ENERGY CRISIS– A NEED FOR ALTERNATE RESPONSE

John Arendshorst 3/07

Two folks, walking with a scarf blowing behind..."Long term, I'm worried about global warming---short term, about freezing my ass off." (New Yorker Magazine, Feb. 19 & 26, 2007)

Pre-introduction: Energy concerns are big news now----documentaries, Hugo Chavez (Venezuela), Big Oil.....

Personal observations raised inquiry into this subject: interest in mass transit, experiences from Grinnell Glacier to Rio, Brazil energy-efficient taxi....

a. Environmental Chemistry
b. Cars and Roads
c. European Buses and Trains and mass transport, why not here?
d. Grinnell Glacier 13 year apart observations
e. Smog over the Lake, pollution of the water, soil, and air
f. Failed Recycling here at home, Power and Gas Use
g. Cooling "Needs"
h. Globalization making all available
i. Travel time power and energy = speed
j. Brazil, energy, and the GM efficient Taxi
k. India – silk plant coal burning for local energy
l. Developing world pollution and Trash

Introduction: Imagine yourself in a jetliner, taking off at night. Looking down, you see lights in houses and cars...each light likely connected to a fossil fuel energy source. These fossil fuels began their stories hundreds of millions of years ago. The near future of these fuels is projected to change dramatically.

Nearly everything around you now is made of or by fossil fuels. We have, in a century, gone from horse carts to space ships. More people, more fuel consumed, more fuel derivatives. At the same time, we have also created several ecological problems that are contributing to a crisis—and not a crisis in the distant future. A crisis NOW.

I. PROBLEMS RELATED TO ENERGY CONSUMPTION

The problems are:
1. The depletion of fossil fuels;
2. Continued population growth (over 6 billion people);
3. Global climate change and habitat destruction;
4. International political instability, with conflicts over Limited energy resources.

This paper will attempt to discuss the results of our current fossil fuel consumption, with a discussion of recommended alternatives.

People in industrialized areas of the world take their combustible fuels for granted. We don't often think of the *source* of energy when we use it. Accessibility to energy is one of the primary differences separating the developed from the undeveloped world. The most

increased energy demand is expected to occur in developing regions, particularly Asia, as nations seek greater access to energy to improve their standards of living. By the year 2020, the world will consume 50% more energy than it did in 1990. The current projection is that 90% of this increased energy production will come from fossil fuels. The following reasons illustrate why continued & increased fossil fuel use must change:

1. **Bad Air**: Our biosphere is subjected to more pollutants than this dynamic self-cleaning system can handle. Toxic contaminants infiltrate our entire eocosystem---atmospheric, aquatic, terrestrial---from power plants, industry, and automobiles.

Main pollutants include: sulfur oxides, nitrogen oxides, carbon monoxides, mercury, soot from diesel engines.

The U.S., like most industrialized countries, has legislated curbing of emissions of hazardous toxins, with some success (1970 Clean Air Act, and the 2002 Clear Skies Act: none of these limited carbon dioxide). China and other developing nations have air quality far worse. Over 20 cities in India with populations over 1 million fail to meet minimum standards set by the World Health Organization. So long as the global community remains dependent on fossil fuels for the bulk of its energy supply, smog and poor air quality problems will not go away. Smog and acid rain negatively affect plant and animal health. Three million lives are lost world wide annually due to urban air pollution.

2. **Global Warming**: If you haven't seen Al Gore's film, An Inconvenient Truth, run to your nearest store, or go online to AIT.org to get it. It is a compelling presentation, a catharsis for Gore, and, while not having many suggestions as to what to do, leaves no chads hanging regarding his message.
The latest International Panel on Climate Change amplified this message. It concluded, with over 90% certainty, that global warming is due to human activity. The panel affirmed most of Gore's trajectory of ongoing and future global change. These findings should be taken seriously, since the panel was designed to produce conservation conclusions.

The basics of global warming include the following:

*The earth is blanketed by an atmosphere consisting of many compounds that act to trap heat (thus they are termed "greenhouse gases").

*These gases are, to a degree (ha), natural & essential for life (without them, our ave. temperature would be Zero).

*The most prominent greenhouse gases are water vapor & carbon dioxide.

