

# A Presentation of a Cost Classification System for Gas Plant Construction Projects

Moonsun, Park<sup>1</sup> and Yongsu, Kim<sup>2</sup>

*Abstract: The purpose of this study is to present a cost classification system that can be used in gas plant construction projects. Towards this end, it examined the detailed statements of the construction companies which had experience in carrying out plant construction projects. Based on the above, it also presented a life-cycle (i.e., EPCC) cost classification system for the gas plant construction projects by conducting the Delphi analysis through the expert opinions.*

*Keywords: Gas Plant, Cost Classification, Life Cycle(EPCC), Delphi Method*

## I. INTRODUCTION

The orders of the plant in Korea increased by 61% compared to the amount of orders in January 2014 despite the worsened situation due to four-low phenomenon such as low oil price because of the collapse of international oil price, low economic growth, and low currency of yen and euro. The increase may be associated to Korea's massive gas facility or plant orders from promising new market countries and the important order strategic countries such as Vietnam. Despite the positive inflow of orders, Korea's plant engineering generic technology still lacks compared to the first world countries.

Currently, the gas plant building technology field of Korea lacks in terms of ordering experiences compared to the other first world countries and the overall level of technology in important fields such as investigation and evaluation of reasonability of plans in early stages and FEED package ability including the basic design runs short as well. Moreover, the case of overseas plant construction project regarding this is claimed to be inefficient in terms of the active usage of engineering technology by elevating the data such as cost and risk by the industry itself. The plant construction project, which is elevation integrated business in overseas construction market, needs the development of generic technology to predict the exact business expenses to minimize the loss incurred due to estimation error.

Thus, this study attempts to suggest a cost classification system for an efficient use of cost analysis of the gas plant construction project.

The purpose of this study is explained in detail below.

1) Life cycle(EPCC) cost classification system shall be

investigated and analyzed through the detailed statement of construction companies which had experience in carrying out plant construction projects.

2) Based on the investigation and analysis above, Delphi analysis shall be conducted upon the opinion of experts and the cost classification system per life cycle(EPCC) stages of gas plant construction project shall be suggested.

## II. LIFE CYCLE(EPCC) COST CLASSIFICATION SYSTEM INVESTIGATION AND ANALYSIS

1) Investigation of cost classification system

This study aims to suggest the cost classification system per life cycle(EPCC) stage, which includes Engineering, Procurement, Construction, and Commissioning, of the gas plant construction project. For this purpose, the detailed statements on life cycle(EPCC) of five construction companies, which had experience of carrying the plant construction projects, are utilized.

2) Analysis of cost classification system

Through the investigated contents on 2.1 above, the cost items per stage were analyzed using the first, second, and third Delphi analysis upon the opinion and decisions of experts (five cost experts of chosen cases, three experts on business related with overseas plant construction project, three senior researchers and doctors who are studying overseas plant and LNG) in order to analyze the cost classification system. To simply put it, the cost items on large and medium categories through the existing gas plant cases were analyzed through three Delphi analysis techniques and the cost items on small and detailed categories were analyzed and classified into Level 1 to 6.

<sup>1</sup> Ph.D, School of Architecture & Building Science, Chung-Ang University, [cemmoon@cau.ac.kr](mailto:cemmoon@cau.ac.kr) (\*Corresponding Author)

<sup>2</sup> Professor, School of Architecture & Building Science, Chung-Ang University, [yongsu@cau.ac.kr](mailto:yongsu@cau.ac.kr)

The schematized data is shown in figure 1 below.

