabricate components in the United States.

Whether the forecast is for a flat beginning in 2010 with an uptick by the fourth quarter, or steady growth, the demand for wind power generation equipment appears to be on the rise.

Whether or not the increase is driven by a pure desire to clean the air that drives the wind turbines, or a combination of environmental conservation and commercial growth, there's no doubt that predicting a bright future for wind power is a breeze.

PROJECT FREIGHT, DELIVERED JUST IN TIME

From factory floor to wind farm is a just-in-time move for Atlantic Container Line.

European manufacturers of wind turbine components are so particular about how their freight is handled that they'll send engineers from the factory to oversee and inspect loads to ensure they are properly stowed, says John Fricker, general manager of RoRo/Special Projects, Europe, for Atlantic Container Line (ACL), headquartered in Westfield, N.J.

The components are heavy and bulky, but also sensitive. Fricker offers a recent shipment as an example: Units destined for a U.S. wind farm measured 9.62 meters long by 3.7 meters wide by 4 meters high (31.6 by 12 by 13 feet). The full order was for 20 nacelles (the part between a wind turbine's tower and rotor), 20 hubs, and 20 spinners. The nacelles weigh 75 tons and the hubs 24 tons.

A project charter vessel could have handled the entire shipment for the manufacturers (as could ACL, Fricker notes), but that would involve staging the components at or near the origin port while the major components for the full order are built and assembled for shipment. In the case of Fricker's example, that's 60 major components.

At destination, the process would be reversed, with the entire load being lifted off the vessel and moved into storage while partial shipments are sequenced and transported inland to the wind farm construction site.

ACL proposed taking a different approach. With weekly sailings from Hamburg to the U.S. East Coast, ACL suggested using RoRo (roll-on, roll-off) methods and moving smaller shipments from the factory to the installation site without the interim accumulation and storage–a just-in-time approach. Employing this method, components flow from the factory to the destination port, where a logistics company arranges the final inland move to a storage or staging site, or directly to the wind farm.

At the origin port, the massive components are loaded onto mafi trailers (roll trailers used in RoRo applications) and positioned according to the manufacturer's specifications. Some components need to be angled on the trailer and welded into place. The mafi trailers then roll aboard the vessel and are lashed or welded in place for the journey across the Atlantic.

With the nacelles comes an added requirement: the mechanism must be rotated regularly during transit. The vessels have power stations, so the necessary connections can be made and factory engineers can inspect and approve the load before it embarks for one of the U.S. East Coast ports.

At destination, the mafi trailers are rolled off, and the loads are transferred to specialized trailers or rail cars for the inland portion of the move.

Fricker sees a strong future for the wind power business, based on interest that is fueled, at least in part, by U.S. government incentives. Manufacturers have located some blade and tower production in the destination markets, but they tend to hold the more highly engineered components for their own plants. This suggests that wherever demand develops, the heavy components for wind power generation will continue to be a long-haul logistics issue.

Tower sections and blades for wind turbines are often imported, but their size and complexity has more manufacturers setting up production in destination countries.

To that end, Fricker and ACL's RoRo/Special Projects group is already lining up moves between Europe and Canada, landing in Halifax with a similar just-in-time solution.

