### 1ac aquaculture

#### Advantage 1: Aquaculture

#### First the impacts:

#### 1) Fisheries – Fish stocks declining now—increased productivity key.

Brian **Kirke**, **2003**. Griffith University School of Engineering. “Enhancing fish stocks with wave-powered artificial upwelling,” Ocean and Coastal Management 46, http://www.cyberiad.net/library/pdf/bk\_ocm\_articleaspublished.pdf.

It has recently been estimated [1] that 75% of the world’s commercial fish stocks are being fished at or above mean sustainable levels. This situation is likely to get worse as the world’s population grows, unless one of two things happens: either consumption must be regulated—a difficult if not impossible task—or **productivity must be increased**. The change from hunting and gathering to cultivation and husbandry on land has supported a huge increase in the earth’s population over the last few thousand years, but the same has not happened to a significant extent in the oceans. Some agricultural techniques have had adverse effects on the land, but others have proven sustainable. These successful techniques generally emulate natural processes, such as the annual floods which replenish soil moisture and nutrients on some flood plains, or the nutrient pump action of deep-rooted plants. For example Yeomans [2] has shown how chisel ploughing and irrigation can increase the depth of biologically active soil, and Groocock [3] has demonstrated how productivity can be enhanced by mixing nutrient-rich clay subsoil with poor sandy topsoil. Ocean fisheries are still at the hunter-gatherer stage, and rather than developing ever more effective ways to further overexploit the existing finite resource, it is time to find ways to increase the resource by developing techniques **which enhance productivity in a sustainable way.**

#### Declining fish stocks will kill billions.

**Science**, 11/8/**2002**. “Poor to Feel Pinch of Rising Fish Prices,” Ebsco.

TOKYO— The first major attempt to project global supply and demand for fish has confirmed what many have long suspected: Rising prices are likely to drive fish out of the reach of growing numbers of poor people who rely on the sea for their protein. But, with several fisheries on the verge of collapse, some analysts believe that the study's dire projections—presented last week at the launching of a global research initiative on fisheries science and policy—might in fact be too rosy. The analysis, by agricultural economists in Penang, Malaysia, and in Washington, D.C., models fish supply and demand to 2020. Under the most likely scenario, it says, prices for salmon and other high-value fish would rise 15%, and prices for low-end fish such as milkfish and carp would increase by 6%. Fish meal prices, it estimates, would jump 18% to satisfy rising demand for feed for cultured, carnivorous high-value fish (below). “The consequences [of current trends] could be dire, depending on whether supply gains are feasible,” says Mahfuzuddin Ahmed, a co-author of the study, which was done by the Penang-based WorldFish Center and the Washington, D.C.-based International Food Policy Research Institute. But a continuation of those gains—which have produced a sixfold rise in total fish catch since the 1950s—is doubtful, says his boss, center director Meryl Williams, because three-quarters of the current catch comes from fish stocks that are already overfished, if not depleted. “Those [who study] the population dynamics of fisheries would probably be pessimistic” about supplies, she says. Fish now account for about 7% of the total food supply, according to the center, **and are the primary source of protein for roughly one-sixth of the world's population**. Yet fish consumption is generally overlooked in food supply models, which focus primarily on cereals and legumes. Scientists hope to correct that oversight with Fish for All, an initiative to develop science-based policy alternatives for world fisheries. Scientists, environmentalists, and industry representatives from 40 countries gathered in Penang last week for a meeting to launch the effort, led by the WorldFish Center, formerly known as the International Center for Living Aquatic Resources. Both the fish center and the policy institute are part of the World Bank-funded Consultative Group on International Agricultural Research.

#### Independently, Food shortages cause extinction

**Cribb 2010** [Julian, principal of JCA, fellow of the Australian Academy¶ of Technological Sciences and Engineering, “The Coming Famine: The¶ Global Food Crisis and What We Can Do to Avoid It”, pg 10]

The character of human conflict has also changed: since the early 1990S, more wars have been triggered by disputes over food, land, and water than over mere political or ethnic differences. This should not surprise US: people have fought over the means of survival for most of history. But in the abbreviated reports on the nightly media, and even in the rarefied realms of government policy, the focus is almost invariably on the players—the warring national, ethnic, or religious factions—rather than on the play, the deeper subplots building the tensions that ignite conflict. Caught up in these are groups of ordinary, desperate people fearful that there is no longer sufficient food, land, and water to feed their children—and believing that they must fight ‘the others” to secure them. At the same time, the number of refugees in the world doubled, many of them escaping from conflicts and famines precipitated by food and resource shortages. Governments in troubled regions tottered and fell. The coming famine is planetary because it involves both the immediate effects of hunger on directly affected populations in heavily populated regions of the world in the next forty years—and also the impacts of war, government failure, refugee crises, shortages, and food price spikes that will affect all human beings, no matter who they are or where they live. It is an emergency because unless it is solved, billions will experience great hardship, and not only in the poorer regions. Mike Murphy, one of the world’s most progressive dairy farmers, with operations in Ireland, New Zealand, and North and South America, succinctly summed it all up: “Global warming gets all the publicity but the real imminent threat to the human race is starvation on a massive scale. Taking a 10—30 year view, I believe that food shortages, famine and huge social unrest are probably the greatest threat the human race has ever faced. I believe future food shortages are a far bigger world threat than global warming.”2° The coming famine is also complex, because it is driven not by one or two, or even a half dozen, factors but rather by the confluence of many large and profoundly intractable causes that tend to amplify one another. This means that it cannot easily be remedied by “silver bullets” in the form of technology, subsidies, or single-country policy changes, because of the synergetic character of the things that power it.

#### 2) Oceans - Phytoplankton are the foundation of the food chain and produce half of the worlds oxygen—decline in phytoplankton risks extinction.

**UPI**, 6/6/**2008**. “Acidic oceans may tangle food chain,” <http://www.upi.com/Energy_Resources/2008/06/06/Acidic_oceans_may_tangle_food_chain/UPI-84651212763771/print/>.

Increased carbon levels in ocean water could have devastating impacts on marine life, scientists testified Thursday at a congressional hearing. Although most of the concern about carbon emissions has focused on the atmosphere and resulting temperature changes, accumulation of carbon dioxide in the ocean also could have disturbing outcomes, experts said at the hearing, which examined legislation that would create a program to study how the ocean responds to increased carbon levels. Ocean surface waters quickly absorb carbon dioxide from the atmosphere, so as carbon concentrations rise in the skies, they also skyrocket in the watery depths that cover almost 70 percent of the planet. As carbon dioxide increases in oceans, the acidity of the water also rises, and this change could affect a wide variety of organisms, said Scott Doney, senior scientist at the Woods Hole Oceanographic Institution, a non-profit research institute based in Woods Hole, Mass. "Greater acidity slows the growth or even dissolves ocean plant and animal shells built from calcium carbonate," Doney told representatives in the House Committee on Energy and the Environment. "Acidification thus threatens a wide range of marine organisms, from microscopic plankton and shellfish to massive coral reefs." If small organisms, like phytoplankton, are knocked out by acidity, the ripples would be far-reaching, said David Adamec, head of ocean sciences at the National Aeronautics and Space Administration. "If the amount of phytoplankton is reduced, you reduce the amount of photosynthesis going on in the ocean," Adamec told United Press International. "Those little guys are responsible for half of the oxygen you're breathing right now." A hit to microscopic organisms can also bring down a whole food chain. For instance, several years ago, an El Nino event wiped out the phytoplankton near the Galapagos Islands. That year, juvenile bird and seal populations almost disappeared. If ocean acidity stunted phytoplankton populations like the El Nino did that year, a similar result would occur -- but it would last for much longer than one year, potentially leading to extinction for some species, Adamec said. While it's clear increased acidity makes it difficult for phytoplankton to thrive, scientists don't know what level of acidity will result in catastrophic damages, said Wayne Esaias, a NASA oceanographer. "There's no hard and fast number we can use," he told UPI. In fact, although scientists can guess at the impacts of acidity, no one's sure what will happen in reality. Rep. Roscoe Bartlett, R-Md., pointed to this uncertainty at Thursday's hearing. "The ocean will be very different with increased levels of carbon dioxide, but I don't know if it will be better or worse," Bartlett said. However, even though it's not clear what the changes will be, the risk of doing nothing could be disastrous for ecosystems, said Ken Caldeira, a scientist at the Carnegie Institution for Science, a non-profit research organization. "The systems that are adapted to very precise chemical or climatological conditions will disappear and be replaced by species which, on land, we call weeds," Caldeira said. "What is the level of irreversible environmental risk that you're willing to take?" It's precisely this uncertainty that the Federal Ocean Acidification Research and Monitoring Act attempts to address. The bill creates a federal committee within the National Oceanic and Atmospheric Administration to monitor carbon dioxide levels in ocean waters and research the impacts of acidification. like Bishop. "**We would lose everything**," he told UPI.

#### The plan solves – Ocean Thermal Energy Conversion increases ocean nutrient content—improves fishing productivity.

Ivan **Goodbody and** Elizabeth **Thomas-Hope**, **2002**. Professor Emeritus in Zoology in the Department of Life Sciences and Professor of Environmental Management, Environmental Management Unit, Department of Geography and Geology University of the West Indies. Natural Resource Management for Sustainable Development in the Caribbean, p. 334.

One of the most important components of an OTEC system is a continuous supply of cold sea water pumped up from ocean depths. These ocean waters not only have low temperatures but they are also rich in nutrients. Compared to warm surface water, inorganic nitrate-nitrite values in deep cold water are 190 times higher, phosphate values 15 times higher, and silicate values 25 times higher. Aquaculturists have long **viewed such waters as a valuable resource that can be utilized for growing a mix of aquatic animals and plants**. This ability of the OTEC system to provide flexible, accurate, and consistent temperature control, high volume flow rates, and sea water that is relatively free of biological and chemical contaminants can be translated into a saleable aquaculture product.

#### OTEC results in net gains of plankton—this increases fishing harvests and solves phytoplankton

William **Avery**, **1994.** B.S. in chemistry from Pomona College and his A.M. and Ph.D. degrees in physical chemistry from Harvard. “Renewable energy from the ocean: a guide to OTEC,” p. 425-427.

Gains of plankton organisms may result some distance away from the OTEC plant as a result of increased nutrient input to euphotic zones that are associated with the shoaling of isopycnal and nutricline. Since plankton is important in the marine food chain, enhanced productivity due to redistribution of nutrients may improve fishing. Fish, which in general are attracted to offshore structures, are expected to increase their ambient concentration near OTEC plants. The world annual yield of marine fisheries is presently 70 million tons, with most fish caught on continental shelves. In fact, the open ocean (90% of the total ocean area) produces only about 0.7% of the fish because most of the nutrients in the surface water are extracted by plants and drift down to the ocean floor in the remains of plant or animal life. The water in the coastal zones is continually supplied with fresh nutrients in the runoff from the adjacent land and, hence, supports a high level of plant life activity and produces 54% of the fish. Only 0.1 % of the ocean area lies in the upwelling regions, where nutrient-laden water is brought up from the ocean depths, yet these regions produce 44% of the fish The reason for this spectacular difference can be seen in Table 9-9, which shows that the nitrate and phosphorus concentrations in deep seawater are about 150 and 5 times more, respectively, than their counterpart concentrations in surface water at a typical site (St. Croix in the Virgin Islands). Proposals to produce artificial upwelling, including one using nuclear power, have concluded that the cost would be excessive. Roels (1980) studied the possibility of using a shore-based OTEC plant to supply nutrient-laden water to a mariculture system, with a series of experiments carried out at St. Croix in the U.S. Virgin Islands. At that site the ocean is 1000 m deep only 1.6 km offshore. Three polyethylene pipelines, 6.9 em in diameter and 1830 m long, have brought approximately 250 liters/min of bottom water into 5-m3 pools where diatoms from laboratory cultures are grown. The food-laden effluent flows through metered channels to pools where shellfish are raised. The resulting protein production rate was excellent; 78% of the inorganic nitrogen in the deep seawater was converted to phytoplankton-protein nitrogen, and 22% of that was converted to clam-meat protein nitrogen. This compares with plant-protein/animal-protein conversion ratios of31 % for cows' milk production and 6.5% for feedlot beef production. The production of seafood is therefore more efficient than that of beef. Thus, shifts from beef to seafood, already underway in some societies for health reasons, could help to meet world needs for high-quality food. Net gains of plankton organisms may result some distance away from the OTEC plant as a result of increased nutrient input to the euphotic zone associated with the shoaling of isopycnal and nutricline. Increased harvests of small oceanic fish, which feed on plankton, would result.

