Magnus Ulseth, Director of LNG and Midstream Products, Quorum Software, explores how software can ensure optimal use of LNG infrastructure.

WHAT DOES OPTIMAL LOOK LIKE?

Despite increased attention from governments, investors, and society on the energy transition, the events that unfolded in 2022 made it clear that natural gas still plays a critical role in the global energy mix. It has also become clear that LNG is the energy carrier which represents the quickest solution towards global misalignments between supply and demand. Meanwhile, more global LNG liquefaction capacity is desperately needed, as well as flexible LNG regasification capacity in the form of FSRUs.

However, investments into hydrocarbon-related activities are evaluated with the highest possible scrutiny due to the fear of stranded assets and the need for energy security at the lowest possible carbon footprint and cost to the taxpayers. In settings such as these, ensuring optimal use of LNG infrastructure, both new and existing, is of the utmost importance to all players involved.

What is considered optimal, however, is in the eye of the beholder. Most industry experts agree that LNG infrastructure is an incredibly costly investment that requires long-term contractual agreements of all sorts to reduce overall project risk. The 15.6 million tpy Gorgon LNG plant in Australia cost US$54 billion, while Reuters reported a suggested construction cost estimate of a new 10 million tpy LNG liquefaction plant built in the US in 2022 would be between US$6 – US$7 billion. What is more, this figure does not consider emissions management or carbon capture and storage (CCS) initiatives which are likely to be required by financiers to support new projects going forward, due to an increased focus on environmental, social, and corporate governance (ESG). Meanwhile, the German parliament approved a bill of US$10.4 billion in March 2023 intended to cover the purchase and maintenance of six FSRUs for the 2022 – 2038 period. This was adjusted upwards from 'only' US$3 billion allocated in the 2022 budget, and according to a paper issued by the German Economy Ministry, the final cost will be even higher.

Tolling business model

Daily LNG import terminal utilisation rates in Europe usually hovered between 15 – 25% from 2012 to 2018. Since the beginning of 2022, they have consistently landed between 60 – 70%, including the highest ever recorded daily rate of 79.3% on 30 November 2022, according to Gas Infrastructure Europe.[1] This increase in European LNG imports is fuelled by US liquefaction running at maximum capacity, combined with LNG cargos diverted from other regions.

Most US export terminals and European import terminals operate on a tolling business model. In this model, the customer (natural gas supplier or shipper) pays a toll to run natural gas through a liquefaction or regasification plant owned by another company (terminal operator). It is therefore in the best interest of the terminal operator to ensure the highest possible utilisation of the terminal infrastructure in

order to maximise total collected tolls and fees, independent of the current market price of natural gas or LNG. As utilisation increases, planning and scheduling exercises managed by the terminal operator become more and more complex. Storage, processing, and berth capacity are just a few possible constraints, while terminal customers typically request their cargoes be processed during peak periods when market conditions are most favourable.

While it might have been sustainable to manage the planning and scheduling process with spreadsheets and manual processes in a low-utilisation modus operandi, software solutions are required when the utilisation rate starts climbing above 40 – 50%. Long-term contractual obligations still need to be fulfilled, while spot cargo opportunities and increased demand for small scale LNG distribution need to be fitted into planning and scheduling. At this rate, planning and scheduling becomes a continuous activity with customer change requests that must be assessed against current cargo lifting or unloading plans on a daily basis. Optimal use of terminal infrastructure in a high-demand environment for LNG also involves finding available slots for additional revenue-generating commercial activities, such as transhipment and storage-and-reload.

In these operating conditions, any terminal operator would benefit highly from having a software solution that manages all capacity constraints in one place, backed by a secure and auditable customer portal that allows streamlined communication between the terminal operator and its customers. An ideal solution would support both manual requests and electronic data interchange (EDI) messaging, backed by business process automation that ensures manual review and approval by the terminal operator and customers for requests that conflict with the current schedule, while also allowing non-conflicting requests to be processed without requiring manual intervention. These capabilities greatly improve the speed and quality of the terminal operator's decision-making process, which also benefits customers that no longer have to wait for a decision on a submitted change request. A scalable software solution is also highly valuable for terminal operators who take on additional terminal operations or are planning capacity increases.

Merchant and integrated business models

As opposed to tolling business models, companies operating under a merchant or integrated business model take on price risk of the commodities involved in LNG trading, including LNG itself, natural gas, or both. With a merchant business model, the LNG liquefaction or regasification terminal owner takes title of the supply. Meanwhile, under the integrated business model, the upstream producer of natural gas is also the owner of the LNG export facilities. Companies operating under these business models often manage a fleet of LNG vessels (fully-owned or long-term chartered) so that their LNG sale and purchase agreements can include both FOB and delivered ex-ship (DES) incoterm cargos.

