Turning Point In History

By
Al Lococo

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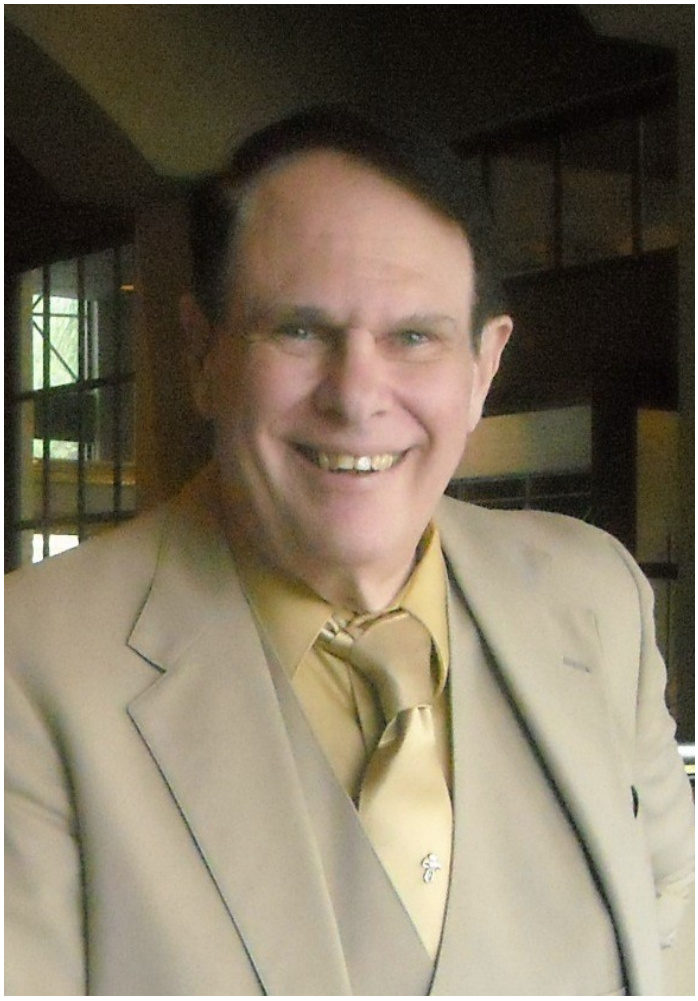
Turning Point

In History

“A society grows great, when old men plant trees,
whose shade they know they shall never sit in.”

The sun shines, even on the silent pump.

Dedicated to John who says:
“Everyone's entitled to their own opinion.”



Apology

I am Al Lococo, of Winter Haven, Florida, the author of this exploration into the subject of Energy and Transportation and how they affect our lives, our economy, our politics and our future. I am not an expert. I am no more qualified to profess an opinion than any other citizen voter. However, as a citizen and voter, I feel obligated to be informed.

Energy and Transportation, because it is a major energy consumer, are the central issues of our time. It is imperative for the preservation of some semblance of our lifestyle, that we understand this issue. I present here a layman's view of the issues for the edification of others like myself. To the experts, you have my apology.

Simplification and Exaggeration

Don't get lost in the numbers. They frequently don't add up. Oil consumption varies from day to day, month to month and year to year. Consumption sometimes includes Ethanol. Production numbers sometimes include Liquefied Natural Gas (LNG), Tar Sands and Shale production and sometimes they don't.

The trends are real. It helps to look at comparisons in fractions like one tenth, one quarter, one third, one half or double or triple or ten times.

The intention is to simplify, not trivialize or exaggerate, the facts related to a very serious situation.

Ad Hominem

People with my view of energy have been called tree huggers, not because we hug trees, at least I don't, but to minimize our credibility. After all, only crazy people would hug trees. Who would pay any attention to a crazy person?

We are called righteous, self righteous, hysterical, emotional, naive, and ill informed. The alternatives we support are called “Happy Talk”. We are presented with double speak and double think as the solution. “Clean Energy” is the answer, we are told. This is green washing of the status quo. Natural Gas, carbon-captured coal and Nuclear are all desperation and unconvincing.

If you can't attack the issue, attack the man. Let me say, in a Nixonian like defense, “I am not a crackpot.”

Goals

I have two goals, first to convince the reader that we have an energy and transportation problem, that is at the root of our current economic trouble. Second, that more of the same, fossil fuels and uranium, are not the answer. They are the problem.

If I am only successful at the first, we have a beginning. You can't solve a problem, if you don't recognize it, as a problem. It is also clear to me, that I may not have a perfect grasp of the solutions, or the time frame in which they will be required. But, if I can inspire a few to consider the issue, this endeavor will have been worthwhile.

Although this scrapbook will be available in printed form, it is best viewed as a PDF file online at http://www.evprogress.org/TurningPoint.pdf

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First

President Obama has a lot to deal with and, in general, is coping well, or as well as can be expected. In addition, I believe too many of his 2008 supporters lost heart in 2010, putting him in the compromising position of having to deal with the political realities of a Republican House and some very difficult Republican Governors.

As a result, in my opinion, he is forced into some less than desirable compromises. However, I believe he is our only hope. He is an intelligent, patient, cautious, thinking leader, who knows how to cope with the political realities of his less than favorable circumstances.

There is no better leader to get this country back on track.

At the same time I believe postings to public forums can help him understand the mood of his supporters. So it is in the context of these opening remarks that I offer my over long and complex view.

Our Origin

We came out of prehistory through the stone age, into the bronze age, and the iron age. We learned early how to use wind and falling or moving water to operate mills. With the industrial revolution, we used these same resources to power textile manufacturing. Wind was used to master the oceans and explore the globe. Then we built and refined steam engines burning wood or coal. This led to the development of the internal combustion engine using refined petroleum fuels. Humanity has made many technological transitions in history.

As we have evolved, these transitions have come at an ever-increasing pace. There are people alive today who were born into households without electricity, telephone, radio, television, or automobiles. Change happens so rapidly that we have a term for it: *"Future Shock"*. The term was coined by sociologist and futurist Alvin Toffler in a book of the same name that was published in 1970 just months before a pivotal moment in U.S. History. By 1972, when Orson Welles narrated a documentary film based on the book, we had past the turning point. The impact of that moment would not be felt until the oil embargo of 1973.

Toffler speaks of the transformation from an industrial society to that of a super industrial society. We are now in the information age.

For me, the dominant nature of the super industrial society is its economic foundation built on fossil fuel consumption in general, but it is oil in particular that has

mobilized this era. This energy source is so portable, it can be used in a weed whacker, a chainsaw, an automobile, a combine harvester, an earth mover, a locomotive or a sea going oil tanker.

The twentieth century is, in my mind, the oil age. Oil is at the root of our prosperity. We are at the dawn of a new transition. The signs and indications are repeatedly pointing the way. Poets call our attention to our inability to grasp the significance of the obvious signs we so consistently ignore or simply overlook.

The words of Bob Dylan

"How many times must a man look up before he can see the sky?" (Pollution).
"How many ears must one man have before he can hear people cry?" (Recession).
"How many times must the cannon ball fly before they are forever banned, and how many deaths will it take till he knows too many people have died?" (Iraq, Afghanistan, Libya).

How many oil spills? (Santa Barbara, Valdez, Deep Water Horizon).
How many nuclear disasters? (Three Mile Island, Chernobyl, Fukushima).
How many families without adequate health-care?
How many college graduates with long term debt and no job prospects?
How many failed State Governments? (California, Wisconsin).
How many failed nations? (Greece, Ireland).

How many economic catastrophes? (mortgage foreclosures, bank bailouts, auto bailouts).?

How many wars, environmental disasters, economic catastrophes and recessions will it take until we make the connection between energy and the economy, and end our reliance on fossil fuels and nuclear power?

"The answer, my friend, is blowin' in the wind, the answer is blowin' in the wind."

What are we?

Modern man ignores what God has written in his heart, "We are of the earth. We are the earth. What we do to the air, water and land we do also to the birds, fish, animals, and ultimately, in the end, we do to ourselves." He ignores the truth he already knows and listens, instead, to those who say what he wants to hear. Fortunately modern woman, (Rachel Carson, Erin Brockovich, Helen Coldicott . . .)

is not so misguided, for she knows the future is in the garden, the sun and the wind.

"It has become appallingly obvious that our technology has exceeded our humanity."
- Albert Einstein

Turning Point

We know and accept the significance of the following turning points in history: 1492, 1776. Too many of us do not realize the significance of this well defined pivotal turning point, December 1970. This is the point at which daily U.S. Oil production reached 10 million barrels per day. At this point we were still self-sufficient in terms of oil consumption. Our daily consumption was equal to our daily production.

In the decades prior to December 1970 we had been a declining oil exporter. In the decades following December 1970, we became, increasingly, an oil importer. It is remarkable, that within three years of peak domestic oil production, we were importing more than a third of the oil consumed domestically. This fact was completely unanticipated by the oil industry, despite the warnings of Marion King Hubbert, Shell Oil Company Geologist, since February 4, 1949. This led to our vulnerability to the 1973 oil embargo. In three short years, we went from oil independence, to gas lines, and no one saw it coming.

We reached the point, in the years leading up to the summer of 2008, where we were consuming over 20 million barrels per day. At the same time our production had declined to little more than half the peak of December 1970.

In the summer of 2008, gas prices reached over $4.00 per gallon. In the following months, consumption quickly declined by 10 percent to 18 million barrels per day, as the economy slowed. Fortunately we have begun to recover from the recession. Unfortunately our oil consumption has climbed back to the levels of the summer of 2008, as have prices at the pump.

We passed the turning point in December of 1970, and we are approaching the tipping point, or the point of no return. For me, the second metaphor is more appropriate. The point of no return is the point at which you no longer have sufficient fuel to reach the point of departure and must proceed to your destination.

“Our ignorance is not so vast as our failure to use what we know."
M. King Hubbert

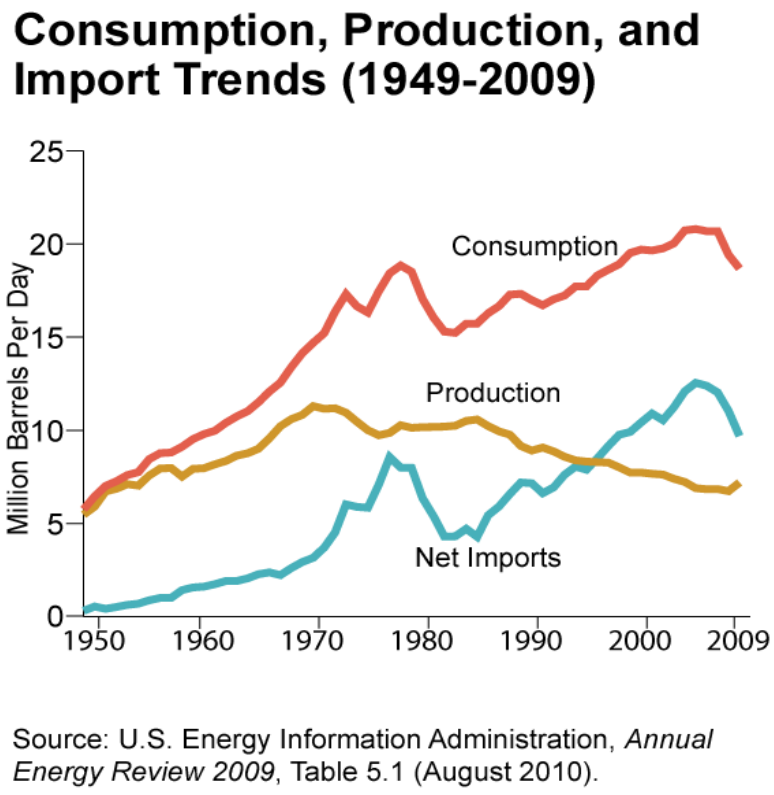

Figure 1: History of U.S. Oil,from 1950

President Carter led us through the first oil shock in the late '70s. He lowered the speed limit, we lowered thermostats in the winter, raised them in the summer and we did without Christmas lights. It was the patriotic thing to do. He gave us CAFE Standards (Corporate Average Fuel Economy). He put solar panels on the White House. Ronald Regan made us feel good about ourselves. He told us what we wanted to hear. He removed the solar panels from the White House. He made us forget about December 1970. We all behave as if it never happened.

What Happens Next?

We are on a course that, if unaltered, ultimately leads to the depletion of all existing fossil fuels. The speed with which these resources are consumed is increasing, as other nations join us on our course. Our problem is that we cannot go back to oil self-sufficiency without a dramatic change in energy policy. Our oil consumption far surpasses our domestic production.

As a nation we have failed to grasp the simple mathematics of our oil economy. We are overwhelmed with what seem like very large sized oil reserves. We tend

not to view them in light of our massive consumption. The failed Deep Water Horizon in the Gulf of Mexico sits above a three billion barrel reserve. This sounds like a large reserve. If you divide 3 billion by 20 million, the number of barrels we consume every day, you see this amount of oil is the amount we consume in five months. It will last much longer because we lack the ability to extract it that fast.

A reserve of even 100 billion barrels of oil is of little value if it can only be brought to market at a rate of a few hundred thousand barrels a day. Our problem is not simply oil reserves, but rather limited world wide daily production rates, combined with increasing daily world wide demand. As long as production is about equal to demand, oil will be available, but expensive. Production costs will rise due to the need to exploit hard to access oil, such as shale oil, tar sands or offshore deep water reserves.

Is there a point of no return with regard to our current course? We will need to produce infrastructure, equipment and vehicles to end our reliance on fossil fuels. The production of renewable sustainable electricity, and the grid required to distribute it, along with public electric transportation, and electric cars, will require energy to produce.

Point of no Return

We can't justify the cost of the alternative, renewable sustainable energy infrastructure today, because of the rising cost of, and spending on, fossil fuels. Our economy is not doing well, although, it appears to be improving. If we can't afford to invest in the long term solution now, due to rising fossil fuel costs, then how will we attack the problem later? Our economy will be further crippled by declining fossil fuel reserves and rising prices due to the increasing cost of extraction, increasing demand and declining production. Will renewable sustainable energy, the only alternative, then be beyond our reach?

There may well be a point of no return. We may finally come to understand, that we can't return to the prosperity of the past, because it was based on fossil fuels and other natural resources which are in decline. We may come to realize that, in the future, sustainable prosperity, similar to the prosperity of the past, can only be achieved through exploitation of renewable sustainable energy. Suddenly we may find the solution is beyond our means, because of lack of economic resources and lack of fossil fuels necessary to make the transition. We will need a healthy economy and energy produced from fossil fuels to make solar, wind and geothermal hardware and equipment.

We may have already reached the point of no return (to the prosperity of the past). We are constantly told that we can't afford renewable sustainable energy. Oil, natural gas and coal, we are told, are cheaper and we must continue to con-

sume these resources. We simply can't afford the alternatives of renewable sustainable wind, solar (photo voltaic and concentrated solar (thermal), geothermal, wave and tidal. We are told our best options are clean energy. These, we are told, are Nuclear, Natural Gas and Coal (carbon-captured).

Politics

We live in a democracy and majority rules. Democracy depends on an informed electorate.

Alexis de Tocqueville described a quality of American society, something he called *"self-interest properly understood".*

Is it in anyone's self-interest to continue to consume fossil fuels? At what point does it become appropriate to our interest to switch to renewable sustainable energy. We know that fossil fuels are finite. And more importantly, our ability to bring these fuels to market at a daily rate equal to our daily consumption rate will diminish, long before we actually exhaust the reserves.

