

# Opening up a market for COMPRESSED natural gas

**After LNG, make way for CNG. Compressed natural gas could be the next big thing as demand grows for natural gas to be shipped around the world, reports Martyn Wingrove**

**W**ITH oil resources around the world in shorter supply and the cost of liquid fuels too high for many industrial consumers in developing nations, there is growing demand for natural gas to be shipped around the world, and not just on liquefied natural gas carriers.

High oil prices and massive costs of building LNG projects have opened up opportunities for energy and shipping companies to co-operate on innovative concepts for transporting gas in international markets, and they have come up with compressed natural gas as the best viable option.

In the past, companies have spoken about the potential for CNG, but no project has ever gone further than the drawing board. This is about to change as a consortium of North American companies has firm plans to get the first project underway in the next three years.

One shipping group thinks there could be around 25 CNG carriers operating globally in the next seven years as CNG shifts rapidly from concept to reality. Overseas Shipholding Group, TransCanada and energy firm Artumas Group are well on their way to developing the world's first CNG marine project off the east coast of Africa, having gained government approval for their venture in Tanzania and Kenya.

Calgary-based Artumas is working to develop gas fields in Mnazi Bay in southern Tanzania to feed a local power plant and export gas along the east African coast to another plant in Kenya.

It has brought in Trans CNG International, a joint venture between TransCanada and OSG, to supply ships to transport the gas 380 nautical miles to Mombasa, a scheme that will need at least four ships working in rotation and probably more in the future.

This is the first CNG project to get off the ground and Trans CNG International thinks there will be more to come in the future as energy companies seek to develop their stranded gas resources.

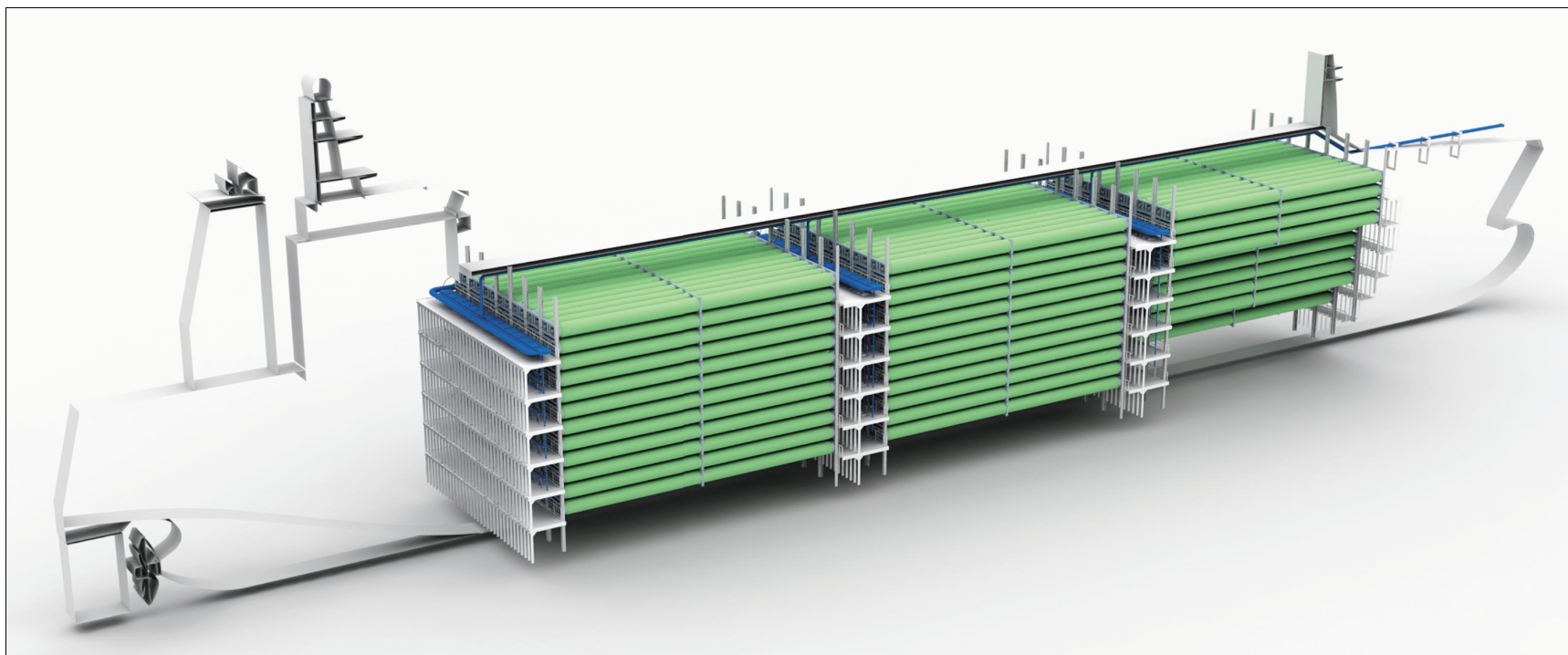
The main driver behind CNG technology development has been the volume of gas reserves that are too far away from a market to build a pipeline, and where building an LNG plant is not a viable option.

