Cold energy air separation storage

A novel air separation unit with energy storage and generation and its energy efficiency and economy analysis. Author links open overlay panel Xiufen He a, Yunong Liu a, Ali Rehman a, Li Wang a b. ... The electrical conversion efficiency of cold energy storage is 51.77%. The contribution of power generation is 23.67%. Therefore, it is a high ...

Cold thermal energy storage (CTES) is suited to air conditioning (AC) systems in building applications. A typical configuration of electric AC systems with CTES is shown in Fig. 1. In this way, cooling capacity can be produced at ...

In order to resolve the problems of the current air separation process such as the complex process, cumbersome operation and high operating costs, a novel air separation process cooled by LNG cold energy is proposed in this paper, which is based on high-efficiency heat exchanger network and chemical packing separation technology. The operating temperature ...

A novel system of liquid air energy storage with LNG cold energy and industrial waste heat: Thermodynamic and economic analysis: Aftercoolers in LAES; ... achieving 0.252 kWh/kg for liquid oxygen and 0.258 kWh/kg for liquid nitrogen through coupling LNG cold energy with an air separation unit. Therefore, coupling LNG-LAES with the air ...

Fig. 5(b) depicts the distribution of cold energy utilization across air separation (AS), ORC, wastewater ice-making (WI), and cold storage (CS), relative to the total LNG cold energy. In the temperature range of -162°C to -96.6°C, the AS subsystem harnesses 1187.8 kW of cold energy, accounting for 24.67% of the total.

One of the solutions to utilizing liquefied natural gas (LNG) cold energy at import terminals is supplying it to an air separation unit (ASU), replacing an external refrigeration ...

amount of cold energy left to be recovered from the LNG. Unlike the integration options mentioned above, an air separation unit (ASU) is a system that can fit in the temperature range of LNG vaporization. Due to the low operating temperature of air separation units (from -170 °C to -190 °C), which is closer to the LNG temperature than any other

Liquid Air Energy Storage (LAES) uses off-peak and/or renewable electricity to produce liquid air (charging). ... LAES + Air separation unit for extra oxygen production ... suggested the storage of the LNG cold energy at peak time and the release to liquefy air, together with LNG cold energy recovery, at off-peak time. They showed that the ...

The results show that the energy consumption of the proposed air separation process with LNG cold energy utilization decreased about 58.2% compared with a conventional cryogenic air separation process. The

compressed pressure of recycled nitrogen has a big impact on the cost of air separation products and utilization efficiency of LNG cold energy.

LNG cold energy can be recovered through the regasification process. Due to environmental risks and energy consumptions, cold energy recovery can be done in the air separation units (ASU) (Ya-jun and Ben, 2008), organic rankine cycles (ORC) (Gómez et al., 2014b), agro-food industry (La Rocca, 2010) and space conditioning (La Rocca, 2011).

A hybrid LAES system combined with organic Rankine cycle based on the utilization of the LNG cold energy was proposed by Zhang [6], and the energy storage efficiency and exergy efficiency are 70. ...

The process of vaporizing LNG in vaporizers generates a large amount of cold energy, which can be used in a variety of applications, such as power generation, air separation, desalination, CO 2 capture, data center cooling, and cold storage . However, it is important to consider the distribution pressure of natural gas when utilizing LNG cold ...

Energy storage technology is pivotal in addressing the instability of wind and PV power grid integration. Large-scale grid-applicable energy storage technologies, such as Pumped Hydro Energy Storage (PHES) and Compressed Air Energy Storage (CAES), can achieve efficiencies of 60-80 % [4], [5], [6].PHES adopts surplus renewable energy or low-priced valley ...

Hence, the search for novel systems of LNG regasification with complete recovery of its cold energy is gaining the attention of researchers. Thus, the novel areas where cold energy of LNG can be utilized are cold storage, waste incineration, air separation, desalination, cryogenic CO 2 capture, and power generation. In addition, other areas ...

The existing ways for recovering LNG cold energy involve electricity generation, air separation, refrigerated storage, liquid carbon dioxide, air conditioning, and refrigeration [17]. ... These issues can be addressed by utilizing LNG cold energy for air separation. This solution involves extracting excess compressed air from the compressor for ...

The electricity demand of the electric chiller is significantly reduced because of the use of LNG cold energy for air pre-cooling. Chen et al. investigated the novel coupling of two distillation columns with the LNG cold energy for air separation. The electricity consumption of producing vapour oxygen was reported to be about 72% less than the ...

