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Critical Small Scale LNG Technologies

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Abstract: *This article describes different small scale LNG technologies and process of those technologies and applications. Also the importance of each process is elaborated to get an overview. The technologies represent different types of mixed refrigeration process to liquefy the natural gas through cold box that's kind of aluminum brazed exchanger.*

Keywords: *MLU, LNG Mirco Plants, FLNG, Isocontainers*

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I. INTRODUCTION

LNG technologies refer to the processes and equipment used for the liquefaction, storage, transportation, and regasification of natural gas. These technologies have advanced significantly over the years and have made natural gas a more viable energy source.

The liquefaction process is typically achieved through refrigeration, which cools the natural gas to approximately minus 260°F (minus 162°C) at ambient pressure, resulting in the conversion of natural gas from its gaseous state to a liquid state. The process requires specialized equipment and significant energy input.

Storage of LNG is typically done in either single or double containment tanks, which are specially insulated and refrigerated to maintain the low temperature required to keep the gas in a liquid state.

Transportation of LNG is primarily done through specialized tankers that are designed to maintain the low temperature required to keep the gas in its liquid state.

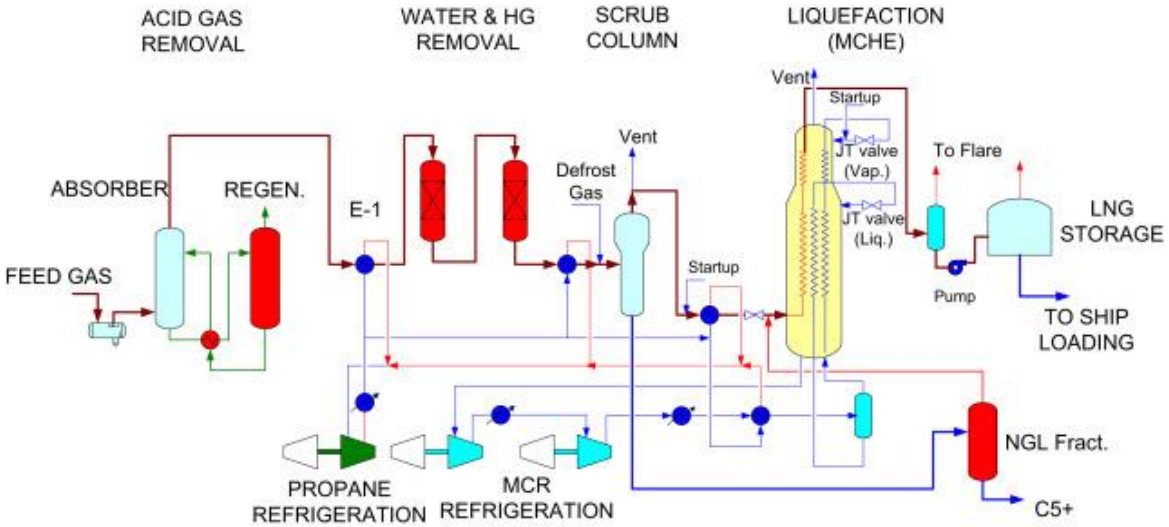

Fig 1: Typical LNG Process

II. SMALL SCALE LNG TECHNOLOGIES

Small-scale LNG technologies are used to liquefy natural gas on a smaller scale, typically for use in remote locations, marine transportation, and small-scale industrial applications. Some examples of small-scale LNG technologies include:

1. Modular Liquefaction Units (MLUs): These are small-scale LNG plants that can be transported to remote locations and can produce between 0.5 and 2 million tons per year of LNG. They can be quickly and easily installed and operated, making them ideal for small-scale applications.
2. LNG Micro Plants: These are smaller versions of the MLUs that can produce between 10,000 and 100,000 gallons per day of LNG. They are typically used to supply LNG to off-grid locations such as mines, power plants, and industrial facilities.

3. LNG Virtual Pipeline Systems: These systems use tanker trucks to transport small quantities of LNG from a liquefaction plant to a regasification plant. The LNG is then regasified and distributed via pipeline to customers.
4. Small-Scale Floating LNG (FLNG) Facilities: These are LNG facilities that are located on a floating vessel, typically in offshore locations. They are ideal for smaller gas fields that are not economically viable for onshore LNG production.
5. LNG Isocontainers: These are insulated containers used for the transport of small quantities of LNG. They are typically used for distribution to remote locations or for emergency backup supplies.