#### OTEC externally solves food shortages through fertilizer production.

Christopher **Barry**, **2008**. Naval architect and co-chair of the Society of Naval Architects and Marine Engineers ad hoc panel on ocean renewable energy. “Ocean Thermal Energy Conversion and CO2 Sequestration,” renewenergy.wordpress.com/2008/07/01/ocean-thermal-energy-conversion-and-co2-sequestration/.

There might be an additional benefit: Another saying is "we aren't trying to solve world hunger," but we may have. Increased ocean fertility may enhance fisheries substantially. In addition, by using OTEC energy to make nitrogen fertilizers, we can improve agriculture in the developing world. OTEC fertilizer could be sold to developing countries at a subsidy in exchange for using the tropic oceans. If we can solve the challenges of OTEC, especially carbon sequestration, it would seem that the Branson Challenge is met, and we have saved the earth, plus solving world hunger. Since President Jimmy Carter originally started OTEC research in the '70's, he deserves the credit. I'm sure he will find a good use for Sir Richard's check.

### 1ac hegemony

#### Advantage 2: Hegemony

#### Investment in offshore OTEC is critical to US OTEC leadership and international OTEC development—this prevents Chinese hegemony.

Bill **Moore**, 4/12/**2006**. Discussion with Dr. Hans Jurgen Krock, the founder of OCEES on the revival of Ocean Thermal Energy Conversion. “OTEC Resurfaces,” <http://www.evworld.com/article.cfm?storyid=1008>.

While onshore installations like the one in Hawaii have their place in providing island communities with power, water, air conditioning and aquaculture, OCEES believes the real potential is offshore. The limiting factor for onshore is the size and length of the pipe needed to reach deep, cold water. Offshore production requires relatively short pipes that can be much larger in diameter that drop straight down below the platform. Krock said he is confident that we can now built 100 megawatt plants and he can foresee the day when 500 megawatt and 1000 megawatt (1 gigawatt) plants will be possible. Because the resource is far out into the ocean, far away from any national political entity, it isn't under the jurisdiction of any particular nation. "So countries such as Switzerland or others could go out there and be completely self-sufficient in energy by having their own energy supply in the tropical zone on the high seas far outside anybody‘s two hundred mile economic zone." Global Warming's Benefit Krock explained that the solar energy stored in the world's oceans is what drives the planet's weather and that a single category five hurricane generates more energy in a day than all mankind uses in a year. This may be the only benefit of global warming, providing even more warm water from which to produce power. "The ocean has increased in temperature by about point six degrees. That extra amount of heat that is in the ocean that has been stored in there over, say, the last forty years; that amount of heat, that amount of energy is enough to run all of humankind's energy requirements for the next five hundred years... just the extra." I asked Dr. Krock about two potential drawbacks to OTEC: environmental disruption and susceptibility to storm damage. He explained that his team has carefully looked at the first issue, environmental disruption, and determined that there would be none despite bringing up hundreds of millions of gallons of water a day to run the facility, because the water could be shunted back down to a level in the ocean where it would be neutrally buoyant. As to the question of tropical storms like typhoons or hurricanes and the risk they might pose for offshore OTEC platforms, he explained that these storms form outside of a tropical zone which extends approximately 4-5 degrees above and below the equator. Platforms operating within this narrower belt won't have to worry about these powerful storms and the damage they might cause, though he does plan to engineer for such contingencies. Unlike the illustration above that uses propellers to drive the plant, Krock's concept for moving the "grazing" OTEC mini-islands would rely on two intriguing systems: thrust vectoring and ocean current "sails". An OTEC plant generates a great deal of thrust from the uptake and expulsion of seawater, which can be directed to gradually move the platform in a desired direction. The 1000-feet stand pipe below the plant is like an inverted mast on a sailing ship. Sensors can detect the direction of the current at various depths, allowing the deployment of underwater "sails" that could also be used to passively steer the plant. "There is nothing better than working with nature," Krock commented. "This is simply a model on a human scale of the world's hydrological cycle." When compared to other renewable energy sources such as wind and biomass, he calls the heat energy stored in the ocean as the "elephant in the room". Krock envisions a plant made of floating concrete that is five square acres in size and could include fish processing facilities, ocean mineral mining and refining and the aforementioned rocket launch pad. An earlier Lockheed design was circular, measured some 100 meters in diameter and would generate 500 megawatts of electric power. "This is a transformation of endeavors from land to the ocean. The world is 70 percent oceans, 30 percent [land]... which we have used up to a large extent. The only major resource we have left is the ocean. This is a mechanism to utilize the ocean." "We do not have the luxury of waiting far into the future because I am sure you have read peak oil is coming... Unless we do this now, a transformation of this magnitude takes time. We have to allocate at least 50 years to do this, but that means we have to start now, because in fifty years we won't have the luxury of having another energy source to let us do the construction for these things. "The United States is the best placed of any country in the world to do this," he contends. "The United States is the only country in the world of any size whose budget for its navy is bigger than the budget for its army." It's his contention that this will enable America to assume a leadership position in OTEC technology, allowing it to deploy plants in the Atlantic, Caribbean and Pacific, but he offers a warming. "If we are stupid enough not to take advantage of this, well then this will be China's century and not the American century." Krock is currently negotiating with the U.S. Navy to deploy first working OTEC plant offshore of a British-controlled island in the Indian Ocean -- most likely Diego Garcia though he wouldn't confirm this for security purposes.

#### China’s rise risks war with the U.S. and threatens kicking the U.S. out of Asia.

John **Mearsheimer**, January **2005**. Professor of political science at the University of Chicago, Foreign Policy, <http://www.foreignpolicy.com/story/cms.php?story_id=2740>.

China cannot rise peacefully, and if it continues its dramatic economic growth over the next few decades, the United States and China are likely to engage in an intense security competition with considerable potential for war. Most of China’s neighbors, including India, Japan, Singapore, South Korea, Russia, and Vietnam, will likely join with the United States to contain China’s power. To predict the future in Asia, one needs a theory that explains how rising powers are likely to act and how other states will react to them. My theory of international politics says that the mightiest states attempt to establish hegemony in their own region while making sure that no rival great power dominates another region. The ultimate goal of every great power is to maximize its share of world power and eventually dominate the system. The international system has several defining characteristics. The main actors are states that operate in anarchy—which simply means that there is no higher authority above them. All great powers have some offensive military capability, which means that they can hurt each other. Finally, no state can know the future intentions of other states with certainty. The best way to survive in such a system is to be as powerful as possible, relative to potential rivals. The mightier a state is, the less likely it is that another state will attack it. The great powers do not merely strive to be the strongest great power, although that is a welcome outcome. Their ultimate aim is to be the hegemon—the only great power in the system. But it is almost impossible for any state to achieve global hegemony in the modern world, because it is too hard to project and sustain power around the globe. Even the United States is a regional but not a global hegemon. The best outcome that a state can hope for is to dominate its own backyard. States that gain regional hegemony have a further aim: to prevent other geographical areas from being dominated by other great powers. Regional hegemons, in other words, do not want peer competitors. Instead, they want to keep other regions divided among several great powers so that these states will compete with each other. In 1991, shortly after the Cold War ended, the first Bush administration boldly stated that the United States was now the most powerful state in the world and planned to remain so. That same message appeared in the famous National Security Strategy issued by the second Bush administration in September 2002. This document’s stance on preemptive war generated harsh criticism, but hardly a word of protest greeted the assertion that the United States should check rising powers and maintain its commanding position in the global balance of power. China is likely to try to dominate Asia the way the United States dominates the Western Hemisphere. Specifically, China will strive to maximize the power gap between itself and its neighbors, especially Japan and Russia, and to ensure that no state in Asia can threaten it. It is unlikely that China will go on a rampage and conquer other Asian countries. Instead, China will want to dictate the boundaries of acceptable behavior to neighboring countries, much the way the United States does in the Americas. An increasingly powerful China is also likely to try to push the United States out of Asia, much the way the United States pushed the European great powers out of the Western Hemisphere. Not incidentally, gaining regional hegemony is probably the only way that China will get back Taiwan. Why should we expect China to act differently than the United States? U.S. policymakers, after all, react harshly when other great powers send military forces into the Western Hemisphere. These foreign forces are invariably seen as a potential threat to American security. Are the Chinese more principled, more ethical, less nationalistic, or less concerned about their survival than Westerners? They are none of these things, which is why China is likely to imitate the United States and attempt to become a regional hegemon. China’s leadership and people remember what happened in the last century, when Japan was powerful and China was weak. In the anarchic world of international politics, it is better to be Godzilla than Bambi. It is clear from the historical record how American policymakers will react if China attempts to dominate Asia. The United States does not tolerate peer competitors. As it demonstrated in the 20th century, it is determined to remain the world’s only regional hegemon. Therefore, the United States will seek to contain China and ultimately weaken it to the point where it is no longer capable of dominating Asia. In essence, the United States is likely to behave toward China much the way it behaved toward the Soviet Union during the Cold War.

**Unchecked Chinese rise causes global nuclear war**

Walton 7 – C. Dale Walton, Lecturer in International Relations and Strategic Studies at the University of Reading, 2007, Geopolitics and the Great Powers in the 21st Century, p. 49

Obviously, it is of vital importance to the United States that the PRC does not become the hegemon of Eastern Eurasia. As noted above, however, regardless of what Washington does, China's success in such an endeavor is not as easily attainable as pessimists might assume. The PRC appears to be on track to be a very great power indeed, but geopolitical conditions are not favorable for any Chinese effort to establish sole hegemony; a robust multipolar system should suffice to keep China in check, even with only minimal American intervention in local squabbles. The more worrisome danger is that Beijing will cooperate with a great power partner, establishing a very muscular axis. Such an entity would present a critical danger to the balance of power, thus both necessitating very active American intervention in Eastern Eurasia and creating the underlying conditions for a massive, and probably nuclear, great power war. Absent such a "super-threat," however, the demands on American leaders will be far more subtle: creating the conditions for Washington's gentle decline from playing the role of unipolar quasi-hegemon to being "merely" the greatest of the world's powers, while aiding in the creation of a healthy multipolar system that is not marked by close great power alliances.

#### OTEC key to mineral extraction.

**Celestopea Times**, **2005**. A monthly online journal dedicated to finding sustainable solutions for the future. “OTEC,” <http://www.celestopea.com/OTEC.htm>.

Many minerals and chemicals can also be derived as byproducts of OTEC operation from the 57 elements dissolved in solution in seawater. Besides the fuels hydrogen, oxygen and methanol, other byproducts include ammonia, salt, chlorine and eventually gold, platinum and other rare and precious elements. Past corporate analysis has always shown such ventures to be unprofitable because of the cost of pumping the large volume of water necessary to extract significant amounts of minerals. This main stumbling block is overcome as the OTEC's will already be pumping vast quantities of water for other purposes. The necessary mining technology is leaping forward as well. The Japanese have recently been experimenting with extraction of uranium from seawater and found pending technology in material sciences is making mining minerals from seawater feasible.