Most LNG analysts are predicting a tight market for LNG going forward, with global demand expected to exceed supply until 2026. New liquefaction projects sanctioned in North America and the Middle East in 2022 and 2023 will only be able to supply significant amounts of additional LNG from 2026 – 2027 and onward, and the Japanese trade ministry claims that long-term contracts that start before 2026 are 'sold out'. During peak demand periods over the last two years, LNG spot cargoes have been traded at prices as high as US$200 – US$300 million.

There is a golden opportunity in the spot market for existing LNG suppliers that still have spare capacity which is not beholden to long-term contracts. However, average spot charter rates in this market have increased for a typical 160 000 m^3 LNG vessel from US$59 400 in 2020 to US$94 300 in 2021, according to Poten & Partners, with peak rates reaching approximately US$500 000 both in the Atlantic and the Pacific in November 2022.

While both the market price and costs of transporting LNG are currently increasing, and will likely remain high for years to come, price fluctuations also mean that the market opportunity for LNG exporters is not as simple as physically producing as much as possible. Instead, finding the optimal use of infrastructure requires a combination of physical constraints at the liquefaction plant – including storage, processing and berth capacity, as well as upstream well work-overs and plant maintenance cycles – and commercial factors in the marketplace, such as charter rates and seasonal demand cycles for LNG. Commodity prices of frequently used price indices, such as Brent, Henry Hub, TTF, and JKM are important to consider as well. These factors must be included alongside the planning and scheduling of end-to-end LNG cargo, while also considering the cost-benefit of diverting a contracted cargo and the potential impact it could have to the rest of the cargo schedule.

When reviewing current market conditions, it becomes clear that the optimisation problem cannot easily be solved without a software solution and an optimisation algorithm that is specifically tailored to the issue. The planning and scheduling exercise becomes a continuous optimisation exercise with constantly changing parameters, and what was the optimal solution yesterday might not be the optimal solution today. The value of finding room for one additional spot LNG cargo using the existing fleet or finding an opportunity to charter out one of the LNG vessels managed by the operation for a defined period could result in additional revenue in the tens or hundreds of millions of US dollars, easily paying back the initial investment cost in the software solution in just one additional opportunity identified.

Energy transition and energy security

LNG's most important role in the energy transition lies within the shift from coal and oil towards LNG and natural gas. This is especially true in developing countries and regions that lack widespread gas grid infrastructure. LNG import terminals are planned in direct connection with gas-fuelled power plants that utilise LNG directly as a new fuel source for electricity generation.

The optimal use of LNG infrastructure in switching from coal and oil to natural gas is not necessarily equal to maximising throughput. Instead, the optimal fuel mix should be determined by supply and demand for electricity, as well as commodity prices for alternative sources. That is why a software solution that can support a broader list of commodities will be needed: to ensure an optimal mix that

also takes seasonality forecasts on both supply and demand into account.

Many of the countries engaged in the shift from coal and oil towards LNG and natural gas face more than just environmental concerns, including energy poverty, growing populations and energy security. In such cases, optimal use of LNG infrastructure could differ from what is typically considered a purely business point of view. In Asia, there has been an increased focus on enabling functioning third-party access (TPA) regimes, which drives the need for secure and auditable software solutions to provide the necessary communication and trust between the parties involved.

Additionally, governments and regulators in the developed world have recently increased their direct involvement in the business of energy supply and distribution. Previously, developing countries often had strong national energy companies with clear government direction, while countries in the developed world relied more on market forces. Recent examples include the development of a daily LNG price assessment by the EU Agency for the Cooperation of Energy Regulators (ACER) and the German government's involvement in chartering and operating six new FSRUs. Software solutions play a key role in such efforts by providing transparency into energy markets and energy security to countries, as manual processes or spreadsheets are not sustainable when the stakes are so high. Industry standard software solutions developed for LNG terminal operators could relieve them of new reporting requirements, while also providing a foundation for a centrally hosted solution that provides transparency on pricing, utilisation, and stocks.

The cloud is the solution

One thing that 2022 has clearly proven to the LNG industry is that business requirements are not static. The energy transition is likely to emphasise this fact even more over the coming decades, which makes sticking to manual processes or in-house developed solutions a risky strategy for all actors in the LNG industry. Industry standard software solutions supported by trusted vendors is a safer approach, as such platforms will evolve at the same pace as the industry itself, while reducing the risk of having to meet new immediate requirements on capacity utilisation, transparency, auditability, security or flexibility in contractual arrangements.

Software-as-a-Service solutions hosted in the cloud provide cost predictability and reduce the total cost of ownership of enterprise software solutions. This software delivery model is also a great fit when the duration of software requirements is either unknown or based on a short-term need. For example, FSRUs are sometimes chartered on five-year contracts and the time horizon cannot defend developing in-house solutions from a financial and time point of view. Business processes relying on manual steps and spreadsheets are both unsustainable and unscalable, and industry standard software solutions can help those in the LNG industry focus on ensuring optimal use of their infrastructure. **LNG**

References

1. 'Data visualisation, Europe, Data by Year', *Gas Infrastructure Europe*, https://alsi.gie.eu/data-visualisation/EU