Carbon dioxide is the big story in our present scenario. Throughout history, volcanic activity and accompanying carbon dioxide increases have been a main cause of rapid climate changes—including the ice ages and mass extinctions.

Our present situation is one of rising temperatures at an ever-increasing rate. The 10 warmest years on record have occurred since 1990, the warmest in the last 1,000 years. The present temperature trends also parallel atmospheric carbon dioxide levels. CO_2 is now 6 times the pre-industrial level and is expected to increase more than 50% by 2025. Fossil fuel combustion is the leading cause of CO_2 emissions. These gases tend to stay in the atmosphere for decades.

The effects of global warming have just begun: direct weather effects of temperature extremes, flooding, storms, and drought are predicted. Loss of habitat, extinctions, and

reduced vegetation and crop productivity will follow. Ocean levels will rise and decrease in salinity with glacier and iceberg melting.

The *Koyoto Protocol*, limiting greenhouse gases as a result of less fossil fuel consumption, is an initial step at addressing global warming as well as energy resource depletion issues. Critics in developed nations worry about the negative effect on the economy, and that the mandated emissions restrictions are insufficient to be effective. It is estimated that we really need the effect of about 30 Koyotos to do the job. As much as we want to think our personal contributions are enough to make ourselves a sustainable society, the reality is that it will take monumental change in response of governments and economic systems to devise ways to impose limits and offer incentives to really achieve these goals.

What to do? "Wait and see" is the traditional attitude. There has been, in this country, a paralysis in the face of mounting evidence. Many argue that money could be spent on what they feel is a more certain threat. This is not "the greatest hoax mankind has ever seen", as the chair of the Environment and Public Works Committee said. The evidence is here and now.

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II. ENERGY SOURCES

So what are our energy sources? And how did we get to this crisis?

We have both renewable and non-renewable energy sources.

Non-renewable energy sources: The 20th Century can be called 'The Petroleum Century", as Paul Heinberg mentions in his book, The Party's Over. During this time, total global energy production increased by 9 times, and efficiency gains doubled that figure. During this energy windfall and *resultant technological* progress, the human *population quadrupled* to take advantage of, and as a direct response to this unprecedented energy subsidy.

What are these relatively cheap and historically readily available, but nonrenewable fossil fuels?

1. **Oil**: An ideal energy source, with a high energy-to-weight ration, and very convenient for automobiles and trucks. It has the advantage of historically cheap recovery & production.
BUT: oil has unequal geographic distribution, creating imbalances with production and demand. Environmentally, it has severe negative implications, from spills to contaminants. (The major issue now is*: supply is running out)*

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The, ***major issue*** now threatening our present lives is that the cheap, easy to get oil that has been driving things for the last 100 years, **is *running out***. In contrast to the concept of unlimited supply, we are now on a projected course where global reserves may not outlast our kids and grandkids.

In 1969, *M. King Hubbert*, an American geologist, predicted that world oil production would peak in 1970 and then decline, following a bell curve shape. This turned out to be

accurate. Production of most resources, nationally and globally, follows the same general curve. A short plateau is seen, at which we are now at the end, represents when declining reserves overcomes the technological abilities to increase production. The down slope of the production curve represents dwindling supplies and an increasingly difficult and costly extraction process.

The global *discovery* of oil is in rapid decline. A drop in discovery rate eventually results in a drop in *productivity*. Globally, less than a quarter of the oil consumed in a year is replaced with new discoveries. The peaks of discovery in the U.S. and the world were in 1930 and 1964 respectively. *Conventional oil sources,* which comprise 95 percent of oil produced, is becoming increasingly difficult and expensive to extract. Much of the energy from oil is now used up in the discovery, production and transportation of the product.

The U.S. crossed the top of this curve for domestic oil production more than 3 decades ago. The rest of the world, excluding the Middle East, has been the production downslide since 1997. The Middle East, controlling more than 63 percent of the world's oil supply, has thus far been able to close the gap between dwindling supplies and growing demand, although they are projected to reach its peak in production around 2012.

The main remaining *conventional* (that is, relatively cheap to find and produce) reserves are in the Gulf of Mexico, the Artic National Wildlife Refuge, the Rocky Mountains, and off the coast of California. The Gulf has enough for 2.5 years; ANWR (after all the debate) only six months; the Rockies, and maybe the California coast have some natural gas and oil. These sensitive areas are unlikely to have a significant role in addressing our long-term energy needs and divert needed funding and development energies away from developing long term solutions.

