

LNG AND THE PANAMA CANAL:

Should Another Expansion Already
be on the Drawing Board?



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35

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Introduction

For at least the past 500 years, the need to improve the efficiency of international trade has prompted businesses and governments to challenge the status quo in order to converge and align their interests. Their determination to make trade more efficient has enabled both to accomplish great things. The expansion of the Panama Canal is one example of how such determination can make monumental infrastructure projects come together.

In 1513, the Spanish explorer Vasco Núñez de Balboa discovered that only a narrow piece of land, or isthmus, separated the Atlantic and Pacific oceans. Based on that discovery, in 1534 King Carlos V ordered the Panama regional governor to develop plans to build a canal from the Atlantic to the Pacific, following the channel of the Chagres River. Upon reviewing the plans, however, the governor determined that the proposed task was not possible.¹

Three hundred years later, interest in building the canal resurfaced. In 1869, U.S. president Ulysses S. Grant ordered U.S. engineers to develop topographic plans in three different areas of Central America in order to choose the best location to build the canal. Of the three areas—Tehuantepec, México; Darién; Nicaragua; and along an existing train route in Panama—the U.S. studies concluded that the best location for a future canal would be Nicaragua. European financiers took a different approach: on January 1, 1881, the French company Société Civile Internationale du Canal Interocéanique de Darien (International Civil Society for the Darien Interoceanic Canal), under the direction of Ferdinand de Lesseps (who had been responsible for the construction of the Suez Canal), started to construct a canal through Panama with the assistance of the Compañía Universal del Canal de Panamá (Universal Panama Canal Company). By the end of the decade, however, technical and financial problems had bankrupted the company and brought the construction to a halt.

In 1903, the U.S. government acquired the former French company's development rights and took over its construction work. In 1905, technical problems with the original plan led to the construction being suspended while the plans were redesigned to include the present system of locks for ease of freight transit. In 1907, the U.S. military resumed construction, and by August 15, 1914, the Panama Canal was officially open for business. The first boat to cross it was named SS *Ancon*, after the location of the Pacific Ocean terminus of the canal.² For more than 80 years, the U.S. military administrated the Panama Canal, until it was transferred back to Panama in December 1999.

The original canal had two sets of locks. In June 2016, a third set of locks was launched. Built for a cost of over \$5.6 billion, these new locks were designed to provide access to NeoPanamax ships, which were triple the size of the ships that had been using the original sets of locks that dated back to 1914.³ Only two years after the inauguration of the expanded canal, the results have far exceeded expectations. The third set of locks has brought several benefits to Panama. The Panamanian treasury increased its earnings from \$1 billion to \$1.6 billion, with the accounted indirect financial benefits increasing to \$5.5 billion.⁴ Beginning in 2019, the loan payments will start with

¹ "Los primeros planes para el Canal" [The first plans for the Canal], Canal de Panamá, 2018, <https://micanaldepanama.com/nosotros/historia-del-canal/los-primeros-planes-para-un-canal/>.

² "Canal de Panamá: Una larga Historia" [Panama Canal: A long history], BBC Mundo, n.d. www.bbc.co.uk/spanish/extra9912panamahistoria.shtml.

³ "Canal Panamá logra récord de 442,1 millones toneladas transitadas por esa vía" [Panama Canal achieves a record 442.1 million tons transited through this route], *El Nuevo Diario*, October 11, 2018,

<https://www.elnuevodiario.com.ni/internacionales/centroamerica/476833-panama-canal-record-toneladas-transitadas/>.
⁴ *Ibid.*

\$230 million per year for 20 years. Moreover, in the nearly two decades since the canal was transferred back to Panama, the country's treasury has received more than \$11.6 billion.⁵

By the end of the 2018 fiscal year (end-September), the Panama Canal set a new record for transit, with around 442.1 million tons (CP/SUAB) crossing through its waters—a 9.5 percent increase over the previous year. Container ships was the segment with the greatest amount of cargo, reaching 159 million tons, of which 112.6 million tons crossed through the third set of locks. Liquid petroleum gas (LPG) and liquefied natural gas (LNG) ships accounted for 130.3 million tons, and airplane carriers accounted for 49.5 million tons.⁶ The size of the ships increased from 5,000 to 14,000 containers. The countries with the highest levels of usage were China, Chile, the United States, Japan and Mexico. The main routes were East United States to Asia and to West South America, Europe to West South America, East United States to West Central America, and from coast to coast in South America. Almost 6 percent of the world's total trade crosses through the canal, connecting more than 140 maritime routes and 1,700 ports in 160 countries.⁷

On October 1, 2018, a new milestone was reached with the crossing of four LNG ships in the same day. A total of 347,000 cubic meters (m³) crossed the canal in the northbound direction and 329,300 m³ crossed the canal southbound. With the modifications to the operations of the canal from that date, the Panama Canal has become prepared to cope with the increasing demand of LNG ships coming from the United States.⁸ According to Jorge Luis Quijano, the general administrator of the Panama Canal Authority, almost 50 percent of LNG exports from the United States are shipped to Asia and cross the Panama Canal, with more LNG ship transit expected in the coming years. This is a new business for the Panama Canal. Ninety-three percent of the LNG ships that transit the canal are from the United States, and by 2020 it is expected that 30 million tons of LNG will transit the canal.⁹

The main users of the canal are the United States and China, accounting for 68 percent and 18 percent of the canal's use, respectively. The canal's expected revenue for 2019 will reach \$3.2 billion, which will generate \$1.73 billion for the Panamanian government. Also, if international trade continues to grow and the demand for the canal increases as well, by 2025 a fourth set of locks will be needed to support the volume of traffic. A team of experts is already carrying out the technical analysis and demand forecasts to plan for the next expansion of the canal.¹⁰

SECTION I: Current LNG Usage of the Panama Canal

Currently, the Panama Canal has two different types of locks: the old Panamax type and the newer NeoPanamax type. Because only 7 percent of the LNG fleet can fit through the smaller Panamax locks, compared to the 90 percent of the LNG fleet that can go through the NeoPanamax locks, the latter are far more useful for LNG trade. Although NeoPanamax slots are much more important for LNG vessels than Panamax slots are, the process for

⁵ "Panamá proyecta nueva ampliación del Canal para 2025" [Panama plans a new canal expansion by 2025], *El Nuevo Diario*, June 15, 2017,

<https://www.elnuevodiario.com.ni/internacionales/431014-panama-proyecta-nueva-ampliacion-canal-2025/>.