#### Rare earths are critical to all military systems

**Richardson 10** (Michael, 10/18, visiting senior research fellow at the Institute of South East Asian Studies in Singapore, Yale Global Online, “China’s Chokehold On Rare-Earth Minerals Raises Concerns ,” <http://yaleglobal.yale.edu/content/chinas-rare-earth-minerals>, 11/16,)

Yet China could keep its dominant grip on the rare-earths industry for some years. It holds 35 percent of global reserves, but supplies over 95 percent of demand for rare-earth oxides, of which 60 percent is domestic, according to Industrial Minerals Company of Australia, a consultancy. Just as important, Chinese companies, many of them state-controlled, have advanced in their quest to make China the world leader in processing rare-earth metals into finished materials. Success in this quest could give China a decisive advantage not just in civilian industry, including clean energy, but also in military production if Chinese manufacturers were given preferential treatment over foreign competitors. Cerium is the most abundant of the 17 rare earths, all of which have similar chemical properties. A cerium-based coating is non-corrosive and has significant military applications. The Pentagon is due to finish a report soon on the risks of US military dependence on rare earths from China. Their use is widespread in the defense systems of the US, its allies, and other countries that buy its weapons and equipment. In a report to the US Congress in April, the Government Accountability Office said that it had been told by officials and defense industry executives that where rare-earth alloys and other materials were used in military systems, they were “responsible for the functionality of the component and would be difficult to replace without losing performance.” For example, fin actuators in precision-guided bombs are specifically designed around the capabilities of neodymium iron boron rare-earth magnets. The main US battle tank, the M1A2 Abrams, has a reference and navigation system that relies on samarium cobalt magnets from China. An official report last year on the US national defense stockpile said that shortages of four rare earths – lanthanum, cerium, europium and gadolinium – had already caused delays in producing some weapons. It recommended further study to determine the severity of the delays.

#### OTEC key to overall US technological leadership.

R. **Ramesh**, K **Udayakumar**, **and** M **Anandakrishnan**, **1997**. Centre for Water Resources and Ocean Management Anna University, India., School of Electrical and Electronics Centre for Water Resources and Ocean Management Anna University, India, and Former Vice Chancellor, Anna University, Tamil Nadu State Council for higher Education. “Renewable Energy Technologies,” pg. 33.

﻿6.2 Non-economic Benefits

﻿The non-economic benefits of OTEC which facilitate achievement of goals are: **promotion of the country’s competitiveness** and international trade, enhancement of energy independence and security, promotion of international political stability, and a potential for control of greenhouse emissions. Maintenance of leadership in 10 the technology development is crucial to the capability of a significant share of the market in the global market for such systems exploitable energy resource available to a large number of countries, particularly developing countries, represents long-term export opportunities. Development of OTEC technology would mitigate dependence on external sources of energy for remote and. A viable OTEC commercial sector also **support national defense by enhancing related maritime industry** and by providing energy and water options for remote island defence installations.

#### That’s key to hegemony.

Adam **Segal**, November/December **2004**. Senior Fellow in China Studies at the Council on Foreign Relations. “Is America Losing Its Edge?” Foreign Affairs, <http://www.foreignaffairs.org/20041101facomment83601/adam-segal/is-america-losing-its-edge.html>.

The United States' global primacy **depends in large part** on its ability to develop new technologies and industries faster than anyone else. For the last five decades, U.S. scientific innovation and technological entrepreneurship have ensured the country's economic prosperity and **military power**. It was Americans who invented and commercialized the semiconductor, the personal computer, and the Internet; other countries merely followed the U.S. lead. Today, however, this technological edge-so long taken for granted-may be slipping, and the most serious challenge is coming from Asia. Through competitive tax policies, increased investment in research and development (R&D), and preferential policies for science and technology (S&T) personnel, Asian governments are improving the quality of their science and ensuring the exploitation of future innovations. The percentage of patents issued to and science journal articles published by scientists in China, Singapore, South Korea, and Taiwan is rising. Indian companies are quickly becoming the second-largest producers of application services in the world, developing, supplying, and managing database and other types of software for clients around the world. South Korea has rapidly eaten away at the U.S. advantage in the manufacture of computer chips and telecommunications software. And even China has made impressive gains in advanced technologies such as lasers, biotechnology, and advanced materials used in semiconductors, aerospace, and many other types of manufacturing. Although the United States' technical dominance remains solid, the globalization of research and development is exerting considerable pressures on the American system. Indeed, as the United States is learning, globalization cuts both ways: it is both a potent catalyst of U.S. technological innovation and a significant threat to it. The United States will never be able to prevent rivals from developing new technologies; it can remain dominant only by continuing to innovate faster than everyone else. But this won't be easy; to keep its privileged position in the world, the United States must get better at fostering technological entrepreneurship at home.

#### Perception of decline will cause the US to lashout---triggers hegemonic wars

Goldstein 7 Professor of Global Politics and International Relations @ University of Pennsylvania “Power transitions, institutions, and China's rise in East Asia: Theoretical expectations and evidence,” Journal of Strategic Studies, Volume 30, Issue 4 & 5 August 2007, pages 639 – 682

Two closely related, though distinct, theoretical arguments focus explicitly on the consequences for international politics of a shift in power between a dominant state and a rising power. In War and Change in World Politics, Robert Gilpin suggested that peace prevails when a dominant state’s capabilities enable it to ‘govern’ an international order that it has shaped. Over time, however, as economic and technological diffusion proceeds during eras of peace and development, other states are empowered. Moreover, the burdens of international governance drain and distract the reigning hegemon, and challengers eventually emerge who seek to rewrite the rules of governance. As the power advantage of the erstwhile hegemon ebbs, it may become desperate enough to resort to the ultima ratio of international politics, force**,** to forestall the increasingly urgent demands of a rising challenger. Or as the power of the challenger rises, it may be tempted to press its case with threats to use force. It is the rise and fall of the great powers that creates the circumstances under which major wars, what Gilpin labels ‘hegemonic wars’, break out.13 Gilpin’s argument logically encourages pessimism about the implications of a rising China. It leads to the expectation that international trade, investment, and technology transfer will result in a steady diffusion of American economic power, benefiting the rapidly developing states of the world, including China. As the US simultaneously scurries to put out the many brushfires that threaten its far-flung global interests (i.e., the classic problem of overextension), it will be unable to devote sufficient resources to maintain or restore its former advantage over emerging competitors like China. While the erosion of the once clear American advantage plays itself out, the US will find it ever more difficult to preserve the order in Asia that it created during its era of preponderance. The expectation is an increase in the likelihood for the use of force – either by a Chinese challenger able to field a stronger military in support of its demands for greater influence over international arrangements in Asia, or by a besieged American hegemon desperate to head off further decline. Among the trends that alarm those who would look at Asia through the lens of Gilpin’s theory are China’s expanding share of world trade and wealth (much of it resulting from the gains made possible by the international economic order a dominant US established); its acquisition of technology in key sectors that have both civilian and military applications (e.g., information, communications, and electronics linked with to forestall, and the challenger becomes increasingly determined to realize the transition to a new international order whose contours it will define. the ‘revolution in military affairs’); and an expanding military burden for the US (as it copes with the challenges of its global war on terrorism and especially its struggle in Iraq) that limits the resources it can devote to preserving its interests in East Asia.14 Although similar to Gilpin’s work insofar as it emphasizes the importance of shifts in the capabilities of a dominant state and a rising challenger, the power-transition theory A. F. K. Organski and Jacek Kugler present in The War Ledger focuses more closely on the allegedly dangerous phenomenon of ‘crossover’– the point at which a dissatisfied challenger is about to overtake the established leading state.15 In such cases, when the power gap narrows, the dominant state becomes increasingly desperate. Though suggesting why a rising China may ultimately present grave dangers for international peace when its capabilities make it a peer competitor of America, Organski and Kugler’s power-transition theory is less clear about the dangers while a potential challenger still lags far behind and faces a difficult struggle to catch up. This clarification is important in thinking about the theory’s relevance to interpreting China’s rise because a broad consensus prevails among analysts that Chinese military capabilities are at a minimum two decades from putting it in a league with the US in Asia.16 Their theory, then, points with alarm to trends in China’s growing wealth and power relative to the United States, but especially looks ahead to what it sees as the period of maximum danger – that time when a dissatisfied China could be in a position to overtake the US on dimensions believed crucial for assessing power. Reports beginning in the mid-1990s that offered extrapolations suggesting China’s growth would give it the world’s largest gross domestic product (GDP aggregate, not per capita) sometime in the first few decades of the twentieth century fed these sorts of concerns about a potentially dangerous challenge to American leadership in Asia.17 The huge gap between Chinese and American military capabilities (especially in terms of technological sophistication) has so far discouraged prediction of comparably disquieting trends on this dimension, but inklings of similar concerns may be reflected in occasionally alarmist reports about purchases of advanced Russian air and naval equipment, as well as concern that Chinese espionage may have undermined the American advantage in nuclear and missile technology, and speculation about the potential military purposes of China’s manned space program.18 Moreover, because a dominant state may react to the prospect of a crossover and believe that it is wiser to embrace the logic of preventive war and act early to delay a transition while the task is more manageable, Organski and Kugler’s power-transition theory also provides grounds for concern about the period prior to the possible crossover.19 pg. 647-650

#### U.S. leadership deters conflict and solves their impacts—collapse results in cascading great power wars

**Thayer 2006** [Bradley A., Assistant Professor of Political Science at the University of Minnesota, Duluth, The National Interest, November -December, “In Defense of Primacy”, lexis]

A remarkable fact about international politics today--in a world where American primacy is clearly and unambiguously on display--is that countries want to align themselves with the United States. Of course, this is not out of any sense of altruism, in most cases, but because doing so allows them to use the power of the United States for their own purposes--their own protection, or to gain greater influence. Of 192 countries, 84 are allied with America--their security is tied to the United States through treaties and other informal arrangements--and they include almost all of the major economic and military powers. That is a ratio of almost 17 to one (85 to five), and a big change from the Cold War when the ratio was about 1.8 to one of states aligned with the United States versus the Soviet Union. Never before in its history has this country, or any country, had so many allies. U.S. primacy--and the bandwagoning effect--has also given us extensive influence in international politics, allowing the United States to shape the behavior of states and international institutions. Such influence comes in many forms, one of which is America's ability to create coalitions of like-minded states to free Kosovo, stabilize Afghanistan, invade Iraq or to stop proliferation through the Proliferation Security Initiative (PSI). Doing so allows the United States to operate with allies outside of the UN, where it can be stymied by opponents. American-led wars in Kosovo, Afghanistan and Iraq stand in contrast to the UN's inability to save the people of Darfur or even to conduct any military campaign to realize the goals of its charter. The quiet effectiveness of the PSI in dismantling Libya's WMD programs and unraveling the A. Q. Khan proliferation network are in sharp relief to the typically toothless attempts by the UN to halt proliferation. You can count with one hand countries opposed to the United States. They are the "Gang of Five": China, Cuba, Iran, North Korea and Venezuela. Of course, countries like India, for example, do not agree with all policy choices made by the United States, such as toward Iran, but New Delhi is friendly to Washington. Only the "Gang of Five" may be expected to consistently resist the agenda and actions of the United States. China is clearly the most important of these states because it is a rising great power. But even Beijing is intimidated by the United States and refrains from openly challenging U.S. power. China proclaims that it will, if necessary, resort to other mechanisms of challenging the United States, including asymmetric strategies such as targeting communication and intelligence satellites upon which the United States depends. But China may not be confident those strategies would work, and so it is likely to refrain from testing the United States directly for the foreseeable future because China's power benefits, as we shall see, from the international order U.S. primacy creates.

