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**LNG business**

LNG contains two forms of energy – one measured in terms of Calorific Value (CV), which is widely recognized, and the other known as cold energy, which also has value but is seldom talked about and utilized.

LNG is made by liquefying natural gas by application of a lot of energy, cooling the gas from atmospheric temperature to -160 deg Centigrade. The gas volume is shrunk in the process by a factor of 600. It is transported through LNG ships to LNG terminals in importing countries and is regasified again by application of thermal energy and is then put in the gas network. The cold energy goes into hot air unutilized. This is the case in most countries, although Japan has been utilizing this cold energy for a long time. Now Spain, Singapore and India too are at varying stages of implementation. By 2017, only 23 LNG terminals out of a total of 111 had some form of utilization of this cold energy.

There are many requirements and uses of cold energy – refrigerating food, medicines etc; space air conditioning; hospital and industrial processes etc. The Intergovernmental Panel on Climate Change (IPCC) has estimated that by the turn of the current century, air-conditioning demand alone would consume half the electricity that is generated today.

Currently cold energy is wasted and even more energy is applied to gasify cold LNG, costing money and pollution. This is truer in FSRUs than in land-based LNG terminals. If the cold energy contained in LNG is usefully utilized in the afore-mentioned cold applications, it has been estimated that additional revenue of $50 per ton of LNG can be generated. For an LNG terminal of 3.5 MTPA, it would amount to annual revenue of $175 million per year.

Traditionally, cold energy has been utilized near the LNG terminals – by installing cold storages and air-conditioning chillers etc. However, new uses of cold energy have been developed which allow off-terminal uses at distant places. Cold energy is utilized in liquefying air, oxygen and nitrogen and other gases. Cheap and abundant availability of industrial gases promotes industrialization. Nitrogen as well as oxygen are used in many industries. The gases are transported to far-off places for utilization in various end uses. Liquid nitrogen based refrigerated trucks have been introduced which have replaced noisy and polluting diesel engine based mechanical refrigeration. Nitrogen cylinders are placed under the truck bed or on the top and liquid nitrogen is passed through radiators cooling the inner truck space. Vaporized nitrogen is exhausted into the atmosphere.

Air separation plants producing oxygen, nitrogen and argon are most useful and versatile. LNG has a liquefying point of -161 C, oxygen -183 C and nitrogen -196 C. It is clearly apparent how much energy would be saved by cooling air mixture from LNG liquid point of -161 to oxygen and nitrogen temperature (-183, -196) as opposed to from the atmospheric temperature of 25-30 C.

A new use of liquid nitrogen is in cryogenic energy storage for the electricity grid. This would be a storage medium in addition to lithium ions etc. Liquid nitrogen expands 700 times in being gasified to come to the atmospheric condition. It can pass and expand through engines and turbines and create mechanical/electrical energy. As liquid nitrogen is transportable to anywhere, cryogenic power storage facilities can also be located anywhere. Liquid nitrogen is also used in cooling turbine inlet temperature, enhancing the thermal efficiency of single and combined cycle power plants.

A novel use of liquid gases has emerged in the form of cryogenic grinding used in the recycling of old tyres. Old tyres are passed through mechanical cutters and then are dipped in cryogenic tanks or are sprayed upon. This makes the rubber brittle which enables separation of textiles and steel fire from rubber tyres and facilitates micro-grinding. There is apparently a lot of potential in Pakistan for this, in addition to the traditional cold energy uses in refrigeration and air-conditioning.

In Pakistan, there are two LNG terminals with a combined capacity of eight million tons per year. In the near future, another three LNG terminals are going to be added to increase the LNG capacity to more than 17.5 MTPA. World trade in LNG is projected to exceed 500 mtpa. Thus, nationally and internationally, there is going to be a very large potential of cold energy availability and its utilization.

FSRUs may offer difficulties in utilizing cold energy, although some arrangements can be made. On-shore terminals or on-shore gasification along with FSUs may be more conducive to cold energy utilization. In the Port Qasim area, a special zone of cold energy industry may be created to utilize the cold energy potential. District cooling projects may also be launched for the adjoining areas and recreational facilities as well. Some new features may have to be added to the LNG policy to promote and encourage adequate utilization of cold energy.

For a take-or-pay existing terminal, a profit-sharing formula or royalty may have to be introduced. There is significant potential for promoting the food and agro-industry by augmenting the cold supply chain. Liquid nitrogen-based refrigeration may add another dimension to this industry. Cold energy utilization can lead to lower RLNG cost and attractive return to investors.

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