NEW CONCEPT FOR STANDARDIZED LARGE-SCALE MODULAR LNG PLANT DESIGN

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ABSTRACT

Recently, modularization has become a practical approach for LNG plants to ensure safe and reliable construction at remote and/or harsh weather location where stick-built construction is unfavorable. However, most modular LNG projects have suffered schedule delay and cost increase due to various reasons. Therefore, to implement the fastest delivery and the lowest CAPEX of an LNG project, one of the most effective concepts is to standardize modular LNG plant design.

This paper presents the results of the challenges for standardization and proposes the new concept of large-scale modular LNG plant design which has been developed by utilizing Chiyoda’s vast expertise through 40 years of providing EPC LNG projects all over the world. Achieving “the fastest project delivery” and “the lowest CAPEX” requires unique valuable ideas to minimize work volume at the construction site.

NEW CONCEPT

For optimizing modularized LNG plant, the new concepts are adopted which were inherited from CHIYODA/LAND-X concepts and further expanded in consideration of the special nature of a modularized plant:

1) Ready-designed block

Each unit can be pre-designed by the experienced contractor as “Ready-designed block” based on the philosophy of safe operation and cost effectiveness. The basic design of the LNG train can be completed within a short time period as shown in below just by connection of these blocks.

MINIMUM WORK VOLUME AT CONSTRUCTION SITE

1) Minimization of welding work volume around Main Refrigerant Compressor (MRC) Even though modular construction is applied, there is much site welding work for hook-up between modules and stick built items.

In past modularized projects, the site welding work volume related to MRC is approximately 50% of total site work volume. How can we shift welding site work volume around MRC to the module yard without extension of the project schedule?

As a result of case study, it was concluded to apply the following solutions;

- Assemble the main refrigerant compressors components on the common skid
- Deliver the common skid to site and integrated into Pre Assembled Unit (PAU)

2) Layout optimization

In past modularized projects, piping hook-up work volume between Pre Assembled Rack (PAR) and PAR were approximately 3 times larger comparing to the one between PAU and PAR, since there are many large bore straight pipes in PAR which do not pass through the PAR. Furthermore, the number of joint locations between PAU and PAR were 4 times larger compared to those between PAR and PAR. Based on past project experience, the following measures are adopted in order to reduce site welding work volume:

- PAR is as long as practical to minimize number of joint locations between PARs which have large site welding work volume.
- PAUs are integrated with PARs as much as practical to reduce the number of joint locations.

3) Minimize electrical and instrument work

In order to minimize cable laying work at site, following concepts are applied;

- Install Local Electrical Room (LER) on each PAU and PAU
- Install Local Instrument Room (LIR) on each PAU and PAR
- Perform pre-commissioning work at module yard

STANDARDIZED LARGE-SCALE MODULAR LNG PLANT DESIGN

Chiyoda Corporation has developed a standardized large-scale modular LNG package, “CHIYODA/LAND-Xm Japan™”, using the new standardization concepts described above and developed from Chiyoda Corporation’s unparalleled expertise and experience in global LNG plant engineering and construction. This concept will minimize site work and optimize the “Plug & Play” model.

CHIYODA LNG-Xm Japan™ has been developed on the following basis;

- Design Package Capacity: 7 Million Tonnes Per Annum (MTPA) at cold climate region
- Liquefaction Process: Propane Pre-cooled Mixed Refrigerant Process
- Refrigerant Compressor Driver: Trent-60 DLE or LM6000PF x 4 (2 strings)
- Cooling: Air cooling
- Specification: Chiyoda Standard Job Specification

Through the 3D model development adopting the concepts mentioned above, site work volume (WV) for pipe welding and cable laying has been compared to a past project which applied conventional measures as shown in right. Note: Comparison in 4-hour data for one LNG train.

CONCLUSIONS

The importance of LNG as a source of energy will continue to grow in response to escalating global clean energy demand. There are many proposed new LNG facilities but only the most competitive of those projects currently under planning stage will be realized. Consequently, “the lowest CAPEX” and “the fastest project delivery” are key criteria to realize successful future LNG projects. Design standardization with Chiyoda’s new “large scale modularization” concept is on the essential element to achieve these two vital targets.

As the No. 1 LNG contractor, Chiyoda Corporation will continue to support clients and contribute to the realization of successful LNG projects.

REFERENCE

Standardization of LNG Plant Design Based on a New Concept, Toshiya Morose, Chiyoda Corporation, LNG18

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