The other states are far weaker than China. For three of the "Gang of Five" cases--Venezuela, Iran, Cuba--it is an anti-U.S. regime that is the source of the problem; the country itself is not intrinsically anti-American. Indeed, a change of regime in Caracas, Tehran or Havana could very well reorient relations. THROUGHOUT HISTORY, peace and stability have been great benefits of an era where there was a dominant power--Rome, Britain or the United States today. Scholars and statesmen have long recognized the irenic effect of power on the anarchic world of international politics. Everything we think of when we consider the current international order--free trade, a robust monetary regime, increasing respect for human rights, growing democratization--is directly linked to U.S. power. Retrenchment proponents seem to think that the current system can be maintained without the current amount of U.S. power behind it. In that they are dead wrong and need to be reminded of one of history's most significant lessons: Appalling things happen when international orders collapse. The Dark Ages followed Rome's collapse. Hitler succeeded the order established at Versailles. Without U.S. power, the liberal order created by the United States will end just as assuredly. As country and western great Ral Donner sang: "You don't know what you've got (until you lose it)." Consequently, it is important to note what those good things are. In addition to ensuring the security of the United States and its allies, American primacy within the international system causes many positive outcomes for Washington and the world. The first has been a more peaceful world. During the Cold War, U.S. leadership reduced friction among many states that were historical antagonists, most notably France and West Germany. Today, American primacy helps keep a number of complicated relationships aligned--between Greece and Turkey, Israel and Egypt, South Korea and Japan, India and Pakistan, Indonesia and Australia. This is not to say it fulfills Woodrow Wilson's vision of ending all war. Wars still occur where Washington's interests are not seriously threatened, such as in Darfur, but a Pax Americana does reduce war's likelihood, particularly war's worst form: great power wars. Second, American power gives the United States the ability to spread democracy and other elements of its ideology of liberalism. Doing so is a source of much good for the countries concerned as well as the United States because, as John Owen noted on these pages in the Spring 2006 issue, liberal democracies are more likely to align with the United States and be sympathetic to the American worldview.3 So, spreading democracy helps maintain U.S. primacy. In addition, once states are governed democratically, the likelihood of any type of conflict is significantly reduced. This is not because democracies do not have clashing interests. Indeed they do. Rather, it is because they are more open, more transparent and more likely to want to resolve things amicably in concurrence with U.S. leadership. And so, in general, democratic states are good for their citizens as well as for advancing the interests of the United States. Critics have faulted the Bush Administration for attempting to spread democracy in the Middle East, labeling such an effort a modern form of tilting at windmills. It is the obligation of Bush's critics to explain why democracy is good enough for Western states but not for the rest, and, one gathers from the argument, should not even be attempted.

Of course, whether democracy in the Middle East will have a peaceful or stabilizing influence on America's interests in the short run is open to question. Perhaps democratic Arab states would be more opposed to Israel, but nonetheless, their people would be better off. The United States has brought democracy to Afghanistan, where 8.5 million Afghans, 40 percent of them women, voted in a critical October 2004 election, even though remnant Taliban forces threatened them. The first free elections were held in Iraq in January 2005. It was the military power of the United States that put Iraq on the path to democracy. Washington fostered democratic governments in Europe, Latin America, Asia and the Caucasus. Now even the Middle East is increasingly democratic. They may not yet look like Western-style democracies, but democratic progress has been made in Algeria, Morocco, Lebanon, Iraq, Kuwait, the Palestinian Authority and Egypt. By all accounts, the march of democracy has been impressive. Third, along with the growth in the number of democratic states around the world has been the growth of the global economy. With its allies, the United States has labored to create an economically liberal worldwide network characterized by free trade and commerce, respect for international property rights, and mobility of capital and labor markets. The economic stability and prosperity that stems from this economic order is a global public good from which all states benefit, particularly the poorest states in the Third World. The United States created this network not out of altruism but for the benefit and the economic well-being of America. This economic order forces American industries to be competitive, maximizes efficiencies and growth, and benefits defense as well because the size of the economy makes the defense burden manageable. Economic spin-offs foster the development of military technology, helping to ensure military prowess.

Perhaps the greatest testament to the benefits of the economic network comes from Deepak Lal, a former Indian foreign service diplomat and researcher at the World Bank, who started his career confident in the socialist ideology of post-independence India. Abandoning the positions of his youth, Lal now recognizes that the only way to bring relief to desperately poor countries of the Third World is through the adoption of free market economic policies and globalization, which are facilitated through American primacy.4 As a witness to the failed alternative economic systems, Lal is one of the strongest academic proponents of American primacy due to the economic prosperity it provides. Fourth and finally, the United States, in seeking primacy, has been willing to use its power not only to advance its interests but to promote the welfare of people all over the globe. The United States is the earth's leading source of positive externalities for the world. The U.S. military has participated in over fifty operations since the end of the Cold War--and most of those missions have been humanitarian in nature. Indeed, the U.S. military is the earth's "911 force"--it serves, de facto, as the world's police, the global paramedic and the planet's fire department. Whenever there is a natural disaster, earthquake, flood, drought, volcanic eruption, typhoon or tsunami, the United States assists the countries in need. On the day after Christmas in 2004, a tremendous earthquake and tsunami occurred in the Indian Ocean near Sumatra, killing some 300,000 people. The United States was the first to respond with aid. Washington followed up with a large contribution of aid and deployed the U.S. military to South and Southeast Asia for many months to help with the aftermath of the disaster. About 20,000 U.S. soldiers, sailors, airmen and marines responded by providing water, food, medical aid, disease treatment and prevention as well as forensic assistance to help identify the bodies of those killed. Only the U.S. military could have accomplished this Herculean effort. No other force possesses the communications capabilities or global logistical reach of the U.S. military. In fact, UN peacekeeping operations depend on the United States to supply UN forces. American generosity has done more to help the United States fight the War on Terror than almost any other measure. Before the tsunami, 80 percent of Indonesian public opinion was opposed to the United States; after it, 80 percent had a favorable opinion of America. Two years after the disaster, and in poll after poll, Indonesians still have overwhelmingly positive views of the United States. In October 2005, an enormous earthquake struck Kashmir, killing about 74,000 people and leaving three million homeless. The U.S. military responded immediately, diverting helicopters fighting the War on Terror in nearby Afghanistan to bring relief as soon as possible. To help those in need, the United States also provided financial aid to Pakistan; and, as one might expect from those witnessing the munificence of the United States, it left a lasting impression about America. For the first time since 9/11, polls of Pakistani opinion have found that more people are favorable toward the United States than unfavorable, while support for Al-Qaeda dropped to its lowest level. Whether in Indonesia or Kashmir, the money was well-spent because it helped people in the wake of disasters, but it also had a real impact on the War on Terror. When people in the Muslim world witness the U.S. military conducting a humanitarian mission, there is a clearly positive impact on Muslim opinion of the United States. As the War on Terror is a war of ideas and opinion as much as military action, for the United States humanitarian missions are the equivalent of a blitzkrieg. THERE IS no other state, group of states or international organization that can provide these global benefits. None even comes close. The United Nations cannot because it is riven with conflicts and major cleavages that divide the international body time and again on matters great and trivial. Thus it lacks the ability to speak with one voice on salient issues and to act as a unified force once a decision is reached. The EU has similar problems. Does anyone expect Russia or China to take up these responsibilities? They may have the desire, but they do not have the capabilities. Let's face it: for the time being, American primacy remains humanity's only practical hope of solving the world's ills.

### 1ac oil

#### Advantage 3: Oil

#### OTEC solves both power plants and vehicle emissions—key to reduce CO2

**Magesh 10** (R., Coastal Energ Pvt, "OTEC TEchnology - A World of Clean Energy and Water," World Congress on Engineering, Vol II, June 30)

Scientists all over the world are making ¶ predictions about the ill effects of Global warming and its ¶ consequences on the mankind. Conventional Fuel Fired Electric ¶ Power Stations contribute nearly 21.3% of the Global Green ¶ House Gas emission annually. Hence, an alternative for such ¶ Power Stations is a must to prevent global warming. One fine ¶ alternative that comes to the rescue is the Ocean thermal energy ¶ conversion (OTEC) Power Plant, the complete Renewable Energy ¶ Power Station for obtaining Cleaner and Greener Power. Even ¶ though the concept is simple and old, recently it has gained ¶ momentum due to worldwide search for clean continuous energy ¶ sources to replace the fossil fuels. The design of a 5 Megawatt ¶ OTEC Pre-commercial plant is clearly portrayed to brief the ¶ OTEC technical feasibility along with economic consideration ¶ studies for installing OTEC across the world. OTEC plant can be ¶ seen as a combined Power Plant and Desalination plant. ¶ Practically, for every Megawatt of power generated by hybrid ¶ OTEC plant, nearly 2.28 million litres of desalinated water is ¶ obtained every day. Its value is thus increased because many ¶ parts of the globe are facing absolute water scarcity. OTEC could ¶ produce enough drinking water to ease the crisis drought-stricken ¶ areas. The water can be used for local agriculture and industry, ¶ any excess water being given or sold to neighboring communities.¶ Index Terms—Desalinated water, Ocean Temperature ¶ Differences, Rankine Cycle, Renewable Energy.¶ I. INTRODUCTION¶ CEAN thermal energy conversion is a hydro energy ¶ conversion system, which uses the temperature difference ¶ that exists between deep and shallow waters in tropical seas to ¶ run a heat engine. The economic evaluation of OTEC plants ¶ indicates that their commercial future lies in floating plants of ¶ approximately 100 MW capacity for industrialized nations and ¶ smaller plants for small-island-developing-states (SIDS). The ¶ operational data is needed to earn the support required from ¶ the financial community and developers. Considering a 100 ¶ MW (4-module) system, a 1/5-scaled version of a 25 MW ¶ module is proposed as an appropriate size. A 5 MW precommercial plant is directly applicable in some SIDS. OTEC ¶ works on Rankine cycle, using a low-pressure turbine to ¶ generate electric power. There are two general types of OTEC ¶ design: closed-cycle plants utilize the evaporation of a working¶ fluid, such as ammonia or propylene, to drive the turbinegenerator, and open-cycle plants use steam from evaporated ¶ R. Magesh is with Coastal Energen Pvt. Ltd., Chennai 600 006, ¶ Tamilnadu, India (e-mail: wellingtonmagesh@ gmail.com). ¶ sea water to run the turbine. Another commonly known design, ¶ hybrid plants, is a combination of the two. In fact, the plants ¶ would cool the ocean by the same amount as the energy ¶ extracted from them. Apart from power generation, an OTEC ¶ plant can also be used to pump up the cold deep sea water for ¶ air conditioning and refrigeration, if it is brought back to ¶ shore. In addition, the enclosed sea water surrounding the ¶ plant can be used for aquaculture. Hydrogen produced by ¶ subjecting the steam to electrolysis during the OTEC process ¶ can fuel hybrid automobiles, provided hydrogen can be ¶ transported economically to sea shore. Another undeveloped ¶ opportunity is the potential to mine ocean water for its 57 ¶ elements contained in salts and other forms and dissolved in ¶ solution. The initial capital cost of OTEC power station would ¶ look high, but an OTEC plant would not involve the wastetreatment or astronomical decommissioning costs of a nuclear ¶ facility. Also, it would offset its expense through the sale of ¶ the desalinated water.

