

**Mark van Meel and Jürgen Essler, BRUGG Rohrsysteme GmbH, Germany,** breaks down how the advent of stainless-pipes has altered small scale LNG for island populations.

In the ever-evolving landscape of the LNG industry, the pursuit of cost-effective and efficient solutions remains paramount. Island communities, amidst escalating demands for cleaner energy, are increasingly turning to LNG as a viable alternative to traditional oil-based sources, driven by the need to bring global energy-related carbon dioxide (CO<sub>2</sub>) emissions to net zero by 2050 and limiting the global temperature rise to 1.5°C as underscored by the recent agreements made at COP28 in Dubai. Transitioning from oil to natural gas significantly reduces carbon emissions,

*Flexible futures for*



mitigating the environmental impact on island ecosystems. Embracing LNG as a cleaner and more sustainable energy source enables island communities to reduce their carbon footprint while enhancing energy security and resilience.

Transitioning to cleaner energy sources and achieving net-zero carbon emissions presents numerous challenges for island communities. One of the most important points is the high cost associated with adopting renewable energy technologies and infrastructure. Islands often rely heavily on imported fossil fuels, leading to inflated energy prices and

economic vulnerability. Furthermore, limited land availability may constrain the deployment of renewable energy systems, such as solar panels or wind turbines. Additionally, the intermittent nature of renewable energy sources poses challenges for maintaining a reliable power supply, especially in remote island locations. Grid stability and energy storage solutions become critical issues in ensuring a consistent energy supply. Moreover, transitioning away from traditional industries like fishing or tourism, which may have carbon footprints of their own, can create social and



*island populations*

economic tensions. Balancing environmental sustainability with economic development and social wellbeing is thus a delicate task for island communities striving for a cleaner, net-zero carbon future.

## Versatility of flexible stainless-steel pipes

Crafted by industry leaders for decades, reeled flexible corrugated stainless-steel pipes offer a versatile departure



**Figure 1.** Reel of flexible stainless-steel pipe for transport to site.



**Figure 2.** Laying of flexible-stainless steel pipe.

from conventional rigid pipelines. Available in sizes ranging from 0.5 – 12 in., these pipes cater to various LNG industry applications. These flexible pipes can be produced in long lengths of hundreds of meters on reels, factory tested, certified, and delivered ready for installation. Whether vacuum insulated or foam insulated, they boast effective insulation properties, ensuring safe and efficient LNG transport from source to destination.

While vacuum-insulated pipes excel in insulation performance, their foam-insulated counterparts provide a more cost-effective solution without compromising efficiency. Tailored for nearly static or dynamic installations, these flexible pipes are ideally suited for diverse LNG import projects, including those in near shore and coastal environments.

## The evolution of LNG infrastructure: a case study

Consider the challenges faced by island communities or other remote areas without existing import infrastructure seeking to transition from oil to natural gas energy sources. Traditionally, establishing LNG import terminals posed significant financial and logistical hurdles. However, flexible stainless-steel pipes offer a transformative solution to this longstanding dilemma.

This case study delves into the implementation of small scale LNG import projects on islands, where weekly imports of up to 30 000 m<sup>3</sup> of LNG are necessary to meet energy demands. Historically, the cost of traditional LNG import terminals has rendered many such projects economically unfeasible. Leveraging the innovative capabilities of flexible stainless-steel pipes, island communities can now transition to cleaner energy sources with speed, ease, and affordability.

Flexible corrugated stainless-steel cryogenic pipes offer a plethora of advantages for small scale LNG terminals, particularly beneficial for island nations. Their low heat leak, facilitated by vacuum insulation, ensures optimal preservation of LNG, crucial for efficient storage and transportation. Moreover, their multi-directional flexibility and self-compensating nature allows integration into diverse terrains and operational setups. The plug-and-play feature, coupled with the ability to provide seemingly endless lengths, simplifies installation and scalability, catering to varying demands. Engineered with precision, these pipes offer bespoke solutions tailored to specific requirements, guaranteeing optimal performance. Additionally, their no-welding solution not only enhances safety but also expedites delivery and installation processes, making them a safer and faster alternative for LNG infrastructure development in remote island environments.

The installation of reeled flexible stainless-steel pipes in shallow water and near shore environments provides a cost-efficient alternative to conventional LNG infrastructure. Bypassing the need for extensive and expensive terminal facilities, these pipes enable the establishment of LNG import infrastructure at a fraction of the traditional cost and in a fraction of the time. Their flexibility accelerates deployment and installation, enhancing operational efficiency and expediting project timelines.

