INTRODUCTION

Huanqiu Contracting & Engineering Corporation Ltd (HQC-BJ), affiliated company of China National Petroleum Corporation (CNPC), has continued to develop new process and improve existing technology for hydrocarbon liquefaction and fabrication businesses and cryogenic storage business, since 1980’s, especially liquefied natural gas (LNG).

Nowadays the performance-based design and refinement-based design are becoming the requirement of modern engineering design, and then dynamic characteristics of critical equipment and process systems need to be taken into account. HQC has studied dynamic simulation technology to apply in LNG plant. The dynamic simulation model is built based on the proven practices of a mature LNG plant (for which HQC had provided all the technical and engineering construction services, including process design package of HQC-DMR, Dual Mixed Refrigerant developed by HQC) liquefaction process, front end engineering design, EPC and commissioning and start up.

The study involves liquefaction system, hydrocarbon fabrication and LNG storage, and analyzes various scenario, e.g. emergency shutdown, black start up and so forth. Combining with engineering experience, operation and start up experience, the possible scenarios with large impacts to the operation and to the critical equipment are identified via the simulation procedure and simulation results, and the potential control optimization and key points of engineering design are also obtained.

OBJECTIVES

The proven practices of a mature LNG plant built with independent intellectual liquefaction technology (HQC-DMR) are selected as research objects. In the liquefaction process flow, there are two refrigerant compression cycles, and two cold boxes operated in parallel for heat exchange of natural gas and refrigerant. A scrubber tower is configured to remove heavier hydrocarbon from natural gas after precooling, and the cold energy required by scrubber reflux is matched with the refrigeration duty of cold box.

CONCLUSIONS

The dynamic simulation flowsheets, including cryogenic heat exchanger, compression strings & refrigeration loops and scrubber column, are built based on the proven practices of the mature LNG plant, which provide a framework to evaluate transient operation and variable operation. The research results show that the interaction of the physical process and the control system has been efficiently studied of different operating scenarios. The control system is effective, and the ESD logic is reliable and operable. In the dynamic simulation for start-up case, the key steps of operation procedure are further clarified, and sensitive design points are determined. Furthermore, the operation procedure is solidified in the model, which provides a good model foundation for other case study, such as start with pressure etc. The dynamic simulation provides a method of verification and improvement for engineering design and operation.

REFERENCES


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ACKNOWLEDGEMENTS/CONTACT

The authors are grateful to the research team, especially rotating equipment expert Joquan Fan and instrument expert Guanlei Bao, as well as Aspen technical supports.

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RESEARCH & INNOVATION SHOWCASE

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NG-Column-ColdBox

LNG system response during black start-up period.