⁶ "Canal Panamá logra récord de 442,1 millones toneladas transitadas por esa vía." The tonnage is given in CP/SUAB (Sistema Universal de Arqueo de Buques del Canal de Panamá), the official measurement unit of Panama Canal transit.

⁷ *Ibid.*

⁸ "Canal de Panamá alcanza récord en el tránsito de buques de GNL" [Panama Canal achieves record for the transit of LNG ships], *GNLGlobal*, October 3, 2018, www.gnlglobal.com/mercados/america-latina/canal-de-panama-alcanza-record-en-el-transito-de-buques-de-gnl/.

⁹ "Casi la mitad de gas natural de EEUU pasa por Panamá, el nuevo negocio del Canal" [Almost half of US natural gas goes through Panama, the new Canal business], *El Nuevo Diario*, September 18, 2018,

<https://www.elnuevodiario.com.ni/economia/474975-gas-natural-eeuu-pasa-canal-panama/>.

¹⁰ *Ibid.*

obtaining the former is based on the same regulations as the latter, with only some exemptions that will be explained shortly.

Every issue concerning navigation, marine traffic control, and pilotage through the Panama Canal is stipulated in Agreement No. 13 of the Board of Directors of the Panama Canal Authority (1999), the Regulation on Navigation in Panama Canal Waters (hereafter Regulation). Although some further agreements have changed specific articles, the main rules concerning the booking of slots and the transit of the Panama Canal are largely unchanged. This section will describe the process for obtaining slots to transit the canal, based on the regulations for all existing locks.

In section 3 of the Regulation, titled “Scheduling, booking, order and preference in transit,” the canal’s board of directors establish the rules for obtaining slots and scheduling transit through the canal. They determine the daily transit schedule, which includes a transit reservation system, with a number of slots determined previously by the Authority, dependent on the safe, efficient operation of the canal.¹¹ As article 16 specifies, “transit reservations must be made with the previously established time in advance for each booking period and shall be charged the prescribed booking fee.”¹² The reservation process consists of four booking periods, each with a specific number of slots available, as shown in table 1:

Table 1. Transit slot allocations by vessel type and booking period

Vessel	Passenger Vessels (547–366 days prior)	1st Booking Period (365–22 days prior)	2nd Booking Period (21–4 days prior)	3rd Booking Period (3–2 days prior)
NeoPanamax: more than 107 ft. (32.62 m) in beam	1	4	2	-
Supers: 91 ft. (27.74 m) in beam and over	3	4	3	5
Regulars: under 91 ft. (27.74 m) in beam	3	-	1	4
Total	7	8	6	9

Source: “OP NOTICE TO SHIPPING No. N-7-2018: Panama Canal Transit Reservation System,” Panama Canal Authority, January 1, 2018, p. 3, <https://www.pancanal.com/eng/op/notices/2018/N07-2018.pdf>.

¹¹ Board of Directors of the Panama Canal Authority, “Agreement No. 13 (of June 3, 1999) ‘Whereby the Regulation on Navigation in Panama Canal Waters is approved,’” Panama Canal Authority, June 3, 1999, p. 7, <https://www.pancanal.com/eng/legal/reglamentos/acuerdo13-eng.pdf>.

¹² Ibid., p. 8.

Passenger vessels, as article 19 stipulates, are “given preference over other vessels in transiting, provided they have been booked, and to the extent that such treatment does not impair safe and efficient operation of the Canal,” so they have an early period of booking from 547 to 366 days before the requested transit date.¹³ Each booking period is then open for every type of vessel, including passenger traffic, where slots are awarded on a first-come, first-served basis through a website. There also are a maximum of six just-in-time booking slots offered per day; four slots are offered to super vessels, (of which no more than two can be transiting in the same direction) and two are offered to regular vessels (one per direction).¹⁴ As table 1 shows, seven slots are per day are allocated to NeoPanamax vessels, out of which only one can be booked in advance to accommodate LNG vessels. The Panama Canal Authority is working to add a new LNG booking slot by the end of the year, and to reach a maximum of twelve vessels per day for NeoPanamax vessels as they gain experience.¹⁵

Another important regulation is specified in article 20, which stipulates that the “substitution of reserved transit slots between or among vessels will be permitted only on conditions specified by the Authority.”¹⁶ Currently, there are two ways to exchange the slots permitted by the authority: (1) between two vessels that have a slot or (2) between a vessel that has a slot and one that does not have one. In both cases, the vessels involved must be transiting in the same direction, have the same restrictions, have the same classification, and be registered by the same operator, but in the first case an extra fee is charged. Finally, an additional slot is available during the third booking period if all normal booking slots have been allocated.¹⁷ In that case, the new slot is allocated through an online auction process, where the highest bidder at the end of the auction will receive the slot available, to be used two days later. This slot is available only for super and regular vessels. The fee for additional slots received through auction will be determined by highest bidder selected. The initial or base price for ships of super-size or larger is \$35,000.¹⁸

Panama Canal transit tolls depend on the vessel’s type and cargo, and there is no seasonality considered in the pricing. For LNG vessels, the tolls are calculated depending on their volume and the amount of LNG they carry. There is a differentiation between the laden tariff (applied to a loaded vessel) and the ballast tariff (applied to an empty vessel, at a maximum 10 percent of total m³ of LNG cargo capacity used). In addition, the return fee is lower if it is a roundtrip and the return transit is taken within 60 days of the outbound trip. Table 2 summarizes the tolls for LNG vessels to transit the Panama Canal.¹⁹

¹³ Ibid., p. 8.

¹⁴ “OP NOTICE TO SHIPPING No. N-7-2018: Panama Canal Transit Reservation System,” Panama Canal Authority, January 1, 2018, pp. 4–5, <https://www.pancanal.com/eng/op/notices/2018/N07-2018.pdf>.

¹⁵ WoodMackenzie analysis of Record LNG Traffic on the Panama and Suez Canal

¹⁶ Board of Directors of the Panama Canal Authority, “Agreement No. 13 (of June 3, 1999),” p. 8.

¹⁷ “OP NOTICE TO SHIPPING No. N-7-2018: Panama Canal Transit Reservation System,” p. 5.

¹⁸ Ibid., p. 6

¹⁹ “Panama Canal Authority Toll Tariffs Approved by Cabinet Council and Published on the Official Gazette [sic] Implementation: October 1, 2017 (FY 2018),” Panama Canal Authority, October 1, 2017, <https://tolls.panama-canal.com/pdf/2018/2018-ApprovedTolls.pdf>.