We also know that shifting the energy paradigm will take time and energy. No one knows exactly when world wide daily demand will exceed world wide daily production, but when that day comes, we will have reached the point of no return (to the prosperity of the past). Energy prices will rise rapidly unless we develop the capability to produce renewable sustainable energy in the quantities needed to maintain our economy. We won't have that capability unless we prepare for it while we have the fossil fuels and the healthy economy necessary to put it in place.

For the short term, it may seem to be in the self-interest of fossil fuel energy providers, to continue the status quo. But, in the long term, the world economy will suffer from energy shortages. This will not be in anyones *"self-interest properly understood".*

There is often talk that we should not subsidize renewable energy. It should pay for itself without government subsidies. This may be true, but the deck is stacked against renewable energy because it must compete with a fossil fuel industry that is heavily subsidized. Oil, for example, gets far more subsidies than solar or wind. President Obama has proposed the elimination of oil subsidies in the amount of $4 billion per year. He wants to use to use those funds subsidize renewable energy instead. However, even this proposal would leave in place military protection of Middle East oil shipping routes, which is a form of oil industry subsidy.

No one wants to lose their prosperity. We all enjoy our air-conditioned life style. Comfortable in the summer, comfortable in the winter. We like the independence and comfort our air-conditioned automobiles give us. We are predisposed to accept the words of those who advise us that our life style and energy future is secure. Fossil fuels have served us well in the past, and we are told, they will in the future.

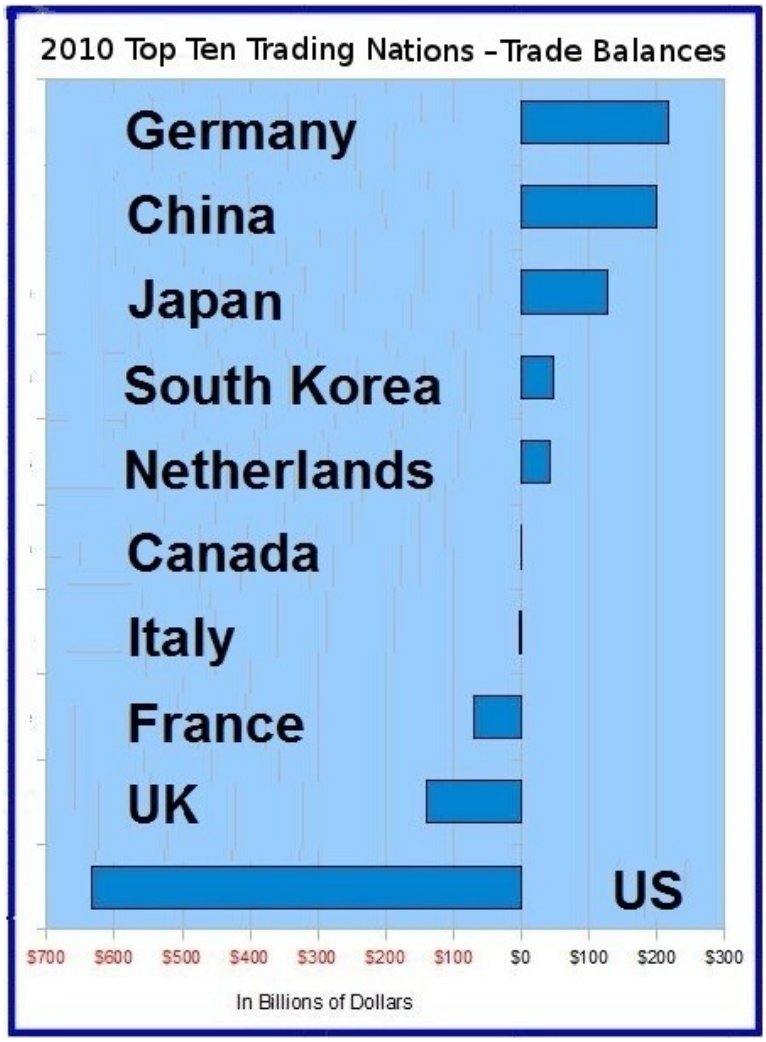

Figure 2: Total Merchandise Excluding Services

The status quo is something we are familiar with and comfortable with. It worked in the past, it is working now, it really needs no justification. Clearly it worked in the past. But how well is it working now? We need to examine and understand the true costs to our economy and the environment of our current energy policy. We need to take a close look at the future of our economy if we continue the status quo.

The Economy

It is a popular idea among more than half of our voters, that we can return to the prosperity of the '50s if we can only cut government spending. This view doesn't account for what I believe is the basis of that prosperity: cheap, abundant, domestic oil. Oil was not the only natural resource at the root of our prosperity. Other fossil fuels contributed to our wealth. We produced much of what we consumed domestically, using domestic energy and raw materials, from food to automobiles. We were an exporter of oil and many other products. The dollar, the life blood of our economy, circulated and was invested here. Federal income tax rates ranged from 22.2% - 92% in 1952 and 1953. The maximum tax rate was never lower than 70% until 1982, when it began its decline to the current maximum of 35%.

It is true that there were parallels at the time in military spending due to the Korean war, the Vietnam war and the Cold war. But the then-healthy economy could better support those efforts.

It is also true that during the Kennedy administration, lowering tax rates, raised tax revenue. There is a big difference between lowering taxes from 92% to 70% and going from 70% to 35%. No one would accept the notion that you could increase tax revenue by dropping tax rates to zero. At some point you reach the turning point, where lowering taxes no longer increases tax revenue. Regardless of President Kennedy's remark that *"A rising tide raises all boats",* you can't pay down debt, fight wars on three fronts, defend oil shipping routes, pay social security . . . by simply reducing the budget to reduce the annual deficit.

We have now extended temporary Bush administration tax cuts based on the Kennedy theory that *"A rising tide raises all boats"*. It is clear, at least to me, that these tax cuts were in place for eight years before being extended, which culminated in the sinking of this great ship of state in the troubled waters of a failed oil economy. There was no rising tide resulting from those tax cuts during the Bush administration, nor will there be from the extension.

By what logic do we conclude that this is a good time to extend temporary tax cuts that failed to increase tax-revenue as intended, but instead led us into the Great Recession more severe than any since the Great Depression.

We then decide we will combine this failed policy with budget cuts in education, health care, unemployment benefits and a host of other cuts, which shortchange the American workers we need to power the prosperity of the future. Apparently the new prosperity has no need for a healthy, educated work force. This, *"more bricks less straw"*, mentality, combined with a propensity to ignore the economic consequences of exporting dollars for oil, is a formula for disaster.

There has been a cumulative balance of payments burden on the U.S. economy for years. Each year we export 365 billion, more or less, depending on the price of oil, to Canada, Mexico and the Middle East and other lesser oil producing nations. China sells these nations everything from Beanie Babies to flat screen TVs, which are paid for with U.S. dollars spent by us on foreign oil. Were it not for the return of these dollars to the U.S., in the form of loans from China, the money would have come from loans from the Federal Reserve, causing increasing inflation or increased taxes or devastating budget cuts.

High Speed Rail combined with other necessary transportation, such as electric cars, and renewable, sustainable energy initiatives, such as wind and solar, will provide the alternatives necessary to keep U.S. dollars in the U.S.

If you believe we can go back to the prosperity of the '40s and '50s by simply cutting spending, I ask you to recognize the source of our economic prosperity at that time. We were then a principle oil exporting nation. To ignore this simple truth is to drive your gasoline powered car and this nation to oblivion.

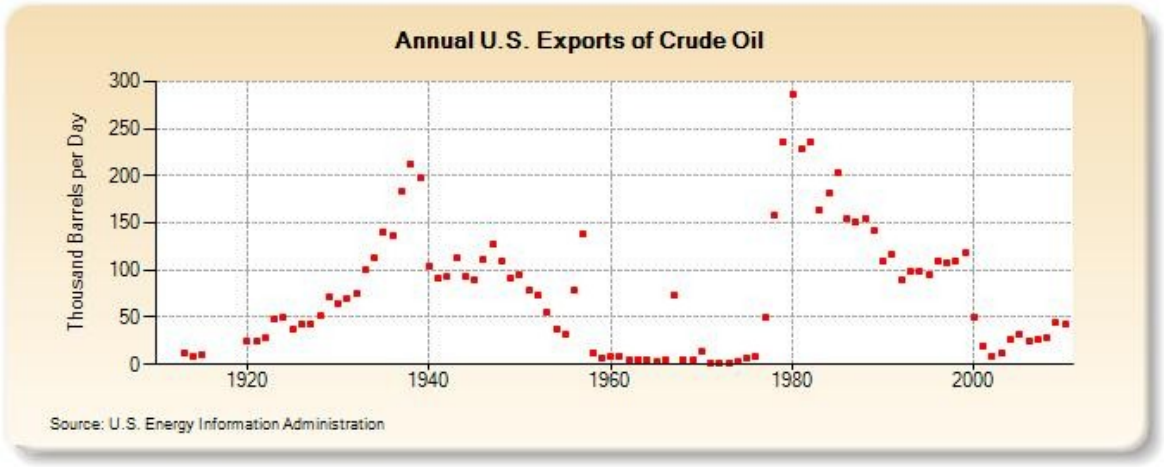

Figure 3: U.S. Oil Exports from 1920

The discovery of oil in Alaska allowed us to resume exports in the '80s. However, we continued to import oil, such that we remained a net importer through the period.

The daily oil production rates and the corresponding surpluses of the '40s, '50s, and '60s are gone forever and so is the prosperity of that time, if we follow the energy policies of the past. What we are left with is an outdated life style, which forces us to export the life blood of this nation overseas day after day, to pay other nations for imported oil. We borrow against our future, to live the futile dream of the past.

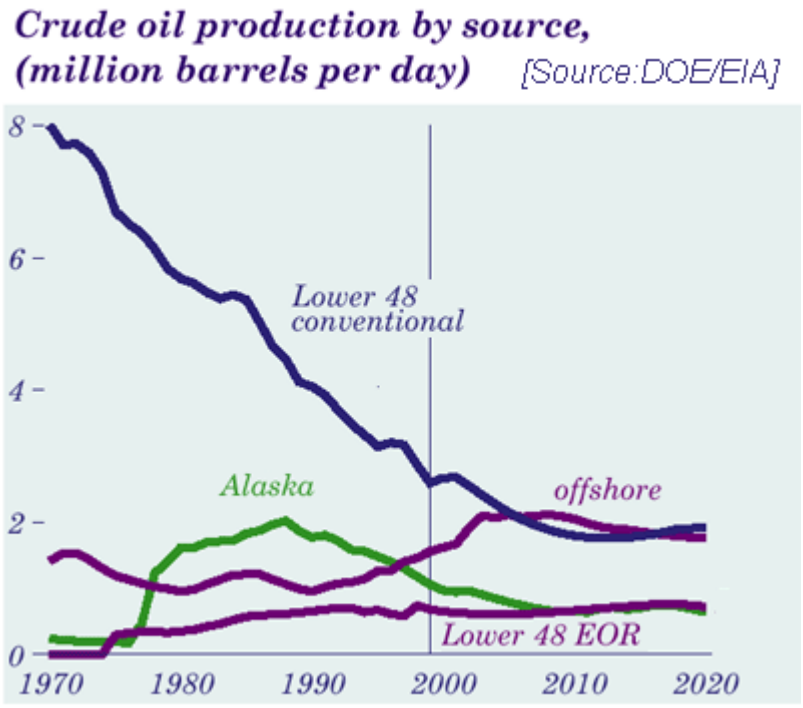

Figure 4: U.S. Production Sources,

EOR = Enhanced Oil Recovery

World Trade

The concept of world trade assumes each nation has something to offer. It doesn't work if some nations consist only of consumers while others supply goods. China supplies the U.S. with goods. Canada, Mexico and the Middle East supply the U.S. with oil. The U.S. funds this consumption with debt.

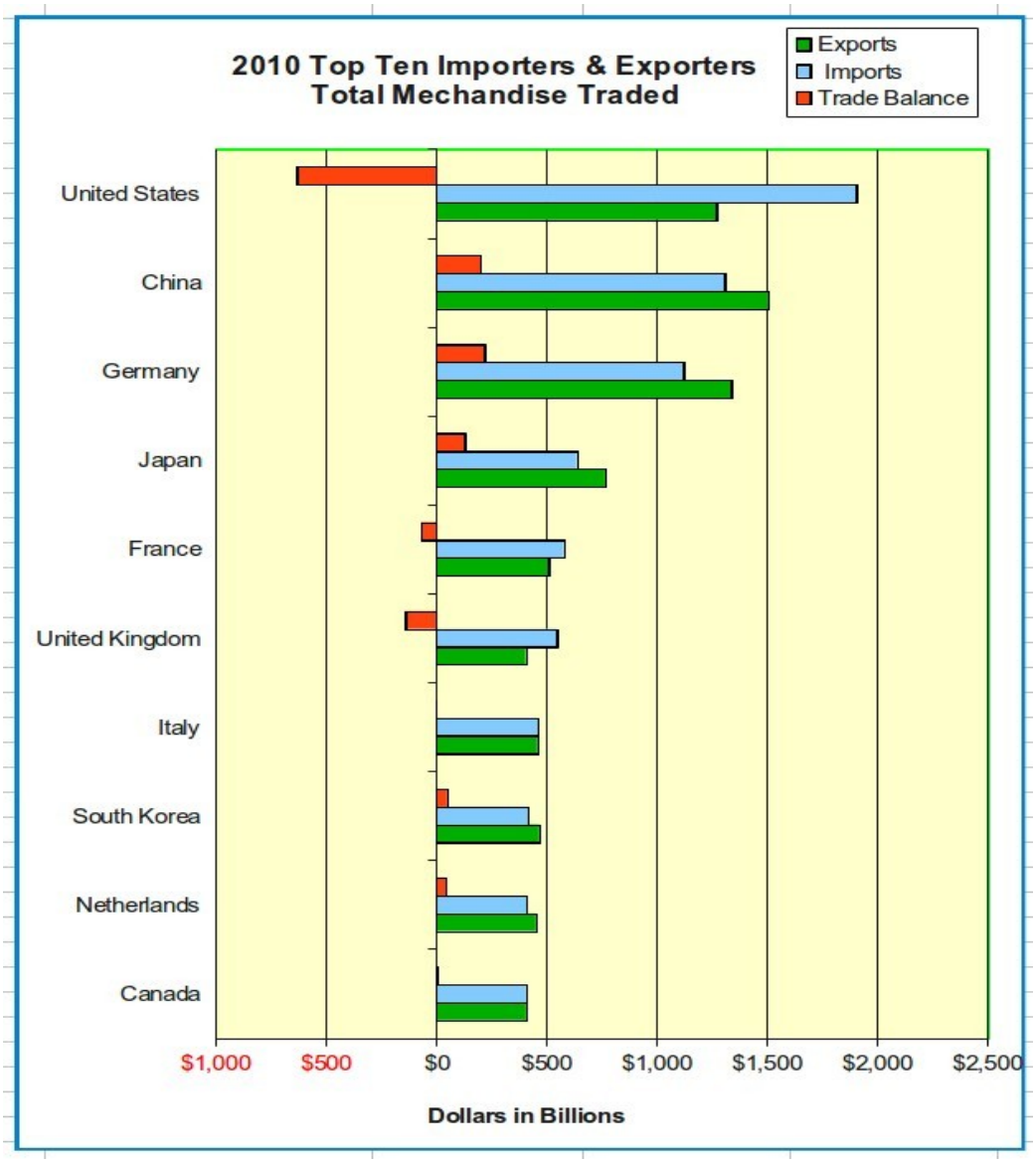

Figure 5: The U.S., a top Exporter, is far ahead of other nations in imports.

