

新能源

以太阳能为高温热源的LNG卫星站冷能发电系统

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摘要:

如何高效合理利用LNG所携带的冷能一直是人们关注的话题。为此,对LNG卫星站中LNG冷能利用方式及工艺流程进行了研究。以山东淄博LNG卫星站为例,建立了一种以太阳能加热的水为高温热源,LNG储罐输出的LNG液态工质为低温热源的热力循环发电系统。设计了该系统的工艺参数,计算了该系统日均净发电量和能量利用效率,分析了该系统的经济性和环保效益。结果表明:在日供气量为 $12 \times 10^4 \text{ m}^3$ 的山东淄博LNG卫星站中建立该热力循环系统,能量利用效率可超过30%且符合工程实际,年可发电 $27 \times 10^4 \text{ kW} \cdot \text{h}$,每年带来约30万元的经济效益;同时,还可以节约气化LNG所需的燃料费用6~8万元/a,减少因燃烧煤炭和天然气而带来的 $400 \sim 1\,000 \text{ kg/a}$ 的 SO_2 排放量和 $56 \sim 146 \text{ t/a}$ 的 CO_2 排放量,实现了节能、环保、增效三赢。

关键词: [LNG卫星站](#) [LNG冷能利用](#) [太阳能](#) [高温热源](#) [低温热源](#) [热力循环](#) [发电系统](#) [山东淄博](#)

Cold energy power generation system at LNG satellite stations with solar energy as a high temperature heat source

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Abstract:

It is a hot topic at present about how to take good advantage of the LNG cold energy. In view of this, a study was carried out of the method for exploring the use of LNG cold energy at LNG satellite stations as well as the involved technical process. Therefore, in the case study of the Zibo LNG satellite station in Shandong province, where the daily gas supply volume reaches $12 \times 10^4 \text{ m}^3$, a power generation system with a thermodynamic cycle, in which the solar energy hot water is taken as a high temperature heat source while the liquid medium from the LNG storage tank as a low temperature source. Then, the technical parameters of this system are designed and its daily net generation and energy efficiency are also calculated. On this basis, the economy and environmental benefit of this system are analyzed. The following results are achieved in this case study. The energy utilization rate is over 30%, which agrees well with the actual engineering practices; the annual power generation reaches $27 \times 10^4 \text{ kW} \cdot \text{h}$, which brings about economic benefit of about RMB 300 thousand Yuan each year. Besides, about RMB 60 ~ 80 thousand Yuan each year can be saved from the fuel consumption for LNG gasification; about 400 ~ 1000 kg of SO_2 and 60 ~ 80 tons of CO_2 emission from coal and natural gas combustion can be reduced each year. In this way, three goals of energy saving, environmental protection and profit enhancement can be achieved.

Keywords:

收稿日期 修回日期 网络版发布日期

DOI: 10.3787/j.issn.1000-0976.2012.10.025

基金项目:

通讯作者:

作者简介:

作者Email:

参考文献:

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