Table 2. Tolls for LNG Vessels, Effective from October 1, 2017

Bands (m ³)	Laden	Ballast	Ballast (Roundtrip)
First 60,000	\$2.88	\$2.56	\$2.30
Next 30,000	\$2.47	\$2.16	\$2.01
Next 30,000	\$2.38	\$2.07	\$1.84
Rest	\$2.25	\$1.97	\$1.73

Source: “Panama Canal Authority Toll Tariffs Approved by Cabinet Council and Published on the Official Gazzette [sic] Implementation: October 1, 2017 (FY 2018),” Panama Canal Authority, October 1, 2017, <https://tolls.panama-canal.com/pdf/2018/2018-ApprovedTolls.pdf>.

In addition to the transit costs, a booking fee may apply if the slot has been booked in advance. The fee amount depends on length and beam of the vessel and is the same for every booking period. The fee for NeoPanamax vessels is \$35,000, and the vessel must arrive by 3:30 a.m. on the booking date. If the vessel arrives too late for a transit on that day, the slot will be cancelled, and a penalty applies. In case a transit is still possible, an additional fee must be paid, between 25 percent and 100 percent of the booking fee.²⁰

To avoid the canal tolls, a vessel can use a different route depending on its destination. There are three main alternative options: through the Suez Canal, around South America, or around Africa. Figure 1 compares the approximate amount of days that a vessel takes to travel from the U.S. Gulf Coast to different locations. It shows that apart from India and Pakistan, where a transit through the Suez Canal or around Africa is much faster, and Malaysia and Singapore, with a time saving of around one day, for all other countries the Panama Canal route is equal to or faster than the other options.²¹

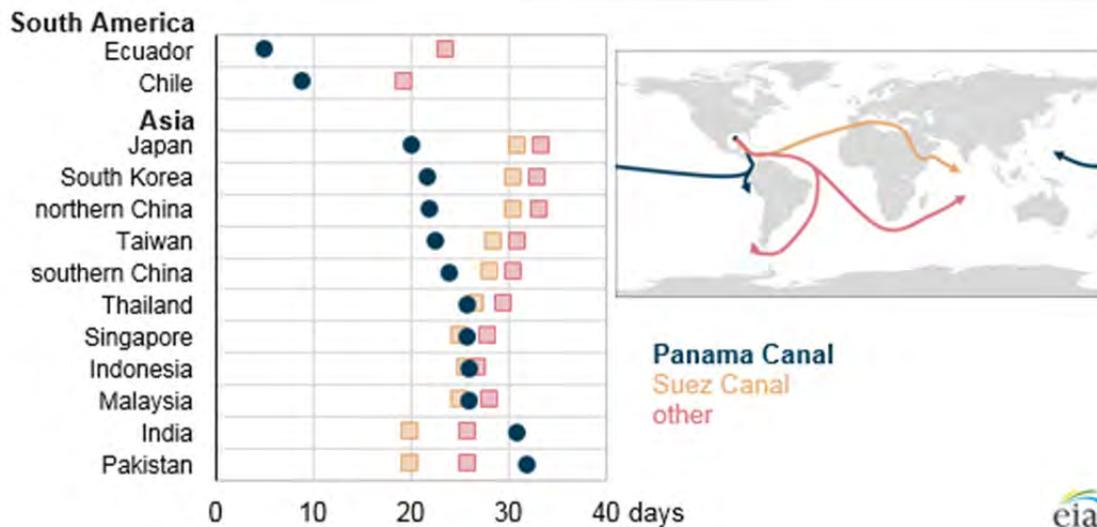


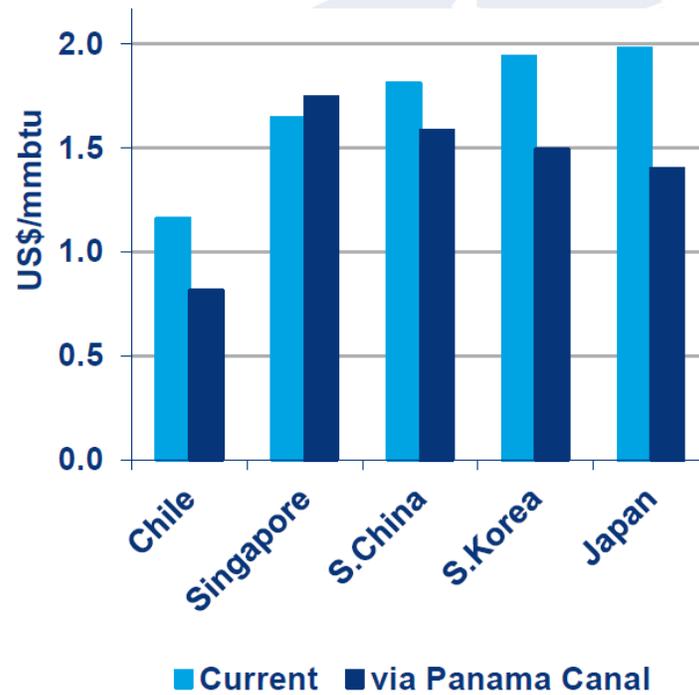
Figure 1. Average travel time from the U.S. Gulf Coast to destinations in Asia and South America on different routes

Source: U.S. Energy Information Administration, “Expanded Panama Canal Reduces Travel Time for Shipments of U.S. LNG to Asian Markets,” *Today in Energy*, June 30, 2016, <https://www.eia.gov/todayinenergy/detail.php?id=26892>.

²⁰ “OP NOTICE TO SHIPPING No. N-7-2018: Panama Canal Transit Reservation System,” pp. 15–17.

²¹ U.S. Energy Information Administration, “Expanded Panama Canal Reduces Travel Time for Shipments of U.S. LNG to Asian Markets,” *Today in Energy*, June 30, 2016, <https://www.eia.gov/todayinenergy/detail.php?id=26892>.

In addition to the distance and sailing time, it must be noted that LNG is a perishable good, with a boil-off of around 0.1 percent to 0.15 percent of the cargo per day. This factor leads to supplementary costs if a vessel's voyage time is longer. Moreover, tolls for a transit through the Suez Canal are usually higher than those of the Panama Canal, a point of additional cost savings.²² Thus, the costs per mmbtu (million British thermal units) decrease by saving significant sailing time, as seen in figure 2.