#### OTEC efficiently produces hydrogen—this will enable transition to a hydrogen economy.

Joseph **Huang and** Stephen **Oney**, July **2003**. Senior Scientist for the National Oceanic and Atmospheric Administration, Professor of Ocean &. Resources Engineering, University of Hawaii and PhD., executive vice present of OCEES. “Revisit Ocean Thermal Energy Conversion System,” http://www.springerlink.com/content/n864l3217156h045/fulltext.pdf.

Perhaps the largest contribution to human society and the global environment that OTEC will have is as the supplier of hydrogen for the impending hydrogen economy. The huge energy reservoir in the tropical ocean available via the OTEC process will require a transportable form of that energy to allow access by the energy demand centers in the temperate zone. The most attractive and versatile transportable energy form is hydrogen. There are natural synergies between OTEC and hydrogen production, especially liquid hydrogen (LH2), which other renewables such as wind and solar do not possess. These include: • Full and efficient utilization can be made of the investment in production capacity because OTEC is available 24 hours per day and 365 days per year. This is in contrast to most renewable energy systems such as wind, waves, tide, direct solar and photovoltaics. Also, OTEC systems cannot exhaust the resource at the location where they are installed – in contrast to oil, natural gas, geothermal or even hydroelectric (the reservoir eventually silts up); • The efficient production of hydrogen by electrolysis requires very pure water for the KOH solution. A small part of the OTEC process can be used to produce this pure water from the surface seawater, resulting in high efficiency electrolysis; • Liquefying hydrogen by the Claude process requires an efficient heat sink to minimize process energy. The Claude process, which cools compressed hydrogen gas with liquid nitrogen prior to expansion through a Joules-Thompson valve to complete the liquefaction process, requires a significant heat sink to maintain liquid nitrogen temperatures (Ministry of Economic Affairs and Technology 1989). The cold seawater that is used in the OTEC process could provide this efficient heat sink; • Liquid hydrogen is most efficiently transported by ocean tanker. The off-shore OTEC hydrogen plant is already located on the transport medium and therefore would result in the lowest cost for transport to market. From a global perspective, ocean transport distances of OTEC derived LH2 are much shorter than our present system of oil transport from the Middle East around Africa to North America or Europe or from the Middle East around India and the Malay Peninsula to Japan. The successful development of a global hydrogen economy will undoubtedly have to involve the largest renewable energy resource in the world – the tropical ocean. OTEC technology is the best way to tap into this virtually limitless thermal reservoir to produce hydrogen to support the impending hydrogen economy. Offshore OTEC plants, utilizing techniques already developed for accessing deep water oil fields, can be adapted to produce and liquefy hydrogen and ensure a sustainable supply of hydrogen from an environmentally benign, renewable resource for future generations.

#### That solves warming and independently prevents grid terrorism

Jeremy **Rifkin**, 12/5/**2002**. President of the Foundation on Economic Trends, degree in economics from the Wharton School of the University of Pennsylvania, and degree in international affairs from the Fletcher School of Law and Diplomacy at Tufts University. “Hydrogen: Empowering the People,” The Nation, <http://www.thenation.com/doc/20021223/rifkin>.

While the fossil-fuel era enters its sunset years, a new energy regime is being born that has the potential to remake civilization along radically new lines--hydrogen. Hydrogen is the most basic and ubiquitous element in the universe. It never runs out and produces no harmful CO2 emissions when burned; the only byproducts are heat and pure water. That is why it's been called "the forever fuel." Hydrogen has the potential to **end the world's reliance on oil**. Switching to hydrogen and creating a decentralized power grid would also be the best assurance against terrorist attacks aimed at disrupting the national power grid and energy infrastructure. Moreover, hydrogen power will **dramatically reduce carbon dioxide emissions and mitigate the effects of global warming**. In the long run, the hydrogen-powered economy will fundamentally change the very nature of our market, political and social institutions, just as coal and steam power did at the beginning of the Industrial Revolution.

#### Grid terrorism causes nuclear war

**Habiger**, 2/1**/2010** (Eugue – Retired Air Force General, Cyberwarfare and Cyberterrorism, The Cyber Security Institute, p. 11-19)

However, from a strategic defense perspective, there are enough warning signs to warrant preparation. In addition to the threat of cyberwar, the limited resources required to carry out even a large scale cyberattack also makes likely the potential for a significant cyberterror attack against the United States. However, the lack of a long list of specific incidences of cyberterrorism should provide no comfort. There is strong evidence to suggest that al Qaeda has the ability to conduct cyberterror attacks against the United States and its allies. Al Qaeda and other terrorist organizations are extremely active in cyberspace, using these technologies to communicate among themselves and others, carry out logistics, recruit members, and wage information warfare. For example, al Qaeda leaders used email to communicate with the 9‐11 terrorists and the 9‐11 terrorists used the Internet to make travel plans and book flights. Osama bin Laden and other al Qaeda members routinely post videos and other messages to online sites to communicate. Moreover, there is evidence of efforts that al Qaeda and other terrorist organizations are actively developing cyberterrorism capabilities and seeking to carry out cyberterrorist attacks. For example, the Washington Post has reported that “U.S. investigators have found evidence in the logs that mark a browser's path through the Internet that al Qaeda operators spent time on sites that offer software and programming instructions for the digital switches that run power, water, transport and communications grids. In some interrogations . . . al Qaeda prisoners have described intentions, in general terms, to use those tools.”25 Similarly, a 2002 CIA report on the cyberterror threat to a member of the Senate stated that al Qaeda and Hezbollah have become "more adept at using the internet and computer technologies.”26 The FBI has issued bulletins stating that, “U. S. law enforcement and intelligence agencies have received indications that Al Qaeda members have sought information on Supervisory Control And Data Acquisition (SCADA) systems available on multiple SCADA‐related web sites.”27 In addition a number of jihadist websites, such as 7hj.7hj.com, teach computer attack and hacking skills in the service of Islam.28 While al Qaeda may lack the cyber‐attack capability of nations like Russia and China, there is every reason to believe its operatives, and those of its ilk, are as capable as the cyber criminals and hackers who routinely effect great harm on the world’s digital infrastructure generally and American assets specifically. In fact, perhaps, the most troubling indication of the level of the cyberterrorist threat is the countless, serious non‐terrorist cyberattacks routinely carried out by criminals, hackers, disgruntled insiders, crime syndicates and the like. If run‐of‐the‐mill criminals and hackers can threaten powergrids, hack vital military networks, steal vast sums of money, take down a city’s of traffic lights, compromise the Federal Aviation Administration’s air traffic control systems, among other attacks, it is overwhelmingly likely that terrorists can carry out similar, if not more malicious attacks. Moreover, even if the world’s terrorists are unable to breed these skills, they can certainly buy them. There are untold numbers of cybermercenaries around the world—sophisticated hackers with advanced training who would be willing to offer their services for the right price. Finally, given the nature of our understanding of cyber threats, there is always the possibility that we have already been the victim or a cyberterrorist attack, or such an attack has already been set but not yet effectuated, and we don’t know it yet. Instead, a well‐designed cyberattack has the capacity cause widespread chaos, sow societal unrest, undermine national governments, spread paralyzing fear and anxiety, and create a state of utter turmoil, all without taking a single life. A sophisticated cyberattack could throw a nation’s banking and finance system into chaos causing markets to crash, prompting runs on banks, degrading confidence in markets, perhaps even putting the nation’s currency in play and making the government look helpless and hapless. In today’s difficult economy, imagine how Americans would react if vast sums of money were taken from their accounts and their supporting financial records were destroyed. A truly nefarious cyberattacker could carry out an attack in such a way (akin to Robin Hood) as to engender populist support and deepen rifts within our society, thereby making efforts to restore the system all the more difficult. A modestly advanced enemy could use a cyberattack to shut down (if not physically damage) one or more regional power grids. An entire region could be cast into total darkness, power‐dependent systems could be shutdown. An attack on one or more regional power grids could also cause cascading effects that could jeopardize our entire national grid. When word leaks that the blackout was caused by a cyberattack, the specter of a foreign enemy capable of sending the entire nation into darkness would only increase the fear, turmoil and unrest. While the finance and energy sectors are considered prime targets for a cyberattack, an attack on any of the 17 delineated critical infrastructure sectors could have a major impact on the United States. For example, our healthcare system is already technologically driven and the Obama Administration’s e‐health efforts will only increase that dependency. A cyberattack on the U.S. e‐health infrastructure could send our healthcare system into chaos and put countless of lives at risk. Imagine if emergency room physicians and surgeons were suddenly no longer able to access vital patient information. A cyberattack on our nation’s water systems could likewise cause widespread disruption. An attack on the control systems for one or more dams could put entire communities at risk of being inundated, and could create ripple effects across the water, agriculture, and energy sectors. Similar water control system attacks could be used to at least temporarily deny water to otherwise arid regions, impacting everything from the quality of life in these areas to agriculture. In 2007, the U.S. Cyber Consequences Unit determined that the destruction from a single wave of cyberattacks on critical infrastructures could exceed $700 billion, which would be the rough equivalent of 50 Katrina‐esque hurricanes hitting the United States all at the same time.29 Similarly, one IT security source has estimated that the impact of a single day cyberwar attack that focused on and disrupted U.S. credit and debit card transactions would be approximately $35 billion.30 Another way to gauge the potential for harm is in comparison to other similar noncyberattack infrastructure failures. For example, the August 2003 regional power grid blackout is estimated to have cost the U.S. economy up to $10 billion, or roughly .1 percent of the nation’s GDP. 31 That said, a cyberattack of the exact same magnitude would most certainly have a much larger impact. The origin of the 2003 blackout was almost immediately disclosed as an atypical system failure having nothing to do with terrorism. This made the event both less threatening and likely a single time occurrence. Had it been disclosed that the event was the result of an attack that could readily be repeated the impacts would likely have grown substantially, if not exponentially. Additionally, a cyberattack could also be used to disrupt our nation’s defenses or distract our national leaders in advance of a more traditional conventional or strategic attack. Many military leaders actually believe that such a disruptive cyber pre‐offensive is the most effective use of offensive cyber capabilities. This is, in fact, the way Russia utilized cyberattackers—whether government assets, governmentdirected/ coordinated assets, or allied cyber irregulars—in advance of the invasion of Georgia. Widespread distributed denial of service (DDOS) attacks were launched on the Georgian governments IT systems. Roughly a day later Russian armor rolled into Georgian territory. The cyberattacks were used to prepare the battlefield; they denied the Georgian government a critical communications tool isolating it from its citizens and degrading its command and control capabilities precisely at the time of attack. In this way, these attacks were the functional equivalent of conventional air and/or missile strikes on a nation’s communications infrastructure.32 One interesting element of the Georgian cyberattacks has been generally overlooked: On July 20th, weeks before the August cyberattack, the website of Georgian President Mikheil Saakashvili was overwhelmed by a more narrowly focused, but technologically similar DDOS attack.33 This should be particularly chilling to American national security experts as our systems undergo the same sorts of focused, probing attacks on a constant basis. The ability of an enemy to use a cyberattack to counter our offensive capabilities or soften our defenses for a wider offensive against the United States is much more than mere speculation. In fact, in Iraq it is already happening. Iraq insurgents are now using off‐the‐shelf software (costing just $26) to hack U.S. drones (costing $4.5 million each), allowing them to intercept the video feed from these drones.34 By hacking these drones the insurgents have succeeded in greatly reducing one of our most valuable sources of real‐time intelligence and situational awareness. If our enemies in Iraq are capable of such an effective cyberattack against one of our more sophisticated systems, consider what a more technologically advanced enemy could do. At the strategic level, in 2008, as the United States Central Command was leading wars in both Iraq and Afghanistan, a cyber intruder compromised the security of the Command and sat within its IT systems, monitoring everything the Command was doing. 35 This time the attacker simply gathered vast amounts of intelligence. However, it is clear that the attacker could have used this access to wage cyberwar—altering information, disrupting the flow of information, destroying information, taking down systems—against the United States forces already at war. Similarly, during 2003 as the United States prepared for and began the War in Iraq, the IT networks of the Department of Defense were hacked 294 times.36 By August of 2004, with America at war, these ongoing attacks compelled then‐Deputy Secretary of Defense Paul Wolfowitz to write in a memo that, "Recent exploits have reduced operational capabilities on our networks."37 This wasn’t the first time that our national security IT infrastructure was penetrated immediately in advance of a U.S. military option.38 In February of 1998 the Solar Sunrise attacks systematically compromised a series of Department of Defense networks. What is often overlooked is that these attacks occurred during the ramp up period ahead of potential military action against Iraq. The attackers were able to obtain vast amounts of sensitive information—information that would have certainly been of value to an enemy’s military leaders. There is no way to prove that these actions were purposefully launched with the specific intent to distract American military assets or degrade our capabilities. However, such ambiguities—the inability to specifically attribute actions and motives to actors—are the very nature of cyberspace. Perhaps, these repeated patterns of behavior were mere coincidence, or perhaps they weren’t. The potential that an enemy might use a cyberattack to soften physical defenses, increase the gravity of harms from kinetic attacks, or both, significantly increases the potential harms from a cyberattack. Consider the gravity of the threat and risk if an enemy, rightly or wrongly, believed that it could use a cyberattack to degrade our strategic weapons capabilities. Such an enemy might be convinced that it could win a war—conventional or even nuclear—against the United States. The effect of this would be to undermine **our** deterrence‐based defenses, making us significantly more at risk of a major war.