A) MLU

Overall, small-scale LNG technologies allow for the production, transport, and distribution of LNG on a smaller scale, making it more accessible and affordable for smaller applications and remote locations.
Modular Liquefaction Units (MLUs) are self-contained, skid-mounted liquefaction plants that can be transported to and assembled on-site. They are designed to produce small to medium-scale quantities of liquefied natural gas (LNG) from natural gas sources that are too small or remote to support a large-scale LNG plant.
MLUs are typically made up of several modules, each containing a specific part of the liquefaction process, such as pre-treatment, liquefaction, and refrigeration. The modules can be easily transported by truck or ship, and assembled on-site to form a complete LNG production facility.

One of the main advantages of MLUs is their flexibility. They can be deployed quickly and at a relatively low cost, making them ideal for remote or small-scale natural gas production sites, as well as for temporary or mobile LNG facilities. They can also be easily scaled up or down depending on the production needs, making them a good option for natural gas producers who want to gradually expand their LNG production capacity.
MLUs are becoming increasingly popular in the LNG industry, as they offer a cost-effective and flexible solution for producing small to medium-scale quantities of LNG.

Fig 2: Typical MLU

B) LNG MICRO PLANT

LNG micro plants, also known as small-scale LNG plants, are compact liquefaction facilities that produce LNG in smaller quantities typically ranging from a few thousand to a few hundred thousand gallons per day. These plants are designed to meet the growing demand for natural gas in areas that are not served by pipelines or where pipeline transportation is not economical.
LNG micro plants are typically modular and transportable, which makes them ideal for remote locations or areas with limited infrastructure. They can be installed on a small footprint and can be transported by truck, rail, or ship to the desired location. These plants typically use either the mixed refrigerant or the nitrogen expansion liquefaction process.

LNG micro plants are being used to supply natural gas to power plants, mining operations, industrial facilities, and transportation applications such as trucks, ships, and locomotives. They are also being used to provide natural gas for remote communities that are not connected to the natural gas grid.
Some companies that offer LNG micro plant solutions include Chart Industries, Black & Veatch, and Wartsila.