Source: Wood Mackenzie

Figure 2. Shipping costs from the U.S. Gulf Coast to selected countries (US\$/mmbtu)

Source: "Has the Panama Canal expansion missed the boat for US LNG to Asia?", Wood Mackenzie

SECTION II. Prospects for Another Expansion?

The Panama Canal's third set of locks opened in June 2016 after around seven years of construction.²³ The Panama Canal Authority faced several challenges that led to a delay of around 1.5 years and additional costs for the expansion. This section will analyze, using the third set of locks as a reference, what is needed to complete or accelerate another expansion. It looks at the option of refurbishing the original sets of locks to expand capacity and allow even larger vessels to cross the canal, considers additional issues that can be or have been major challenges during the recent canal expansion, and analyzes these issues and their implications for a further expansion.

²² "The LNG Shipping Forecast: Costs Rebounding, Outlook Uncertain," Oxford Institute for Energy Studies, March 2018, <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2018/02/The-LNG-Shipping-Forecast-costs-rebounding-outlook-uncertain-Insight-27.pdf>.

²³ "The Expanded Canal," Canal de Panamá, n.d., <https://micanaldepanama.com/expansion/>; Proposal for the Expansion of the Panama Canal: Third Set of Locks Project, Panama Canal Authority, April 24, 2006 (p. 6f).

Refurbishing the original set of locks—not a feasible option

One discussed alternative to handle larger vessels in the Panama Canal is to refurbish the original set of locks. This way, larger vessels will be able to pass through the canal, and a greater volume of ships could be handled. However, analysis shows that this is not a feasible option, especially because the original set of locks have their own market and are still in use. Around 74 percent of all vessels today are of Panamax size or smaller.²⁴ Even as the trend toward larger NeoPanamax or even post-Panamax ships continues, these vessels will be in operation for years or even decades to come. In addition to that, if the two original locks are closed for the many years needed to enlarge them, no revenue can be earned from them in that time period. As the current expansion has not yet been repaid, the Panama Canal Authority is highly dependent on the income from the original locks. Finally, there are major water issues regarding the original set of locks, as around 55 million gallons of freshwater are needed per transit.²⁵ By enlarging the locks without considering water demand management techniques, even more water would be necessary for vessels above the Panamax size during transit. During the construction of a new set of locks, water use issues will have to be considered carefully.²⁶ As a result, refurbishing the original set of locks is not deemed a reasonable option, and will not be analyzed further in this paper.

Local political factors

For the past decade, Panama has had sustained economic growth. The forecasted economic growth for 2019 is 5.6 percent.²⁷ Nevertheless, most of this growth has been concentrated in the Panamá and Colón provinces, and it has not reached more rural provinces in Panama.²⁸

The Centro Nacional de Competitividad and the Inter-American Development Bank jointly published a document that presents economic policy recommendations for rural provinces that have not seen any economic development associated with Panama Canal income and operations. These provinces are Bocas del Toro, which is known for tourism, banana production, and energy generation; Coclé, known for tourism, rice farming, and sugar production; Chiriquí, known for tourism and farming; Herrera, known for tourism, agribusiness, and the production of spirits and ethanol; and Los Santos, known mostly for farming and agribusiness. All of these provinces lack solid education systems, training programs for adults and for small businesses, access to micro credit, and economic incentives to foster economic development.²⁹ These regions are all in desperate need of support from the current economic benefits of the Panama Canal.

Any future expansion of the canal may be compromised if these regions are neglected. Because a referendum may be needed for future canal expansion, these regions may form a solid opposition to future canal expansion if they are not included in the greater short-term economic impact, especially from the economic programs derived from

²⁴ Jorge L. Quijano, "The Panama Canal Expansion Program: A Story of Challenges, Innovation and Commitment," Panama Canal Authority, March 20, 2014, p. 20, http://ufdcimages.uflib.ufl.edu/AA/00/02/46/20/00001/Panama_Canal_Authority_University_of_Florida_Copy.pdf.

²⁵ Agustín A. Arias, Jorge de la Guardia, Bruce L. Johnke, and Nicholas Pansic, "Alternatives for Expanding the Panama Canal" (presentation at Ports Conference 2004, Houston, Texas, May 23–26, 2004), p. 4, [https://doi.org/10.1061/40727\(2004\)69](https://doi.org/10.1061/40727(2004)69).

²⁶ *Ibid.*, p. 6.

²⁷ Roberto González Jiménez, "Panamá crecerá 5.6% en 2019, según la Cepal" [Panama will grow 5.6% in 2019, according to ECLAC], *La Prensa*, December 21, 2018, https://impresa.prensa.com/economia/Panama-crecera-Cepal_0_5195480435.html.

²⁸ "Provincias producción, competitividad y polos de desarrollo" [Provincial production, competitiveness, and development poles], *El Capital Financiero*, November 10, 2014, <https://elcapitalfinanciero.com/provincias-produccion-competitividad-y-polos-de-desarrollo/>.

²⁹ *Ibid.*

the third set of locks. These regions may find it hard to buy into any future economic development programs based solely on the promises of benefits from a future expansion of the canal. It is advisable to address these concerns in the short term and ensure that some spillovers take place.

Referendum—required or not?

To build the third set of locks, the Panama Canal Authority had to present the proposal to the Panamanian executive and legislature for approval. Following the government's approval, the proposal had to be approved by the Panamanian citizens through a national referendum.³⁰ On April 24, 2006, the Authority presented to the executive the Panama Canal Expansion Proposal, which President Martín Torrijos approved the next day.³¹ On July 17, 2006, the National Assembly decreed Law No. 28, which approved the proposal submitted by the executive and confirmed (in its Article 7) that the construction proposal for the third set of locks had to be approved by the citizens through a national referendum.³² Finally, on October 22, 2006, as per Law No. 28, the referendum took place and was approved by 76.8 percent of the voters (with 21.76 percent dissenting), with 43.59 percent of the voting population participating in the referendum.³³

The Panama Canal Authority had to go through this process because of the stipulations regarding the canal in the Panamanian Constitution, which regulates a wide variety of canal-related issues. For any extension or transformation of the canal, the Constitution states in Article 325 that “any proposal of construction of a third set of locks or of a canal at sea level through the existing route, that the Panama Canal Authority proposes to realize, . . . will be submitted to referendum, . . . having been approved previously by the Executive Power and by the Legislative Power.”³⁴ As this statement shows, the constitution mentions only the considerations needed for the construction of a third set of locks or a canal at sea level. It does not regulate the construction of a fourth set of locks, thereby leaving the door open for a future expansion without the necessity of another referendum process. In that sense, any further expansion of the canal (with the exception of the construction of a canal at sea level) is not regulated by the constitution, and the Panamanian Constitution itself would have to be reformed to force a national referendum.

