# SECTION 7.0

## OTHER METHODS FOR CARRYING OUT THE PROJECT

GOLDBORO LNG

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# 7.0 OTHER METHODS FOR CARRYING OUT THE PROJECT

Having chosen Goldboro as the best location for the Project, the following sections discuss other (alternative) methods for implementing the Project, in the context of design options that affect environmental impact and sustainability. These include such topics as transportation of LNG, facility siting and layout, process and storage options, as well as energy and water supply.

## 7.1 Transportation Mode

Since the purpose of the Project is the export surplus natural gas to overseas markets, the discussion of alternative methods relative to transportation mode does not include road or railway options. Utilization of a pipeline to connect to the target market is not a viable option due to the distances required to be spanned. Shipping of the processed product in its gaseous form (as Natural Gas) is also considered to be an unviable alternative. By liquefying the Natural Gas, the overall volume is reduced approximately 600 times, thus making the shipping of LNG an economically feasible option and reducing the overall number of shipments required.

Although the current design does include a small component for truck delivery of LNG to local domestic markets, the scale proposed does not warrant consideration of railway or pipeline delivery.

## 7.2 Site Layout

### 7.2.1 LNG Facility

The precise location of the LNG liquefaction plant is limited by the arrangement of the Industrial Park property relative to the shore, and the Project area of the previously assessed Keltic Project. There is no other part of the industrial park where shoreline access is feasible. Therefore, no other location for the land-based components was considered. The layout of land-based components is based on a long list of considerations including design function/constructability, safety, and environmental and cost optimization. Future development has also been included.

### 7.2.2 Marine Jetty and Marginal Wharf

The location and orientation of the jetty structure is determined by the location of the vessel turning circle, the berth pockets and the preferred orientation of the vessels when berthed alongside. The preferred orientation of the vessels is determined by the requirement of a quick departure of the vessels in case of an emergency and by the physical conditions at the site (such as wind, waves and currents). Based on the prevailing wave and current direction an orientation of 150°N was proposed for the jetty head (to be confirmed during FEED). The location of the marginal wharf is determined by the location of the LNG facility. During construction the wharf will be used for the delivery of large pre-assembled Project components and therefore needs to be as close to the site as possible. During operation, a close location to the LNG jetty is also required to minimize the travel distance for the tugs, line boats, and pilot boats. The orientation of the wharf is also influenced by the physical conditions at the site.

Given these major restrictions, the following environmental considerations were applied in the precise location and layout of marine components:

- minimize footprint;
- provide for sufficient depth and thus to avoid dredging; and
- minimize footprint on Red Head (including Dung Cove Pond).

## 7.3 LNG Technology

The target LNG production capacity for each LNG train for the Project is around 5 Mtpa. Of the liquefaction technologies currently offered, the only ones in operation at this train capacity are:

- propane pre-cooled mixed refrigerant (C3MR);
- dual mixed refrigerant;
- optimized cascade process; and
- mixed fluid cascade.

The C3MR technology was selected because has been used on ~70% of the world's LNG base load production and its operation and control is relatively simple and well understood. For the purpose of the Project, a proven process configuration could be developed using this technology to meet the LNG train capacity requirement and it will deliver a representative concept with respect to plot utilization, power consumption, production, emissions and cost.

## 7.4 On-site Storage

LNG tanks may be constructed in various combinations of single or double walled steel containment, or with concrete outer protection. Full containment LNG tanks (include outer concrete wall) have been selected for the Project based on the following:

- full containment LNG storage tanks are regarded as industry best practice;
- in full containment LNG storage tanks, both inner and outer tank can contain the LNG and minimize fugitive emissions;
- concrete outer wall provides protection from radiant heat from fires, blast loads and projectiles; and
- the original environmental approval for the Keltic Project was based on full containment LNG tanks.

## 7.5 Power Production

The only reasonable alternative to the self-sufficient gas-turbine power generation plant currently proposed for the Project would be the use of hydroelectric/grid power. This alternative may be the subject of further feasibility study during the FEED stage. One advantage of this approach would be the reduction in local GHG air emissions by the Project. However, the grid electricity is currently provided mainly from combustion of fossil fuels, which would offset any local benefits by contributing to overall provincial air emissions. In any case, a power line extension would likely be required; which would increase the total Project footprint. Therefore, the on-site gas-turbine power source remains the preferred option.

## 7.6 Process Cooling

One of the most important decisions made during the design selection was the process cooling method; which had environmental implications on water source and water volume related impacts. Five options were considered (four in detail) to achieve the cooling duty for the Goldboro LNG liquefaction plant:

- air cooling;
- direct seawater cooling;
- indirect seawater cooling;
- fresh water cooling with a cooling tower; and
- open Loop Freshwater Cooling (discarded early due to large water volume requirement).

Air cooling is the preferred option for several reasons including:

- lower overall cost (despite higher operating cost from greater refrigerant power requirement);
- construction benefits for the modules, such as reduced construction schedule and on-site installation cost;
- higher availability and lower maintenance requirements; and
- significantly reduced water requirement for the Project and at the same time significantly reducing the volume of process wastewater.

## 7.7 Utilities and Common Support Facilities

At the planned location of the LNG facility there are no other plants within the vicinity that could be used as potential sources for utilities or provide common support facilities.

The current design has considered the option for servicing the tug boat fleet at other local harbours. A preliminary decision has been made to conduct fuelling and maintenance at other existing harbours/facilities; however, the marginal wharf will remain the permanent mooring facility for tug boats in order to reduce the impact to the local industry reliant on the harbouring facilities located along Isaac’s Harbour.

## 7.8 Alternative Methods Evaluation

This section has identified the various alternative methods for implementing the Project that were considered and the reasons for the selection of components and design decisions that are incorporated in the Project description. Considerable benefits for impact avoidance and sustainability have been demonstrated and the principles described above will continue to be applied during the FEED process.