Furthermore, the conventional LNG infrastructure's prohibitive costs have long hindered such projects. Enter flexible stainless-steel pipes – a revolutionary solution

promising unprecedented efficiency and cost-effectiveness for small scale LNG import endeavours.

## Towards hydrogen and beyond

It is noteworthy that the adoption of flexible stainless-steel pipe systems not only revolutionises LNG imports, but also sets the stage for broader energy transitions. These pipes pave the way towards hydrogen as a fuel and hydrogen carriers like methanol and ammonia. Thus, they represent a pivotal step towards a more diverse and sustainable energy future.

Furthermore, the versatility of flexible stainless-steel pipes extends beyond hydrogen alone. They serve as essential conduits for a spectrum of alternative fuels and hydrogen carriers, including methanol and ammonia. By facilitating the transport of these substances, these pipes play a crucial role in expanding the scope of renewable energy solutions and reducing reliance on fossil fuels.

The potential of hydrogen as a fuel and hydrogen carriers like methanol and ammonia is undeniable. Hydrogen, when produced through renewable methods such as electrolysis, offers a clean and sustainable energy source with zero emissions. Methanol and ammonia, meanwhile, present viable alternatives for energy storage and distribution, enabling greater flexibility and scalability in renewable energy systems.

In essence, flexible stainless-steel pipes represent more than just conduits for fluid transportation; they embody the cornerstone of a cleaner, greener future. By accommodating the evolving needs of the hydrogen economy and facilitating the adoption of alternative fuels, these pipes are instrumental in shaping a sustainable energy landscape for generations to come.

For island communities embarking on the ambitious task of establishing LNG import infrastructure, the adoption of reeled plug-and-play flexible corrugated stainless-steel pipes

presents a bespoke solution, uniquely tailored to address the multifaceted challenges inherent to island environments. These pipes promise a plethora of advantages, encompassing safety, cost-effectiveness, schedule adherence, and quality control, all while intricately weaving in considerations for the delicate environmental and social fabric of island life.

Prefabricated construction techniques taking advantage of flexible plug-and-play LNG piping systems offer a multitude of advantages that revolutionise the traditional approach to building LNG import infrastructure projects. One significant benefit lies in the expedited construction timeline facilitated by prefabrication. By manufacturing the ready for use flexible piping systems off site in controlled environments, construction processes become more efficient and predictable, minimising the potential for delays due to adverse weather conditions or on-site mishaps. This efficiency translates into cost savings as well, as shorter construction periods reduce labour expenses and overhead costs associated with prolonged projects, ultimately bringing cleaner burning LNG faster to island communities. Moreover, prefabrication promotes sustainability by optimising material usage and minimising waste through precise manufacturing processes. Additionally, the controlled environment of prefabrication facilities ensures higher quality standards, as factors like temperature, humidity, and dust are regulated, leading to superior craftsmanship and durability of the final product. Thus, avoiding unnecessary delays at the terminal construction site. Beyond these practical advantages, prefabricated construction also offers versatility in design, allowing for customisation and adaptability to various import mooring terminal development phases and local project requirements. Furthermore, prefabrication promotes safety on construction sites by minimising on-site activities and potential hazards, thus creating a safer working environment for construction workers. Overall, the embrace of prefabricated construction techniques signifies a paradigm shift in the construction industry, promising enhanced efficiency, sustainability, safety, and quality in building LNG import projects at remote island locations.

## Conclusion

The adoption of reeled flexible stainless-steel pipes represents a shift in the LNG industry, particularly for small scale import projects in island communities. By offering a cost-effective, efficient, and environmentally friendly alternative to traditional infrastructure, these pipes make previously unfeasible projects achievable. Moreover, their versatility extends beyond LNG, paving the way for broader energy transitions towards hydrogen and other alternative fuels. Reeled flexible corrugated stainless-steel pipes offer island communities a tailored solution for establishing LNG import infrastructure.

As island communities prioritise energy diversification, reliability and sustainability, the significance of flexible stainless-steel pipes cannot be overstated. Through collaboration and innovation, the LNG industry is poised to usher in a new era of sustainable development. By embracing proven pre-fab plug-and-play construction techniques and flexible stainless-steel pipes, island nations can embark on a transformative journey towards a cleaner, more resilient energy future. Working together can drive positive change for both the industry and the planet, shaping a brighter tomorrow for generations to come. [LNG](#)



**Figure 3.** Vacuum insulated flexible pipe.



**Figure 4.** Foam insulated flexible pipe.