When I went to school in the late '40s and early '50s, we had a large map of the United States that hung on the wall. It rolled up like a window shade. When the teacher pulled it down it revealed an unlabeled map of the U.S.. We learned to

identify each state and name its capital. In addition we had to know something about the economy of each state and what they produced. We learned what geographical features contributed to the economy and growth of states and regions.

What we learned in these social studies lessons, was the important role natural resources played in America's prosperity. We were asked, and we discovered, why New York City, Boston, Chicago, St. Louis and other cities were located where they were. We learned about the Erie Canal, the Mississippi, the Great Lakes and the St. Lawrence. We learned the importance of ocean-going sea ports in the development of population centers.

We learned that cotton came from the south, corn and wheat came from the central plains, textiles were produced in the north east, steel came from Pittsburgh, silk came from China, and tea came from India. Cars came from Detroit and airplanes came from the Pacific states. We learned that oil came from Texas.

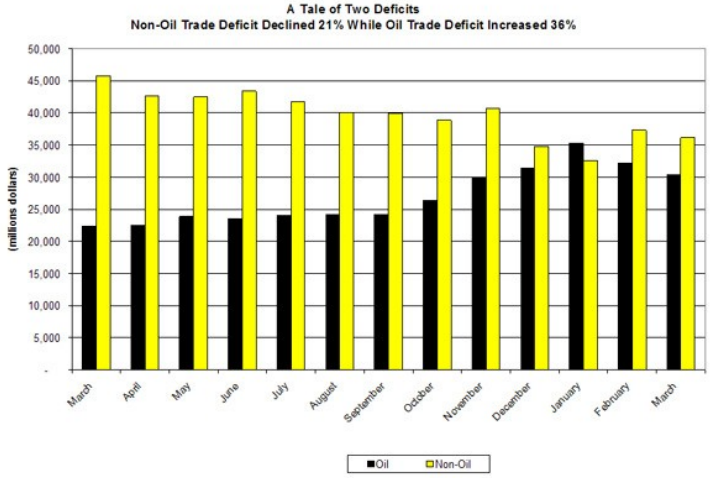

Figure 6: Oil in black, is an increasing proportion of imports, in yellow, starting March 2007.

We learned about exports. The United States was the bread basket of the world. We had things that other countries needed, both products and raw materials. The U.S. is still today, one of the world's largest exporters. Our position among the top three exporting nations depends on the value of the dollar. Right now the dollar is weak, raising our position as a top exporter.

As with oil, over-consumption is our problem, with balance of trade. We export crops, aircraft, medical equipment etc. in large numbers, such that we are one of the world's major exporters. But we are, by a large margin, the world's largest consumer and importer. Our imports are almost twice our exports, and, of equal

concern, our trade deficit is half as large as our exports. No nation has a trade deficit or surplus as large as our deficit.

President Obama recognizes this and plans to double U.S. exports over five years. This plan combined with a reduction in oil imports would go a long way toward eliminating our balance of payments problem.

Foreign Policy

If we want to return to the prosperity of the '50s, we will have to do more than cut federal spending. Annual deficits and accumulated national debt are the result, to a large degree, of our unrestrained consumption of oil. We are willing to thrust ourselves into the affairs of any nation in cooperation with other oil consuming nations or unilaterally, if necessary, to assure the free flow of oil. In addition to oil wars, we spend billions of dollars to assure the security of Middle Eastern oil shipping routes. This is over and above the cost of oil wars.

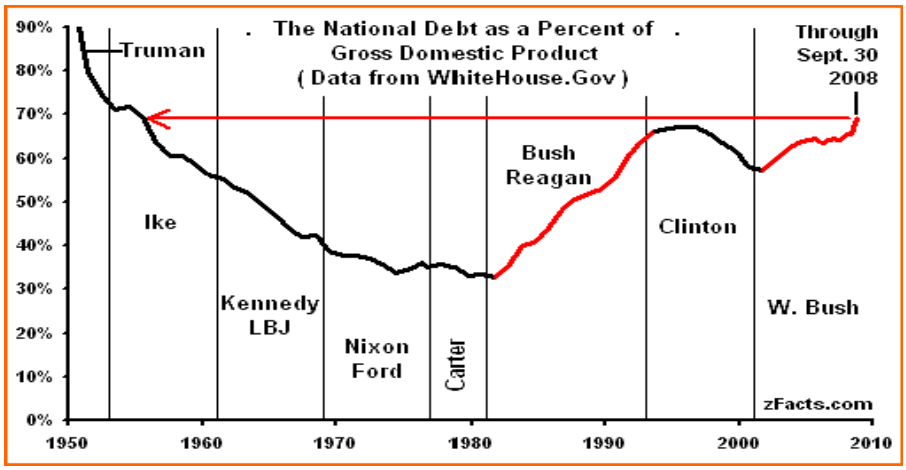

Figure 7: Presidential Administration vs. National Debt

To support this spending while providing tax cuts across the board, but heavily benefiting high income individuals and corporations, we pick at essential social programs, education and renewable sustainable energy and transportation programs.

Reductions in the highest tax rates, combined with tax loopholes, have resulted in some of the wealthiest corporations, such as Exxon-Mobile and General Electric paying no taxes at all. This combined with subsidies has resulted in a shift of wealth and power from middle and lower income families to the wealthy.

Most people understand this at some level, but when you look at actual tax rates over time in detail, it is shocking. Tax loopholes make the trend even more pronounced. The data shows that generally tax cuts have little or no effect at the low end, ranging from 23% to 10%, while at the high end ranging from 92% down to 28%. it is also interesting to correlate this data to administrations.

Table 1: Partial History of U.S. Federal Marginal Income Tax Rates Since 1913

Applicable Year	No. Income Brackets	First Bracket	Top Bracket	Source	Administration
1913 -1915		1%	7%	IRS	Wilson
1916		2%	15%	IRS	
1917		2%	67%	IRS	
1918		6%	77%	IRS	
1919 -1920		4%	73%	IRS	
1921		4%	73%	IRS	Harding
1922		4%	56%	IRS	
1923		3%	56%	IRS	Coolidge
1924		1.5%	46%	IRS	
1925 -1928		1.5%	25%	IRS	
1929		0.375%	24%	IRS	Hoover
1930 -1931		1.125%	25%	IRS	
1932 -1933		4%	63%	IRS	Roosevelt
1934 -1935		4%	63%	IRS	
1936 -1939		4%	79%	IRS	
1940		4.4%	81.1%	IRS	
1941		10%	81%	IRS	
1942 -1943		19%	88%	IRS	
1944 -1945		23%	94%	IRS	Truman
1946 -1947		19%	86.45%	IRS	
1948 -1949		16.6%	82.13%	IRS	
1950		17.4%	84.36%	IRS	
1951		20.4%	91%	IRS	
1952 -1953		22.2%	92%	IRS	Eisenhower 1953
1954 -1963		20%	91%	IRS	Kennedy 1961
1964		16%	77%	IRS	Johnson 1963
1965 -1967		14%	70%	IRS	
1968		14%	75.25%	IRS	
1969		14%	77%	IRS	Nixon 1969
1970		14%	71.75%	IRS	
1971 -1981	15	14%	70%	IRS	Ford 1974 Carter 1977
1982 -1986	12	12%	50%	IRS	Reagan 1981
1987	5	11%	38.5%	IRS	
1988 -1990	3	15%	28%	IRS	Bush 1989
1991 -1992	3	15%	31%	IRS	Clinton 1993
1993 -2000	5	15%	39.6%	IRS	
2001	5	15%	39.1%	IRS	W. Bush 2001
2002	6	10%	38.6%	IRS	
2003 -2011	6	10%	35%	Tax Foundation	Obama 2008

The prosperity of the past is gone for all but the wealthiest Americans. The rest of us suffer with the burden of a failing oil economy and increasing taxes. Remember we have gone from self-sufficiency in 1970 to importing 70 percent of the oil we consume. In an economy based on oil, it makes a difference where the oil comes from.

If we had something else to export, equal in value, we might get by, but we don't. That is not to say that we don't have exports. We're just not exporting enough to cover our spending for imported oil, and to sustain the levels of prosperity we enjoyed in the decades prior to 1970.

The combination of an energy policy that relies on oil that can never again be supplied domestically, at current consumption rates, along with a foreign policy of preemptive wars designed to provide stability in the part of the world supplying that necessary oil, is simply beyond our means. We can impoverish ourselves with debt, to buy oil we can't produce domestically and cut essential social programs to try to make up for lost wealth, to what end? Since 1970 we have been repeating the same pattern. It is not working anymore.

Oil

We will never run out of oil. There will always be some, even large quantities of oil somewhere. We will lose interest in oil as a source of energy long before we suck or squeeze the last drop out of the earth.

But we have, in location after location, lost the capacity to produce oil at rates required to meet demand. Oil production is the ability to bring a barrel of oil to market, consistently and reliably, on a daily basis.

On the other hand, we have demand and consumption. When our daily demand for oil exceeds our daily production, we must import the difference. In the past ten years our consumption has approached 21 million barrels per day. It has dropped as low as 18 million barrels a day during the Great Recession.

When we are consuming 20 million barrels per day, which we are close to now, we import 13 million barrels a day. At the current price of $100 per barrel, we are exporting $1.3 billion of U.S. wealth each day to oil producing nations.

“The wisdom of God and the folly of man are unlimited, everything else is limited, even tolerance has a limit.” - W. Tuczinio

"The Greatest transfer of Wealth in the History of Mankind"

This slogan is used from time to time in different contexts to dramatize economic burdens or benefits shifting, from one class to another, or from one nation to another, or group of others. T. Boone Pickens has used it to describe our payments to foreign countries for oil imports.

I don't know if the slogan holds true in the context of U.S. Oil imports, but it may. There certainly have been abuses of power that have resulted in transfers of wealth from the poor to the rich in history. This transfer involves no coercion, we make these transfers quite voluntarily. Our blind lust for crude is unbounded.

It was John Kennedy who said, in a different context, *"Let every nation know, whether it wishes us well or ill, that we shall pay any price, bear any burden, meet any hardship, support any friend, oppose any foe, in order to assure the survival and the success of liberty."* Well, if the *"survival and the success of liberty"* depends on oil, this is a good summary of what lies ahead, if we fail to make the necessary transition to sustainable renewable energy.

We have already demonstrated our willingness to pay any price, bear any burden, meet any hardship, and oppose any foe (real or imagined) to secure the blessings of oil. We have proved that we will pay costs, far in excess of $1 billion a day, even approaching$2 billion. However unwillingly, we have endured the burdens and hardships of the Great Recession. And we are now engaged in three oil wars, under a new policy called preemption.

Drilling can't reverse decline

Despite new technology and an increased rate of drilled wells and decreases in the number of dry wells due to improved technology, production has declined to half of the December 1970 daily production peak.

Two examples of our increasing desperation to sustain the unsustainable oil economy need to be understood for what they are by all Americans.

Shale oil is being mined, by the ton, with heavy earth moving equipment. These large volumes of shale rock, called marl, contain a mixture of organic compounds called kerogen, is heated to a temperature of 700 degrees using natural gas. This operation produces a thick gooey product which can only be refined into transportation fuel in special refineries. This is being done in sufficient quantities, as to be profitable. No one would do this if there were lots of easily accessible oil, just waiting for a hole to be drilled, so it can gush out of the ground. The production of shale oil is an act of desperation.

Deep water offshore drilling in the floor of the ocean below 5,000 feet, or more, of sea water, is also an act of desperation. Who would do this, if oil were easily accessible, in sufficient quantities to meet our needs, in shallow water.

This is not to say we have or will exhaust existing oil reserves any time soon. It is simply an indication that the cost of recovering oil is rising because the global rate of oil production is falling, while the current global rate of consumption is rising.

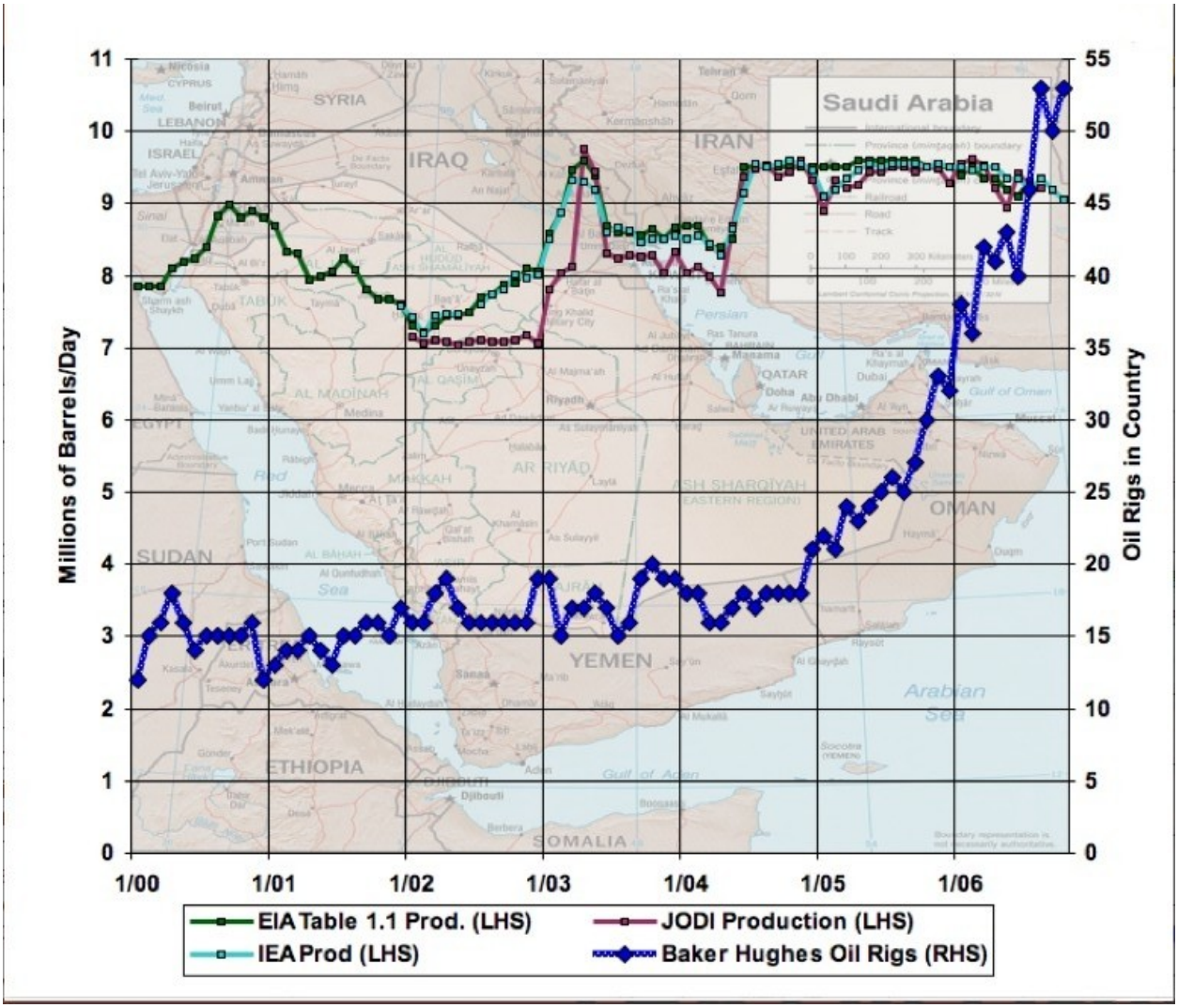

Figure 8: Saudi Arabia is drilling more since 2005, to maintain production below Peak.