These stipulations notwithstanding, a referendum process may be desirable even if it is not mandatory, because a referendum can be used to secure the Panamanian people's support for the project, endorsing it throughout the process. Thus, a brief analysis of the past referendum opposition is necessary when considering the possible benefits of incorporating a referendum into the construction proposals for a fourth set of locks.

Even though a vast majority of the referendum voters approved the construction of the third set of locks, there was also a sizeable opposition campaign, led mainly by key political actors (including former presidents) and local organizations. One important opposing figure was Juan Carlos Varela—Panama's current president. Varela, who was not yet president at that time, claimed that the project had not been issued in an open and constructive process, but

³⁰ “Panamanian Constitution (1972 [rev. 2004]),” Constitute Project, https://www.constituteproject.org/constitution/Panama_2004?lang=es.

³¹ “Panamá presenta un proyecto para ampliar el canal y evitar su sustitución por otras rutas” [Panama presents a project to expand the canal and avoid its replacement by other routes], *El Mundo*, April 25, 2006, <https://www.elmundo.es/elmundo/2006/04/25/internacional/1145945876.html>

³² Law No. 28, “Que aprueba la propuesta de construcción del tercer juego de esclusas en el Canal de Panamá, sometida por el Órgano Ejecutivo, y dicta otras disposiciones” [Approval of the proposal for construction of the third set of locks in the Panama Canal, submitted by the Executive Branch, and other provisions], July 17, 2006, <https://micanaldepanama.com/wp-content/uploads/2011/12/acp-plan-ref-ley-28.pdf>.

³³ Quintín Moreno, “Así se aprobó la ampliación del Canal” [Thus, the expansion of the Canal was approved], *La Estrella de Panamá*, April 4, 2016, <http://laestrella.com.pa/panama/nacional/aprobo-ampliacion-canal/23932043>.

³⁴ Authors' translation from “Panamanian Constitution (1972 [rev. 2004]).”

rather had been imposed on the people of Panama.³⁵ However, this type of opposition could be seen as a political issue rather than an actual rejection of the idea of expanding the canal; in essence, opposition to the canal proposal was a demonstration of political rivalries, not necessarily an opposition to expanding the canal itself.

At the same time, in terms of local organizations, the biggest one that campaigned against the expansion was the Front for the Defense of Economic and Social Rights (Frente por la Defensa de los Derechos Económicos y Sociales; FRENADESO). FRENADESO also argued against the political scenario and was skeptical of the campaign carried out by the project. It declared that the project was a scam, and would hurt the Panamanian people because the project's proposers were lying about the payment issues, had not carried out an environmental evaluation, and had not taken steps to ensure that local water supplies would avoid being salinized.³⁶ Compared with the political opposition, this opposition stemmed from social discontent and concerns about corruption, and chose to blame the political class as a whole (and not a specific party) for these problems.

Admittedly, the referendum process, which is not constitutionally mandatory to build the fourth set of locks, could be carried out regardless. Even with the strong opposition campaign, the previous proposal won widespread approval from the Panamanians. It appears that Panamanians were able to understand the benefits of expanding the canal—however, to secure that level of public support for a new expansion, an educational campaign that explains the further benefits would have to be established as well.

Water issues

Given that the Panama Canal requires large amounts of freshwater to be able to move the vessels from one side to the other, the availability of water in Gatun Lake (the source of the canal's water) is crucial for its long-term operations. According to the Panama Canal Authority, Gatun Lake has eight months of rainfall season and four months of drought, where precipitation decreases considerably. Without the right amount of water available, the Authority has to limit the load amount permitted to vessels in the canal, as happened in 1997–1998 during the El Niño climate phenomenon.³⁷

The project proposal for the third set of locks included an analysis of the canal's water availability until 2050, calculating the increased usage caused by public demand and the operation of the canal. It stated that the expansion will produce a capacity surplus of 6.22 million m³ by 2050, with three chambers used to recycle the water.³⁸ This expansion solved one of the problems that the old canal faced—freshwater loss—by recycling 60 percent of the water used.

However, there are two problems with the water in the existing locks and for any further locks. One is the possible effects of climate change on the availability of water, which past evaluations might not have considered, and the other is the saltwater intrusion into Gatun Lake, which threatens Panama's biodiversity. Even though climate change impacts are not very clear and are too complex to analyze in this brief paper, it is important to examine them

³⁵ "Piden 'no' popular a la ampliación del Canal de Panamá" [They publicly say 'no' to the expansion of the Panama Canal], *infobae*, September 29, 2006, <https://www.infobae.com/2006/09/29/278765-piden-no-popular-la-ampliacion-del-canal-panama/>.

³⁶ "Foro sobre la no Ampliación del Canal de Panamá" [Forum on the Non-Expansion of the Panama Canal], FRENADESO, December 10, 2018, www.frenadesonoticias.org/modules.php?name=Content&pa=showpage&pid=42.

³⁷ "Estudio de Impacto Ambiental Categoría III: Proyecto de Ampliación del Canal de Panamá – Tercer Juego de Esclusas" [Category III Environmental Impact Study: Expansion Project of the Panama Canal - Third Set of Locks], URS Holdings, July 2007, p. 114, <https://micanaldepanama.com/wp-content/uploads/2012/01/cap-03.pdf>.

³⁸ *Ibid.*

carefully if a fourth set of locks is proposed. In particular, climate change can intensify rain and drought seasons, greatly affecting the availability of water for the canal and the level of allowable activity. Saltwater intrusion is also an issue that is not yet confirmed. Some have argued that Gatun Lake has been growing saltier with the usage of the water recycling chambers from the expansion. The Panama Canal Authority has not made any declarations or studies regarding this problem, so the official cause of the salinization is not known, nor is it certain what could be done to prevent salinization in the future and in future expansions.³⁹

Labor issues

The construction of the third set of locks faced many challenges that are likely to arise in any future expansions. One such challenge is labor issues. In 2015, during the construction of the new locks, several labor strikes took place. The striking workers' main demands were for higher pay, but they also sought better working conditions, such as safety improvements, and overtime payments from the project contractor GUPC (Grupo Unidos Por el Canal). These strikes extended the construction time and led to higher costs for the GUPC, which had to meet the workers' wage increase demands.

