Waste cold recovery from the regasification process of Liquefied Natural Gas

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Barcelona: waste energy usage
LNG Regasification Process

- LNG transferms
- LNG tanks
- Primary pumps
- Secondary pumps
- Compressor
- Reliquefaction unit
- Submerged combustion vaporizer (auxiliary)
- ORV (see water vaporizer)
- Tank truck loading station
- Odorization
- Measurement station

Technical specifications:
- P: 80 bar
  T: -160°C
- P: 8 bar
  T: -160°C
- P: 0.1-0.25 bar
  T: -160°C
- P: 0.1-0.25 bar
  T: -160°C
- P: 8 bar
  T: -160°C
- P: 9.5 bar
  T: -160°C
- T: -160°C
Valuable energy for number of applications

- Food industry
- Pharmaceutical industry
- Industrial cooling: petrochemical plants, power plants and steel, etc, etc
- Data Centers
- Industrial Gases production
- Space cooling of buildings
STV evaporator (Shell & Tube) in substitution of an ORV in order to recover the cold generated in the transformation of LNG to NG.

**Project Concept**

SHELL & TUBE VAPORIZER

LNG (shell side)

- IN
- P: 80bar
- T: -160ºC

LNG (shell side)

- OUT
- P: 72bar
- T: +1ºC

24 MWth of cold recovery

CO₂ outlet (tube side)

CO₂ as cold carrier fluid:
The system allows to provide the necessary energy to be used for food conservation and frozen rooms (almost) without the use of primary energies.

To Measurement point station (Regasification plant)

CO₂ inlet (tube side)

DRY ICE STORAGE

- T: -15/-30ºC

High cooling demand

ICE STORAGE (300 MWh)

MERCABARNA (Wholesale market)
Key elements:
LNG Evaporator and Storage

CO₂ as a PCM storage on negative temperatures:
Dry ice formation and melting, phase change storage on -55 °C.
Main barriers identified

- Lack of boost/motivation. Gas market is fully regulated
- Application of waste cold not always evident near the regasification plants
- Lack of demonstration projects
- Technology constrain: need for a high critical mass on demand

Great Opportunities

- 37 LNG regasification plants in Europe, which represents ≈20% of world capacity
- Developing solutions for further industrial symbiosis within industrial parks – circular economy
Presently foreseen // Full potential

- 24 MW LNG waste energy recovery
- 162 GWh/year of useful cold // 665 GWh/year
- 104 GWh/year primary energy savings // 459 GWh/year
- equivalent to 0.7% of total electrical energy consumption of Barcelona // 3%
- 16,500 ton/year CO2 emissions reduction // 73,123 tonCO2/year
Replicability
EU (untapped)
Energy recovery potential

• 4,5 TWh/year of high commercial value cooling,
• 1,5 times higher than all the cooling provided through existing district cooling networks at present.
• 5,4% of total cooling consumption on buildings and industry together.

• Savings roughly 1,5 TWh/year of electricity,
• reduction of 4,4 TWh/year primary energy consumption
• 649,500 ton/year of CO2 emissions