Saudi Arabia appears to be working harder to maintain production levels. When the world's largest oil producer goes into decline, it is very likely that world production will decline.

Here is a list of the seven largest oil producing nations in the world; Saudi Arabia, Russia, United States, Iran, China, Canada, Mexico. It is important to note that we have a great deal of domestic oil. We are the third largest oil producer in the world. The problem is that our consumption is three times our production.

Top World Oil Producers, 2008
(thousand barrels per day)

Rank	Country	Production
1	Saudi Arabia	10,782
2	Russia	9,790
3	United States	8,514
4	Iran	4,174
5	China	3,973
6	Canada	3,350
7	Mexico	3,186
8	United Arab Emirates	3,046
9	Kuwait	2,741
10	Venezuela	2,643
11	Norway	2,466
12	Brazil	2,402
13	Iraq	2,385
14	Algeria	2,180
15	Nigeria	2,169

Figure 9: U.S. is Third Largest World Wide Oil Producer. Saudi Arabia in 2009 became number two at 9,760 behind Russia at 9,934.

Mexico led Canada in daily oil production until 2007. We have in Mexico a repeat of the story of oil discovery, exploitation and inevitable decline. In the U.S, oil was first discovered in Pennsylvania. Vestigial remains of the oil era there are evidenced in product names like Pennzoil and Quaker State. When oil ran out

there we moved to Ohio. From there we got Standard Oil of Ohio. We moved from there to Oklahoma.

I remember visiting Oklahoma City in the sixties and being surprised to see oil pumps, rocking up and down, on every street corner, right in the center of the city. We went from there to Texas, Alaska, to the shallow waters of the Gulf and the Pacific, off the beaches of California. And now, we are into the deep waters of the Gulf and shale oil of the Rockies.

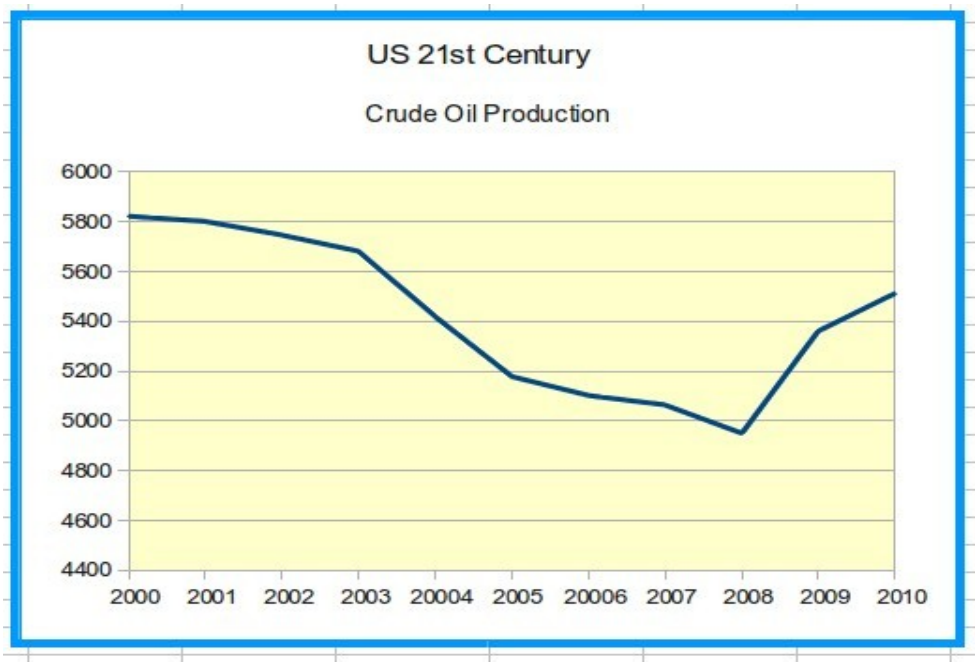

Figure 10: U.S. Oil Production drops to 4,950 barrels per day, Half the 1970 Peak, followed by the first increase in nearly 20 years. Similar previous increases have been short-lived.

There is new oil to be discovered, but it is increasingly difficult to find, because remaining deposits are decreasing in size. So although we are drilling more wells than ever, our production continues to decline. New oil fields are small and old oil fields are in decline. You can't simply add today's discovery to today's production, because today's discovery, must first make up for the decline. You can't replace large declining reserves with small numbers of smaller reserves.

The best you can do is slow the decline, at ever increasing cost, because of decreasing energy return on energy investment (EROEI). EROEI is declining because of increasing costs of producing oil related to deep water drilling, and mining of shale oil and tar sands. Easily accessible light sweet crude is the dream of the past.

We must take stock. We need to understand the life span of oil. As we see the process repeat over and over again, in well after well, in state after state, in

nation after nation: discovery, production and depletion. When will we ever learn? The process is quite predictable.

The last large discoveries of the 60's have now, each in turn, gone into decline. The great hope of Western Europe, North Sea Oil, is now in decline. The last three major discoveries of the sixties were North Sea Oil, 1965, Gulf of Mexico, 1966 and Prudhoe Bay, Alaska, 1967. Prudhoe Bay peaked in 1989. As the shallow waters of the Gulf come to the end of their decline, we move to the extreme deep waters of the Gulf. Mexico's Cantrell discovered in 1975, peaked in 2003.

Oil Discoveries

Much fanfare is made about recent discoveries, but they are much more difficult to recover, such as deep-water discoveries like Deep Water Horizon in the Gulf or shale oil reserves like Eagle Ford In Texas. EROEI for shale oil in these fields is much lower and production rates lower than conventional light sweet crude.

Bakken shale oil in North Dakota, discovered in 1951, has been in successful production since 2008, with new horizontal drilling techniques and large numbers of wells. It is due to new technology and rising prices of oil, that these deposits are being recovered. Still, although the size of these deposits is large, while estimates of recoverable oil keep growing, the recovery rates are low, for the reserve size. At the end of 2010, Bakken was producing less than 500,000 barrels per day. The estimated recoverable oil has grown from about 4 billion barrels to 24 billion due to technology and changing economics.

There is enough oil at Bakken to supply the U.S. for three years if it were our only source of supply and could be delivered at a rate of 20 million barrels per day. However, Bakken will take 130 years to produce its 24 billion barrels of oil at current rates of production. This is good news and bad news. The oil will last a long time. It will help make up for decline in other areas. But, it will not likely lead to any significant reduction in imports, by itself, or in combination with other domestic discoveries.

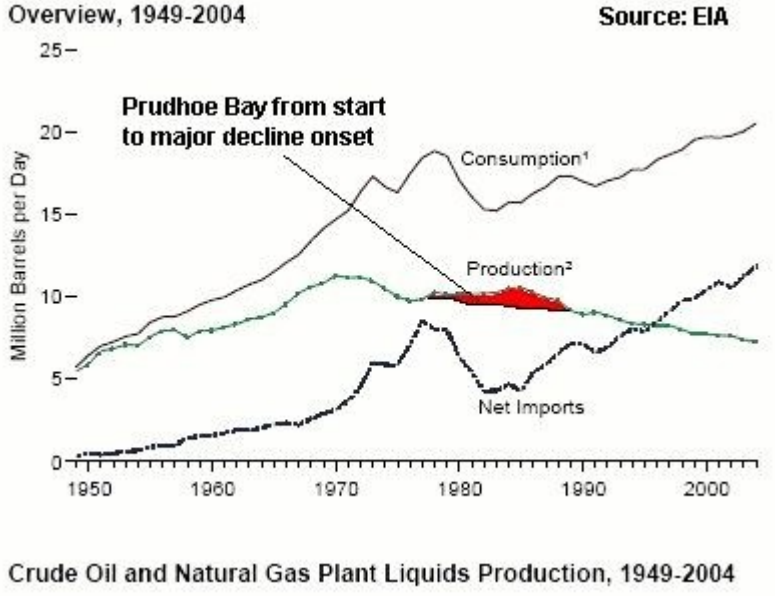

Figure 11: U.S. Oil History, shows effect of Prudhoe Bay on imports is over.

If you've heard all this before, and simply don't believe it, visit the BP Web Site where you can review production and consumption figures by country, and by year, from 1965 to the present.

No discussion of this subject would be complete without acknowledging Matthew Simmons, *"Twilight In The Desert"* , and Colin Campbell, *"The End Of Cheap Oil"*.

The prosperity of the past was based on abundant domestic oil production, sufficient to meet domestic demand while producing a positive balance of payments due to exports. It is physically and geologically impossible to duplicate this prosperity with our current energy and transportation system.

Mortgage Crisis

Even the Mortgage Crisis is related to the price of oil. I first became aware of rapid rises in the cost of homes over thirty years ago. I often traveled to California on business. In conversations with associates over lunch or sometimes in the evenings, on visits to their homes, the subject of real estate prices would come up.

I was living and working in New York State and was shocked to hear the difference in the prices of homes in California. Over the years, as a result of my frequent trips, I could see prices rising and hear stories from associates of their home buying decision process.

People were moving further and further from work to get lower priced homes of equal size and quality to those closer to work. As time passed, commute times were getting longer and longer. Commutes in excess of an hour, were not unusual.

These home buying decisions were based on the price of gas at the time the home was purchased. As gas prices rose, the advantage of these long commutes were being eaten away. In the long term, many of these outlying developments were abandoned by their owners. Some were foreclosed as homeowners could no longer afford mortgage payments due to the rising price of gas, and others just got up and left.

Many factors have contributed to the current mortgage and housing crisis, but I believe the rising price of gas was a contributing factor.

Coal

Half the electricity in the U.S. is generated using Coal. Significant coal reserves are found in the United States and Russia, but not in the Middle East. Worldwide, compared to all other fossil fuels, coal is the most abundant and is widely distributed across the continents. The estimate for the world's total recoverable reserves of coal as of January 2006 was 930 billion short tons. Coal reserves will

last approximately 138 years at current consumption rates. There is an estimated 60 - 200 years of coal reserves, depending on future consumption rates.

If coal remains a significant source of energy, in the foreseeable future, the Middle East could become dependent on the U.S. for its energy. On the other hand, places like Saudi Arabia are investing heavily in renewable sources of energy like solar.

More than oil or gas, coal is one of the worst pollutant producing sources of energy, particularly fly-ash, carbon dioxide ($CO_{2)}$, and pollution (NOx, SOx). NOx and SOx are the terms used to indicate the general oxides of nitrogen (NO, NO_2, N_2O_2, etc.) and the general oxides of sulfur (SO_2, SO_3, etc.). Filtering is being used to scrub the smoke stack output of these pollutants.

Carbon dioxide is a more difficult problem. Carbon sequestration has been proposed as a method of reducing carbon dioxide emissions.

Then there is the question of where to store the gas, which can asphyxiate any human or animal life. It is proposed that underground caverns be used. Particularly, cavities from which oil or natural gas have been extracted. There is some concern about leakage from these cavities, either slowly, or catastrophically, all at once. When carbon dioxide erupted from two West African volcanic lakes in 1984 and 1986, nearly 2,000 people died.

Another danger related to coal mining is fires. Centralia is a ghost town in Pennsylvania. Its population has dwindled from over 1,000 in 1981 to 10 in 2010, as a result of a mine fire, burning beneath the borough since 1962.

Coal actually can be a source of uranium. Fly-ash piles have been experimentally processed in China to successfully extract uranium.

Natural Gas

Natural Gas can be used for many purposes, including electric power generation, heating and CNG (Compressed Natural Gas) transportation. I believe natural gas is and will be essential to electric power generation because it can be quickly throttled to meet varying load conditions. In the beginning and for some time, it will facilitate and smooth the transition to renewables. We can't wait until this resource is in short supply to begin the transition. It will be essential to the transition. And the transition is essential to survival.

In the long term, all home heating will have to be electric and/or geothermal using heat pumps supplemented with resistive electric heat in cold climates. During the transition, natural gas will help to meet heating requirements where it is available.

CNG for transportation can not be a long term solution. It requires an expensive infrastructure to be viable for personal transportation. It can be most effective in fleets where electric vehicle ranges do not meet requirements. CNG vehicles can be fueled at the terminal where they are garaged. These fleets may include local trucking.

Long haul trucking if powered with CNG, would require an infrastructure similar to personal private transportation (cars). In my opinion this not a practical use of resources in the long term view. A better approach would be to transfer the task of long haul trucking to rail freight and local electric trucking or local CNG trucking. UPS or FedEx type long haul could piggy back on high speed rail with local distribution by local electric or CNG trucking.

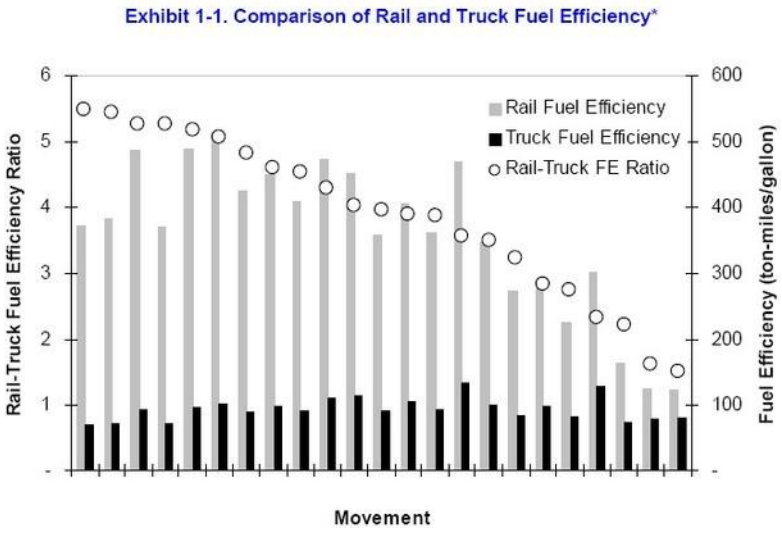

Figure 12: Long Haul Shipping by Rail is far more Energy Efficient than Trucking.

The bottom line on natural gas is, that it is the lesser of poor alternatives. We need to move away from it as quickly as possible. But, it is preferable to imported oil, coal and nuclear.

Nuclear

Nuclear power, in the U.S. and to a large degree, world wide, has been stagnant for decades. New construction of nuclear power plants is not economically attractive without huge amounts of taxpayer support. The consequences of a catastrophic failure, however unlikely, last until the end of time. I first learned of the practice of placing spent nuclear fuel rods in pools at the top of reactor buildings from a presentation given by Helen Coldicott in March of 2010, a full year prior to the Fukushima disaster, where these uncontained pools proved to be a significant part of the problem.

