

Go beyond traditional concepts of geoengineering. Plankton Ocean Digester (POD)energy is a holistic solution of renewable energy + carbon sequestration + nutrient recycle + food production + increased species diversity. It sustainably and economically reduces atmospheric carbon dioxide.

PODenergy steps:

1. Sunlight powers macro-algae (kelp) grown over 4% of the world's oceans. The kelp will take in carbon dioxide equal to the world's 2005 fossil carbon dioxide emissions. Like an ocean rain forest, this kelp supports various diverse species, permitting an additional harvest of 1,000 kg per year of fish for each of the 7 billion people on the planet.
2. The algae are harvested into large "tea-bags" which are pulled into thin plastic "balloons" at depths below 100 meters. (There are no wave forces below 100 meters.)
3. Natural ubiquitous bacteria convert the harvested kelp into pure biomethane with energy equal to half the world's 2005 energy consumption, pure carbon dioxide (equal to half the world's 2005 fossil carbon dioxide emission), and the nutrients needed to grow more kelp. Because of the high pressure, the carbon dioxide remains dissolved with the nutrients in the water inside the balloon. Relatively little methane dissolves, hence the gases and nutrients are recovered separately.
4. The recovered biomethane powers the process equipment; excess is pumped to shore as renewable natural gas. Carbon dioxide is captured for sequestration as a bottom stable liquid with secondary containment below 3,000 meters, and nutrients are recycled for algae growth.

PODenergy is a holistic solution. It is powered by sunlight. It does not mine ocean nutrients or thermal gradients, consume fresh water or precious metals, require a monoculture, displace food production, or decrease species diversity. PODenergy's biomethane can be used as is, or converted into hydrogen or liquid fuel. It also converts into the plastics needed to make process equipment.

With a cap-and-trade incentive, PODenergy is economically sustainable. Fossil carbon dioxide emitters could pay \$30 per ton for PODenergy's carbon sequestration. Through this payment, biomethane production is subsidized, resulting in a cost of about \$0.70 per therm. The net biomethane product displaces coal, oil, and fossil natural gas. The biomethane also provides the energy bank needed for a world with inconsistent weather producing substantial electricity from wind, wave, solar-photovoltaic, and solar-thermal energy.

The quantification, 4% of ocean surface relative to 2005 world energy demand and fossil carbon emissions, is based on calculations employing the research contained primarily in:

Chynoweth, D.P. and Isaacson, R., *Anaerobic Digestion of Biomass*, New York: Elsevier Applied Science Publishers LTD, 1987.

Sheehan, J., Dunahay, T., Benemann J., Roessler P., *A Look Back at the U.S. Department of Energy's Aquatic Species Program: Biodiesel from Algae.*, U.S. National Renewable Energy Laboratory, July 1998.

van der Meer, B., "Carbon Dioxide Storage in Natural Gas Reservoirs", *Oil & Gas Science & Technology* - Rev. IFP, Vol. 60 (2005), No. 3 pp. 527-536