



North Lebanon Alternative Power

Ras Maska/Tripoli, 01.05.23

Tasks for Master 2 Trainees in Energetics Physics/Chemical Engineering 8.5.23 – 15.10.23

Task1: Liquefaction and Storage of Biogas (Methane)

For the Biogas Test system at Ras Maska. Design and Realization of:

- Filter system for Biogas Fermenter to get pure Methan gas
- Liquefaction Unit
- Storage of Liquefied Methan Gas

Methane liquefaction تسييل الغاز الطبيعي

LNG Properties

- LNG has the best safety record of all fossil fuels: Not flammable or explosive in liquid form
- Noncorrosive and nontoxic
- Stable and stored at low pressures
- Evaporates quickly and completely leaving no fire hazard puddle
- LNG is refrigerated around -160 °C
- Volume reduction 600 times with the same calorific capacity
- LNG is composed mainly from methane (more than 90%)
- The liquefaction factory consumes nearly 10% of the natural gas while functioning
- The LNG will be stocked at an atmospheric pressure in storages made from concrete or metallic tanks, possessing double wall and thermal insulation.
- The principals LNG exporters are: Qatar, Australia, Malaysia, Nigeria and Indonesia (more than two-thirds)

LNG Production diagram

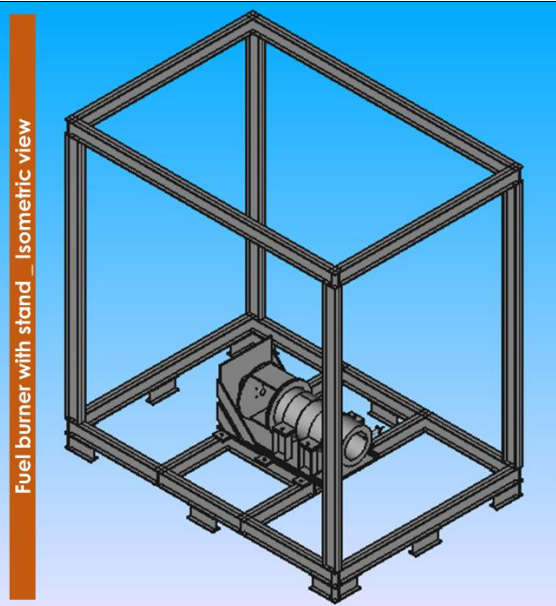
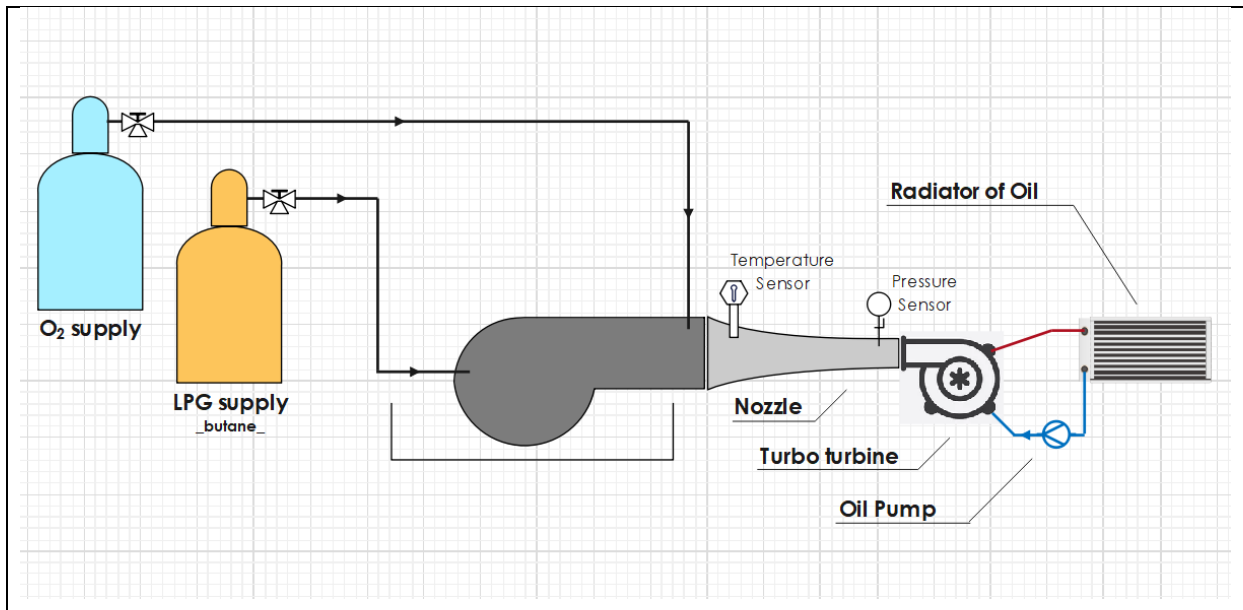
Liquefaction process of natural gas