The integrity of the containment vessel provides no security to spent rods stored in pools in such a manner. The chain is only as strong as the weakest link. However safe or unsafe the nuclear reactor core is, from natural disasters or human error, these spent fuel rod pools are especially vulnerable, particularly to terrorist attack.

The nuclear industry in the U.S. has a remarkable safety record. It can be compared to NASA. At the same time they have both had failures. They are not infallible.

Nuclear is also not carbon free or sustainable. Uranium, like petroleum, is a finite resource. It is mined using earth moving equipment like shale oil and coal in some locations. It is a carbon intensive process. The refinement process adds further to the carbon cost of uranium.

The carbon cost of uranium recovery will rise as high concentration ore is exhausted and lower concentrations are mined. More earth will have to be processed to yield the same amount of uranium. Currently uranium production and other nuclear related carbon costs amount to about one third the cost of electricity generation with natural gas. This will rise as uranium ore concentrations decrease. As with fossil fuels EROEI will decrease as resources are exhausted.

Because uranium is a finite resource, the more successfully we exploit it as a source of energy, the more quickly we will exhaust it.

Every dollar misspent on nuclear is a dollar diverted from renewable alternatives. A dollar spent on renewables has higher sustainable energy output than the same dollar spent on nuclear.

Lead time on renewables is shorter and costs and risks lower and narrower in scope, in terms of geography and time. A nuclear disaster could make a hundreds square miles or more unusable for thousands of years.

Fukushima

Fukushima, as of this writing, March 30, 2011, is neither stable nor under control. Despite assurances from Nuclear Industry experts, in both Japan and the U.S., it becomes increasingly clear that officials and plant workers are in an ad hoc reactionary mode, without a procedure manual to guide them. They are dealing with circumstances that, according to the book, can't happen.

Catch 22

They can't produce electricity until radiation levels drop so they can make repairs. They can't lower radiation levels until they stop cooling with sea water. They can't stop cooling with sea water until they make repairs and turn on electricity.

Dilemma

What to do with radio active sea water? They put it in barges. Where do they put radio active sea water when the barges are full? This is a dilemma. Since radio activity levels are rising, they choose the lesser of evils. They dump the less

radio active sea water into the sea and store the more radio active sea water in barges, once emptied. The question that remains, is what do they do when the barges fill again? Hopefully, they will have solved the catch 22 and won't need to store anymore radio active sea water. Now the problem is, what do they do with the barges?

Any declaration as to the severity of this disaster, at this time, is premature. No one can say with certainty that this event is comparable to Three Mile Island, or not as bad as Chernobyl, or equal to Chernobyl, or worse than Chernobyl. We do not yet understand all the implications, or the full, final impact on Japan or the world. But this does not seem to hinder industry and government experts from making such pronouncements. What is clear from what little hindsight we have, is that although we have seen the appearance of stability at times, this was a slowly worsening situation, thanks to the heroic efforts of those responsible for containing the unfavorable progression of events. It is clear now, that these lulls, were temporary respite from an increasingly desperate situation.

Japan has experienced scandals where Industry decisions to take shortcuts have been exposed. Expensive regulatory procedures, deemed to be unnecessary and overly cautious by some, were circumvented. We have in the U.S. similar examples of such practices. Industry experts seem to, when they can't contain radiation, try to contain public opinion and public reaction, by trivializing the impact of such unconfined radiation.

It has long been the contention of U.S. Nuclear industry, that what happened at Chernobyl could never happen here, because the Chernobyl reactor was a poor, carbon controlled, design with no containment. We all hope this is true. But Fukushima shows us that even a U.S. designed reactor can get out of control.

Cost of Nuclear Disaster

First we have, in the case of Fukushima, the loss of the use of six nuclear reactors. Replacement cost would be in the billions. Now you can say these plants have served for decades, and simply depreciate their replacement cost, and only count the loss of their remaining useful life, had there been no disaster. In that case, the cost is a lesser amount, still in the billions of dollars, compared to full replacement cost. Most likely, you can add the depreciated value lost, to the cost of whatever technology is used to replace the lost capacity.

Replacement will likely be some other technology for two or three reasons. One, time to bring replacement online. Two, cost of replacement. And perhaps three, the Japanese people may have lost faith in nuclear. Nuclear is slow to come online, expensive and dangerous. In addition, it is not carbon free because of the process of mining and processing uranium. And it is not renewable, it is a finite resource.

Additional costs include lost use of land. Currently, they are using 20 kilometers as a radius around the Fukushima plant. That is 12.4 miles. Using the formula Area = πr^2, we multiply 3.141 by 12.4 raised to the power of 2 equals 1,517 square miles. Since Fukushima is not far from the coast, a part of that circle defined by that radius may be in the sea. Still anything approaching fifteen hundred square miles is a lot of real estate to lose. Some will dismiss this is just farmland. I have no dollar estimate for the value of this land, but in Japan real estate is limited, as is farmland. But the cost can not be completely understood by looking only at acreage.

Futaba, Tomioka, Namie, Okuma, Minami Soma, Japan's nuclear ghost towns, are lost to service. More than 80,000 human beings evacuated from their homes within this radius. What is the cumulative total dollar value of all those homes buildings appliances, computers, furniture and personal and commercial property?

These are immediate costs. This ignores personal hardships, deaths from radiation in the first few months and long term cancer costs, some of which can be quantified, but most of which are too precious to be measured in dollars. What is the value of a husband or a son or a father whose remaining life is shortened to weeks due to radiation exposure during cleanup.

A Fukushima farmer has said, in response to the question, who is responsible? *"Ultimately, everyone who uses convenient nuclear power, without thinking about the consequences."* You might expect, as we so often hear, that the blame should be laid on government regulators or TEPCO. But this farmer who has lost his home, his farm, which has been in his family for 150 years, and his livelihood, did not point the finger at those easy targets. He placed the blame on the beneficiaries of the status quo.

Tepco confirms extra partial fuel rod meltdown at plant, 23 May 2011 Last updated at 23:59 ET

"Tepco has been trying to contain radiation from the plant, crippled by the 11 March earthquake and tsunami."

"The company said that it planned to stick to its timetable of getting the radiation under control by January."

"The spokesman added that most of the fuel from the Number 2 reactor had melted approximately 100 hours after the earthquake, which measured 9 on the Richter scale, struck Japan. The meltdown in the Number 3 reactor took place about 60 hours after the quake."

"The company has said that it wants to reach a "cold shutdown" of the power plant by January, and has been trying to cool the reactors and get the unstable fuel rods back under control."

"Earlier in May, Tepco revealed that the damage sustained by the Number 1 reactor immediately after the earthquake and tsunami was far more severe than initially thought."

"Professor Akiyama said that the IAEA had come under criticism for its reaction to the Fukushima crisis.
"First of all, it has not been able to provide the information on what's going on on the ground," he said. "Secondly, it hasn't been able to provide a prescription for the solution of the crisis.""

Things at Fukushima, late in May, appear to be slightly out of hand, despite earlier assurances such as this in late March.

Nuclear Power Wins It Over Hydrocarbon Romance: By Gwyneth Cravens, March 23, 2011, 7:03 PM EDT

"The technical community will review the Japanese nuclear crisis and recommend improvements. Although the reactors properly shut down with the first jolt, the cascade of difficulties brought by the tsunami overwhelmed the site.
. . .
In any case, that 1966 plant is outmoded."

This early assessment, assures us once more, following such a disaster, that this could never happen here in the U.S. Perhaps this is true, we can only rely on the judgment of the experts. The financial sector will likely not be so generous, when it comes to future nuclear investments.

Fukushima is a bad omen. It will serve to quantify the costs of nuclear failure in a very real and tangible way for investors. Enormous costs, that are not yet fully understood, will weigh heavily in investment decisions. Government should not step in and force taxpayers to, pay for, and bear the risks related to potential failure of, nuclear power, when private investors dare not risk their assets.

The worlds strongest economy shows the way. "Germany to abandon nuclear power by 2022". BERLIN (AP)

The only safe nuclear power source, we will ever need, is 93 million miles away.

Disasters of the past

Everyone knows about Three mile Island and Chernobyl. There are others, Fermi 1, SL-1, Selafield, Sizewell . . .

1) Experimental Breeder Reactor I (EBR-I) is a decommissioned research reactor located in the desert near Arco, Idaho. EBR-I suffered a partial meltdown during a coolant flow test on November 29, 1955.
2) The Windscale fire of October 10, 1957 was the worst nuclear accident in Great Britain's history, The core of a nuclear reactor at Windscale, Cumberland (now Sellafield, Cumbria) caught fire, releasing substantial amounts of radioactive contamination into the surrounding area.
3) Explosion and meltdown at the National Reactor Testing Station called SL-1 (Stationary Low-Power Plant No. 1) in Idaho Falls, Idaho, killed three January 3, 1961.
4) A nuclear power plant called Fermi 1 suffered a partial fuel meltdown on October 5, 1966 at the Enrico Fermi Nuclear Generating Station on Lake Erie near Monroe, Michigan.
5) There have been 21 incidents at Sellafield in the U.K.of radiological releases from from 1950 to 2000, some of which released plutonium into the Irish Sea for extended periods of time.
6) Radioactive cooling water from a pond that stores spent nuclear fuel was found leaking onto the floor of the laundry room on the morning of Sunday January 7, 2007 at the Sizewell-A, nuclear power station on the Suffolk coast in the U.K.
7) Check Wikipedia for a more complete list of military nuclear accidents.

Renewable Energy

Simple observations about renewable solar and wind, often, seemingly intuitive and obvious, the sun doesn't always shine and the wind doesn't always blow, are fallacious. Although this may seem obvious to an observer at single location, it is not true over a state or nation or continent. In nations heavily invested in renewables, it has become clear that renewables can, and do, provide 34 to 50 percent of their electricity now, with plans to add capacity, approaching 100 percent. If this is true in a country with a geographical area as small as Denmark, it should work well in a country as large as the U.S. by exploiting our widely varying weather and the addition of a new efficient grid.

Every dollar spent on nuclear power generation with its expensive installation cost and long lead time, is a dollar that can't be spent on renewables. Even where installation costs are similar, renewables don't require expensive uranium production and disposal when spent. This leaves nuclear investors (taxpayers) with the uncertainty about the cost of remediation in the event of failure, which, we are so often assured, can't happen.

It would be a mistake to rely on assertions made by nuclear experts that the only alternative to nuclear is coal or gas. These are not sustainable. Wind, photovoltaic and concentrated (thermal) solar are renewable with comparable installation cost per megawatt and long term environmental benefit with lower operating costs.

Study shows Energy Subsidies Favor Fossil Fuels Over Renewables.

- *The vast majority of federal subsidies for fossil fuels and renewable energy supported energy sources that emit high levels of greenhouse gases when used as fuel.*
- *The federal government provided substantially larger subsidies to fossil fuels than to renewables. Subsidies to fossil fuels—a mature, developed industry that has enjoyed government support for many years—totaled approximately $72 billion over the study period, representing a direct cost to taxpayers.*
- *Subsidies for renewable fuels, a relatively young and developing industry, totaled $29 billion over the same period.*
- *Subsidies to fossil fuels generally increased over the study period (though they decreased in 2008), while funding for renewables increased but saw a precipitous drop in 2006-07 (though they increased in 2008). The largest subsidies to fossil fuels were written into the U.S. Tax Code as permanent provisions. By comparison, many subsidies for renewables are time-limited initiatives implemented through energy bills, with expiration dates that limit their usefulness to the renewables industry.*
- *The vast majority of subsidy dollars to fossil fuels can be attributed to just a handful of tax breaks, such as the Foreign Tax Credit ($15.3 billion) and the Credit for Production of Nonconventional Fuels ($14.1 billion, though this credit has since been phased out). The largest of these, the Foreign Tax Credit, applies to the overseas production of oil through an obscure provision of the Tax Code, which allows energy companies to claim a tax credit for payments that would normally receive less-beneficial tax treatment.*
- *Almost half of the subsidies for renewables are attributable to corn-based ethanol, the use of which, while decreasing American reliance on foreign oil, raises considerable questions about effects on climate.*

Solar on every, commercial and residential rooftop would, in the long term, result in a highly distributed and resilient electric power system. This combined with wind and an improved grid would allow for a balanced power distribution system with a high percentage of solar and wind providing in excess of 70 percent input

to the grid supplemented by other renewables such as hydro, geothermal, tidal, energy storage systems, and limited amounts of natural gas.

Renewables are currently a small proportion of our input to the grid. Other countries such as Germany and Denmark are already heavily invested in renewables. We can learn from their experience. This is a better source for understanding the potential of renewables than remarks made by proponents of an economically inefficient and dying nuclear power industry.

Do you recognize this language? *"A well regulated electric power grid, being necessary to the security of a free state, the right of the people to produce, use and sell electricity, shall not be infringed."* This is a, perhaps facetiously, proposed amendment to the U.S. Constitution.

Solar and Wind

This is what the current Governor of Texas has to say about electric cars. *"In a state where the oil and gas industry is king, the arrival of electric vehicles and building the charging infrastructure have jolted the public's perception about Texas."*

Illinois has Chicago, *"the windy city"*, but it is Texas that leads the nation in the production of electricity from wind. In Texas the future of oil and natural gas production is well understood. Texas is, and has been for some time, moving forward on all fronts, when it comes to energy and personal transportation.

It is also interesting to examine the energy policy of Saudi Arabia with regard to sustainable renewable energy. What is already history in Texas, peak oil, is the very near future of oil and natural gas production in Saudi Arabia. Nowhere is the future of oil production better understood. It is there, in Saudi Arabia, that you will find massive solar projects. They are building their energy future with the resources they have while they last. We on the other hand debate about the cost of renewable energy while we borrow and squander our remaining resources on fossil fuels. *“We run from the truth like frightened mules from the lion.”*

We need to understand what is being done, here at home, in places like Texas and in other nations, around the world,so successfully. In 2009, Germany installed one thousand times more solar panels than Florida, the sunshine state. Why is that? We are constantly reminded, here in the U.S., that the sun doesn't always shine. This is why it is, we are told, that solar just doesn't make sense. Is it possible that the sun never sets in Germany? Why is Texas leading the nation in wind produced electricity, don't they know the wind doesn't always blow? Why is Denmark so heavily invested in renewable energy?

Either these early adopters, these leaders in renewable energy, are making a big mistake or perhaps they know something, we have not yet grasped. To be sure, mistakes have been made with regard to renewable energy. Spain is heavily invested in wind production of electricity. There are those who suggest that the

Spanish government invested far more than it could afford in renewable energy, and that doing so was a major cause of their economic problems. There may be some truth in that.

Germany, on the other hand, has prospered, while investing heavily in renewable energy. The difference may be in where the investment in renewable energy came from. In Spain government subsidies were used to promote renewable energy. Germany uses the FIT (Feed In Tariff).

The FIT is the thing most feared by those opposed to renewable energy. Opponents of renewable energy cite Spain as an example rather than Denmark or Germany, and are reluctant to discuss Texas or Saudi Arabia. The thing they don't want to do is create the impression in the minds of the American voter that the sun shines to great advantage during the period of peak load, when it is most needed, and that the wind never stops blowing everywhere at the same time. The people who tell us that we can't solve our problems with renewable energy are the people invested in the status quo. They profit from the continued use of fossil fuels. This includes uranium which is also a finite resource that is extracted from the earth.