Lately, the Panama Canal Authority has been looking for more efficiency in its operations. Some of its efforts have focused on reducing its labor costs. The most controversial area thus far has been the reduction of the tugboat crews by one captain and one sailor per tugboat. This effort triggered a strike during April 12–13, 2018, which caused a huge delay and financial losses for many ships. This strike was organized and supported by the Union of Captains and Deck Officers (Unión de Capitanes y Oficiales de Cubierta; UCOC).⁴⁰ The UCOC complaints toward the Panama Canal Authority persisted over the next few months, as the union had the support of the Maritime Labor Alliance of North America and Canada, a major voice in the maritime shipping industry.⁴¹ Another UCOC complaint was an outsourcing contract established by the Authority with the tugboat company Meyer Tugs. This form of outsourcing was a direct threat to UCOC.⁴²

If the Authority plans to build a fourth set of locks in the near future, the accompanying labor issues must be resolved sooner rather than later. Relationships with the unions must be improved, or the potential losses caused by possible future strikes may increase if they happen more often and for longer periods.

Financing

There are several possible ways to fund a further canal expansion. To understand the most suitable approach, it will help to first examine the recent expansion in more detail and then describe how a following expansion could be financed.

³⁹ Rafael Spalding, "Rumor de salinización" [Salinization rumor], *La Prensa*, November 28, 2007, https://www.prensa.com/opinion/Rumor-salinizacion_0_4904509585.html.

⁴⁰ "El Canal de Panamá defiende las operaciones y denuncia la injerencia sindical extranjera" [Panama Canal defends operations and denounces foreign trade union interference], *Qué Pasa*, July 12, 2018, <https://raleigh.quepasanoticias.com/noticias/mundo/centroamerica-y-caribe/el-canal-de-panama-defiende-las-operaciones-y-denuncia-la>.

⁴¹ "Sindicatos marítimos de Estados Unidos y Canadá respaldan a Capitanes del Canal de Panamá" [U.S. and Canadian maritime unions support Captains of the Panama Canal], *Portal Portuario*, April 25, 2018, <https://portalportuario.cl/sindicatos-maritimos-de-estados-unidos-y-canada-respaldan-a-capitanes-del-canal-de-panama/>.

⁴² "Prácticos del Canal de Panamá denuncian supuesta ilegalidad de contrato por servicio a remolcadores" [Panama Canal pilots denounce alleged illegality of tugboat service contract], *China Radio International*, August 20, 2017, <http://espanol.cri.cn/2786/2017/08/20/321s417566.htm>.

The calculated overall costs of the current canal expansion totaled \$5.25 billion. In addition, the “Proposal for the Expansion of the Panama Canal” stated that the expansion should not lead to any higher debts for Panama, as the project will be self-financeable.⁴³ The proposal specified that \$2.3 billion would be financed through loans, while the remaining part would come from the canal’s existing revenues. Five development banks—the Japan Bank for International Cooperation, the European Investment Bank, the Inter-American Development Bank, the Corporación Andina de Fomento (Latin American Development Bank), and the International Finance Corporation—funded the expansion, with total loan amounts between \$300 million and \$800 million. All loans were to be granted with the same conditions, which included an amortization period of 20 years with a grace period of 10 years. The financing was provided without any guarantees from the Panamanian government, and the lenders were not to intervene in the operation or management of the canal.⁴⁴

Soon after the Panama Canal Authority published its calculations for the overall expansion costs, some voices spoke out against them, stating that it would not be possible to reach this amount. The project nonetheless was implemented in the projected way. To design and build the new locks, GUPC, a consortium of several European companies and a Panamanian construction company, was chosen with a bid price that was over \$1 billion below the second-lowest bidder.⁴⁵

During the construction, several difficulties led to much higher costs for GUPC than initially expected, such as the previously mentioned labor strikes and issues with the newly built locks.⁴⁶ In 2015, leaks and cracks were found in the cement walls of the lock heads. Although GUPC’s engineers were able to solve this problem by reinforcing the walls with additional steel, this increased the time and costs needed to complete the expansion. The main reason for these structural problems was most likely that too little cement had been budgeted for the construction.⁴⁷

These additional costs and delays led to major disputes between the Panama Canal Authority and GUPC. In 2014, GUPC even threatened to stop the project. Even though this stoppage did not happen, the dispute was one of the reasons that the opening date for the expansion had to be postponed several times.⁴⁸ To date, the total costs for the Panama Canal expansion are \$5.4–\$5.6 billion (depending on the source), a few hundred million over the initial budget.⁴⁹ However, the dispute could cost up to \$2 billion additionally, and it may take another six years of further litigation to settle the final costs of the expansion.⁵⁰ Implementation challenges like these most likely can be

⁴³ “The Expanded Canal,” Canal de Panamá, n.d., <https://micanaldepanama.com/expansion/>; Proposal for the Expansion of the Panama Canal: Third Set of Locks Project, Panama Canal Authority, April 24, 2006 (pp. 10-12).

⁴⁴ “Panama Canal Authority: Special Purpose Audit Report on the Costs of Investments in Progress and Operating Expenses in the Panama Canal Expansion Program,” Deloitte – Panama, September 30, 2009, p. 12, <https://www.pancanal.com/eng/fn/reports/special-expansion/english-2009.pdf>; *Annual Report 2010*, Panama Canal Authority, 2010, p. 68ff, www.pancanal.com/eng/general/reporte-anual/2010/pdf/LIBROing.pdf.

⁴⁵ “Panama Canal Expansion Program 2010,” Panama Canal Authority, p. 11, <https://micanaldepanama.com/expansion/wp-content/uploads/2014/04/components-2010-02.pdf>.

⁴⁶ “Panama Canal Expansion Workers Strike Over Pay,” BBC, January 18, 2012, <https://www.bbc.com/news/world-latin-america-16607458>; “Worker Unrest Threatens Panama Canal Expansion Timeline,” JOC, August 11, 2015, https://www.joc.com/port-news/panama-canal-news/worker-unrest-threatens-panama-canal-expansion-timeline_20150811.html.

⁴⁷ “Myriad of Issues Could Cause More Delays for the Panama Canal Expansion,” *OCEANAIR*, November 4, 2015, <http://oceanair.net/myriad-of-issues-could-cause-more-delays-for-the-panama-canal-expansion/>; “Panama Canal Lane Opening Delayed,” *Maritime News*, December 21, 2015, <https://www.maritime-executive.com/article/panama-canal-opening-delayed>.