There could also be a secondary market in the future for CNG carriers as there is increasing pressure on oil companies to halt flaring operations on their onshore and offshore facilities. A proposal to get around this pressure, and eventually a heavy tax burden, will be to pump associated gas produced during oil extraction and shipping it to markets.

All this can be for the medium term future, but for now the shipping and energy industries will be watching closely the progress made by Artumas and Trans CNG International in East Africa.

Although preparation work has been underway for some months, Artumas has been waiting for the Tanzanian government to sanction the export of gas on CNG carriers, but now the Canadian company has received the green light.

"CNG is innovative and an emerging technology for projects such as ours," said Artumas chief executive Stephen Mason. "There are three or four viable players with technology. But we are working with TransCanada in studies and they are working in a joint venture with OSG.



"We have the authorisations for the Mnazi Bay gas project and now we have to finalise the gas agreements in the next few months. Preliminary work on CNG is already underway and the indications are that it will take 24 months from the final investment decision to the first delivery."

Artumas has allocated 270bn cu ft of gas reserves for marine export. It plans to be shipping 35m cu ft per day in 2011 on CNG carriers and raising this to 50m cu ft per day in 2013.

This will be the first project to move into the implementation stage and will be viewed as a ground-breaking venture that sets up a precedent for the energy industry to follow. It will also open the gates for more CNG-based projects to move forward, setting up a sub-sector of energy shipping that other companies can capitalise on.

TransCanada is bringing its experience with high pressure storage vessels and pipeline technology to the project and OSG has vast knowledge of owning and operating gas carriers, so most of the technical work has already been completed; now it is down to putting all the pieces together and getting through the final investment decision.

Angus Campbell, head of CNG with OSG, is confident that this project will get through the last stages of planning and that actual physical progress can be made in the near future to make sure the first CNG ships will be available in 2011.

"We hope to be ordering the first ships with shipyards for the first CNG project in the next six months. We are anticipating an 18-24 months build period, which is a normal shipbuilding time frame, and then one month for positioning before the first marine CNG project can start," said Mr Campbell.

"Marine CNG is in its own niche and should be seen as a floating gas pipeline, so it will not involve just a single ship. There will be a number of ships working in rotation to take gas volumes from the production site to markets."

So the number of vessels required per CNG project will depend on the production rate at the field, delivery requirements at the other end and the capacity of the ships.

At least four ships will be required per project — one for loading CNG, another on the way to its destination, another in port discharging its gas cargo and a fourth travelling back to the loading terminal. For longer distances and higher flow rates around six or more vessels will be required.

"There should be one ship in port every day which will make this economically viable so there will be a number of ships performing a shuttle service, which



Top: a model of the proposed storage system for a CNG cargo. Above: a computer-generated image of what a CNG carrier will look like.

makes them profitable," said Mr Campbell. The ships will be operated by ship owners and leased to the energy company on long term charters for probably the entire operating period of the project — until either the gas runs out or the vessels need to be replaced.

Artumas' East African project is likely to start making progress before the end of this year as the Tanzanian government is keen to get its gas resources shipped to markets and the Kenyans want to use cheap gas instead of expensive liquid fuels for power generation.

Mr Mason said construction work in Tanzania would involve the drilling of more wells, installation of a gas terminal and compression station and the building of a pier in Mnazi Bay so gas carriers can be loaded.

But this is only the first stage of the company's development plan for the area as it has much more

exploration drilling to do in Tanzania and over the border in Mozambique.

Success with this drilling could lead to oil field developments and a tanker terminal being built in the future, and potentially an increase in gas exports.

If Artumas gets its project into production in the next three years, it will put Tanzania on the energy map and highlight the potential for energy projects in East Africa, a region that has so far been only lightly explored.

Trans CNG International is also working with other energy companies with similar ideas of exporting gas as CNG around various regions, although they are tight-lipped as to who else they are working with.

"This is seen as an energy delivery system whose time has come so we can commercialise stranded gas fields. There could be projects worldwide including some in Asia, Australia, the Middle East and off Africa. The Caribbean is another area that has potential," said Mr Campbell. "We have a number of project proposals, so in 2015 we could have a fleet of 24 vessels and we will be disappointed if there are not more under construction by then."

TransCanada thinks there could be four compressed natural gas marine projects underway by the middle of the next decade, as the technology is due to be taken up by the energy industry more quickly once the first project is underway.

"There has been a lot of interest in CNG. We have done screening studies for hundreds of fields and are working with a number of companies on projects similar to Artumas' Tanzania development," said TransCanada director of CNG Gary Steven.

He said that there are two projects, including the one in Tanzania, that are close to going into the ship construction phase, and that by 2015 there could be four projects transporting gas on CNG carriers.

Mr Steven said Trans CNG International could own the CNG carriers and OSG would operate them in the future using its pool of experience in other shipping sectors.