The FIT incentivizes electricity generation from any source by anyone possible. It encourages co-generation. In Florida if you install solar panels on your roof, and you want to sell your excess electricity to the power company, the power company requires you to have two meters. One measures electricity you take from the grid at night for example, and the other measures electricity you put into the grid during the day. This allows the power company to charge 12 cents per Kwh and pay only 6 cents per Kwh. Florida law requires power companies to pay the same price for electricity as they charge. The power company believes they are in compliance, because the electricity they generate includes a 6 cent fuel adjustment fee. So they believe they are really only charging 6 cents, because they don't benefit from the fuel adjustment fee, because that pays for fuel.

The simple truth is that power flows from the solar panels of one home out the 6 cent meter and into the neighbors home through the 12 cent meter. The power company just charged one customer 12 cents for something they bought for 6 cents. No fuel was involved. The big guy gets to interpret the law at the expense of the little guy. This doubles the payback time for the home owner who installed the solar panels generating profit for the power company, who has no capital invested in the equipment generating the electricity they are selling. This policy is not designed to make the power company rich, but to discourage the installation of solar panels. The irony here is that the power company will pay as much as 60 cents per Kwh to another utility during peak load when they need it.

In California, a simple metering system measures input to and power drawn from the grid at the same rate, which is as you might think it should be. A California solar system pays for itself in half the time as a Florida system.

But Germany goes even further. They say the power company has to pay premium over what they charge customers for input to the grid. This makes the installation of solar panels even more attractive in Germany, than California with even faster payback.

So it is not because Germany has more sun than Florida that Germany installed one thousand times more solar panels in 2009. It is because they have a positive incentive rather than a negative one. The result is that Germany is building a robust, distributed, renewable and sustainable electric system.

Florida frequently suffers from storm damage to the grid causing massive outages to thousands of homes and businesses. In such circumstances a distributed co-generation system would provide power to many more homes for at least part of the day, powering air-conditioners and refrigerators during the hottest part of the day. Having lived through several of these outages, I know how welcome power would be for even part of the day.

Every home and every business should have solar and/or wind generation built in. We should not be building roofs and installing solar panels on them. We should have self supporting solar integrated roof systems as a standard feature of every new home or building. New buildings and homes will potentially last beyond the availability of cheap and abundant fossil fuels.

There are over 100 million private residences in the U.S.. If each home had a 5 KW solar system on the roof we would have over 650 gigawatts of electricity for 3.5 hours per day. This capacity would build with daily peak load starting in the morning and taper with load towards the afternoon. World wide electricity production is 8.750 terawatts.

Wind

Wind is sometimes criticized for its intermittence and variability. Our personal experience supports this, but we are exposed to surface winds. Wind speed increases sharply with the tower height, causing a major increase in the power output of the system. In the U.S. coastal areas and the Great Lakes have the highest wind speeds. There are inland areas in New England and the Central States that are less windy, but still favorable for wind power.

It is true that wind speeds vary and stop unpredictably. When considering a single tower or farm, wind output will vary with local wind conditions. If wind farms are distributed and connected to an efficient grid at different locations, it is less likely they will all stop at the same time. For example a wind farm on Lake Erie is likely to have different peaks and lulls than one off the coast of Long Island.

Wind power is more likely to reduce fuel consumption, as the percentage of wind on the grid increases, rather than replace fossil fuel plants. Wind works best in combination with quick response generators like hydro and natural gas fired plants.

The Grid

In any system, demand will vary and generation capacity will need to be brought online from standby as demand requires. Predictability is essential to effective load balancing. This is called load following. If wind is in the base load more predictable and agile load following generators can be brought online to fill the gaps.

Solar is more predictable than wind and has a natural load following production cycle. Although the sun rises and sets at different times throughout the year, these times are predictable, as are increases, peaks and declines, in solar output throughout the day. This is mitigated by weather conditions which are slightly less predictable, such as overcast days and rain.

Geothermal is the most predictable and least variable sustainable power source. It is even more consistent than hydro. In coastal areas, there are opportunities for wave and tidal power generation which are more variable. Tidal power generation tends to be somewhat predictable, while wave-power behaves more like wind-power and likely to follow the same output cycles of wind generation.

In a diversified renewable system with sophisticated computer controlled load following, we should be able to approach 100% renewable sources at times. This would allow slowly phasing out nuclear and coal, using natural gas fired plants to fill gaps not met by renewables.

The U.S. has given up first place in world wide wind power production to China who has moved up from third place, behind Germany. The U.S. is now second at 40.2 gigawatts and China is leading with 42.3 gigawatts having installed 16.5 gigawatts in 2010. World wide total wind production is 194.4 gigawatts.

When the wind is blowing, generator output is variable. Even when the wind is continuous the speed will vary due to gusts. This presents a problem when connecting wind generators to the grid.

Capacitors are used with wind turbines for power factor correction, harmonics filtering and voltage correction. Capacitors are assembled in capacitor banks that frequently contain more than 100 capacitors.

Energy storage over periods of time longer than just a few seconds provides a solution to the variability, intermittence, and unpredictability of renewable sources such as solar and wind power. Energy storage adds to the cost of a renewable energy system.

Batteries have been used for longer term storage of larger amounts of energy than capacitors, but work best on a small scale like a single home. While it's difficult to create centralized battery banks at a large power plant that can provide power for a town or a region, batteries could work very well in a highly-distributed solar-generation system where each house has solar panels and batteries to cover overnight power-usage.

Hydrolysis can be used to create hydrogen which can be used later in a fuel cell to generate electricity. This method of energy storage scales well at small to medium neighborhood levels and larger. For example, First Energy is Testing Large Utility-Scale Fuel Cell System in Ohio.

Another storage method, which scales well for large energy stores at centralized power plants, is to pump water uphill which can be used to generate hydro-electricity later.

Not only do these storage systems add to the cost of sustainable energy systems, but they decrease the overall efficiency. In the long term, fossil fuel savings will justify their added cost and efficiency losses.

Centralized vs. Distributed Generation

The Roman Empire used a distributed power structure out of necessity. Caesar ruled the world from Rome, by giving Governors and Administrators limited autonomous power, to act in his name. Communication was by messenger using sealed documents. The seal was a method for insuring privacy and authenticity of the message. If Caesar were in the Emperor business today, he would no doubt use a centralized system of Empire management.

The computer business has gone through several transitions. Initially mainframe computers provided the computing power and software applications, to *"Dumb Terminals"*. These terminals were initially typewriter like devices. They were eventually replaced with text displays and keyboards. Some displays were green, some amber and later some were black and white. This was a centralized system.

As personal computers came into use, much of the work of main frame computers was offloaded to desktop computers, which were eventually connected to the Internet. This was the great transition to decentralization. Although centralized main frame computer systems are still in use, the world of computing is highly decentralized and distributed.

The latest thing is cloud computing. This is a move back to the dumb terminal concept. The new *"Dumb Terminal"* is a graphic device, not the old boat anchor text only terminal. Google has a new notebook computer that works strictly from the cloud for both applications and data.

So, what does this have to do with the generation of electricity? Well, power generation has traditionally been a *"Main Frame"* type of operation. It has been the responsibility of the big boys in the Utility Business.

Solar Panels are the personal computer of the Utility Business. The Utilities are not very interested in them. Especially not for Rate Paying customers. If there is to be any solar power put into the grid, they want to be the ones doing it.

Distributing power generation to rooftops all over the world has the advantage of reducing the load on the Grid. Power distribution is less of a problem if you can distribute power generation. Grid failures tend to deprive large numbers of users of power.

Another means of distributing power generation is Co-Generation also known as Combined heat and power (CHP).

In this article, Rod Macgregor examines the oil depletion debate, Mar 9, 2007 mentions such a system.

"renewables in combination can work on a small scale, and, in fact, there is living proof that they do right here in Britain – in the town of Woking in Surrey. Woking Borough Council has reduced carbon dioxide emissions by 77 per cent since 1990. How has this remarkable reduction occurred?

It has been achieved using a hybrid-energy system which utilizes private wires, Combined Heat and Power Plants, solar PV and energy efficiency, plus some absorption chillers and fuel cells. Housing estates have been made into their own little energy worlds.

If the national grid collapsed tomorrow, never to rise again, the inhabitants of Woking would still have an all-year-round electrical supply. In the winter the Combined Heat and Power units generate heating and lots of electricity when the solar cells are not working at their optimum. The solar cells generates lots of electricity in the summer when the heating is not needed, meaning the CHP can't generate lots of electricity. The systems works in perfect harmony. If it can be done in one small town, why can't it be done in all of them?"

On a small scale, locally, electrolysis can be used to store hydrogen for later use with fuel cells to produce electricity. Although this is not perfectly efficient, fuel cells provide electricity at night from hydrogen produced and stored during the day using electricity from solar panels.

Distributed generation provides a more reliable and robust supplement to the centralized grid based distribution system, that we have lived with in the past. Renewables work well on a small scale. They do not have a favorable effect on the income of large centralized Utility Companies, hence their opposition.

Food

Fuel intensive process

The rising price of Fuel and Food in our Oil Based Economy.

Food production rivals transportation in consumption of oil. Eating industrially farmed food, is a major contributor to our reliance on imported oil.

When fuel prices rise, the price of corn rises.

The production of corn is a petroleum based fuel intensive process. Fuel is used in all phases of corn production, from plowing, sowing, fertilization (fertilizer production itself is fuel intensive), application of insecticide (again a fuel intensive product), and harvesting, to the trucking to the silo, loading using a grain elevator, shipping by rail to food a processing plant and shipping by truck to the supermarket. All highly petroleum based fuel intensive steps in a complex food production system.

When corn prices rise, the price of food rises.

Using corn to produce Ethanol raises demand for corn and hence, the price of corn at the food processing plant and the supermarket. We should not have to choose between putting food on the table or Corn Ethanol in our gas tank.

Corn Ethanol diverts corn from the food supply. This increases demand for other grain commodities such as rice, wheat and soy. Because we are an exporter of corn, this increases world wide demand and prices for these commodities.

When corn ethanol production increases, the price of all food commodities rise.

Of 10,000 items in a typical grocery store, at least 2,500 use corn in some form during production or processing. Not just corn flakes and corn oil, but a range of foods sweetened with corn fructose, such as beverages, snacks and candy. Dairy, poultry and meat come from corn fed animals like chickens, turkeys, cows and pigs.

The only way to break the cycle of rising prices is to reduce demand for oil dramatically. The production of corn ethanol is so petroleum intensive, that it has little or no energy payback, and its use contributes to rising food prices.

Although, cellulosic ethanol made from saw grass and/or switch grass requires very little fuel input for its production, this alternative is not yet available. Liquid fuels should be abandoned for electric transportation. Public Light Rail, High speed Rail and the Battery Electric Vehicle are superior to using fossil fuels or Ethanol and the best solution.

Read *"The Omnivore's Dilemma"* by Michael Pollan - his chapters on corn and agribusiness are important to understanding the rising price of food in our Oil Based Economy.

There was an oil crisis in Cuba in 1990. As a result of the collapse of the Soviet Union, Cuba's imports were cut in half overnight. The impact on the economy was devastating. The way this oil crisis changed food production is very interesting. It was the end of industrial farming and the dawn of a new era of local organic farming. Cuba imported 1.2 million bicycles and manufactured 500 thousand more. Visit the web site for the documentary.

The Power of Community: How Cuba Survived Peak Oil

Localization is part of energy efficiency. This applies in all areas, not just food production.

Ethanol

The Inflexibility of Flex Fuel Vehicles

Flex fuel vehicles use Gasoline, Ethanol, Diesel or BioDiesel Fuels. The problem is, that you must own two automobiles to use all four fuels.

The flex fuel vehicle is really a dual fuel vehicle.

One of the fuels used in a flex-fuel vehicle is petroleum derived, which is the source of the problem we are trying to solve with the flex fuel vehicle. So, if you are buying a flex fuel vehicle to have a positive effect on our Foreign Oil Dependence, your flex fuel vehicle is really just a single biofuel vehicle.

Diesel + Electricity =
biomass (Corn or Soy) =
BioFuel (Ethanol or BioDiesel) =
poor fuel economy (MPG).

Depending on which data source you use, estimates are that it takes the equivalent of one third to one half a gallon of gasoline to produce a bushel of corn and almost three bushels of Corn to produce a gallon of poor fuel economy Ethanol.

You do the math.

The Electric car is a true flex fuel vehicle.

It uses electricity directly from local wind or solar, or indirectly from wind, solar, geothermal, Hydro, oil, natural gas, coal or nuclear via the grid.

Transportation

It has been said that cars don't run on solar and wind. The implication being that you can't replace oil with solar and wind. While it's a simple and obvious observation, it's not a sound principle upon which to plan sustainable transportation policy. Electric cars, High Speed Rail, and Light Rail use electricity from any source, including solar and wind. If cheap sustainable transportation is your goal, electric vehicles powered by solar and wind are the answer.

The prosperity of the past was based on abundant domestic oil production, sufficient to meet domestic demand while producing positive balance of payments due to exports. It is physically and geologically impossible to duplicate this prosperity with our current energy and transportation system. HS Rail, Light Rail and Electric cars are an essential part of the solution.

New York City is an example of the benefits of public transportation. In New York City, only half the households have a car and in Manhattan only one in four households have a car. New York City also has one of the lowest per-capita energy use rates in the U.S., less than one-third of the U.S. average.

Rail

If we are to achieve a sustainable renewable energy and transportation system, we will need local light rail and high speed rail taking some of the burden from air transport and automobile usage. These rail modes of transport fit well with the capabilities of electric cars.

High Speed Rail

In 1975, I spent six weeks in Japan on business. I was working in Tokyo. While there everyone insisted, that I should not leave Japan without seeing the shrines at Kyoto. The trip from Tokyo to Kyoto was 263 miles or 423 kilometers. The Shinkansen or Bullet train had a large digital speedometer in the front of each car. As I rode on the train to Kyoto, I remember seeing speeds in excess of 200 kph. The trip takes a little over two hours. This would take over five hours by car.

Figure 13: Japanese Shinkansen, Bullet Train

The Shinkansen at that time was already over ten years old. It is now 36 years later and there is no similar form of transport here in the U.S. It is, to me, quite amazing. In the intervening years France, Germany the U.K., and now, even China have High Speed Rail similar to the Shinkansen, Bullet train. It is often said that the U.S. is too large for rail to work. This country is better suited to highways. This argument was often used when European high speed rail was held up as a standard, before China had high speed rail in place.

I remember taking my father to the train station in Troy, N.Y. where he departed for destinations like Cincinnati or Boston on business trips in the '50s. The train station in Troy is gone now as are the train tracks that serviced it.

During World War II, troops were transported all over the country by rail. Every town and city had a train station. We have gradually dismantled the system instead of improving it. We have converted railroad right of way to bicycle paths, and torn down train stations or converted them to other uses. If China is not too large for high speed rail, it should work as well here.

In those days we had what we called station wagons or station cars. It was popular for these vehicles to have wood body panels. The Model A Ford was affectionately called the *"Woody"*. But it was not the only *"wagon"*. They were made by many manufactures, for years, after the original *"Woody"*. My son drove a Chrysler *"K"* car, of that style, in college. He graduated in 2000. He called it the *"Log"* because of its wood side and rear panels.

We no longer have station wagons, because we no longer have ubiquitous train stations. Cars are made in a similar style with a rear facing drop down tail gate,

but they are called sports wagons. The name station wagon or station car would, perhaps, be appropriate for an electric car. Conventional cars are not part of a transportation system including light rail and high sped rail. Cars are, *"the transportation system."* The term station car is thought of as an aberrant anachronism, because we no longer have a culture that includes train travel.