⁴⁸ “Panama Canal Lane Opening Delayed”; <https://www.reuters.com/article/us-sacyr-panama-idUSBREA0M0A020140123>.

⁴⁹ Lomi Kriel, “Halt in Expansion of Panama Canal Could Cause Major Delays: Arbitrators,” Reuters, January 23, 2014, <https://www.reuters.com/article/us-panama-canal-idUSKCN0ZC0Q9>; “Canal Panamá logra récord de 442,1 millones toneladas transitadas por esa vía.”

⁵⁰ “Panama Canal Cost Overrun Claim Rises \$2 Billion,” *Maritime News*, January 11, 2017,

avoided if the selection process is improved and the bidders' proposals are examined in more detail. Moreover, the financial issues surrounding the dispute with the GUPC are connected to specific concerns that occurred during the recent expansion. This makes the overall costs and their implications for a further expansion difficult to predict.⁵¹

Still, the next expansion is already on the drawing board. In 2015, Panama Canal Authority head Jorge Quijano announced that the canal's administrator were examining a further expansion of the canal so that even larger vessels could pass through it and the canal would be more competitive with the Suez Canal. This project could be completed within 15 years. The Authority estimated costs of around \$16 billion to \$17 billion, around three times more than the current expansion cost. Thus, this would be an enormous investment that needs to be financed. Nevertheless, analysis shows that there are several options for Panama to do so.⁵²

First, the Panama Canal Authority proposed to finance the project by issuing bonds or using the canal's own revenues.⁵³ In 2017, the overall revenue of the canal was \$2.2 billion, including \$1.4 billion for the original set of locks and roughly \$800 million for the newly expanded canal. By 2021, the Authority is expecting a yearly revenue of \$2.1 billion from the third set of locks.⁵⁴ With total expenses of \$1.7 billion in 2017, it has a considerable profit every year. As a result, once the financing of the third set of locks is complete, funding by the canal itself will be a viable option. However, this also will depend on the settlement of the dispute between the Panama Canal Authority and GUPC and the additional expenditures related to that.⁵⁵

Second, China has a great interest in the region and an expansion of the canal's capacity, as China is highly dependent on import and export through the canal. The state-owned China Harbour Engineering Company (CHEC) has expressed interest in building and financing a further expansion.⁵⁶ It announced this interest during an informal meeting with the Panama Canal Authority in 2014.⁵⁷

In 2013, Wang Jing, a Chinese billionaire, won a contract to build a parallel canal through Nicaragua, which would cost around \$50 billion according to current estimates. However, apart from some feasibility studies that have not been published, the project has not moved forward significantly.⁵⁸ Other projects that China has been involved in Panama include the construction of a fourth car bridge over the canal that will be carried out by China

<https://www.maritime-executive.com/article/panama-canal-cost-overrun-claim-rises-2-billion>.

⁵¹ "Panama Canal Authority Signs Loan Agreement with International Banks to Finance Canal Expansion," Development Bank of Latin America, December 9, 2008, <https://www.caf.com/en/currently/news/2008/12/panama-canal-authority-signs-loan-agreement-with-international-banks-to-finance-canal-expansion/>; and Walt Bogdanich, Jacqueline Williams, and Ana Graciela Méndez, "The New Panama Canal: A Risky Bet," *New York Times*, June 22, 2016, <https://www.nytimes.com/interactive/2016/06/22/world/americas/panama-canal.html>.

⁵² Simon Gardner and Elida Moreno, "Panama Canal Sets Sights on New \$17 Billion Expansion Project," Reuters, March 26, 2015, <https://www.reuters.com/article/us-panama-canal-idUSKBN0MM24I20150326>.

⁵³ *Ibid.*

⁵⁴ Enrique Pretel and Elida Moreno, "Panama Opens Canal Extension Amid Growth Risks, Cost Battle," Reuters, June 26, 2016,

<https://www.reuters.com/article/us-panama-canal/panama-opens-canal-extension-amid-growth-risks-cost-battle-idUSKCN0ZC0Q9>.

⁵⁵ *Annual Report 2017*, Panama Canal Authority, 2017, p. 98,

<https://www.pancanal.com/eng/general/reporte-anual/2017-AnnualReport.pdf>.

⁵⁶ Gardner and Moreno, "Panama Canal Sets Sights on New \$17 Billion Expansion Project."

⁵⁷ "China Wants to Invest in Fourth Set of Locks in Panama," *World Maritime News*, August 12, 2014, <https://worldmaritimeneews.com/archives/133744/china-wants-to-invest-in-fourth-set-of-locks-in-panama/>.

⁵⁸ "Nicaragua's US\$50b Rival to Panama Canal 'Going Ahead Slowly' as Funding Evaporates and Chinese Investor Keeps Low Profile," *South China Morning Post*, February 22, 2018, <https://www.scmp.com/news/world/americas/article/2134250/nicaraguas-us50b-rival-panama-canal-going-ahead-slowly-funding>

Communications Construction Co Ltd (CCCC) and CHEC.⁵⁹ In addition, CCCC has built around 30 percent of the new Panama Colón Container Port, which will be capable of handling larger vessels and includes a station for the reception of LNG. Panama and China are also currently negotiating a free trade agreement that would further intensify their relationship.⁶⁰

Moreover, there are concerns that China has already started to conduct a feasibility study for the construction of a fourth set of locks, without any approval, hoping to move the project further by doing so.⁶¹ It is estimated that around 43 percent of the zone's activities are already under Chinese control, and state-owned Chinese companies are showing interest in developing additional projects on the land around the Panama Canal.⁶²

Finally, several other companies and countries, including the United States, have a great interest in a further expansion of the canal. Considering that a \$17 billion investment in a further expansion would have comparable cost savings—for instance, for LNG vessels transiting from the United States to China—it can be assumed that funding from development banks and similar sources should be available. Judging by the high levels of interest in the region and the Panama Canal Authority's own revenues, financing for a further expansion of the canal should not be a major challenge.

