LNG carrier

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An **LNG carrier** is a ship designed for transporting liquefied natural gas. As the LNG market is growing rapidly in the present decade, the fleet of LNG carriers is also growing rapidly.

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History

In 1914, Godfrey Cabot patented a barge to carry liquid gas, demonstrating that waterborne transportation was technically feasible. It was not until 1959, however that the *Methane Pioneer*, a converted cargo ship, was used to carry LNG between Lake Charles, Louisiana and the UK [1] (http://www.intertanko.com/pubupload/curt.pdf) .

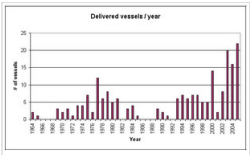

Diagram of newbuilding rate.

The first purpose-built ship, called the *Methane Princess*, went into operation in 1964 and remained in operation until 1998 when it was scrapped. To the end of 2005 a total of 203 vessels had been built and only 10 of them had yet been scrapped.

Mid decade, there is a boom in the size of the LNG fleet. The *Gas Carrier Register* indicates that there were more than 140 vessels on order at the world's ship yards in late 2005. Today the majority of the new vessels are in the size range of 120,000 m3 to 140,000 m3, but there are orders for ships with capacities of up to 200,000 m3.

Containment systems

In order to transport natural gas, it is cooled to approximately -163 degrees Celsius where it condenses to a liquid at atmospheric pressure shrinking to approximately 1/600 of its original volume and obtaining a density of 420 to 490 kg/m³. The tanks onboard the LNG carriers function, in effect, as big thermos containers wherein the liquid remains boiling for the duration of voyage. Some gas is removed to prevent a gradual buildup in pressure; this is known as Boil Off Gas (BOG). The latent heat of vapourization required to turn a small amount of LNG from a liquid to a gas is what keeps the remaining liquid cooled.

Recently, designs have been developed for pressurized transport systems as well, to be called compressed natural gas or PNG carriers, although none have yet been constructed [2] (http://www.dnv.com/maritime/maritimeconsulting/technicalsolutions/structures/gascarriers.asp) .

At present, there are four containment systems in use for new ships. Two of the designs are of the self supporting type. The other two are of the membrane type which are patented designs owned by Gaz Transport and Technigaz (GT&T). There is a trend towards the use of the two different membrane types instead of the self supporting. This is most likely due to lower construction costs.

Moss tanks

This design is owned by the Norwegian company Moss Maritime and it is a spherical aluminum tank. It was developed in 1971 by Kvaerner. This is a self supporting type.

IHI prismatic

Ishikawajima-Harima Heavy Industries has developed a self supporting tank type. This tank type is very similar to the ones used on the first ship, *Methane Princess*. The tank is made of aluminum.

TGZ Mark III

This design was developed by Technigaz and it is of the membrane type. The membrane consists of stainless steel with 'waffles' to absorb the thermal contraction when the tank is cooled down.

GT96

This is Gaz Transport's tank design. The tanks consists of a primary and secondary thin membrane made of the material Invar, which has almost no thermal contraction. The insulation is constructed of plywood boxes filled with Perlite, a lightweight insulating material.

Propulsion

LNG carriers are unique in that the large majority of them are propelled by steam turbines, with new ships still being built with this propulsion method. This is because the simplest way of handling the boil off gas (BOG) is to burn it in the ships' boilers, creating enough steam to propel the ship when supplemented with additional gas from the cargo tanks. Diesel engines have largely replaced steam turbines in all other ship types, but until recently diesel engines adapted to run on BOG have not been widely utilised, even though technology has been around since the early 1980's enabling this to happen. However, the rapid expansion of the LNG fleet has meant that in the first decade of the 21st century there is a shortage of sea going personel qualified to operate steam turbine ships. High prices for LNG are also driving the quest to maximise the yield from the transported cargo. Modified diesel engines burn less gas than steam turbines due to greater fuel efficiency. Combined cycle systems have also been

implemented, with COGAS (COmbined Gas And Steam) electric propulsion arrangements having thermal efficiencies close to or greater than diesel engine systems. In this arrangement, the gas is burnt in a gas turbine and the waste heat from the gas turbine used to generate steam to run a supplementary steam turbine. However, recent developments have enabled the boil off gas to be re-liquified and returned to the cargo tanks, allowing conventional diesel engine propulsion systems to be utilised. All this has meant that coming into the 21st century the last refuge for steam ships could eventually disappear.

External links

- Marine Transportation of LNG (Pdf) (http://www.intertanko.com/pubupload/curt.pdf)
- Society of International Gas Tankers and Terminal Operators (http://www.sigtto.org/)
- Transportation of LNG in Small LNG carriers (http://www.small-lng.com/)

Sources

- *The Gas Carrier Register*
- Hamworthy LNG Reliquefication (http://www.hamworthy.com/newsevents/news.asp?strAreaNo=21_1&intElement=2252) website viewed 30th June 2006

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