Non-conventional oil sources include oil shale, tar sands, and heavy oil. These sources are all still environmentally harmful, energy-intensive, and more difficult and expensive to produce than conventional petroleum..

In the U.S. we have failed for decades to adopt *a consistent national energy policy* that addresses a quickly diminishing world oil supply.

Oil prices and the economy are closely linked in the heavily oil dependent nations. The last five oil price increases have immediately preceded recessions in the U.S. In 2000, petroleum imports accounted for 20 percent of our total annual trade deficit. Political tension and international conflict seem to be natural outgrowths of resource shortages.

The National Defense Council Foundation calculates the *real cost of gasoline* is *over $6 per gallon* if you include; military expenditures designed to protect strategic oil reserves, the outflow of financial resources and jobs to foreign suppliers, and the added costs of oil supply inconsistencies. These prices *exclude* billions of dollars of tax subsidies given to oil companies, the real cost of environmental degradation and health problems attributable to oil combustion. These costs, which would naturally make the real cost of gasoline even higher, have largely been externalized and passed on to consumers indirectly.

The majority of oil is used to power vehicles. Technological advances have made our cars more fuel-efficient over the past few decades. These advances, however, have been offset by the doubling of the number of vehicles, and the tripling of the miles traveled. *Corporate Average Fuel Economy (CAFÉ)* standards have not been effective and will fail to appreciably improve overall fuel economy, due primarily to political pressure yielding too small mpg goals, too distant deadlines, and numerous implementation loopholes. Buses and heavy trucks are by far the most polluting vehicles. The EPA has set strict new emission standards for those produced after 1997.

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It is time for a rational response to the fact that we're rapidly running out of oil that is cheap and can supply our ever-increasing demand. Energy efficiency, conservation, and renewable alternatives will be needed to transition us from conventional oil to a post-oil era.

2. **Natural Gas**: Since the 1990's, methane has been the fastest growing energy source worldwide, providing 25% of U.S. energy. It burns cleaner than coal. Although North American produces most of its own natural gas, more than ¾ of the world's reserves are in the Middle East and Russia.
The U.S. production has peaked and been level for the last 30 years, but with an expected bell curve decline about a decade behind oil. As with oil, most of the relatively cheap and easy to produce natural gas is now gone.

3. **Coal**: Coal reserves are abundant and well-distributed, and prices are usually low and stable. Coal provides 25% of world energy. Coal is the United States most abundant source of energy. It is becoming an increasingly considered option for power, as the price of the cleaner options, such as natural gas has risen over the last twenty years. The greatest negative is that coal is dirty, with a history of harm to the environment and human health; it is one of the leading causes of acid rain, smog and greenhouse gas emissions. Recent advances in clean coal technologies have reduced this environmental impact. *None of these technologies, however, reduce greenhouse gasses, including carbon dioxide* that contribute to global warming.

In pursuit of this persistent problem with coal, there has been an increasing focus on *carbon sequestration*. To reduce atmospheric CO2, carbon is captured and stored in oceans, geologic formations, and other land ecosystems. While presently cost prohibitive, the federal government plans to capture and store 90 percent of utility-generated CO2 emissions by 2012. The high-energy requirements of carbon sequestration currently results in a low net energy gain for this fossil fuel consumption.

4. **Nuclear Fission**: The first nuclear power generator arrived in 1951. In the U.S. it is second only to coal for electricity production. We are 17th as a world nuclear user, with Europe leading. Nuclear is considered seriously in emerging nations. Nuclear energy provides 16% of the world's energy; nuclear power is 2nd only to coal, with 20% of our electricity production. The Dept. of Energy is supporting nuclear energy as an important part of the nation's long-term energy plan. The U.S. has about 3% of the world's uranium ore reserves; it is found in only a few countries. Nuclear plants are expensive to build and decommission; currently nuclear energy is more expensive than fossil fuels. The greatest problem is how to handle radioactive waste. There is no acceptable solution for transport & storage of the hazardous spent fuel rods.

