

Title: *New energy sources and storage systems in the energy transition: natural gas hydrates.*

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Indicative period: November – December. The course will consist of 7 lessons 3 hours each, one every week (interested students should contact the teacher as soon as possible in order to define the lessons schedule)

ABSTRACT. Natural gas hydrates (NGH) represent one of the most promising alternative energy sources currently known; moreover, energy producible from hydrates world reserves is estimated to be more than twice the quantity associated to all conventional energy sources. Those compounds were initially studied for their tendency to form into gas pipe-lines and so cause gas blockage. Since the mid-1960, a growing number of researchers started exploring them for the possibility to perform a completely carbon neutral energy source, or an opportunity for a transition towards a near carbon neutral energy system. The first part of the course will lead with a detailed description of NGH and all their main applications; in particular: energy production, gas storage, cold energy storage, carbon capture and storage, water desalination, gas transportation, gaseous mixtures separation and others. Then, scientific results produced in the last years in our Department and with the collaboration of the City College of New York and the Chinese Academy of Science, will be discussed in depth and contextualized in the current energy scenario. Finally, based on results shown, future researches will be proposed, with particular attention to possible integrations with further areas of research.

PROGRAM

- Natural gas hydrates and main characteristics;
- Main perspectives and current applications, mainly about energy production and storage;
- Methane recovery via CO₂ injection: CCS to optimize the production of energy;
- Use of hydrates for gas storage and transportation, gaseous mixtures separation and water desalination;
- Future expansion of the industry and research, with particular attention to the Mediterranean area.