Cold energy storage processes enable the utilization of the nonstorable LNG cold energy by converting it into other forms of cold energy, which can be stored for longer periods. ... Selecting suitable locations with a sufficient number of end users requiring large amounts of cold energy, such as air separation and power generation plants, and ...

The combination of the air separation unit and cryogenic energy storage enhances system efficiency; however, there are still significant irreversible losses in the energy conversion process and high investment costs. This paper explored the potential for deep integration of these two process and proposed a novel air separation with liquid nitrogen ...

Exergy flows from (a) baseline combined cycle (b) LNG assisted power cycle (c) thermal network (d) thermal 1173 storage (e) LNG assisted air separation unit when coupled to all cold ...

The cold thermal energy storage (TES), also called cold storage, are primarily involving adding cold energy to a storage medium, and removing it from that medium for use at a later time. It can efficiently utilize the ...

Therefore, a refrigeration cycle based on the expansion method is introduced to recover part of the cold energy taken away by CO 2 separation. Air is chosen as the working fluid for this refrigeration owing to its cryogenic temperature resistance and near-free cost. ... Performance analysis of liquid air energy storage with enhanced cold ...

On the basis of the above analysis, an external-compression air separation unit with energy storage (ECAS-ES) is proposed, which combines ASU and LAES. This paper investigates the system"s power consumption, economic benefits and peak shaving effect on the power grid. ... The liquid air releases cold energy, generates electricity, and then ...

ASU-ES-AESA can store liquid air on the greatest scale during energy storage when the air compressor is operating at 105 % of its design load and all of the energy storage air (streams 13 and 23, flow rate 10.30 kg/s) is released into the surroundings; however, the discharge of energy storage air will lead to a low air liquefaction ratio for ...

Li et al. [7] reviewed the PCMs and sorption materials for sub-zero thermal energy storage applications from -114 °C to 0 °C. The authors categorized the PCMs into eutectic water-salt solutions and non-eutectic water-salt solutions, discussed the selection criteria of PCMs, analyzed their advantages, disadvantages, and solutions to phase separation, ...

Liquid air energy storage (LAES) emerges as a promising solution for large-scale energy storage. However, challenges such as extended payback periods, direct discharge of pure air into the environment without utilization, and limitations in the current cold storage methods hinder its widespread adoption. Moreover, the current liquid air energy storage power and ...

Therefore, many LNG cold energy recovery methods have been proposed, such as power generation [12, 13], cryogenic energy storage [14], air separation [15], cryogenic carbon ... (Pump-4), in which part of the liquid air cold energy is recovered by propane and methanol. Then the liquid air (State A18) is heated up by the thermal oil (State O7 ...

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The objective of this research on the cold utilisation of LNG integrated with air separation processes is to investigate the feasibility of using the cold energy contained in LNG ...

Liquid air energy storage (LAES) emerges as a promising solution for large-scale energy storage. However, challenges such as extended payback periods, direct discharge of pure air into the environment without utilization, and limitations in the current cold storage methods hinder its widespread adoption. Moreover, the current liquid air energy storage power and transmission ...

Cryogenic LNG has a high potential for cold energy recovery throughout the regasification process. This research examines a novel air separation unit (ASU) design that is combined ...

An innovative air separation process that is integrated with the cold utilization of LNG is presented in this study along with a thorough conceptual design and analysis. The ...

This study aims to elucidate the technical and economic aspects of a real-size air separation unit and analyze the feasibility of incorporating some alternatives recently ...

Liquid air energy storage (LAES) is a promising technology for large-scale energy storage applications, particularly for integrating renewable energy sources.While standalone LAES systems typically exhibit an efficiency of approximately 50 %, research has been conducted to utilize the cold energy of liquefied natural gas (LNG) gasification. This ...

In worldwide, some of LNG cold energy utilizations have been applied in commercial ranges, such as air separation, cold storage, liquefied carbon dioxide and dry ice, cold energy power generation and low-temperature crush, etc. . Currently, world"s average utilization efficiency of LNG cold energy is about 20 %.

One of the solutions to utilizing liquefied natural gas (LNG) cold energy at import terminals is supplying it to an air separation unit (ASU), replacing an external refrigeration process and reducing the power consumption. Thus, two different options for the integration of a novel single column ASU process with LNG vaporization have been developed to achieve optimal ...