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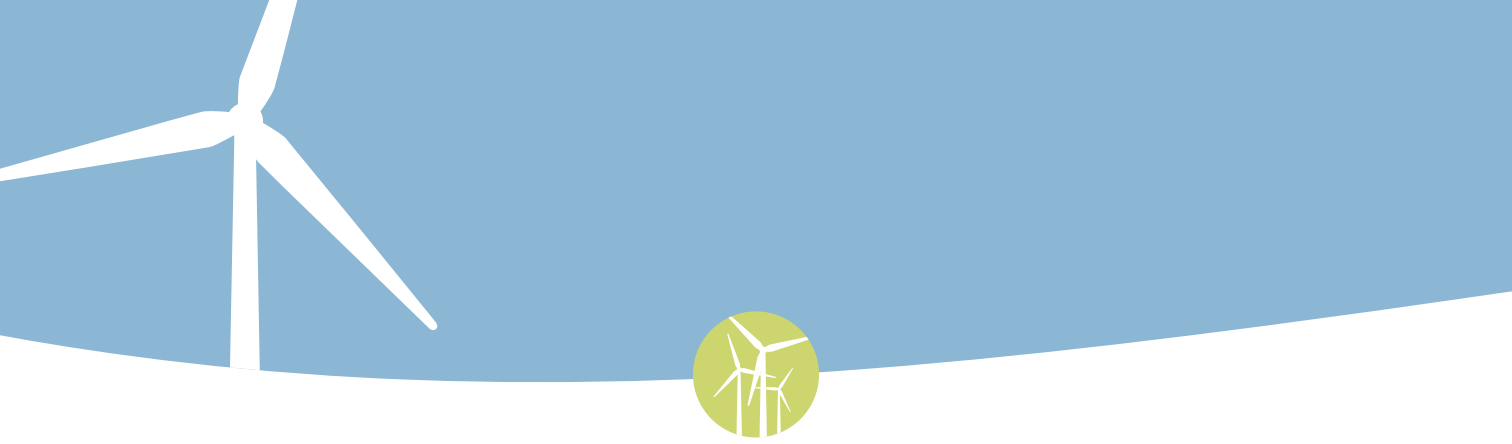

POOLING KNOWLEDGE

No two wind projects are ever the same. Pooling knowledge from global sources pays in specialized moves.

The rapid growth of wind power presents both an opportunity and a challenge. While the segment is growing, it is also changing. One example: sourcing, in some cases, is becoming more regional, notes Gille de Groot, global sales development director for freight management company Geodis Wilson.

Most wind energy technology still comes from Europe, in part because of the region's history of alternative energy development and use. But, some European companies are establishing production in their strong foreign markets, including the United States and China.

Wind power growth in the United States and China is not limited by technology or manufacturing capability. Wind energy manufacturers such as GE Energy already operate in the United States, and China is rapidly developing its own alternative energy industry. China has seen production grow from six wind energy manufacturers in 2004 to 70 today.

This rapid growth in the wind power segment compelled Geodis Wilson to form a wind power group as part of its larger Industrial Projects division. The group draws from the knowledge base of other logistics professionals in its global network who have experience in various types of industrial project cargo moves.

> **"Because no two wind logistics projects are the same, we draw on lessons, experience, and knowledge from across our network to keep up with new challenges."**
>
> —**Henrik Funk,** Geodis Wilson

"Best practices today don't last long," says Henrik Funk, manager industrial projects Denmark for Geodis Wilson. "Because no two wind logistics projects are the same, we draw on lessons, experience, and knowledge from across our network to keep up with new challenges."

One such logistics challenge is dealing with a constantly changing product. While many industries measure growth by the number of units being moved, the wind industry measures growth in output. The generating capacity of wind turbines has risen from 1.5 megawatts to three megawatts in recent years.

But, while the size and complexity of wind power equipment has changed, the supply chain demands have not. Driving last-mile performance are issues such as the rising expense of large cranes used to handle and erect wind turbines, and the speed of construction at the job site. In most cases, Geodis Wilson clients want to erect the wind turbine the same day it arrives. With U.S. wind farms receiving between 20 and 300 turbines during the course of construction, that spells a lot of synchronized, sequenced loads.

The role Geodis Wilson plays in wind logistics projects varies widely by installation. In some cases, the company may only handle traditional logistics functions, such as arranging transportation and ensuring available capacity. In more complex contracts, Geodis Wilson could be responsible for everything from delivering shipments to the site to commissioning the wind turbine.

Wind equipment manufacturers appear to be focusing on determining demand for their product and meeting it in a timely manner, according to Funk. Manufacturing blades and tower components locally doesn't lift the pressure on delivering all the components to the job site in a tight time frame.

In addition, "the companies handling the transportation equipment have been forced to be more mobile with their resources," says Funk. Their challenge is to bring wind power equipment as close as possible to the job site, without using special trailers if possible. And all modes come into play during planning.