The principal solution under consideration is deep geological disposal. This idea is plagued with unknowns, including the geologic stability of the site, and the integrity of the encapsulating material over thousands of years. The Department of Energy has been under increasing pressure to find a solution for the past 20 years. *Yucca Mountain*, 90 miles from Las Vegas, and first considered in the '80s, had the attraction of being government-owned land, and was chosen by the government primarily for this reason, more than for its inherent safety or geologic soundness. Research into technologies to transmute the radioactive waste into benign substances has been slow, but not without hope. Photonuclear Transmutation (gamma ray bombardment) is one possibility.

Despite these negatives, there is renewed interest in Nuclear Energy, as it is clean, consumes relatively little fuel, has had a mostly very good safety record, and is a potential for increased energy output relatively quickly. I feel there is a real role for nuclear energy in the future.

The true costs of all these energies, oil, natural gas, and nuclear, are distorted by huge subsidies and costs absorbed by the government.

Renewable Resources

These resources constantly replenish themselves and are sustainable, if not inexhaustible. Renewable resources must be considered as alternative sources for our energy needs, as well as answers to our energy consumption. They are:

1. **Hydrogen**: Together with a fuel cell, hydrogen crosses the best aspects of batteries and generators into a single unit. Fuel cells can be used for nearly any energy need. Downsides: hydrogen must be extracted; currently it is extracted from natural gas, the present cheapest source. Production uses electricity generated by fossil fuels—which negates any gains in energy efficiency. Storage & transportation are problems. Hydrogen fuel cells do not look promising on the near horizon.
   Any attractive prospects for hydrogen come from research in increased production efficiencies. These include; nuclear powered hydrogen generation; and the Renewable Energy Corporation's mirror-intensified solar energy methods which bypasses the problem of electrical generation needs altogether

2. **Solar power**: traps thermal energy or converts heat into electricity using photovoltaic cells. Passive solar heating is efficient, with increasingly competitive costs and utility rates, even after higher initial capital costs.

3. **Wind**: has become the world's fastest-growing energy industry. It can work anywhere, with enough breeze. It is low in environmental impact and local in energy generation. Wind farms, both large & small, can supplement energy. It has been the main renewable non-hydropower source in Europe.

4. **Hydropower**: nonpolluting, cheap, efficient, and locally produced. This technology is becoming increasingly controversial; it has safety risks and severe impacts to local ecosystems and human populations. This is especially true with new systems in developing nations (e.g. China's Three Gorges Dam), where there is more initial concern with economic development than ecological impact.

5. **Geothermal energy sources:** reflect the earth's core heat and can be used to generate electricity. Where available (Iceland and other major faults), it is economical with little environmental impact.

6. **Biomass and Biofuels**: provided fuel for people long before coal & oil. It includes organic matter in forestry & agricultural products, municipal & industrial solid waste, bio-generated gas, and animal byproducts. There are numerous potential advantages of biomass energy, many still needing research. Potential applications are diverse, including electricity production, transportation, and a potential source of hydrogen for

fuel cells. Advantages also include reducing landfill wastes & emissions. It is a fuel produced domestically.

Biofuel crops grown for energy production fall into two categories: food crops and energy crops. *Food crops* such as corn and soybeans are starches most suitable for converting into liquid petroleum substitutes including ethanol and bio-diesel. *Energy crops*, including trees and grasses, have a cellulose structure that has been most effectively used for heat and electricity production by burning. Cellulose can be converted into petroleum substitutes. Making this process economically viable is another hot area of ongoing research. Unfortunately, after taking into account the carbon and monetary costs of conversion to fuel, food crops are now a net loser at energy effieciency and carbon production. Corn prices are going up as food and fuel uses compete. Brazil is the world leader in ethanol production.

7. **Ocean tide and wave energy**: a huge untapped source of energy, but the technology is in its infancy. Thermal energy conversion, using energy potential in temperature gradients in the ocean shows potential as well.

8. **Nuclear fusion**: not presently a viable source; takes more energy to create reaction than is produced from it. Has potential. If successfully commercialized, however, it has the potential to power civilizations using an inexhaustible fuel source.

Currently, renewable resources provide only 14% of the world's energy, with biomass accounting for 11% of the total world energy (predominantly in the developing world). Well-designed renewable sources provide clean, low-emission sources of energy and contribute to local economies. No political or international conflicts are necessary. Renewable energy industries are faced with huge challenges, however.
The greatest challenge is the strength & influence of the fossil fuel industries. So far renewables have filled only niche markets. BUT many experts (including Amory Lovins of the Rocky Mountain Institute, an economic, environmental think tank) believe that with present technological advances in efficiency, our nation could reduce its oil and natural gas consumption by half, while consuming ¼ of its current power generation---at a profit. Growth will depend on more aggressive political support systems in most countries. President Bush is just beginning to address this issue.

