Methane Storage & Transport, the role of Gas Hydrates.

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Methane is an increasing energy source, the world consumption of methane is rising about 3% by year for the last 30 years. Just to give an example the market of Natural Gas Vehicles (NGVs) is rising about 20% by year since 2000. Methane is mostly used in developed countries, in EU Germany aim to cover the 10% of its internal consumption of Methane with Biomthene within 2030 and currently has more than 150 Biomethane plant connected to the Natural Gas Grid with a production capacity of 93650 Nm3/h. Italy instead shows the highest NGVs fleets in UE with 840000 vehicles just 8 times more than Germany. The increasing use of methane poses the problem of its efficient storage and transport infrastructure with technologies both for small and large scale application. Currently for large application Pipeline and LNG tanks are the most used technologies. For the small scale instead the pressurized gas cylinders are widely used. The US DOE with the US Advanced Research Project Agency-Energy (ARPA-E) fixed the challenging target for the Methane storage and transport for various application sectors. Emerging technology like Metal Organic Frameworks, Graphene, High Pressure Reinforced Cylinders are suggested in order to meet the ARPA-E targets. Therefore, many studies are being devoted to the development of novel efficient technologies for gas storage and transport; one of those is methane and hydrogen storage in solid, water-based clathrate hydrates. Gas Hydrates (GH) are nonstoichiometric, nanostructured complexes of small “guest” molecules enclosed into water cages, which typically form at relatively low temperature-high pressure. In nature, GH of natural gas represent an unconventional and unexploited energy source and methane hydrate technology is already applied industrially. Methane hydrate formation has been shown to be heavily promoted by some chemicals, notably surfactants.
Models demonstrates that the storage and transport by GH may result 24% cheaper than conventional technologies. Our studied focused on compare energy efficiency of various storage and transport systems in order to evaluate the real applicability of GH. The Specific Energy Consumption (SEC), namely the Energy used to store and release Methane to and from the storage media have been calculated and thus the net energy storage capacity have been obtained. SEC and CO_2 emission have been compared among Compressed Natural Gas at 200 bar (cNG200), Liquefied Natural Gas (LNG), Metal Organic Frameworks (MOF), and Natural Gas Hydrates (NGH). The results shows how NGH may be competitive both in terms of SEC and CO_2 emission. The performance obtained for NGH are in a good accordance with the target fixed by ARPA-E.