Many of the proposed developments where CNG technology can be used are in the developing world where there are no established gas markets, but the states are generating power by burning hydrocarbon liquids.

"One of the drivers is displacing liquid fuels for power plants as this will be a huge cost saving for plant operators and governments," said Mr Mason. "There are also a lot of stranded gas fields in the world where the reserves are not enough for an LNG project or are too remote from markets for a pipeline. These are the niches that CNG can fill.

"There is increasing gas demand and concerns about flaring gas, so CNG can be a viable way to monetise gas resources.

"Another advantage is that most of the assets are on ships, unlike pipelines and LNG."

Mr Steven said CNG marine technology would work in Arctic and deepwater gas projects and that the pressure vessels work better in colder climates.

He also said there is potential for applying the technology in areas such as off the east coast of Canada, where field developments in Newfoundland could feed markets in the US eventually.

The ships can also be fed gas by a variety of loading systems such as production and storage ships or piers, or submerged buoys or other offshore loading systems.

With all this interest, and finally some real progress, a market is opening up for energy shipping that can help several parties to create more wealth and reduce their costs.

CNG marine transportation is at the crest of a new dawn and has the potential to become a strong part of the shipping market just as LNG did 30 years ago.



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**Angus Campbell, head of CNG at Overseas Shipholding Group**

## OSG set to send out the first tenders

**O**VERSEAS Shipholding Group is preparing to order the first ships that will be able to carry compressed natural gas in pressure vessels developed by TransCanada. The New York-listed company has identified shipyards that it wants to negotiate with and will be sending out tenders soon in order to have the first ships available for loading CNG in 2011.

Now their first client — Artumas Group — has given the green light to progress with an East African project, OSG will be moving swiftly to get the yard slots sorted out for a 2011 delivery.

"We are about to start discussions with shipyards to get the tendering process underway," said OSG head of CNG Angus Campbell. "The funding for the first ships for the first marine CNG project will come from in-house sources but for later projects we will consider project finance and bank funding."

OSG will be looking to build a series of CNG carriers in the future, including four for Artumas' Tanzania-Kenya project, so it will be taking time to discuss how well these ships will be built and how long it will take with the interested yards.

"We are looking at yards that want to have a long-term arrangement so we can continue using the same shipyards in the future. There is nothing complicated in the hull, but installation of gas containment systems will be important and the yard should be able to cope with high pressure gas work," he said.

"So there are a number of yards available to us and selection will depend on track record and experience of keeping to budget and delivery schedules. The first project will show how well Trans CNG International performs and this will influence the choice of yard. So the quality of construction and ability to deliver on schedule is important."

The cost of building these ships will be more than a standard tanker and possibly a little more than LNG carriers, but should be much lower than building or converting a floating production storage and offloading vessel.

The ships will have several of TransCanada's high-strength, lightweight pressure vessels installed horizontally on top of each other in the hull to provide the storage capacity so the shuttle service of ships will be able to deliver 35m cu ft of gas per day to a power plant in Kenya.

The pipes, in three open ventilated holds, will be designed for bow or mid-ship loading and there will be valves at the top of each hold for pressure release and adequate space for regular inspections between the pipework.

Although the first ships will be of a certain capacity, the size of vessels in the future will vary. For the first few projects the ships are likely to be similar in design so the CNG carriers can be deployed on different transportation projects if necessary.

"We have a number of ship designs and these are governed by the gas delivery rates per day. The typical one is for 35m cu ft per day, but cargoes can be as large as 150m cu ft per day," said Mr Campbell. "We can go beyond that, but this is what project developers have come to us with so far. We want to keep designs as similar as possible so the only changes are how to configure the hull and the size of the pressure vessels."

OSG has been working with Rolls-Royce Marine on the design of its ships and will be using Rolls-Royce gas powered engines because the energy companies will be able to provide fuel to the propulsion system from the cargo holds.

It is also working with BMT and ABS on a vessel design that could be used to carry CNG in benign environments from oil production facilities where associated gas is being flared.

The ocean-going ships will be Lloyd's Register AI standard for deep sea trading and Solas compliant so they will also be available for gas projects in harsher marine environments than those encountered off East Africa, said Mr Campbell.

Once the CNG carriers are delivered, they will be manned by experienced officers and crew that will be trained both for marine operations and also at TransCanada's CNG training centre in Canada. "We can take tanker officers and train them to operate on the gas carriers," said Mr Campbell. "Training and recruitment are an important part of managing these ships, so we will be investing in manning and training early on."

"All of the operations of these vessels — services such as manning, insurance, lubes, stores and crews — will be managed through the OSG organisation in Newcastle, UK.

The first ship will be staying on the projects on long-term charters of perhaps 10-20 years, but they will be somewhat interchangeable, an advantage of keeping the designs similar."

If everything goes to plan, OSG will have at least four CNG carriers operating in 2011 and perhaps 24 in 2015, a large growth in fleet capacity in anyone's books.