#### Independently, hydrogen economy solves nuclear war

Julian **Gresser and** James A. **Cusumano**, March/April **2005**. Chairman of Alliances for Discovery org), a nonprofit organization dedicated to accelerating breakthrough discoveries and founder and retired chairman of Catalytica Inc., former research director for Exxon, and currently vice chairman of the World Business Academy. “Hydrogen and the New Energy Economy,” The Futurist, Ebsco.

Today, oil supplies 40% of the world’s energy needs and 90% of its transportation requirements. Global economic growth over the next 15 years will increase petroleum’s share of energy generation to 60%, most of this demanded by the transportation sector when the number of cars increases from 700 million to 1.25 bil- lion. The annual economic growth rate of rapidly industrializing nations such as China (10%) and India (7%) will greatly intensify the pressure, while at the same time proven reserves will continue to be drawn down at four times the rate of new discoveries. If the world were constant and only the demand for oil increased— without the concomitant decrease in production that we project—a signif- icant rise in the price of oil could be managed solely as an energy supply problem as it was in the 1980s. But the world has become far riskier and uncertain, and the coming sharp spikes in the price of oil could have severe impacts. For one thing, the world’s financial, economic, energy, environmental, and other systems have become increasingly integrated. If the integrity or robustness of any of these systems is significantly compromised, the stresses may well be rapidly transferred to other systems, leading to global chaos. A sharp rise in the price of oil will also fall most heavily on the most impoverished countries and the poorest people in industrialized soci- eties, substantially increasing their suffering. Systems based on suffer- ing of this magnitude eventually become unstable. The systemic chaos ensuing from this predicted oil crisis could pose psychological trauma because throughout most of human history the rate of change has proceeded in a linear, if not entirely orderly, way. Today in virtually every sector of the industrialized world, the rate of change is becoming exponential. We are poorly adapted psychologically and emotionally for this shift and will be prone to panic in times of crisis. **Such panic could quickly escalate to catastrophe, with weapons of mass destruction now widely avail- able, inexpensively produced, and easily deployed**. That possibility is all the more threatening as the num- ber of terrorist groups actively seek- ing to acquire these weapons and to cause havoc, murder, and mayhem multiplies. When tightly coupled systems become as stressed as they currently are, and when these stresses do not abate, but rather compound as now seems likely, there is a tendency for these systems to reach a tipping point—when a single event, though not catastrophic in itself, has the potential to unleash a cascade of disorder and turbulence. Most policy makers overlook the oil-price tipping point because they do not appear to understand—from a systems perspective—the linkage of oil prices to other destabilizing trends. Currently, more than 20% of the world’s oil is in the hands of nations known to sponsor terrorism, and are under sanctions by the United States and/or the United Nations. As a re- sult, oil-producing nations in the Middle East will gain an influence on world affairs previously unthink- able by energy and political strate- gists. These nations will continue to increase their arms, leading to greater instability in that region and worldwide. Massive wealth will flow to terrorist organizations as the free world indirectly rewards their sponsors through the purchase of oil at increasingly higher prices. Fixed supplies, stalled discoveries, and sharply increased consumption will drive prices in the near future to an oil-price tipping point. The wisest way to anticipate and mitigate this risk would be to implement an immediate “quantum jump” into energy conservation and hydrogen development. This will help us avoid, or at least minimize, the dislocations of the oil-price tip- ping point, while achieving an orderly and smooth transition to a Hydrogen Economy in later stages of the program. To be sure, even this quantum jump strategy will likely require 15 to 20 years to achieve broad displacement of current oil sources by hydrogen.

#### OTEC sequesters carbon – that’s necessary to solve climate change

Christopher **Barry**, **2008**. Naval architect and co-chair of the Society of Naval Architects and Marine Engineers ad hoc panel on ocean renewable energy. “Ocean Thermal Energy Conversion and CO2 Sequestration,” renewenergy.wordpress.com/2008/07/01/ocean-thermal-energy-conversion-and-co2-sequestration/.

However, deep cold water is laden with nutrients. In the tropics, the warm surface waters are lighter than the cold water and act as a cap to keep the nutrients in the deeps. This is why there is much less life in the tropical ocean than in coastal waters or near the poles. The tropical ocean is only fertile where there is an upwelling of cold water. One such upwelling is off the coast of Peru, where the Peru (or Humboldt) Current brings up nutrient laden waters. In this area, with lots of solar energy and nutrients, ocean fertility is about 1800 grams of carbon uptake per square meter per year, compared to only 100 grams typically. This creates a rich fishery, but most of the carbon eventually sinks to the deeps in the form of waste products and dead microorganisms. This process is nothing new; worldwide marine microorganisms currently sequester about forty billion metric tonnes of carbon per year. They are the major long term sink for carbon dioxide. In a recent issue of Nature, [Lovelock and Rapley](http://blogs.nature.com/climatefeedback/2007/09/lovelock_and_rapley_propose_cu_1.html) suggested using wave-powered pumps to bring up water from the deeps to sequester carbon. But OTEC also brings up prodigious amounts of deep water and can do the same thing. In one design, a thousand cubic meters of water per second are required to produce 70 MW of net output power. We can make estimates of fertility enhancement and sequestration, but a guess is that an OTEC plant designed to optimize nutrification might produce 10,000 metric tonnes of carbon dioxide sequestration per year per MW. The recent challenge by billionaire Sir Richard Branson is to sequester one billion tonnes of carbon dioxide per year in order to halt global warming, so an aggressive OTEC program, hundreds of several hundred MW plants might meet this.

#### Warming is real and anthropogenic – carbon dioxide increase, polar ice records, melting glaciers, sea level rise

**Prothero 12** [Donald R. Prothero, Professor of Geology at Occidental College and Lecturer in Geobiology at the California Institute of Technology, 3-1-2012, "How We Know Global Warming is Real and Human Caused," Skeptic, vol 17 no 2, EBSCO]

**Prothero 12** [Donald R. Prothero, Professor of Geology at Occidental College and Lecturer in Geobiology at the California Institute of Technology, 3-1-2012, "How We Know Global Warming is Real and Human Caused," Skeptic, vol 17 no 2, EBSCO]

Converging Lines of Evidence¶ How do we know that global warming is real and primarily human caused? There are numerous lines of evidence that converge toward this conclusion.¶ 1. Carbon Dioxide Increase.¶ Carbon dioxide in our atmosphere has increased at an unprecedented rate in the past 200 years. Not one data set collected over a long enough span of time shows otherwise. Mann et al. (1999) compiled the past 900 years' worth of temperature data from tree rings, ice cores, corals, and direct measurements in the past few centuries, and the sudden increase of temperature of the past century stands out like a sore thumb. This famous graph is now known as the "hockey stick" because it is long and straight through most of its length, then bends sharply upward at the end like the blade of a hockey stick. Other graphs show that climate was very stable within a narrow range of variation through the past 1000, 2000, or even 10,000 years since the end of the last Ice Age. There were minor warming events during the Climatic Optimum about 7000 years ago, the Medieval Warm Period, and the slight cooling of the Little Ice Age in die 1700s and 1800s. But the magnitude and rapidity of the warming represented by the last 200 years is simply unmatched in all of human history. More revealing, die timing of this warming coincides with the Industrial Revolution, when humans first began massive deforestation and released carbon dioxide into the atmosphere by burning an unprecedented amount of coal, gas, and oil.¶ 2. Melting Polar Ice Caps.¶ The polar icecaps are thinning and breaking up at an alarming rate. In 2000, my former graduate advisor Malcolm McKenna was one of the first humans to fly over the North Pole in summer time and see no ice, just open water. The Arctic ice cap has been frozen solid for at least the past 3 million years (and maybe longer),4 but now the entire ice sheet is breaking up so fast that by 2030 (and possibly sooner) less than half of the Arctic will be ice covered in the summer.5 As one can see from watching the news, this is an ecological disaster for everything that lives up there, from the polar bears to the seals and walruses to the animals they feed upon, to the 4 million people whose world is melting beneath their feet. The Antarctic is thawing even faster. In February-March 2002, the Larsen B ice shelf - over 3000 square km (the size of Rhode Island) and 220 m (700 feet) thick- broke up in just a few months, a story typical of nearly all the ice shelves in Antarctica. The Larsen B shelf had survived all the previous ice ages and interglacial warming episodes over the past 3 million years, and even the warmest periods of the last 10,000 years- yet it and nearly all the other thick ice sheets on the Arctic, Greenland, and Antarctic are vanishing at a rate never before seen in geologic history.¶ 3. Melting Glaciers.¶ Glaciers are all retreating at the highest rates ever documented. Many of those glaciers, along with snow melt, especially in the Himalayas, Andes, Alps, and Sierras, provide most of the freshwater that the populations below the mountains depend upon - yet this fresh water supply is vanishing. Just think about the percentage of world's population in southern Asia (especially India) that depend on Himalayan snowmelt for their fresh water. The implications are staggering. The permafrost that once remained solidly frozen even in the summer has now Üiawed, damaging the Inuit villages on the Arctic coast and threatening all our pipelines to die North Slope of Alaska. This is catastrophic not only for life on the permafrost, but as it thaws, the permafrost releases huge amounts of greenhouse gases which are one of the major contributors to global warming. Not only is the ice vanishing, but we have seen record heat waves over and over again, killing thousands of people, as each year joins the list of the hottest years on record. (2010 just topped that list as the hottest year, surpassing the previous record in 2009, and we shall know about 2011 soon enough). Natural animal and plant populations are being devastated all over the globe as their environments change.6 Many animals respond by moving their ranges to formerly cold climates, so now places that once did not have to worry about disease-bearing mosquitoes are infested as the climate warms and allows them to breed further north.¶ 4. Sea Level Rise.¶ All that melted ice eventually ends up in the ocean, causing sea levels to rise, as it has many times in the geologic past. At present, the sea level is rising about 3-4 mm per year, more than ten times the rate of 0.10.2 mm/year that has occurred over the past 3000 years. Geological data show Üiat ttie sea level was virtually unchanged over the past 10,000 years since the present interglacial began. A few mm here or there doesn't impress people, until you consider that the rate is accelerating and that most scientists predict sea levels will rise 80-130 cm in just the next century. A sea level rise of 1.3 m (almost 4 feet) would drown many of the world's low-elevation cities, such as Venice and New Orleans, and low-lying countries such as the Netherlands or Bangladesh. A number of tiny island nations such as Vanuatu and the Maldives, which barely poke out above the ocean now, are already vanishing beneath the waves. Eventually their entire population will have to move someplace else.7 Even a small sea level rise might not drown all these areas, but they are much more vulnerable to the large waves of a storm surge (as happened with Hurricane Katrina), which could do much more damage than sea level rise alone. If sea level rose by 6 m (20 feet), most of die world's coastal plains and low-lying areas (such as the Louisiana bayous, Florida, and most of the world's river deltas) would be drowned.¶ Most of the world's population lives in lowelevation coastal cities such as New York, Boston, Philadelphia, Baltimore, Washington, D.C., Miami, and Shanghai. All of those cities would be partially or completely under water with such a sea level rise. If all the glacial ice caps melted completely (as they have several times before during past greenhouse episodes in the geologic past), sea level would rise by 65 m (215 feet)! The entire Mississippi Valley would flood, so you could dock an ocean liner in Cairo, Illinois. Such a sea level rise would drown nearly every coastal region under hundreds of feet of water, and inundate New York City, London and Paris. All that would remain would be the tall landmarks such as the Empire State Building, Big Ben, and the Eiffel Tower. You could tie your boats to these pinnacles, but the rest of these drowned cities would lie deep underwater.