"We attack a wind logistics project from all angles and base a solution on the manufacturer's or customer's footprint," says Funk. "We turn over every stone looking for hidden factors that could affect the project."

Wind logistics experience is an added advantage, according to de Groot. The Geodis Wilson team working on these projects brings knowledge from other heavy and oversize industrial moves. And, the flexibility of having a global network allows Geodis Wilson to be wherever the customer needs it to be.

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KEEPING UP WITH CHANGE

Knowledge, skill, and capital commitments are important to serve the logistics needs of the wind power market.

"2008 was an explosive year for wind power growth," says Pat O'Malley, co-COO of Landstar System, Inc., Jacksonville, Fla. That's good news for a company that specializes in oversize and heavy cargo moves. But the last few years have brought changes to this specialized segment.

The wind power industry measures growth by power output. If you analyze the trend by units shipped, it would be easy to mistake changes in those numbers as a leveling or decline in demand. In fact, the units are growing larger in both output and physical size.

For example, just a short time ago, Landstar was moving 1.5-megawatt (MW) units in three sections. Recently, it has been handling 2.5-MW units in four sections.

"Wind power components are growing bigger and more complex," says O'Malley, and that requires a corresponding upgrade in the carrier's ability to handle the loads.

It also requires an upgrade in resources. Carriers taking on wind power logistics projects have to invest capital in specialized trailers and equipment.

Careful handling, detailed planning, and specialized loading and hauling equipment are needed to move oversize and overweight wind power components from port to site or plant to site. ***(Photo courtesy of Landstar System)***

Heavy haul has always been part of Landstar's business. So, when the wind power sector started to take off, Landstar acquired the modified equipment necessary to transport wind power components.

Landstar's structure as an asset-light logistics provider didn't stop it from investing in some trailers. It acquired four Schnabel trailers at about $500,000 each, and its network of Business Capacity Owners (BCOs) invested in 24 trailers. One agent, who handles much of the wind power business, is frequently called in by engineers at various manufacturers to consult on the transport and logistics implications of making design changes to wind power components.

The BCOs bring their own experience to bear on wind power moves, and Landstar enhances that knowledge with additional training. Landstar provides long-commercial-vehicle training, as well as specialized training in Schnabel trailer operations.

"But just owning a piece of specialized equipment like a Schnabel trailer doesn't necessarily mean it can automatically move within the Landstar system," O'Malley notes. For instance, if Landstar hasn't trained and certified a BCO on a piece of equipment, it wouldn't be qualified to move.

The BCOs concentrate on the domestic portion of specialized wind power shipments, handling port-to-site or plant-to-site moves. When they first started handling these shipments, a high percentage of moves were from ports. Now, thanks to the growth of U.S. wind power equipment manufacturing and overseas manufacturers siting production in the United States, more moves come from domestic U.S. plants. That's another reason wind power growth numbers might be misleading.

Manufacturers are focusing on the last-mile portion of these moves because of their size and scope. Not only do oversize components have to arrive at the site as planned, careful coordination is required to ensure the crane needed to manipulate the components is on site, as well as the engineers and technicians who will be involved in the installation. It's a case of synchronized logistics, and that can entail some off-site staging.

In O'Malley's opinion, Landstar is positioned to meet the requirements of wind power's next evolution. "Reputation and a solid financial background put Landstar in a position to address any new challenges," he concludes.

CLOSE COMMUNICATION KEY TO SUCCESS

Large, complex project cargo moves succeed through constant communication.

Every port has its perceived strengths, but geography is one you can't argue with. As the westernmost port on the U.S. eastern seaboard, location plays a key role for the Port of Savannah when it comes to wind energy project cargo.

The complexity of the overland move drives manufacturers to land their project cargo close to the destination site to minimize highway or rail miles. With new wind energy projects developing in the Midwest, the Port of Savannah finds itself benefiting from geography.

"If you follow the longitude lines due north from Savannah, you will find yourself on a line that runs between Cleveland and Akron, Ohio," notes Bill Barrs, cargo sales and trade development for the Georgia Ports Authority (GPA).