Microchannel heat exchanger (MCHE-main heat exchanger in LNG plant)

- The MCHE is a spiral wound heat exchanger consists of bundles with thousands of tubes to provide sufficient surface area needed for a close temperature approach between the hot gas and the cooling medium.
- These bundles can be classified as warm and cold bundles and are arranged in a vertical (down) the way based on the bottom and the cold top.
- The high pressure mixed refrigerant is pre-cooled by pressure and is subsequently separated into light and heavy mixed refrigerant streams.
- The high pressure mixed refrigerant and feed gas streams flow upward through the tube side of the MCHE while the high pressure mixed refrigerant undergoes a series of flash and condensation/evaporation temperature.
- The cold flashed mixed refrigerant flows counter current (shell side) to cool both the incoming mixed refrigerant.
- As final cooling stage is accomplished through a JT valve or half valve, expansion to further cool the liquid and reduce refrigerant consumption.
- At this stage the gas stream is fully liquefied to -160°C and is prepared to storage. The warm vapour MB (mixed refrigerant) stream is taken off the bottom (shell side) of the exchanger condenses and is recycled to the MB compressor.
- The separated MB is first cooled with air or water followed by pre-cooler before returning to the MCHE to repeat the process.

Task 2: Gas Turbine Test Rig with LPG/Methane


- **Completing Realization**
- **Testing and Documentation**



Task 3: Longterm Storage System for Photovoltaics based on Water Electrolysis

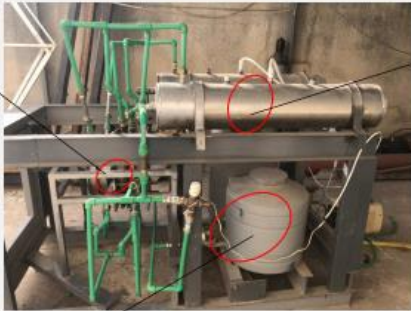
- **Completing Realization**
- **Testing and Documentation**

Mechanical




Electrolytic Cells:
An electrolytic cell is a device that split water into its two elements, oxygen and hydrogen, where the oxygen and hydrogen.

خلية التحليل الكهربائي هي عبارة عن جهاز يقوم بتحليل الماء الى عنصريه وهما الاكسجين والهيدروجين حيث يتم تخزين الاوكسجين والهيدروجين.



1:O₂ condenser
2:H₂ condenser
The condenser is mechanical part that serves to condense the excess water vapor that comes with H₂ and O₂ gases to water.

المكثف عبارة عن جزء ميكانيكي يعمل على تكثيف بخار الماء الرائد الذي يأتي مع غازات الهيدروجين و الأكسجين ماء.



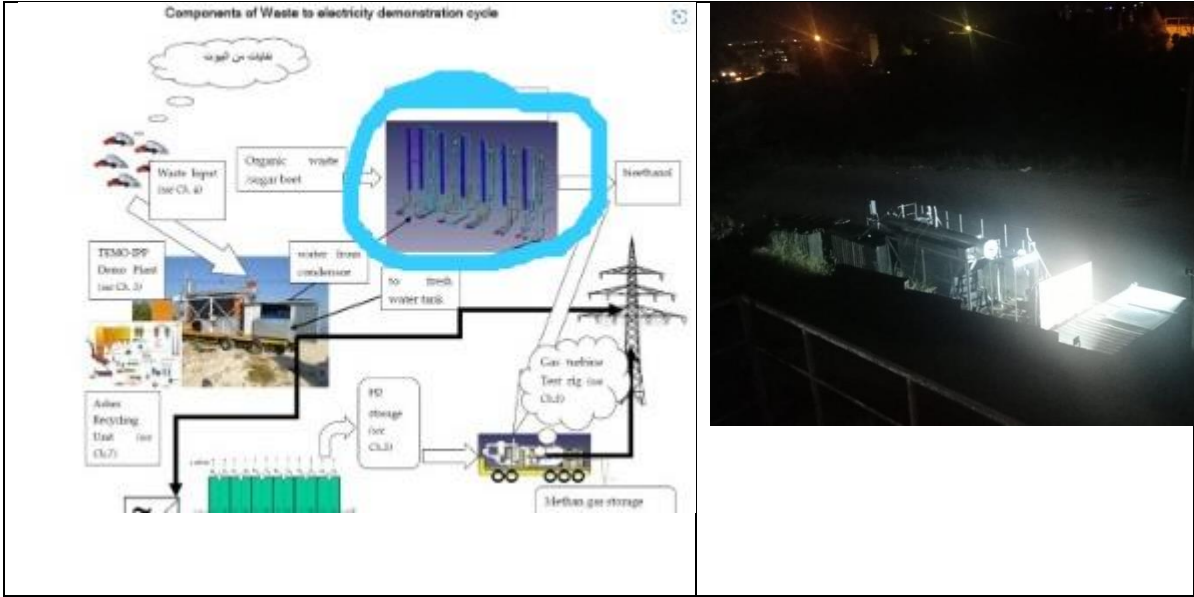
1: KOH (electrolyte) tank
2: H₂O (water) tank