Recently, Governor Rick Scott made headlines by canceling Florida's High Speed Rail project. He rejected Federal Funds of $2.4 billion, which would have funded it almost entirely. These funds will likely go to California. It is ironic that in just two days, We spend more on oil imports than the total rejected by Scott.

High Speed Rail is an essential part of the solution and Orlando - Tampa would have been just the beginning of a system from Miami to Jacksonville, Tampa and Tallahassee through Orlando.

The Orlando -Tampa route may not be the most important route in the nation, but is the most ready. The right of way is in place and the environmental impact has been evaluated. Ridership and costs have been determined and there is interest from investors around the world, with High Speed Rail experience, who believe in the project and have nothing to gain from its failure. Their interest in this project, is as a profitable investment.

This decision is not unpopular among those who voted for Governor Scott. It is characteristic popular opinion across the nation. It solves a problem that, in the minds of many Americans, does not exist. They believe the only transportation problems we have are poor highway maintenance, and the high price of gas. They believe that if the folks in D.C. would do their jobs, these problems would be solved easily. These voters feel there is no connection between foreign oil independence and high speed rail.

You can, with limited success, drive down a road while looking in the rear-view mirror exclusively. But if the road takes a change in direction, you will be headed for imminent disaster.

Not all change in direction is planned, predictable, or the consequence of decisions taken, whether for good or ill. There is always the other choice, often the easiest and most popular choice, *"do nothing."* Actually this is really not "*do nothing."* It is, *"continue doing what you have been doing."* This leads to the turn in the road that surprises you because you were speeding and looking in the rear view mirror to see if the police are following.

When things are moving fast you need to pay attention to what lies ahead. We all suffer from future shock. We resist change if it doesn't look like fun, based on present criteria. We can ignore reality, but we can't ignore the consequences of ignoring reality.

U.S. high-speed rail 'myths' debunked, From CNN.com staff April 13, 2011

Light Rail

I remember electric trolley cars as a child. By the time I went to school they were disappearing. You could stand at the trolley stop on an island in the middle of the street and see a car coming, every two or three minutes. When you stepped onto the car you could see the next one coming a few blocks behind and the one you just missed a few blocks ahead.

There was a time in New York State when you could travel by trolley from New York City to Buffalo. At the border between each city's system, the next city's system began. You could get off one trolley at the end of the line and get on the trolley for the adjacent system and ride it to the end of the line.

These clean efficient electric light rail systems were bought up by corporate highway interests and systematically dismantled and replaced with polluting buses and cars. No one complained. We didn't care for the buses, they never provided the service the trolleys did, but we loved the cars.

Once purchased, trolley schedules were changed with increasing delays between cars. Each two or three additional minutes delay between trolley cars caused loss of ridership and revenue. Revenue was drawn out of the system without reinvestment. The clean efficient electric trolley system was declared to be a dying mode of transport. In fact it had been systematically killed. It wasn't hard to kill. Human nature is such that we were all easily seduced by the automobile. The thrill of driving was in some ways, and somehow connected (through advertising), to the joy of sex. We were hooked and there was no turning back.

That light rail system was efficient at moving people. It could be part of a sustainable energy and transportation system once again, if it were implemented using current technology. This view of a robust integrated distributed sustainable renewable electric energy and transportation system has been ignored, to this point. It's also the only system capable of supporting something resembling our current culture, civilization and way of life, in a manner that is economically and environmentally sustainable in the long term.

We need to understand that in the business as usual scenario, coal might last 200 years, at the absolute outside, if we had the inclination to run that resource out. Other resources such as oil, natural gas and uranium, can't possibly carry us another 50 years, even under the most optimistic estimates

I believe if we make a serious effort to become sustainable now, we have two benefits. First, we begin to enjoy the environmental and economic benefits of the new sustainable electric economy. Second, the fossil fuels and uranium will last longer.

Electric Cars

We have 250 million automobiles in the U.S. In 2010 President Obama set a goal of one million electric cars on the road by 2015. This is 0.4%. Less than half of one percent. If we double that amount every five years, it will take 45 years to replace the entire fleet. So by 2055 all the cars on the road in the U.S. would be electric cars. Personal transportation would consume no oil, foreign or domestic.

There are many who say, even this modest plan, will never happen. They may be right. But what will happen if they are right? Fifty years is a long time, but what is likely to happen to daily oil production in fifty years? It will either: A) increase, B) decrease, or C) stay the same. If you chose A or C, we need to understand what will happen to world wide demand. If you chose C and world wide demand rises, we have the problem of demand exceeding supply. If you chose A, we need to understand how the increase in production compares to increasing demand if any.

We also need to understand when any shortfall in oil production might happen, if it happens. Where would we be in the transition to electric cars at the time of any possible oil shortage. The point is that we must able to predict when any shortages will occur, if our life style and our economy are to continue unaffected. Simply predicting shortages is not enough. Our prediction has to leave us sufficient time and resources to prepare.

It is not likely that we will come up with any better prediction than many experts have already provided. We have already reached peak daily oil production. What is not perfectly clear is when daily oil production will begin irreversible decline. But aside from decline we are faced with increasing world wide consumption. When the rate of consumption meets the rate of production, we encounter demand destruction, caused by rising prices, because consumption cannot exceed production, without consuming reserves.

These possible future scenarios can be compared to the fact that this has all played out in the U.S. Our daily oil consumption has long since outpaced our domestic daily oil production. One might think this would serve to convince us to take action. Rather we simply throw borrowed money at the problem. We substitute foreign oil for domestic in ever increasing amounts. This solution will not work when we reach world wide peak oil.

Electric cars are expensive

New technology in limited production is not a formula for low prices. Annual car sales are in excess of 16 million. Car prices are a function of competition, demand and economy of scale. Electric cars are selling in some cases at premiums above MSRP. The availability is not sufficient to meet initial demand, and they are not yet benefiting from mature technology and economy of scale. This will change over time, if this alternative is embraced.

President Obama's five year plan, which some believe will not be achieved, introduces 200 thousand electric cars per year compared to 16 million conventional vehicles.

"Who cares about electric cars? when they can go 400 miles on a charge, then we'll talk." Let's talk now. Do you drive 400 miles in a day? Do you own two cars? Could one of them be electric? Did you know that the Chevy Volt will go 40 miles without using any gas, then will get 35 miles per gallon on gas?

I find this conversation interesting because it occurs at car shows, where there are hundreds of cars that have been modified or restored, at great expense to their owners. These cars, glorifying the achievements of corporate auto and corporate oil, are based on the wealth and health of the oil economy.

The Chevy Volt costs $42,000. Maybe you can't afford it. Buying a used electric car is not yet a frequently available option. For most people this is not an important issue and certainly not one they can do anything about.

You don't have to own and drive an electric car to be an advocate. If you understand and appreciate the energy problem in general, and the oil problem in particular, keep informed. If you want to see the problems addressed, vote for people and policies that address the issues. Advocate and influence those around you.

In the near term, the cost and capabilities of electric cars will not fit everyone's pocketbook or meet everyone's requirements. But we need to encourage those who can afford them and those whose needs are met by them. We certainly don't need politicians and policies that discourage the use of electric cars.

According to a recent Consumer Reports article, the Chevy Volt *"isn't particularly efficient as an electric vehicle and it's not particularly good as a gas vehicle either, in terms of fuel economy."* They concluded that it just *"doesn't make an awful lot of sense".*

This is the most efficient hybrid ever built. It travels 30 to 50 miles in all electric mode and gets 35 miles per gallon after that. To compare the Volt to cars that get 30 to 50 miles per gallon is ridiculous. The Volt only gets 35 MPG if you ignore the miles you drove without gas. If you drive 75 miles you will use one gallon of gas. That's 40 electric miles and 35 gas miles. What if you drive 25 miles between charges? You won't use gas at all. How many miles per gallon is that?

For example, if you charge each evening and drive 50 miles per day on weekdays, plus 150 on Saturday and 150 on Sunday, you will have driven 270 miles on gas and 280 miles on electric. You will have traveled 550 miles on 7.7 gallons of gas, or 71 mpg for the week.

The thing about the Volt is that *"your mileage may vary"* by a lot. You could get 300 miles per gallon or a thousand MPG. It all depends on how far you travel between charges. This car makes more sense for some, than for others. But there is really no driver who can't use this car because of limited range.

If you own two automobiles, you may prefer an all electric car with no gas backup such as the Nissan Leaf or the Ford Focus. The Leaf is almost $10,000 cheaper than the Volt putting it within the price range of more consumers. These cars will travel further than the Volt in all electric mode, having a range of 70 to 100 miles or more depending on road conditions, ambient temperature and driving habits. So depending on your needs and your pocketbook, you may prefer an all electric car over the Volt because even these cars are more expensive to buy than gas cars. But if you look at life cycle costs, these cars have distinct advantages for those who drive them. Additionally, and of equal importance for the overall economy, they reduce foreign oil imports.

Used Electric Cars

If you are driving a five year old car that you bought used, you probably won't be able to drive an electric car until there is a used market. What some people are doing now, is buying a used Prius and adding the Hymotion plug-in upgrade.

Hymotion claims 100+ MPG for 30 to 40 miles before depleting the battery, which uses A123 System's Lithium Ion technology (A123 owns Hymotion). The top speed in pure EV mode seems to be 52 MPH, although you still get ~80MPG at speeds above that. After the battery is depleted, normal Prius fuel economy resumes.

So depending on how you drive a plugin Prius Hymotion conversion, you might get results comparable to a Volt.

Personal Experience Applied to Electric Cars

When it comes to the value of a used electric car, people tend to draw on what they know from experience. Well, gas car experience may not be the best source for predicting used electric car resale values. Take batteries for example. There is a large body of experience to draw from, but most people are unaware of it. Everyone has experience with 12 volt accessory/starter batteries in their gas cars, especially if they buy used cars. A three or four year old used car is likely to have the original battery unless it has just been replaced. More likely than not it hasn't. So we expect that after as little as three years and no more than five years we have to replace the battery.

This gas car experience has led to some outrageous estimates as to the value of a used electric car. If you believe a used electric car needs an expensive battery replacement by the time it is five years old or even sooner, this car is of little value as a used car.

The Prius has a nickel metal hydride (NiMh) battery in it with an eight year warranty. Toyota prides itself on never having replaced a battery under warranty. Here is a Toyota statement, *"We are very pleased with the performance durability of the NiMh battery powering the Prius,"* said Gary Smith, TMS corporate manager for Product Quality and Service Support. *"However, there will be rare cases where owners will require a hybrid battery replacement beyond the mileage limits of the 10-year 150,000-mile warranty or 8-year/100,000-mile warranty in non-California compliant states. For the most part, these high-mileage customers have a positive ownership experience and want to keep their vehicle. We've stated from the beginning that battery replacement costs would continue to decline due to technology and volume related advancements, and we believe this will continue."*

Blame Battery Costs For Low Electric Car Resale Value, by admin on April 13, 2011, Motoring News Blog

Toyota RAV4-EV

Toyota has produced another vehicle from which we can learn about battery life. From 1997 until 2003 Toyota produced the RAV4-EV. This is a small, all-electric SUV. Some of these cars have been on the road for about ten years. Many of these cars have been driven over 100,000 miles. The first one of these has recently passed 200,000 miles. This car went 150,000 miles on the original

Figure 14: Gary Francis purchased his 2001 RAV4-EV. He paid $33,100 in January of 2009 when it had 47,788 miles on it.

battery and has traveled an additional 67,000 miles on a reconditioned battery. These batteries are reconditioned because new batteries are not available. Gary's car, shown in Figure 14, now has 55k miles, and still gets 80 miles per

charge. This is the car where the buyer failed to close on a final eBay bid of $89,000. The price in this auction is often quoted as the high point of RAV4-EV pricing, at the height of gas prices, in 2008. Gary who lives in Winter Haven, Florida, got this car from the owner in Texas who paid $69,000 in 2008 in the follow-up to the failed eBay auction.

Hybrid vehicles like the Prius and the Ford Escape have been using the same battery chemistry through the same ten year period with great success. So you can see why 12 volt starter battery experience does not apply to electric cars.

The RAV4-EV is interesting in terms of its resale value. These cars do experience loss of range depending on care and usage. When new, they had a range of 120 miles and if treated well, give good service over time. But even if their range drops to 60 or 80 miles late in life, they are still quite useful and are selling today for $20,000. The price when new was $42,000.

I believe as electric cars come into wider acceptance, there will be an increasing demand for used electric cars just as there is now for the RAV4-EV. Comparisons of life cycle costs are often based on the price of gas at the time of vehicle purchase. The sale price of a used electric car will be based on the price of gas at the time of resale, which will increase resale value in an economy with rising fuel prices. New electric cars have an eight year 100,000 mile warranty on their batteries, which will make a three or five year old electric car very attractive to both the owner and potential buyers. This will make owners reluctant to sell and buyers eager to find a used electric vehicle. At the same time used gas cars will be less and less attractive to buy used or new due to increasing fuel costs.

Life Cycle Costs

Comparisons of life cycle cost usually low ball the trade in value of an electric car and the future price of gas. Surprisingly, even with this bias, it becomes increasingly obvious, that the electric car is both necessary to our economic stability, and cost effective for the owner, in the long run. A gas car may be cheaper to buy, but it costs more in the long run, and is of little use without gas. Whether we see a return of the gas lines of the past with odd and even days and pump closed signs, depends on how quickly or slowly we adopt the alternative and make the transition.

If you search the web for “electric car calculator”, you will find a tool to help you make Life Cycle cost comparisons. I compared a Nissan Leaf to a Toyota Corolla, 2.4 liter, four cylinder, automatic. This calculator includes all costs including fuel. I entered $3.50/gallon for gas and 13 cents/kWh for electric. I let it calculate average maintenance costs, MPG etc. I entered 15 miles per day (city) and 25 miles per day weekend (highway) and 3 trips a year of 190 miles. For these values, the cost of the Leaf is equal to the Corolla in seven years, after which the Leaf gets cheaper each year.

In four years, the Leaf gains the cost advantage, if you drive 50 miles per day (city), 80 miles per day weekend (highway) and 12 trips a year of 300 miles round trip. The 300 mile trip would require a fast charge stop each way.

This shows that with modest range requirements, the Leaf is as cost effective as the Corolla in seven years. With more aggressive use, the Leaf catches up in four years. So the initial cost of an electric car, even at low production rates, at introduction to market, before technology costs are recovered, and the advantages of scale kick in, the electric car is cheaper in the long run. And that is at the current price of gas. If the price of gas rises to $4.50 per gallon, the Leaf recovers faster. At the time of this writing average gas prices have risen to $3.85 per gallon and rising.

The Electric Highway

Range is the most often mentioned topic when the subject of electric cars comes up. A vastly overrated concern. Electric car drivers use these cars with ranges of 100 miles or less to great advantage. I drive a converted Ford Ranger Pickup truck routinely. My typical round trip is between 8 and 12 miles. This is not a limitation. It meets my requirements. The longest trip I have ever made is 41 miles on a single charge. The most I have driven in one day is 54 miles with opportunity charging. But these were unusual trips and not at all typical.