On an operational level, the Port of Savannah's dedicated breakbulk facility, Ocean Terminal, is located in close proximity to interstate highways. It also has good clearance to move large project cargo. Savannah has enjoyed considerable success moving long wind turbine blades between the port and the highway. The Port of Savannah also provides on-dock rail capabilities with Norfolk Southern and CSX.

Project cargo tends to move to those load center ports offering access and lift capacity, says Barrs. Recognizing the huge potential for alternative energy projects, the Georgia Ports Authority has built strong breakbulk teams to work closely together on wind energy projects. With most of the moves leaving the port by truck, these teams of specialists assist port customers during the entire process, including pre-delivery planning and post-shipment follow-up.

With the fall 2009 announcement by heavy-lift dependent Mitsubishi Power Systems to construct a large-scale steam and gas turbine plant within minutes of Savannah's two deepwater terminals, the GPA's breakbulk team received

The Georgia Ports Authority employs a dedicated breakbulk team well-versed in handling the special requirements of moving wind power components.

more good news with the announcement of extra lift capacity.

"The addition of a new mobile crane to supplement existing heavy-lift capabilities will further enhance our ability to capture a larger portion of the heavy-lift market, which includes wind power equipment," says Tom Swinson, general manager commercial communications, GPA.

Swinson is quick to point out that the port already has on-site lift capacity and, when needed, can bring in outside crane capacity. A delivery date for Savannah's new mobile crane has not been announced.

A wind energy movement in mid-2009 led the GPA's breakbulk teams to identify challenges of escort requirements for oversize shipments. The close relationship the Georgia Ports Authority has with the Georgia Department of Transportation helped them receive a clarification on some rules that will allow the use of private escort services rather than police escorts, adds Barrs.

The change in escort requirements should improve not only cost, but efficiency on highway moves of the wind power components. With most of these loads moving into the Midwest by truck, police escorts were tied up driving across the entire state of Georgia. In addition to the large turbine components, each wind turbine includes three blades. Multiple turbines moving in convoy could require a number of police units for escort, adds Barrs.

The GPA's team approach is central to project cargo operations. Many projects involve bringing a variety of components from different origin ports to the load center port in the United States, then to the construction site.

Wind energy equipment is not only large, it is very delicate, adds Barrs, and planning and handling the loads requires a high level of expertise. The breakbulk team can help secure permits, including the Superload-plus Permits that require route surveys, bridge analysis, and alternative transport modes.

In the end, says Barrs, it's communication that keeps these large, complex loads on track.

EXPERIENCE COUNTS

Involvement from beginning to end, and knowledge of project cargo complexities, keep things moving.

The growth of wind energy may be a recent development, but the field isn't new to Lars Buchwardt, regional director of IJS Global, a Stamford, Conn.-based global logistics service provider.

When Buchwardt started his logistics career, one of his first jobs was loading components for a wind turbine manufacturer and driving them to the airport for shipment. Back then, he could load an entire wind turbine, including the blades, in a 40-foot ocean container.

But, a logistics challenge arose as the industry evolved and new blades were produced that were too long to fit into a 40-foot container. The solution was to load the blades and leave the container doors open. Those containers were then loaded on the back of an ocean vessel with the blades extending over the water, Buchwardt recalls.

Solving wind logistics challenges is no longer as easy as opening a container door. Today's complex shipments require the expertise of a project group, such as IJS Global's team of professionals with experience in project cargo.

The days of containerization are well behind the wind

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power industry, so it is important to move shipments through ports that specialize in project cargo, Buchwardt notes. Wind shipments are growing larger and typically fill or share a charter vessel. Those vessels tend to call at ports where project cargo is a large part of the mix.

It is important for a third-party company such as IJS Global to become involved from the onset of a wind power project. In addition to handling site surveys, route surveys, and landside planning, a professional third party can manage details specific to each job. Some job sites, for example, have specific requirements – such as completing two wind turbine installations per day, or limiting the number of trucks they can handle daily. These details can impact the entire flow of the project cargo.