III. STRATEGIES FOR CRISIS SOLUTION

The energy problem is really more complex than resource consumption and energy needs. The oil dependence & depletion problem is more than an abstract engineering or economic problem. It must be viewed as a symptom of a universal ecological dilemma consisting of (these may sound familiar):

***depletion of fossil fuel resources**
***population growth & pressure**
***global climate change & habitat destruction**

The main responses to this ecological problem have been, and are now:

1. Go to unexploited territories;
2. Exploit existing resources more intensively (fire, agriculture, technologies);
3. Discover new exploitable resources, eg., uranium;

4. Limit population (tribal taboos, birth control, soylent green).;
5. Limit resource usage (ideally ethically volunteer systems);
6. Die off (famine, disease, predation).

If we understand the ecological nature of our problem, whether "supply side" responses (1-3), or "demand side" responses (4-6), we can consider decisions to be made for solutions to these problems.

IV.SOLUTIONS

The following represents the major strategies available as responses to these challenges:

1. Last One Standing: The way of war and competition over resources

We may respond to energy resource depletion by increased competition. Most wars have been resource wars. The more powerful and wealthy nations exert control over the rules and terms of trade, and over the currencies of trade as well. War has become an integral part of the market system. Without changing our present patterns of resource consumption, the increase in the frequency and intensity of resource wars in the next few decades is not just the worst-case scenario, but the default scenario. Competition & conflict may prove to be an easier course politically than other alternatives. (Tom, you have your work cut out for you!)

2. Powerdown:

This strategy requires a tremendous level of a collective effort of conservation—mostly with cooperation & help from one or more governments. Everything is conserved. Industrialized societies would execute a costly transition to alternative energy resources, with minimal impact on economic growth. All nations would have to do what can be done to limit per capital resource usage. This includes limiting population growth. A peaceful global powerdown, which we demonstrated in the 70s, would happen most likely with American leadership. It would initially be difficult & costly.

3. Waiting for the Magic Elixir

Many feel that technology will save the day. A main goal in this strategy is waiting for, primarily, a solution to replace oil. Such as:

*tar or oil sands
*methyl hydrates *hydrogen economy
*nuclear "rewound"

The problem with these technologies is that, with the exception of nuclear, the energy relief possibilities exist only in the future.

These 3 strategies are related: even a magic elixir, such as a perfect energy source, will not sustain growth indefinitely. We are in a perpetual growth machine, by design, in order to prevent collapse. We have become accustomed to an unsustainably high standard of energy use. If the powerdown path is too difficult to consider, with its need to reduce population and self-limit resource use, then war again looms as the default strategy.

V. FAILURE OF STRATEGIES: SURVIVAL POST-SOCIETAL COLLAPSE, OR, BUILDING LIFEBOATS

The building lifeboats perspective is one in which we interpret our situation as a failure of other strategies, and need to prepare for the collapse of our industrial society.

The study of collapse (think of the Mayan empire, or Rome) is a fascinating one with common features, some of which are: incompetent leadership with inertia towards change, with more war due to increased competition.

However, today we are the first global civilization in history. This is a system where almost no single country is self-sufficient in food & energy. Environmental impacts are global and large-scale warfare is possible.

Our resource depletion/collapse scenario would begin with dramatically intensified energy shortages over 2-30 years, with food shortages, economic turmoil, energy supply disruptions, increased wars, climate changes, government failure, with global population drops.

V. OUR CHOICE: final thoughts

There is a chance of getting out of this and avoiding the worst of this global energy resource/population/environmental crisis. We need to emerge from our comfortably numb state and start living and promoting more sustainable lifestyles and communities. The pursuit of peace, social justice, and environmental sustainability will be a critical part of this path. Our solutions and actions must attend to demand-side issues, rather than only the temporary solutions to the supply-side strategies. Otherwise, we simply create an ever-increasing need for energy with resource depletion, followed by escalating competition. Next, we become the dwindling resource.