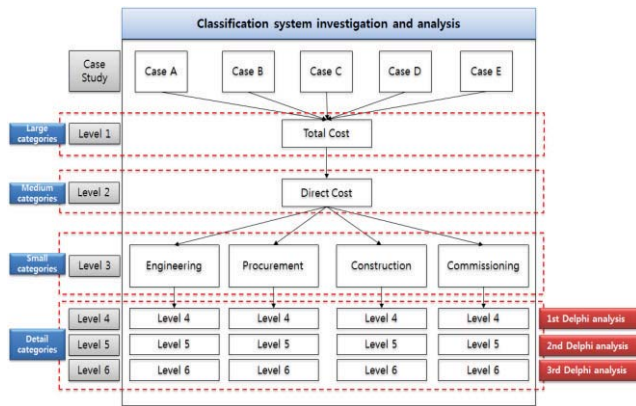


FIG I. Classification System Investigation and Analysis

### III. SUGGESTION OF COST CLASSIFICATION SYSTEM PER LIFE CYCLE(EPCC)

This study suggested the cost classification system per life cycle(EPCC) stage, which are Engineering, procurement and supplying, construction and trial run, of the gas plant construction project based on the investigation and analysis of the cost classification system which were demonstrated in chapter 2 above. Table 1 below shows the cost classification system of the Engineering stage and the cost classification systems of Procurement, Construction, and Commissioning are schematized through the same process.

TABLE I. Classification of Life Cycle(EPCC)

Cost Item Classification	
1. Total Cost	
2. Direct Cost	
3. Direct Cost Engineering	
4. Direct Cost Engineering - HumanCost	
5. Direct Cost Engineering-Human DirectCost	
6. Direct Cost Engineering - Human Direct Technical	
6. Direct Cost Engineering - Human Direct General	
5. Direct Cost Engineering - Human LaborCost	
6. Direct Cost Engineering - Human Labor Technical	
6. Direct Cost Engineering - Human Labor General	
4. Direct Cost Engineering - OutsourcingCost	
5. Direct Cost Engineering - Outsourcing DomesticCost	
6. Direct Cost Engineering- Outsourcing Domestic StorageTank	
6. Direct Cost Engineering - Outsourcing Domestic Machinery	
6. Direct Cost Engineering - Outsourcing Domestic Installation	
6. Direct Cost Engineering - Outsourcing Domestic Piping	
6. Direct Cost Engineering - Outsourcing Domestic Ventilating	
6. Direct Cost Engineering - Outsourcing Domestic Electricity	
6. Direct Cost Engineering - Outsourcing Domestic NetworkSystem	
6. Direct Cost Engineering - Outsourcing Domestic CivilEngineering	
6. Direct Cost Engineering - Outsourcing Domestic Architecture	

				5. Direct Cost Engineering - Outsourcing OverseasCost
				6. Direct Cost Engineering - Outsourcing Overseas Safety
				6. Direct Cost Engineering - Outsourcing Overseas Machinery
				6. Direct Cost Engineering - Outsourcing Overseas Installation
				6. Direct Cost Engineering - Outsourcing Overseas Piping
				6. Direct Cost Engineering - Outsourcing Overseas Electricity
				5. Direct Cost Engineering - Outsourcing LocalCost
				4. Direct Cost Engineering - Expense
				5. Direct Cost Engineering - Expense SuppliesGoods
				5. Direct Cost Engineering - Expense OperatingCost
				5. Direct Cost Engineering- Expense PrintingCost

### IV. CONCLUSION

This study is conducted in order to suggest a cost classification system which can be utilized in the gas plant business projects. For this purpose, the detailed statements of construction companies with the experience of carrying out the gas plant construction were investigated. Moreover, based on the abovementioned, Delphi analysis was conducted upon the opinions of the experts and the cost classification system per life cycle(EPCC) of the gas plant business project is suggested. The conclusion gained through the above process is summarized as follows.

First, the cost items per stage, Engineering, Procurement, Construction, and Commissioning were examined using the first, second, and third Delphi analysis based on the detailed statements of five construction companies with the experience in carrying out gas plant construction projects.

Secondly, from the analyzed contents through the above Delphi analysis, a cost classification system with large, medium, small, and detailed categories was presented which can be utilized in the gas plant construction projects from Level 1 to Level 6

### ACKNOWLEDGEMENT

This research was supported by a grant from the LNG Plant R&D center funded by the Ministry of Land, Transportation and Maritime Affairs(MLTM) of the Korean government

### REFERENCES

- [1] Abel Pinto, "Occupational Risk Assessment in Construction industry - Overview and Reflection", Safety Science, 2011.
- [2] Dogan, S., Arditi, D., and Günaydın, H.at.. (2006). "Determining Attribute Weights in a CBR Model for Early Cost Prediction of Structural Systems", Journal of Construction Engineering and Management. 2006
- [3] MoonSun Park, "The Research on Conceptual Model of LNG Plant Project Planning Expert System", ICCEM/ICCPM, 2009.