Global context

In the recent U.S.-China trade war, China struck a blow against the United States—one that will have long-term implications that are hard to measure in the short term—by implementing a tariff on American LNG imports. Many important players worldwide in the LNG business might benefit significantly from this war. Certainly, these players will try to establish or expand their LNG exports to China for the long term. For example, LNG Canada, a joint venture of Royal Dutch Shell, Petronas Malaysia, PetroChina, Mitsubishi, and South Korea's KOGAS, announced a new \$31 billion investment to continue the construction of a LNG plant in the west coast of Canada—a direct threat and competition to the American LNG exports to China.⁶³ Another example is the increase in Russian LNG exports to China. In 2014, Gazprom and the Chinese National Petroleum Corporation (CNPC) agreed on jointly building a 3,000-kilometer pipeline to supply China with 38 million m³ of natural gas per year for the next three decades. This pipeline extends from the Yakutia Region in Russia all the way to the border with China. By June this year, 85 percent of the pipeline was already built. Also, CNPC recently announced the completion of its Yamal LNG plant, with an annual capacity of 16.5 million tons.⁶⁴

⁵⁹ "Chinese Consortium to Build Fourth Panama Canal Bridge," Reuters, July 29, 2018, <https://www.reuters.com/article/panama-china/chinese-consortium-to-build-fourth-panama-canal-bridge-idUSL1N1UP05W>.

⁶⁰ "US Concerns Over Chinese Expansion in Panama Canal Region," Newsroom Panama, June 16, 2018, <https://www.newsroompanama.com/news/panama/us-concerns-over-chinese-expansion-in-panama-canal-region>; "Panama Continues Negotiation of FTA with China," *Panamá Today*, August 20, 2018, <https://www.panamatoday.com/economy/panama-continues-negotiation-fta-china-7615>.

⁶¹ Fernando Menéndez, "US Concerned as China Makes Inroads in Central America," *Epoch Times*, October 18, 2018, https://www.theepochtimes.com/us-concerned-as-china-makes-inroads-in-central-america_2690333.html; Fernando Menéndez, "China, the US, and the Panama Canal," *Epoch Times*, October 11, 2018, https://www.theepochtimes.com/china-the-us-and-the-panama-canal_2683183.html.

⁶² "Chinese State Companies Are Eyeing the Panama Canal for Their Next Big Projects," *Business Insider*, March 27, 2017, <https://www.businessinsider.com/r-china-state-firms-eye-land-around-panama-canal-waterway-authority-2017-3>.

⁶³ "China asesta un duro golpe a la competitividad de EEUU en el comercio del GNL" [China deals a heavy blow to US competitiveness in LNG trade], *Sputnik Mundo*, October 24, 2018, <https://mundo.sputniknews.com/asia/201810241082937260-efecto-bumeran-gnl-eeuu-pierde/>.

⁶⁴ "La geopolítica de la energía" [The geopolitics of energy], *Vanguardia Dossier* 53, (October/December 2014), <https://www.lavanguardia.com/internacional/20140923/54415053281/la-geopolitica-de-la-energia-vanguardia-dossier.html>; "China sustituye las importaciones de crudo estadounidense por petróleo y gas de Rusia" [China replaces US oil imports

It is important to mention that in addition to LNG, China is making moves in the oil business. For example, Russian oil exports to China increased 58 percent by October 2018, compared to the same month in 2017.⁶⁵ If this trend continues, China will aggressively continue to diversify its supply mix of LNG imports and increase imports from competitors of the American LNG players. This combination of factors in the LNG business may be a direct threat to an expansion of the Panama Canal. However, as mentioned above, the Chinese have shown their interest in financing the fourth set of locks, which may be a part of the Chinese strategy to diversify and control its risk exposure to American imports of LNG.

Conclusion

The current state of play in the international energy business, especially in LNG business, is definitely changing since the U.S.-China trade war began. With that in mind, the most important aspect of this paper is Section II, which uses as reference the construction of the third set of locks during the first expansion of the Panama Canal and establishes what is needed to complete or accelerate another expansion for the fourth set of locks. The authors of this report looked into the option of refurbishing the old set of locks so that more and larger vessels can pass. However, our analysis demonstrated that this is not a feasible option, as the current locks have their own market and are an important financial source for the Panama Canal Authority.

As another incentive to build the fourth set of locks, the report also examined the referendum process. Even though a referendum would not be needed to construct the new locks, it could be prudent to hold a referendum because the main campaign against the previous one stemmed mainly from political issues rather than resistance to the actual necessity to expand the canal. The third lock expansion was approved with an overwhelming majority, and if the benefits of further expansion are clearly explained, similar levels of support are likely. Furthermore, a referendum would give the expansion project the people's support throughout the process.

In terms of water issues, even if the future of water availability is uncertain because of undetermined climate change impact, the fourth set of locks could be done with new technologies that introduce improved recycling techniques and better protect Gatun Lake from saltwater intrusion.

Another major challenge to consider in a further expansion of the canal is its funding. The third set of locks was financed by both canal revenues and development loans from several banks. Analysis showed that China is highly dependent on the canal, and CHEC, a state-owned Chinese company, has already expressed interest in building and financing a fourth lock. Another option to fund an expansion would be to issue bonds or use the canal's own revenues. Overall, as several countries have a high interest in the region and the canal, financing should not be an obstacle to further expansion.

Local political and labor issues also will need to be considered in determining the best approach to further canal expansion. Possibly the most important local political issues are the distribution of the economic benefits of the canal and the lack of knock-on effects in some rural areas of Panama. These areas, which have been neglected to date, need to resolve some basic needs such as better education and training programs for their adult population and small business owners, greater access to micro credit, and stronger incentives for the local economy. Labor-

with oil and gas from Russia], *Sputnik Mundo*, November 27, 2018, <https://mundo.sputniknews.com/economia/201811271083722234-china-sustituye-gnl-petroleo-iran-eeuu-por-rusia-aranceles/>.

⁶⁵ "China sustituye las importaciones de crudo estadounidense por petróleo y gas de Rusia."

related problems such as strikes, labor complaints, and international labor organizations involvement must be monitored and resolved before they escalate and negatively affect the operations of the canal. The economic losses of shutting the canal are paramount for all stakeholders.

Finally, the new global context has serious implications for the canal. The U.S.-China trade war has triggered a series of events that are hard to quantify and evaluate over the long run. But one thing is certain: as China becomes the world's largest consumer of LNG, it will continue to diversify its mix of LNG suppliers and reduce its risk exposure to the United States by increasing its imports from other countries in Asia, the Middle East, and especially from Russia.

Where the Panama Canal fits in the larger geopolitical outlook could be greatly determined by its future expansion, how such an additional expansion is financed and if LNG continues to grow in importance for the canal's operations and financial well-being.

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