We know that we are past the midpoint of the drop in oil production, with a real change in the next 10-20 years. Our best efforts can probably only soften the landing of this energy source & needs imbalance freefall. Any and all means must be considered to reduce our carbon fuel pollution and other industrial toxins. This problem cannot be ignored any longer.

America remains the biggest contributor to global warming. Reluctance by the federal government has been the biggest obstacle to an effective global scheme to tackle the problem. It appears that change is beginning.

So, like the 2 guys walking on the street so clearly pointed out, we need to consider long-term solutions, and understand our short-term solutions regarding energy. And as so often happens, my Dad, who said that the world's main problems were "there were too many damn people" and that "people are in too much of a hurry", was right.

THE END

Recent News Releases - A good summary (Economist)

After continued resistance to recognize and discuss the implications of global warming, the Current Resident stated in his recent State of the Union message that he acknowledged the "serious challenge of global climate change".

Public opinion's rapidly increasing awareness of the carbon/global warming problem has generated responses and action at the public, state, national, and business levels. Climate change and resultant extreme weather issues had been a science-sector warning for some time. The series of hurricanes in Florida a couple of years ago, and the Katrina disaster brought the picture of extreme weather to the forefront. Extreme weather in Europe, and melting glacier news increased public recognition of something which fits the warnings.

National

In *congress*, with the recent changes following the Democrat's Nov. victories, Barbara Boxer in the Senate, and Nancy Pelosi in the House are both advocates of firm action on climate change issues and foreign oil dependence issues. They have targeted eliminating tax breaks for oil producers in America, and penalties for failure to renegotiate government alleged misguidedly-granted leases. The Senate has several bills supported by most of the presidential candidate front-runners, favoring *cap and trade* systems.

In a *cap and trade* scheme, the government would create a fixed number of permits to produce greenhouse gases and then auction them or allocate them to businesses. Firms without enough permits to cover their emissions would either have to polute less, or buy up spare ones from firms that had managed to cut back.

A concern is weather any of these proposals will change emissions enough, fast enough. All previous attempts have faced uphill Congressional battles. John Dingell (D. Detroit) of the House Energy Committee has, in support of the auto industry, long opposed caps. He is quoted that Ms Pelosi's new committee is "as useful as feathers on a fish". Any bill passing Congressional review will also risk a presidential veto.

Many previous critics are responding to the global climate crisis on national security concerns, including imports' effects on the dollar, and the threat if military confrontations over dwindling resources, and the dependence on oil from unstable and often hostile countries.

Evangelicals are beginning to take global warming as a moral issue, that we should be better stewards of our God-given earth. (Evangelical Environmental Network – WWJ drive?)

Business

Big business has traditionally taken the stance that they have the most to lose, short term, from stricter environmental regulations. Now the vast majority of energy utility executives expect mandatory emissions caps within a decade. With regulation seemingly inevitable, many firms are eager to see Congress decide the "rules" soon to help them plan investments in these utilities plants with long life-spans. They want to avoid a patchwork of conflicting local regulations on environmental issues, and especially greenhouse-gas emissions. Businesses are also taking advantage of the research and new product opportunity. Investments in new energy areas such as ethanol, solar, and wind are showing significant recent action as well.

States

State action on these issues has been at the forefront of American regulatory response to date. Nine states in the Northeast have a shared cap and trade scheme to reduce emissions from power utilities. Ten states have greenhouse-gas car emission standards. Many more have programs promoting renewables, ethanol, and energy efficient buildings. Texas is the largest wind-power state.

California has been the leader in many of these initiatives. Its Global Warming Solutions Act ('06) plans to cut greenhouse-gas emissions to 1990 levels by 2020, using a cap and trade scheme. They have set state standards for transportation emissions, and even are suing the EPA for failure to regulate greenhouse-gas emissions. State laws require utilities to have renewables as 20% of the power mix by 2010. Solar is soaring under the "million solar roofs" schemes. California is also pursuing efficiency increases from utility companies utilizing *decoupling*. In decoupling, the utility is rewarded for energy sales lower than expected. It takes away for the utility to simply sell as much electricity as possible.

Although energy is expensive in California, and the climate is favorable for energy conservation, programs have kept per capita energy use stable since the 1970s.

(Michigan is near tail end Charlie in many of these issues, with very recalcitrant support)

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