OMEGA Background:

OMEGA (Offshore Membrane Enclosures for Growing Algae) was invented by Jonathan Trent, Ph.D. to address the world's need for a sustainable alternative to fossil fuel that does not compete with agriculture for water, fertilizer, or land. The OMEGA system integrates the production of sustainable carbon-neutral biofuels with wastewater treatment, water reuse, alternative energy production (solar, wind, and wave energy), and food production by expanded aquaculture. OMEGA was inspired by NASA's closed-loop life-support systems used for space exploration—in this case for Spaceship Earth. OMEGA is a patent-pending technology that has the potential to provide sustainable fuel, food, and clean water, while improving the local environment—it will change the world. More background information is available at:

http://www.algaeindustrymagazine.com/nasas-omega-scientist-dr-jonathan-trent/

Dr. Trent is currently a visiting Professor at Tokyo University of Agriculture and Technology. He is also a senior Scientist at NASA Ames Research Center and an Adjunct Professor at the University of California, Santa Cruz. Dr. Trent has received numerous international awards and acknowledgments for his research and teaching. Most recently, NASA awarded him US $10M and the California Energy Commission US $800K to lead the feasibility study of his OMEGA project. In 2009, the Danish government selected him to organize and lead an international workshop called "Wind, Sea, and Algae" to consider the OMEGA concept for Denmark. Prior to inventing OMEGA, Dr. Trent received support from Google to initiated a project called "Global Research into Energy and the Environment at NASA (GREEN)." Before his involvement in GREEN projects, Dr. Trent was acknowledged for his fundamental research in bio-nanotechnology and he received the NASA Nano50 Award for innovation in 2006. For his earlier research in microbiology, Dr. Trent received a Howard Hughes Fellowship at the Boyer Center for Molecular Medicine, at Yale Medical School, a European Molecular Biology Organization (EMBO) Fellowship at Copenhagen University in DENMARK, and a visiting Scholar grant from the University of Paris at Orsay in FRANCE. He also received a Fellowship to conduct research at the Max Planck Institute for Biochemistry in Munich GERMANY. Dr. Trent has a PhD from Scripps Institution of Oceanography and for his many contributions to marine science, he was elected to be a lifetime Fellow of the California Academy of Sciences.

Dr. Trent lectures on OMEGA are on the Internet at:

http://www.ted.com/talks/jonathan_trent_energy_from_floating_algae_pods.html

http://www.youtube.com/watch?v=A6oekxl0JAs

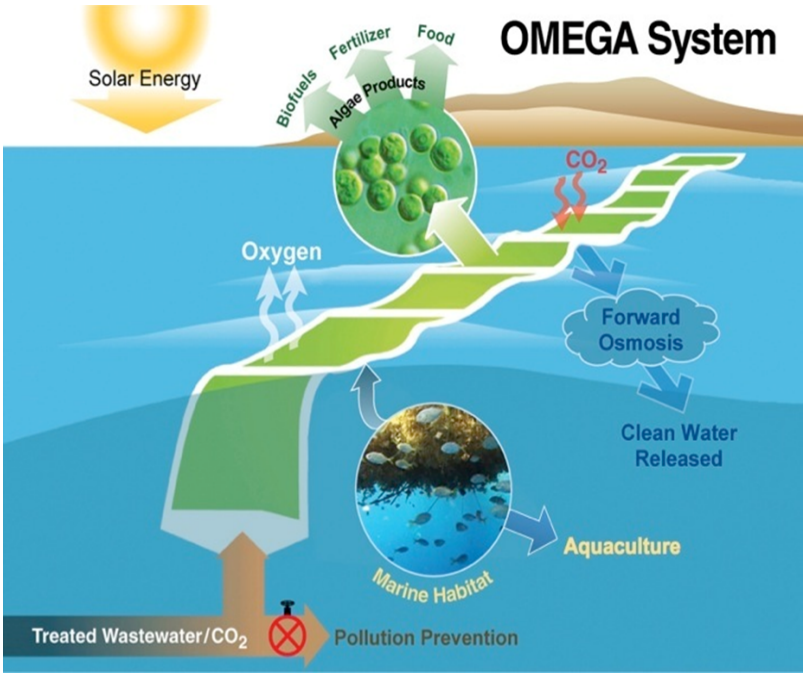
http://www.youtube.com/watch?v=1_z-LnKNlco

http://www.youtube.com/watch?v=c7Goyg12Reg

What is the OMEGA technology? OMEGA is a system that uses Photo-Bio-Reactors (PBRs) made of flexible clear plastic tubes floating in protected offshore environments. The PBRs are filled with nutrient-rich water and carbon dioxide (CO_2) to cultivate microalgae that are the fastest producers of biomass and the best producers of oil. There is already a thriving industry using microalgae to produce high-value products (e.g., pharmaceuticals, nutraceuticals, and cosmetics) and a growing interest in using microalgae for producing biofuels, if they can be cultivated at large scale without competing with agriculture for water, fertilizer, or land. The OMEGA system is the answer.

OMEGA can use wastewater from the offshore outfalls of coastal cities to provide water and fertilizer for algae growth. By locating offshore, it is scalable without competing for land. In addition, OMEGA uses seawater to maintain the system's temperature and the salt gradient between wastewater and seawater to kill algae that escape from the system. It also uses the salt gradient to assist in harvesting the algae by a process called forward osmosis. In addition to producing microalgae, OMEGA provides advanced wastewater treatment and carbon sequestration. Furthermore, depending on the location, the OMEGA infrastructure can provide surfaces for solar arrays and access to offshore sites that can be used for wind and wave energy generation, as well as offshore aquaculture.. The economics of the OMEGA system will depend on the location, the scale, and local conditions, but the potential products and services are diverse and the impact on local job creation would be significant.

OMEGA and Japan—the next steps



OMEGA has passed the planning and testing stage. With support from NASA (US $10M) and the California Energy Commission (US $0.8M) for the last three years (2010-2012), Dr. Trent with a team of NASA scientists and engineers developed and extensively tested floating microalgae cultivation systems in seawater tanks. The technical results are available on request. These results confirm that OMEGA is feasible for growing microalgae on wastewater and suggest that in the right location the system could be scaled and highly productive, but where?

Japan, with its extensive coastline, protected bays, and coastal cities, has ideal sites for OMEGA. Furthermore, with its long history of ocean engineering and aquaculture, all the technical expertise to realize OMEGA is available locally. The question is whether there are organizations powerful enough to take on the OMEGA strategic vision to develop sustainable offshore systems to 1) produce algae products including biofuels for clean energy, 2) treat wastewater recycle clean water, and 3) expand aquaculture to significantly contribute to food production. The techno-economic model, based on diversified products and services with the ultimate goal of developing a sustainable alternative to fossil fuels, has the depth to support any scale of activity and create local jobs and prosperity. The question:

Is Japan willing and able to lead the world in OMEGA development and commercialization?

Initial Requirements for OMEGA-Technology Development in Japan

1- Identify commercial, academic, and governmental partners
2- Establish strategic partners to facilitate technology transfer and development
    a. Select team of Engineers (systems, civil, marine, mechanical) and scientists (phycologists, biochemists, marine biologists, ecologists)
3- Evaluate potential sites and commercialization strategies.

For more information about OMEGA see:

http://www.nasa.gov/centers/ames/research/OMEGA/index.html

http://www.future-science.com/doi/abs/10.4155/bfs.12.53

http://www.slate.com/articles/health_and_science/new_scientist/2012/09/algae_for_biofuel_omega_project_has_success_in_california_ready_to_scale_up_.html

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