IJS Global tries to take a holistic approach to its wind energy moves, from inception to delivery. That means getting involved with clients from the time they are preparing their proposal, to ensuring the logistics flows are realistic and achievable.

For example, with flows to some job sites constrained by the capacity to store and install equipment, a large part of a shipment may need to move to a marshaling yard, preferably one with Foreign Trade Zone status for import cargo. Then the "pull" from the site can be managed in a timely manner in case of weather delays or an increase in the pace of work. Companies that set up a project plan at the beginning of a job, and try to stick to it without accounting for variation, risk delays and additional costs.

Things also tend to go wrong when parts of a project are handed off to another entity, says Buchwardt. That's one reason why IJS Global added specialized compliance expertise to its service portfolio. As part of the end-to-end approach Buchwardt prefers, IJS Global brings in customs brokers who are dedicated to the classification of project cargo and wind components. This helps importers classify and process loads through U.S. Customs and Border Protection, and manage customs audits as needed. And increasingly, the IJS Global group is working closely with Homeland Security.

To be successful in the complex and ever-changing wind power logistics industry, the experience of specialized logistics professionals can make all the difference. "There is a passion we have for this sector of our business," says Buchwardt. "Involvement in each step of the process is not only professionally gratifying, but also a strong contribution to our planet's environment."

GREEN MOVE FOR GREEN ENERGY

Environmental considerations take priority in all CN shipments.

While it is true that sustainable energy is a target market for CN, the Montreal, Canada-based railroad also has a strong policy of environmental stewardship. Its aim is to integrate environmental priorities into each of its operating units, according to the carrier's corporate statement.

One environmental initiative is called Precision Railroading. It focuses on ensuring the scheduling of every support process prior to a move, the actual move, and the on-time delivery of every shipment. That type of commitment fits well with CN Specialized Services (CNSS), the group responsible for over-dimensional moves. And when it comes to moving wind turbine components, CNSS coordinates from port to wind farm with a host of custom services.

As generating capacity has increased, the size of components has changed dramatically. Certain components now exceed railroad clearances.

Since 2005, CN has shipped more than 2,100 carloads of wind tower components including tower sections, blades, nacelles, and hubs. It also participated in the first rail move of twin-pack wind turbine blades.

The blades, which measure 135 feet (41 meters) long, were transported aboard three vessels from the Port of Emden, Germany, through the St. Lawrence Seaway and across the Great Lakes to the Port of Thunder Bay, Ontario. CNSS, which coordinated the unloading and transfer to rail, also arranged for modifications that would allow the rail cars to accept the container locks on the special frames used to nest two blades "tip to root," explains CN's Doug Coleman. Six trains were needed to complete the move to Dawson Creek,

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where CNSS provided unloading services.

With these types of loads, there is almost always a truck move at one or both ends, but for the long-haul component, CN is the only North American railroad that serves all three coasts–Atlantic, Pacific, and the Gulf of Mexico, notes Coleman. And that means CN has been involved in wind power component moves entirely within Canada, from Canada to the United States, from the United States to Canada, and intra-U.S.

As the generating capacity of the wind turbines has increased, the size of the components has changed dramatically as well, Coleman notes. Some base sections for the towers can measure as wide as 15 feet in diameter. And while certain components now exceed railroad clearances, some manufacturers keep transportation in mind when designing components. For example, Denmark's Vestas Wind Systems, a manufacturer, seller, installer, and servicer of wind turbines, operates its own fleet of specialized rail cars.

As wind energy continues to grow in North America, more of the manufacturing has been moving to the United States and Canada. Some incentive is the complex logistics involved in wind power moves, but there are also provincial moves in Canada to require a percentage of local content. Provincial governments are helping manufacturers locate production in Canada, and the United States also is experiencing production growth.

CN remains confident rail will play a significant role in wind power development, pointing out that rail itself is a very green mode: Rail emits six times less greenhouse gases than heavy trucks. CN can move one tonne of freight 197 kilometers on just one liter of fuel.

In addition, CN's new main-line locomotives produce approximately 40 percent less nitrogen oxides than older locomotives and consume up to 20 percent less fuel.

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