Terraforming Planet Earth

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The atmospheric carbon crisis precipitated by the use of fossil fuel combustion as the primary source of energy for the civilized world has doubled human population in the last fifty years and resulted in great stresses on climate and the environmental and biological diversity of present day life on planet Earth.

The most direct method of remediating this problem involves immediate reductions in population, and reduction of fossil fuel use through increased increased efficiency, cogeneration and thermal insulation, with the use of alternatives to fossil fuels wherever appropriate – solar, wind, hydroelectric and nuclear. Additionally, reduction in power use will also come from device progress and improvement as well as radical new and innovative applications of electromagnetism and chemical physics and engineering.

More importantly the excess concentration of carbon dioxide in the atmosphere must be drawn down to perindustrial level of roughly 300 ppm (to stave off further ice ages) and the acidification of the ocean basins must be reversed to pH levels which are adequate enough for carbonate forming organisms. The only technological solution capable of achieving this necessary goal within a reasonable time period is cryogenic carbon capture using liquid natural gas and turbocompressors and/or modern thermoelectrics. The immense amount of frozen carbon dioxide produced in this manner must be either fixed or stored. Fixation requires speeding up aqueous carbonate precipitation by many orders of magnitude, however, the south pole on Antarctica is an ideal place to store thousands of gigatons of frozen carbon dioxide.

For Earth's climate to reliably revert to preindustrial interglacial stability further requires what is called solar Lagrange point L1 occultation sunshade - a physical reduction and modulation of solar irradiance hitting the surface of the earth using vast, thin two-dimensional sheets of material drifting in free space. Ideally this material would be composed of arrays of solar energy collection devices for use in space, and their spatial and temporal modulation of coverage area would be used to produce weather effects such as more consistent rainfall patterns and storm front pumping across continents and hemispheres.

This project in turn requires a vast new fleet of reusable heavy lift launch vehicles and the expansion of human economic endeavor to the development of space, such as Lagrange points and the lunar surface. The lunar poles, in particular, contain many permanently shadowed cold dark thermal reservoir craters containing water, carbon and volatiles and possessing radiative exposures and thermal gradients which provide a rich new environment for industrial and planetary scale cryogenic liquid and gas operations. This cryogenic cascade spans water, ammonia, carbon dioxide, methane, oxygen, hydrogen and helium. Cis-lunar development also provides an immediate route to planetary protection from asteroid impacts, and their subsequent exploitation and utilization for future deep space industrial development efforts.