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CO2 sequestration below the Venice Lagoon can help fulfill the Kyoto requirement s and mitigate land subsidence

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There is a growing concern for the influence that the increase of greenhouse gases may have on climate change. The 1997 Kyoto protocol prescribes for the agreeing nations a reduction of the carbon dioxide emission to the atmosphere that for Italy should be in prospective as much as 100 Mt/y by 2012. Geological CO2 sequestration in deep geological formations can help fulfill this requirement. The potential to store large CO2 quantity is offered by gas reservoirs (either in production or depleted) and saline aquifers. Several of the latter are located in the sedimentary basin underlying north-eastern Italy and the Upper Adriatic Sea. The study of CO2 sequestration in these formations is a multi-disciplinary effort involving the simulation of the multi-phase flow of groundwater and carbon dioxide along with the porous medium deformation due to the pore pressure increase in the injected formations. This can cause the ground surface to rise because of the partial effective stress release within the aquifer with the consequent rock swelling. This aspect can be attractive in low-lying areas, such as the Venice Lagoon and the city herself, that have experienced a pronounced land settlement in the recent past because of groundwater withdrawal. A preliminary analysis of CO2 sequestration in a brackish formation located between 600 and 800 m below the Venice lagoon is performed. Based on the available geological, geophysical, hydrological, and geo-mechanical data provided by recent studies of the Northern Adriatic subsurface, several scenarios are addressed to investigate the potential of the proposed solution as far as both the CO2 storage and the possible land uplift are concerned. The results show that with the most probable hydrogeological setting the total amount of CO2 released from five nearby thermo-power plants, i.e. 20 Mt/year overall from Monfalcone, Porto Marghera, Fusina, Porto Tolle and Porto Corsini, can be safely

disposed of with an expected Venice uplift over 10 years ranging between 7 and 13 cm depending on the configuration of the injection wells (vertical or sub-horizontal). This outcome would enable the offsetting of between 50% - 70% of the 'acqua alta' which periodically floods Venice with huge distress and economical damages to the city. The uplift can be larger if the sequestration process is continued, as is obviously expected, beyond the 10 year period. The simulations, however, show a high sensitivity to sand permeability and compressibility, which points to the need for new ad hoc field investigations before the present preliminary proposal may be turned into an actual feasibility study.