#### Worst-case warming results in extinction

Ahmed 2010 (Nafeez Ahmed, Executive Director of the Institute for Policy Research and Development, professor of International Relations and globalization at Brunel University and the University of Sussex, Spring/Summer 2010, “Globalizing Insecurity: The Convergence of Interdependent Ecological, Energy, and Economic Crises,” Spotlight on Security, Volume 5, Issue 2, online)

Perhaps the most notorious indicator is anthropogenic global warmings warming. The landmark 2007 Fourth Assessment Report of the UN Intergovernmental Panel on Climate Change (IPCC) – which warned that at then-current rates of increase of fossil fuel emissions, the earth’s global average temperature would likely rise by 6°C by the end of the 21st century creating a largely uninhabitable planet – was a wake-up call to the international community.[v] Despite the pretensions of ‘climate sceptics,’ the peer-reviewed scientific literature has continued to produce evidence that the IPCC’s original scenarios were wrong – not because they were too alarmist, but on the contrary, because they were far too conservative. According to a paper in the Proceedings of the National Academy of Sciences, current CO2 emissions are worse than all six scenarios contemplated by the IPCC. This implies that the IPCC’s worst-case six-degree scenario severely underestimates the most probable climate trajectory under current rates of emissions.[vi] It is often presumed that a 2°C rise in global average temperatures under an atmospheric concentration of greenhouse gasses at 400 parts per million (ppm) constitutes a safe upper limit – beyond which further global warming could trigger rapid and abrupt climate changes that, in turn, could tip the whole earth climate system into a process of irreversible, runaway warming.[vii] Unfortunately, we are already well past this limit, with the level of greenhouse gasses as of mid-2005 constituting 445 ppm.[viii] Worse still, cutting-edge scientific data suggests that the safe upper limit is in fact far lower. James Hansen, director of the NASA Goddard Institute for Space Studies, argues that the absolute upper limit for CO2 emissions is 350 ppm: “If the present overshoot of this target CO2 is not brief, there is a possibility of seeding irreversible catastrophic effects.”[ix] A wealth of scientific studies has attempted to explore the role of positive-feedback mechanisms between different climate sub-systems, the operation of which could intensify the warming process. Emissions beyond 350 ppm over decades are likely to lead to the total loss of Arctic sea-ice in the summer triggering magnified absorption of sun radiation, accelerating warming; the melting of Arctic permafrost triggering massive methane injections into the atmosphere, accelerating warming; the loss of half the Amazon rainforest triggering the momentous release of billions of tonnes of stored carbon, accelerating warming; and increased microbial activity in the earth’s soil leading to further huge releases of stored carbon, accelerating warming; to name just a few. Each of these feedback sub-systems alone is sufficient by itself to lead to irreversible, catastrophic effects that could tip the whole earth climate system over the edge.[x] Recent studies now estimate that the continuation of business-as-usual would lead to global warming of three to four degrees Celsius before 2060 with multiple irreversible, catastrophic impacts; and six, even as high as eight, degrees by the end of the century – a situation endangering the survival of all life on earth.[xi]

#### Warming causes extinction – oceans

**Sify 2010 –** Sydney newspaper citing Ove Hoegh-Guldberg, professor at University of Queensland and Director of the Global Change Institute, and John Bruno, associate professor of Marine Science at UNC (Sify News, “Could unbridled climate changes lead to human extinction?”, <http://www.sify.com/news/could-unbridled-climate-changes-lead-to-human-extinction-news-international-kgtrOhdaahc.html>, WEA)

The findings of the comprehensive report: 'The impact of climate change on the world's marine ecosystems' emerged from a synthesis of recent research on the world's oceans, carried out by two of the world's leading marine scientists. One of the authors of the report is Ove Hoegh-Guldberg, professor at The University of Queensland and the director of its Global Change Institute (GCI). 'We may see sudden, unexpected changes that have serious ramifications for the overall well-being of humans, including the capacity of the planet to support people. This is further evidence that we are well on the way to the next great extinction event,' says Hoegh-Guldberg. 'The findings have enormous implications for mankind, particularly if the trend continues. The earth's ocean, which produces half of the oxygen we breathe and absorbs 30 per cent of human-generated carbon dioxide, is equivalent to its heart and lungs. This study shows worrying signs of ill-health. It's as if the earth has been smoking two packs of cigarettes a day!,' he added. 'We are entering a period in which the ocean services upon which humanity depends are undergoing massive change and in some cases beginning to fail', he added. The 'fundamental and comprehensive' changes to marine life identified in the report include rapidly warming and acidifying oceans, changes in water circulation and expansion of dead zones within the ocean depths. These are driving major changes in marine ecosystems: less abundant coral reefs, sea grasses and mangroves (important fish nurseries); fewer, smaller fish; a breakdown in food chains; changes in the distribution of marine life; and more frequent diseases and pests among marine organisms. Study co-author John F Bruno, associate professor in marine science at The University of North Carolina, says greenhouse gas emissions are modifying many physical and geochemical aspects of the planet's oceans, in ways 'unprecedented in nearly a million years'. 'This is causing fundamental and comprehensive changes to the way marine ecosystems function,' Bruno warned, according to a GCI release. These findings were published in Science

### 1ac plan

#### Plan: The United States federal government should substantially reduce restrictions on Ocean Thermal Energy Conversion in the United States imposed by entites other than the National Oceanic and Atmospheric Administration.

### 1ac solvency

**Solvency:**

#### Current patchwork of restrictions prevents commercial viability—removing it is key to solve

**Griset 2010** (Todd, J.D. from the University of Pennsylvania, advises utilities going before state and federal regulating agencies, "Harnessing the Ocean's Power: Opportunities in Renewable Ocean Energy Resources", Ocean and Coastal Law Journal, Vol. 16:2)

Whether renewable ocean energy development will occur in U.S. ¶ waters on a commercial scale remains to be seen. The potential ¶ environmental impact of individual units remains largely unknown, let ¶ alone the impacts of build-out and development on a larger scale.¶ 226¶ The slate of technologies available for extracting usable energy from the sea ¶ is promising, but most—and particularly those with the greatest ¶ potential—remain in an immature state. As interest in refining these ¶ technologies continues, mechanisms for converting the oceans’ energy ¶ into usable power are improving in efficiency and cost-effectiveness. ¶ Regulatory regimes applicable to renewable ocean energy continue to ¶ evolve as well. For example, the decision of the Massachusetts DPU to ¶ approve Cape Wind’s power purchase agreement with National Grid, and ¶ the FERC order approving the concept of a multi-tiered avoided cost rate ¶ structure under which states may establish a higher avoided cost rate for ¶ mandated renewable power, both represent an evolution in the traditional ¶ regulation of public utilities. In both cases, regulatory policy has shifted ¶ to favor renewable energy production even though it may initially bear a ¶ higher cost than production from fossil fuel-based resources. These ¶ shifts may continue to bring renewable ocean energy closer to costcompetitiveness or cost-parity with traditional resources. Time will tell ¶ whether the trend toward greater ocean energy development will rise and ¶ fall like the tides, as has the trends responsible for the initial enactment ¶ of the OTEC Act, subsequent removal of NOAA’s regulations, and the ¶ current resurgence of interest in OTEC, or whether these shifts represent ¶ definite progress toward a new form of energy production. ¶ Furthermore, clarification and simplification of the patchwork of ¶ regulatory regimes governing renewable ocean energy projects will bring ¶ about additional reductions in the cost of energy from the sea. As a ¶ general principle, uncertainty or inconsistency of regulation tends to ¶ deter development and investment.¶ 227¶ Unknown or shifting regulatory ¶ regimes add risk to the development of any given project.¶ 228¶ Indeed, in ¶ the context of ocean energy, regulatory uncertainty has been called “the ¶ most significant non-technical obstacle to deployment of this new ¶ technology.”¶ 229¶ Consistent government commitment and the ¶ simplification of licensing and permitting procedures, rank among the hallmarks of a well-planned system for developing ocean renewable ¶ energy.¶ 230¶ Arguably, such a system has not yet been fully realized. Some ¶ observers believe that the MOU between MMS and FERC has “resolved ¶ the uncertainty” over the jurisdictional question, and by extension, over ¶ the question of which set of regulations a developer of a project on the ¶ OCS must follow.¶ 231¶ On the other hand, the dual process created by the ¶ MOU under which MMS/BOEMRE must first approve a site and issue a ¶ lease, after which FERC may issue a license or exemption, may lead to ¶ delays in the development of hydrokinetic energy resources on the ¶ OCS.¶ 232¶ Nevertheless, the agencies have committed themselves to ¶ cooperate and have issued guidance suggesting that where possible, the ¶ agencies will combine their National Environmental Policy Act ¶ processes.¶ 233¶ At the same time, technologies such as OTEC remain under the ¶ jurisdiction of NOAA. As noted above, a host of other federal agencies ¶ retain authority to regulate various aspects of renewable ocean energy ¶ projects. The nation’s regulatory program for ocean energy projects thus ¶ lacks a single “one-stop shop” approach for project licensure, site ¶ leasing, and other required permitting. Project developers must not only ¶ obtain permits from a variety of federal and state entities, but moreover ¶ face uncertainty as to which permits may be required. The net impact of ¶ this regulatory patchwork is to place a chilling effect on the ¶ comprehensive development of the nation’s renewable ocean energy ¶ resources. ¶ Moreover, few renewable ocean energy projects have been fully ¶ permitted. Indeed, the Cape Wind project represents the first ¶ commercial-scale offshore wind project to complete its permitting and ¶ licensing path.¶ 234¶ Although each future project’s details and regulatory path may be unique, the success of the first United States offshore wind ¶ project to go through the public regulatory process provides subsequent ¶ developers with valuable insight into challenges, procedures, and ¶ provides an understanding of how to apportion permitting and ¶ development costs with greater certainty.¶ 235¶ However, because that path ¶ took nine years to navigate, and because many of the regulatory shifts ¶ described herein occurred during that time, project developers today will ¶ face a different regulatory structure than that faced by Cape Wind. ¶ Moreover, depending on the technology involved, site-specific issues, ¶ and the regulatory environment of each state, each project must in ¶ essence forge its own path forward toward complete regulatory approval. ¶ Congressional action could further streamline the regulatory ¶ framework applicable to renewable ocean energy projects. Providing a ¶ stable structure for the development of the oceans’ renewable energy ¶ potential would reduce the capital cost required to develop a given ¶ project. By providing a clear and consistent legal path for project ¶ developers to follow, such legislation would enable the best ocean ¶ energy projects to become more cost-competitive. This in turn could ¶ provide benefits along the lines of those cited by the Massachusetts ¶ Department of Public Utilities in approving the Cape Wind power ¶ purchase agreement: economic development, a diversified energy policy, ¶ greater energy independence, and reduced carbon emissions. The states’ ¶ role in such a regulatory framework should be respected. While ¶ renewable power benefits the region, the nation, and the world at large, ¶ most of the negative impacts of a given project are felt locally. ¶ Establishing a clear regulatory framework including appropriate federal ¶ agencies as well as state authority could empower greater development ¶ of ocean energy resources without sacrificing values such as navigational ¶ rights, fisheries and wildlife, aesthetic considerations, and states’ rights. ¶ Our oceans hold vast promise. The opportunity to transform that ¶ potential into usable energy is significant. Whether developing that ¶ potential into commercial-scale energy production is a reasonable choice ¶ remains to be seen. If renewable ocean energy resources are to be ¶ developed, promoting regulatory certainty would do much to promote ¶ their cost-effective development.