ELECTROLYTE:
An electrolyte is a substance that produces an electrically conductive solution when dissolved in a polar solvent, such as water.

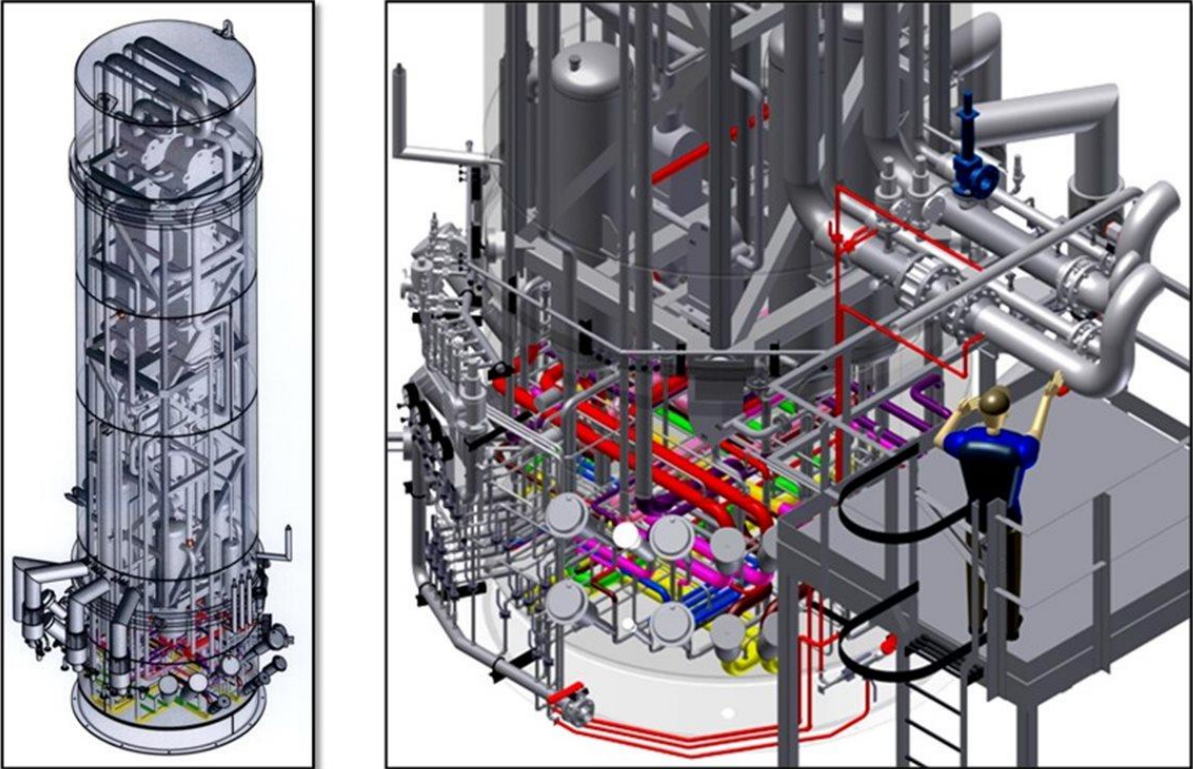
الإلكتروليت هو مادة تنتج محلول موصل كهربائي عند إذابته في مذيب قطبي ، مثل الماء

Task 4: Design of a mobile Desalination Plant for Integration at Mobile Incineration power plant

The cooling of the condenser of NLAP-IPP plant shall be combined with desalination



Task 5: Design of a Helium liquefier



Attendance, Meetings, Documentation

- Daily Work 9-15
- Daily Meeting: 9-9.15
- يدفع بدل الطريق لمن له حاجة لذلك

For further questions:

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