


## SC7: ORIENTED GO MEMBRANES FOR WATER TREATMENT AND LITHIUM RECOVERY

CNT/GO MMMs for CO<sub>2</sub> capture and water treatment

PARTNERS			PILOTLINE	CURRENT TRL	EXPECTED TRL
			11	4 to 5	n/a

### THE CONTEXT

Global warming and water scarcity could be addressed effectively by 2050, based on the development of novel nanotechnology-enabled high CO<sub>2</sub> and H<sub>2</sub>O diffusivity membrane systems.

### THE CHALLENGE

This showcase will design, develop, validate and demonstrate oriented GO/CNT tailored to develop low energy-demand (a) CO<sub>2</sub> capture and (b) water treatment needs. a. CO<sub>2</sub> capture CNT/GO MMMs. The estimated cost of the abrupt sea level rise due to global warming ranges from \$200 to 800 T\$ over the next 30 years<sup>19</sup>, whereas the estimated cost for the required CO<sub>2</sub> capture at 20\$/ton CO<sub>2</sub> captured is 5.2 T\$ for the capture and 8 T\$ for the storage. Based on this there is a great need for a drastic reduction of CO<sub>2</sub> capture costs and this can be addressed by two major CO<sub>2</sub> capture technologies, the established MEA sorption and the membrane technology. A drastic reduction of the CO<sub>2</sub> capture is expected to be obtained by membrane technology with increased permeance above 1000 GPU. The showcase will develop High Permeability Membrane (HPM) and High Selectivity (HSM) MMM HF tailored to provide cost-effective treatment of the flue gases. Three HPM membranes with different permeances >1500 GPU will be developed based on functionalized oriented GOs and three high CO<sub>2</sub>/N<sub>2</sub> selectivity (HSM) >120 will be fabricated. The deployment of the HPM in a first-stage will allow the reduction of the compression flue gas cost by 40% while boosting the inlet CO<sub>2</sub> concentration of the second stage (HSM) to allow the production of 95% CO<sub>2</sub>. The incorporation of a third HPM unit using flue gas as sweep will further reduce the CO<sub>2</sub> concentration. The introduction of the third membrane combined with the reduction of the compression cost and with the elimination of the regeneration of sorbent cost of the competing sorbent technology, will lead to the CO<sub>2</sub> capture cost down to.

### KEY DRIVERS OF THE SERVICE: THE VALUE PROPOSITION

As it was not possible to have a workshop session, the latest update from the Innovation Radar was used. This showcase will benefit from the facilities (e.g., Pilot Line 11 - GO/CNTs MMM system) to determine the orientation of CNT (Carbon NanoTubes) and GO (Graphene Oxides), the separating layer nanostructure and to relate the nanostructure characteristics to the membrane's performance. In addition, assistance in the process design of the two-and three-stage combinations and of the NF/FO/MD combinations will facilitate the determination of the optimum nanostructure of the membrane.