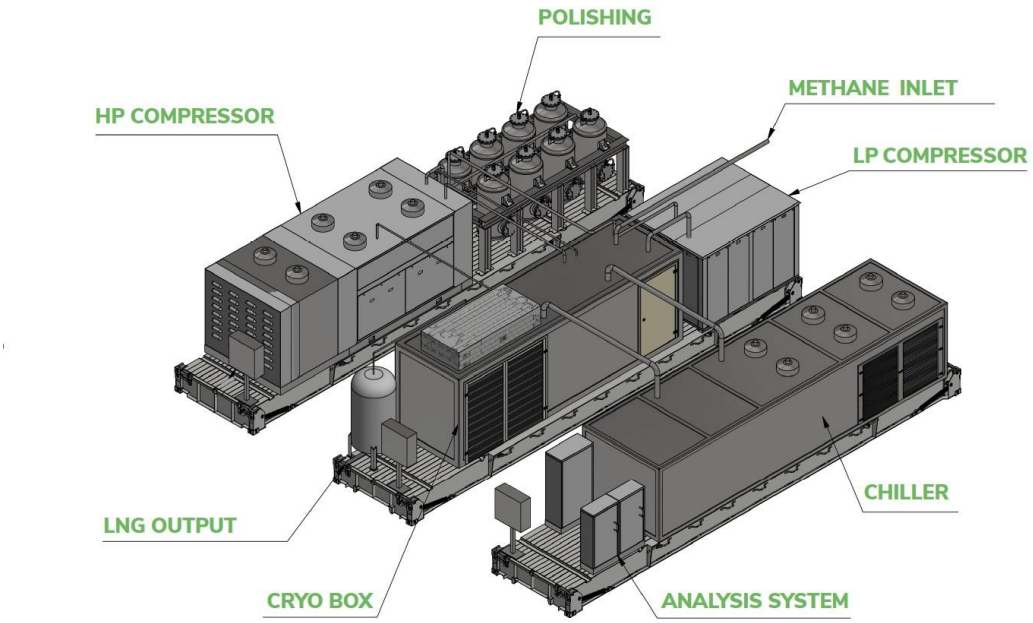

Fig 2: Typical LNG Micro Unit

C) SMALL SCALE FLOATING LNG

Small-scale floating LNG (liquefied natural gas) refers to the production, storage, and transportation of LNG on a small scale using a floating vessel or barge. Small-scale floating LNG technology enables the exploitation of small and remote natural gas reserves that would be uneconomical to develop using traditional onshore LNG facilities.
The small-scale floating LNG facilities can be used for various applications, such as bunkering, power generation, and transportation. The technology allows for the production of LNG in quantities as small as a few thousand cubic meters per day up to 1 million cubic meters per day.
Small-scale floating LNG typically involves the use of a floating storage and regasification unit (FSRU), which is a specialized vessel designed to store LNG and convert it back to its gaseous form for transportation through pipelines or for use in power generation. The FSRU is typically connected to an offshore platform or a jetty to receive LNG from small-scale LNG carriers.
Small-scale floating LNG can provide an alternative to traditional onshore LNG facilities, offering greater flexibility and reduced capital costs. It is also seen as a more environmentally friendly option, as it can reduce the need for long-distance pipelines and associated infrastructure.

Fig 3: Typical FLNG

D) LNG ISOCONTAINERS

LNG isocontainers are specialized containers used for the transportation of liquefied natural gas (LNG) by sea, road, or rail. These containers are designed to maintain the low-temperature conditions required for LNG to remain in a liquid state during transport.

The standard size of an LNG isocontainer is 40 feet long, with a capacity of around 45,000 liters. They are typically made from high-strength, low-temperature-resistant steel, and have several layers of insulation to keep the LNG at a temperature of around -162°C (-260°F).

LNG isocontainers can be transported on standard cargo ships, trucks, or trains. They are often used in remote locations or for small-scale LNG supply chains, where it may not be cost-effective to build a large-scale LNG terminal or pipeline. They are also used as an alternative to LNG tanker ships for short-distance transport of LNG. Once the LNG isocontainer reaches its destination, the LNG can be offloaded and regasified for use in power generation, heating, or other applications.

Fig 4: Typical LNG Isocontainers

III. CONCLUSION

It's very critical to know which technology to use based on the design requirements and also better efficiency. Also cost effective and considering the past projects lessons learned plays a vital role for better and safe design.

REFERENCES

[1]. Shukri, T., "LNG Technology Selection," Hydrocarbon Engineering, Vol. 9, Iss. 2, 2004.

[2]. Vink, K. J. and R. K. Nagelvoort, "Comparison of baseload liquefaction processes," LNG-12 Conference and Exhibition, Perth, Australia, May 4–7, 1998.

[3]. Finn, A. J., G. L. Johnson and T. R. Tomlinson, "LNG technology for offshore and mid-scale plants," 79th Annual GPA Convention, Atlanta, Georgia, March 13–15, 2000.

[4]. Roberts, M. J., Y. N. Liu, J. M. Petrowski and J. C. Bronfenbrenner, "Large-capacity LNG process—the AP-X cycle," Gastech 2002 Conference and Exhibition, Doha, Qatar, October 13–16, 2002.

[5]. Martin, P.-Y., J. Pigourier and B. Fischer, "Natural gas liquefaction processes comparison," LNG-14 Conference and Exhibition, Doha, Qatar, March 21–24, 2004.

[6]. Richardson, F. W., P. Hunter, T. Diocee and J. Fisher, "Passing the baton cleanly—Commissioning and startup of the Atlantic LNG project in Trinidad," Gastech 2000 Conference and Exhibition, Houston, Texas, November 14–17, 2000.

[7]. Ransbarger, W., "A fresh look at LNG process efficiency," LNG Industry, Spring 2007.

[8]. Vist, S., et al., "Startup experiences from Hammerfest LNG—A frontier project in the North of Europe," LNG-16 Conference and Exhibition, Oran, Algeria, April 18–21, 2010.

[9]. Dam, W. and S.-M. Ho, "Engineering design challenges for the Sakhalin LNG project," 80th Annual GPA Convention, San Antonio, Texas, March 12–14, 2001.

[10]. Meher-Homji, C., D. Messersmith, T. Hattenbach, J. Rockwell, H. Weyermann and K. Masani, "Aeroderivative gas turbines for LNG liquefaction plants—Part 1: The importance of thermal efficiency," and "Aeroderivative gas turbines for LNG liquefaction plants—Part 2: World's first application and operating experience," ASME Turbo Expo 2008 Conference, Berlin, Germany, June 9–13, 2008.

[11]. Meher-Homji, C., D. Messersmith, K. Masani and H. Weyermann, "The application of aeroderivative engines for LNG liquefaction—Higher plant thermal efficiency, lower CO_2 footprint, and modularization capability," Gastech 2009 Conference and Exhibition, Abu Dhabi, UAE, May 25–28, 2009