#### Overlapping restriction of OTEC collapses the industry—both state and federal agencies can claim jurisdiction, preventing a viable industry from developing

**Elefant 2002** (Carolyn, Principle Attorney at LOCE, November 19, " Proposed Strategies for Addressing Regulatory Uncertainty in Ocean Energy Development in the United States ", http://www.energypulse.net/centers/article/article\_display.cfm?a\_id=79)

The Regulatory Barriers To Ocean Energy Developers - Overview of Regulatory Uncertainty: The foregoing events suggest that presently, there is sufficient confidence in the functionality of ocean energy technology to warrant further investigation of its potential for commercialization. However, even if these pilot projects and investigative programs resolve all of the feasibility and economic concerns about ocean energy, one substantial barrier to commercialization of ocean energy would still remain: regulatory uncertainty. Regulatory uncertainty refers to those risks inherent in the obtaining any necessary licenses or permits to construct and operate the project from the appropriate regulatory authority. Risks exist in the regulatory process because both federal and state licensing or permitting authorities typically have the option of rejecting a permit application or alternatively, issuing a permit but including limits on operation or required enhancement measures to mitigate environmental impacts which can increase the overall cost of the project. In deciding whether to fund an energy project, investors must factor in the risks associated with licensing a project and will decline investment where there is considerable uncertainty that a project can or will be licensed on favorable terms. Indeed, regulatory uncertainty explains why nuclear power plants have long been regarded as an unappealing investment: given strong public opposition and stringent licensing requirements, the chances of a nuclear project obtaining a license which does not include onerous operating and mitigating conditions are slim. Why Ocean Energy Projects Carry Regulatory Uncertainty: For a variety of reasons, ocean energy projects carry with them a higher degree of regulatory uncertainty than conventional energy projects. These reasons include: Overlapping or unknown jurisdictional issues and requirements Most conventional energy projects such as fossil fuel, natural gas and even wind farms are subject to well established state siting and/or zoning laws applied by state regulatory bodies while development of most hydro power plants has been regulated by the Federal Energy Regulatory Commission ( FERC) for the past seventy five years. By contrast, it is unclear which regulatory agencies will have primary jurisdiction over ocean energy projects (with the exception of OTEC projects which are regulated by NOAA, pursuant to the OTEC Act). Consider the following myriad of possibilities: \* Projects which will be sited up to three miles from shore are technically on state lands per the Submerged Lands Act which vests states with control and title over those lands. 43 U.S.C. sec. 1301(a)(2). Arguably then, states would have primary regulatory jurisdiction through state power plant siting and coastal development statutes At the same time, even for projects located on state lands, federal interests in navigation are implicated and as a result, even projects regulated by the state would likely still require various permits from the Army Corps of Engineers. \* To throw another wrench into the equation, the Federal Energy Regulatory Commission has jurisdiction over hydro power projects located on navigable and commerce clause waterways. 16 U.S.C. sec. 817. Several statutes define navigable waters as including waters within the three mile limit from shore while ocean projects could be classified as hydro power since they utilize water to generate electricity. Thus, FERC is another possible candidate for permitting or licensing ocean projects and indeed, has issued preliminary permits to study wave power projects. See Passamadquoddy Tribal Council, 11 FERC para. 62,236 (1980)(permit for tidal project near Cobscook Bay); Quantum Energy orders supra. \* For projects beyond the three mile limit from shore, i.e., on the Outer Continental Shelf, the Corps of Engineers retains permitting authority under Section 10 of the Rivers and Harbors Act, as extended by Section 4(d) of the Outer Continental Shelf Lands Act (OCSLA), 43 U.S.C.A. sec 1331-56. Indeed, as discussed earlier, the Corps is currently processing a permit for an offshore windfarm located five miles off the coast of Cape Cod, Massachusetts. However, the Secretary of Interior, through the Mineral Management Service (MMS) has long had administered the oil and gas leasing and production program on the Outer Continental Shelf and arguably, has more expertise over ocean based energy projects than the Corps of Engineers. Variety in Types of Ocean Energy Projects In contrast to conventional technologies which can fall into more definite categories, e.g., coal, gas, hydro, there are a huge variety of projects which fall roughly within the rubric of ocean energy. These include OTEC, tidal power, wave energy systems employing pneumatic devices such as the Wells turbine; current energy which might employ slow moving turbines designed to operate in low head rivers and even offshore wave projects or hybrid wind-wave projects. The location of an ocean energy project - i.e., at shoreline, within three miles from shore or beyond three miles, depends upon the technology employed and thus, it might be impossible for one regulatory body to have jurisdiction over all ocean projects based on the existing parameters just discussed. • Lack of Information as to Regulatory Standards Even after resolving which agency has regulatory responsibility over ocean energy projects, another unknown is what types of regulatory standards these agencies will apply to evaluate ocean energy projects? These agencies may decide that existing permitting regulations (which may either apply a broad public interest standard or establish specific criteria for reviewing environmental impacts, economic feasibility, etc...) suffice to evaluate ocean energy projects. Or the agencies may determine that ocean energy development, with an unproven track record, unknown impacts and questionable permanence (e.g., how long will the projects last in a harsh ocean environment?) could require additional regulations which would require more extensive studies on environmental impacts or the implementation of a decommissioning plan. Why Regulatory Uncertainty, if Left Unresolved, Will Present Problems: The problem of regulatory uncertainty, if left unresolved, will stand as a major impediment to ocean energy development and commercialization for the reasons listed below: \* Questions about which agency has authority to license ocean energy projects can contribute to turf wars amongst agencies and lead to a duplicative and confusing application process where a developer must submit several permit applications and possibly be subject to competing conditions for operation and mitigating impacts. Overlap between agencies thus leads to increased development costs and delay. \* Opponents of ocean energy projects can use regulatory uncertainty to their advantage to oppose a project by arguing that a particular regulatory agency lacks jurisdiction over the project. Jurisdictional questions can be taken all the way to the courts which could agree with project opponents and conclude that an agency lacked jurisdiction, thereby rendering the entire permit process a waste.

#### NOAA can do the plan – authority overall OTEC laws and licensing

Carolyn **Elefant**, CEO and legislative director of the Ocean Renewable Energy Coalition, no date, “Regulation of Offshore Renewables Development -Existing Regulatory Regime and Proposals for Improvement,” <http://www.his.com/~israel/loce/naspresent.pdf>

OTEC Act, 42 U.S.C. § 9111 - gives NOAA jurisdiction to license OTEC projects: No person shall engage in the ownership, construction or operation of an OTEC facility...[located in waters of the United States] except with a license issued by NOAA. A) OTEC Act was intended to create one stop shopping for licensing of OTEC plants. NOAA promulgated regulations governing applications for OTEC licenses (15 C.F.R. Part 981) but withdrew them in 1996 due to lack of OTEC applicants. B) To obtain an OTEC license, applicants must comply with applicable federal and state laws (See Summary Chart for more details). For example, OTEC applicant will need to get a Section 10 permit from Corps of Engineers because plant may pose an obstruction to navigation. But NOAA regulations provide for Consolidated Application Review (CAR) to coordinate timing and processing of multiple permit applications. C) OTEC regulations allow exemption for demo projects qualified by Department of Energy and non-permanent test platforms D) Standard for issuance of license: project is in national interest and complies with applicable laws.

#### OTEC is feasible, economically viable, and recent advancements solve all problems

**McCallister and McLaughlin 2012** [Captain Michael, Senior Engineer with Sound and Sea Technology, Commander Steve, Critical Infrastructure Programs Manager at Sound and Sea Technology, January, "Renewable Energy from the Ocean", U.S. Naval Institute Proceedings, Vol. 138, Issue 1, EBSCO]

The well-known OTEC operating principles date to the original concept proposed by Jacques-Arsène d'Arsonval in 1881. OTEC recovers solar energy using a thermodynamic cycle that operates across the temperature difference between warm surface water and cold deep water. In the tropics, surface waters are above 80 degrees Fahrenheit, while at depths of about 1,000 meters water temperatures are just above freezing. This grathent provides a differential that can be used to transfer energy from the warm surface waters and generate electricity.¶ For a system operating between 85 and 35 degrees Fahrenheit, the temperature differential yields a maximum thermodynamic Carnot cycle efficiency of 9.2 percent. Although this is considered low efficiency for a power plant, the "fuel" is free. Hence, the real challenge is to build commercial-scale plants that yield competitively priced electricity.¶ Overcoming Barriers¶ Previous attempts to develop a viable and practical OTEC commercial power system suffered from several challenges. The low temperature delta requires large seawater flows to yield utility scale outputs. Therefore, OTEC plants must be large. Thus, they will also be capital-intensive. As plant capacity increases, the unit outlay becomes more cost-effective due to economy of scale.¶ Survivable cold-water pipes, cost-efficient heat exchangers, and to a lesser extent offshore structures and deep-water moorings represent key technical challenges. However, developments in offshore technologies, new materials, and fabrication and construction processes that were not available when the first serious experimental platforms were developed in the 1970s now provide solutions. When located close to shore, an OTEC plant can transmit power directly to the local grid via undersea cable. Plants farther from shore can also produce power in the form of energy carriers like hydrogen or ammonia, which can be used both as fuel for transportation and to generate power ashore. In agricultural markets, reasonably priced, renewablebased ammonia can displace natural gas in fertilizer production.¶ Combined with marine algae aquaculture programs, OTEC plants can also produce carbon-based synthetic fuels. OTEC facilities can be configured to produce fresh water, and, from a military perspective, system platforms can also serve as supply bases and surveillance sites.¶ Facing Reality¶ Availability of relatively "cheap" fossil fuels limits societal incentives to change and makes energy markets difficult to penetrate. However, the realization of "peak oil" (the theoretical upper limit of global oil production based on known reserves), ongoing instability in Middle East political conditions, adversarial oil-supply partners, and concerns over greenhouse-gas buildup and global warming all contribute to the need for renewable energy solutions.¶ An assessment of OTEC technical readiness by experts at a 2009 National Oceanic and Atmospheric Administration workshop indicated that a 10 megawatt (MW) floating OTEC facility is technically feasible today, using current design, manufacturing, and installation technologies.¶ While readiness and scalability for a 100 MW facility were less clear, the conclusion was that experience gained during the construction, deployment, and operation of a smaller pilot plant would be a necessary step in OTEC commercialization.