The average driver travels less than 40 miles per day. These same drivers, however, do make occasional trips of extended distances. Hence, all the discussion about range anxiety. There is talk of new battery technologies, super capacitors, fast charging, and battery pack swapping. We are not ready to use public transportation for long distance trips. Driving an electric station car to a public transport hub and traveling longer distances on light rail or high speed rail is currently unattractive to many. We demand that electric cars become capable of high speed long distance driving before we will accept them.

An alternative solution to the problem of electric car range that is not often mentioned is the addition of an inductive charging strip in the right lane on interstate highways. Inductive charging allows the car to be charged without plugging in, either while it's parked in a parking spot with an inductive charging pad embedded in the pavement, or even while rolling over a strip embedded in the highway.

In a world with ubiquitous inductive charging infrastructure, gasoline vehicles would be handicapped by range and electric vehicles could travel on the highway indefinitely without stopping to charge. An electric highway would have the inductive strip embedded in the right hand lane of the interstate highway, allowing cars to keep to the right while charging and travel on battery power in the left lane or on local roads that lack inductive charging infrastructure.

Electricity Used to Produce Gasoline

It has been said that gas cars use as much electricity as electric cars. The argument says that electricity is used at several different points in the process of producing gasoline and delivering it to the tank of your car. We all know that when there is a power outage, you can't buy gas for your car because the electric pump at the gas station is not working. But obviously there's more. The process of getting oil to the refinery is varied depending on the type of oil, light sweet crude, shale oil etc., and where it is in relation to the refinery. It might have to be pumped through a pipeline to the refinery. It might have to be pumped in and out of tankers. After refining, it must be transported to the gas station. There are lots of energy intensive steps in the process.

The one that seems to have garnered some attention, is the electricity and natural gas used at the refinery, to produce a gallon of gas.

Figure 15: Refinery at night uses electricity for more than lights.

Nissan at one point made a statement, which they have stopped making, without saying why, that: *"it takes 7.5 kwh to refine a gallon of gas"*, precipitating the following type of blog entries on the net. *"It takes about 7.5 kwh of electric power to refine a gallon of gasoline. An electric car can go 25 miles on that much power. So your conventional gasoline car is already consuming just as much electricity as my electric".*

An interesting observation. Quite startling if true. Imagine, the electricity you save, by not refining a gallon of gas, would power an electric car the same distance, as the gallon of gas would propel a gas car.

Whatever the truth is, and the oil industry knows the answer, this is an important factor. Apparently no one wants to go on record here. Clearly, the answer to this question is that the cost in electricity to obtain, refine, and deliver, the oil necessary to produce a gallon of gas, is greater than zero. Whatever that number is, it will have a favorable effect on the cost of the all electric fleet to the environment and the economy,.

This from plugs and cars blog

"Electricity consumption by petroleum refineries in the US is over 49,000,000,000 kWh.

One electric car, roughly speaking, will use about 3000 kWh to go about 12,000 miles.

That means the electricity alone we use to refine petroleum each year could drive over 16,000,000 electric cars 12,000 miles each year.

And that doesn't include the electricity used in oil extraction and pumping.

[Source: Energy Statistics Database | United Nations Statistics Division under "Total Electricity" then "Consumption by petroleum refineries"]"

The current in**car**nation, interesting word, of the electric car has been criticized in the media since the announcement of the Volt at the Detroit Auto Show in January 2007. Since the Leaf and the Volt have begun deliveries, in December of 2010, criticism has diminished, but continues.

What I find interesting, is that most vocal critics have never owned an electric car. I can understand why someone who does not believe an electric car, would satisfy their requirements, wouldn't buy one. That makes sense. But why would you campaign against their manufacture or purchase? There seems to be this fear, although it is diminishing, that the reemergence of the electric car, will, bring with it some negative impact on society which must be stopped before large numbers of innocent consumers are duped into wasting money on this deception.

I can understand passion, I am myself a passionate advocate. We see this type of opposition to the of the risks of radiation resulting from the construction and operation of nuclear power plants. We see opposition to the dumping of toxic chemicals into the environment.

We are told that electric cars are not zero emission vehicles, they just have a longer tail pipe, referring to coal plant smoke stacks. No question. Smoke stacks are longer than tail pipes and quite remote from any vehicle they may support. That doesn't mean that electric vehicles pollute more than gasoline powered vehicles as some would have us believe.

When charged with electricity produced from coal, electric vehicles contribute to the emission of Carbon dioxide and other pollutants depending on which type of coal fired plant the electricity comes from. In the worst case, electric cars are almost as bad as conventional internal combustion engine cars. Parity is no crime.

But opponents of electric cars who use this argument apply the exception to the entire electric fleet. This is erroneous because only half of our electricity is produced from coal. Not all coal fired plants have the same levels of emissions. And if investments in clean energy reduce plant emissions, the emissions of the entire electric car fleet are reduced with no change to the vehicles. Additionally, electricity can be produced from non-polluting sources. Electric cars can, are, and will be charged during the daytime by solar charging stations at work and other public places. As the number of these facilities increases, the vehicle related emissions will be reduced.

One Expert

Margo Thorning tells us, the wind doesn't always blow and the sun doesn't always shine. The point is, the oil won't always flow. And more importantly, when the oil stops flowing, the wind will still be blowing and sun will still be shining. We need to make hay (electricity) while the sun shines.

There are two concerns with these type of remarks. The first is problem acceptance. The second is solution delay.

It is absolutely certain that we are headed for economic disaster unless we change course. It is also certain that the long term solution is not fossil fuels. We have some solutions that are often called alternatives. They are really not long term alternatives to fossil fuels, they are the only choice we have. That's because fossil fuels will not be available for the long term.

What the truth may be is that there is no solution that allows us to maintain our current way of life. We may all have to go to bed when it gets dark and rise with the sun, because the power goes off at night.

Too many financial experts look only at short term costs. They divert our attention from problem acceptance, simply because the *"alternatives"* are not *"cost effective"*. This leaves us with the status quo. We continue to ignore the

problem. Waiting for the perfect solution will not make the problem go away, and it causes us to exhaust fossil fuels more quickly.

On March 24, 2011, in an opinion piece by Margo Thorning, Pull the Plug on Electric Car Subsidies, we have this, *"They are costly and don't do enough to protect the environment . . . after 180 years, PEVs are still not a commercial success"*. Really 180 years?

This expert is telling us we are wasting money on Electric Car subsidies. The $4 billion in subsidies we give the Oil Industry each year, along with tax loopholes, military spending to protect shipping lanes, and wars to "stabilize" the Middle East, are, we are told, necessary. When the oil is gone, we will have a fleet of 250 million cars that don't go anywhere.

Let's understand the problem. Let's understand that fossil fuels are not the long term solution. We have to start to work on the solution with the technology available to us. No expert really believes fossil fuels will last forever.

To invest in the technology of the past, at the expense of new technology that solves the problem, however inadequately, simply retards the development of the solution. It wastes resources on increasingly expensive fossil fuels. Fossil fuels are a drain on the economy.

We ignore the true cost of fossil fuel because it is in the budget. The cost of the solution seems like additional spending and must be justified because we need the money to feed the problem, fossil fuels. It is all foolishness.

When Thomas Edison introduced the first electric car in 1903 gasoline cars soon became what seemed to be a superior alternative. Who knew the fuel for these cars would not last forever. Gasoline cars have become, in just one century, a drain on the economy that we can no longer afford. We need only to examine the true cost of driving these cars.

Our reliance on the imported oil, necessary to continue the use of this technology, has crippled our economy. We act as the world's policeman protecting oil shipping routes at tax payer expense. Oil has caused us to initiate preemptive wars. It has also provoked the poor people of oil producing nations to hate us and retaliate with terrorism. This has resulted in a permanent war on terror. In turn we react by curtailing our own civil liberties.

We ignore all these costs and the rising cost of oil extraction. We look at electric cars and conclude that they are not a cost effective solution. They do not deserve subsidies. We say, let them stand or fail on their economic merits.

Why Do So Many Small Business Owners Drive Hummers?

Cars consuming petroleum based fuels have the support of the U.S. Army, Air Force and Navy. Companies producing petroleum-based fuels get tax breaks

and subsidies. No one expects the old technology to stand or fail on its own merit. But still, it has, and is, failing us. Our economy is crippled by this burden.

The energy problem is a fossil fuel problem. Fossil fuels and uranium are limited resources, rising in cost of recovery, and being consumed globally at ever increasing rates. The simple truth is that you can't solve the fossil fuel problem by increasing consumption of diminishing fossil fuel resources.

The fallacy lies in the belief that fossil fuels and uranium are not limited, or that they will last for a really long time, or in the hope that some new technology (not Wind or Solar or Geothermal electricity, not electric cars or electric rail) will save us just before things get worse than they already are.

The hope lies in cold fusion and cars that run on water or air. This is the kind of thinking that allows us to pursue solutions to the fossil fuel problem involving the extraction and recovery of more fossil fuels at a decreasing EROEI in increasingly risky circumstances.

“We of an older generation can get along with what we have, though with growing hardship; but in your full manhood and womanhood you will want what nature once so bountifully supplied and man so thoughtlessly destroyed; and because of that want, you will reproach us, not for what we have used, but for what we have wasted.” Theodore Roosevelt, 1907 Arbor Day Message

How Often do you Cook a Turkey?

"It's like the microwave oven. When the microwave came along people were stunned by its limited use. They weren't able to cook a turkey dinner. But then they sat down and realized, how often do you cook a turkey dinner?", says Monte Gisborne of Whitby, Ontario while reflecting on electric vehicle acceptance. *“Now there's a microwave in every house.”*

You can't drive a stake with a tack hammer. You can't cook a turkey in a microwave. You can't make a call on a cell phone when you're out of range and you can't drive an electric car 1,200 miles in 24 hours. How often do you drive a stake? How often do you cook a turkey? How often are you out of cell range? How often do you travel 1,200 miles in 24 hours? Can you hear me now?

Hydrogen

Hydrogen does not exist in a free state as an element in nature. It is found combined with other elements such as oxygen and carbon in compounds such as water and hydro-carbons like natural gas.

Access to compressed hydrogen suitable for fuel or use in fuel cells requires the expenditure of energy in hydrolysis of water or the reforming of natural gas. These processes are not efficient in terms of energy return on energy investment (EROEI). It can best be thought of as an energy storage system. You put

electricity into water and get hydrogen. You put hydrogen into a fuel cell and you get electricity. A lithium ion battery is a much more efficient way to store electricity.

In terms of transportation, why would you combine energy and natural gas to make hydrogen to power a car when you could just use the natural gas? The same goes for water, why would you use electricity and water to make hydrogen to power a car when you could simply use the electricity.

What is a Fuel Cell Car?

What is a Hydrogen Fuel Cell Vehicle? Well, it is an electric car like any other electric car, except that it does not need batteries to store electricity. Like the space station, it makes electricity from a Hydrogen Fuel Cell, and a super capacitor. The super capacitor is used to store the regenerative braking energy when slowing the car so it can be used when you need extra power for acceleration (more power than the fuel cell can deliver quickly).

The most common and efficient way to make hydrogen is refining hydrogen from fossil fuel, usually natural gas. This is an energy intensive process that yields a volume of hydrogen containing less energy than the energy used to produce it.

Hydrolysis is often suggested as convenient way to convert water to Hydrogen and Oxygen. This process is less efficient than reforming fossil fuels. Once the Hydrogen is liberated from the water it must be compressed. The combined process yields a volume of Hydrogen with an amount of energy equivalent to about 65% of the energy used to create it. The fuel cell itself is only 65% efficient and the electric motor is 90% efficient. The result is 38% of the energy used to create the hydrogen gets converted back to drive the car.

By contrast, in a battery electric car, the battery is over 90% efficient and the electric motor is 90% efficient for a combined efficiency of 81%. The result is that an electric car travels twice as far on the same amount of energy, when compared to a Hydrogen Fuel Cell car.

Disadvantages of Fuel Cell Cars

Fuel Cell cars take several minutes to start, they don't tolerate cold well, and vibration makes their membranes rupture. Because of the low energy density of Hydrogen, fuel cell cars have no advantage in range over an electric car. Because of limited availability of Hydrogen refueling stations, they are limited as to where they can be used. And finally they are half as efficient as battery electric cars at using electricity. If fossil fuels are used to create the hydrogen, what is the point? Why not use the fossil fuel to drive the car?

Now, here is an interesting question. Why would automobile manufacturers make fuel cell vehicles and not battery electric vehicles? The answer is,

incentives. The Bush Administration replaced battery electric vehicle incentives and Hybrid research incentives with Hydrogen fuel cell vehicle research incentives. Auto manufacturers are being subsidized to develop Hydrogen vehicles.

Clarity

The most successful fuel cell car is the Honda FCX Clarity. These cars have been leased in Southern California for $600 per month for a term of three years. These cars are not available for sale. The first car was delivered on July 25, 2008. The plan was to deliver 200 cars in the first three years.

"So far," says James May from the *"Top Gear"* TV Show, *"most electric cars have been appalling little plastic snot boxes that take all night to recharge and take half a minute to reach 40 [miles an hour) and then run out of juice miles from anywhere. But when the Clarity runs out of juice, you just pull into a hydrogen refuel station."*

I know this is just hyperbole, but it is a bit over the top. The Tesla roadster hits 60 in under 4 seconds. The Nissan Leaf takes 7 seconds, 2 seconds faster than the Clarity. Not bad for a snot box.

He is right about refueling, there are 30 refueling stations in Southern California. So there is no limit to the range of the car? Your range is limited only by the number and location of fueling stations. Today, that means that the car can only be driven in Southern California and the surrounding area where it can be refueled. The Tesla roadster can be driven any where. Electric outlets are ubiquitous. It can be charged anywhere there is an outlet. But in fact too much is made of range, as any electric car driver will tell you. And there are many more electric car drivers than hydrogen fuel cell car drivers that you can ask.

Emissions

We are told fuel-cell vehicles are zero-emission vehicles that produce only clean water as exhaust. At the same time we are told that electric cars actually burn coal because they use electricity from coal-burning plants. For some reason it is not popular to talk about the electricity used to make Hydrogen and compress it. People forget that by far the most common method of producing hydrogen for fuel cells uses electricity, and that hydrogen cars use twice the electricity and thus twice the coal to travel an equivalent distance, compared to battery electric vehicles.

In the advertising for Hydrogen cars we hear about hydrogen produced from electricity generated from renewable energy sources such as hydro, solar, wind and geothermal. But Battery electric cars are always portrayed as being charged with electricity from coal fired plants. In reality, the same power sources work for both types of vehicles, battery electric cars simply make more efficient use of the power.

Petri Dish

Bacterial growth in a Petri dish is interesting in that it is a microcosm in which we can observe life, population growth and decline. The dish is the environment in which a student or scientist places agar. Agar is the nutrient which supports the growth of the bacteria. The agar is inoculated with bacteria and observation begins.

The bacteria will grow in four stages. These are Lag, Exponential, Stationary and Death. The agar will support growth which starts slowly during the Lag Phase. Then growth will rise rapidly. It is important to note that as the bacteria population increases, they produce toxins. These toxins tend to stifle growth. During the early phases, there is space and agar sufficient to support growth unhindered by the toxins. Eventually the population reaches a point where the toxins inhibit growth and the death rate is equal to the birth rate and the population size stabilizes.

Finally the toxins overwhelm the population and the birth rate declines as the death rate rises. This scenario can be varied by limiting the amount and content of the agar also.

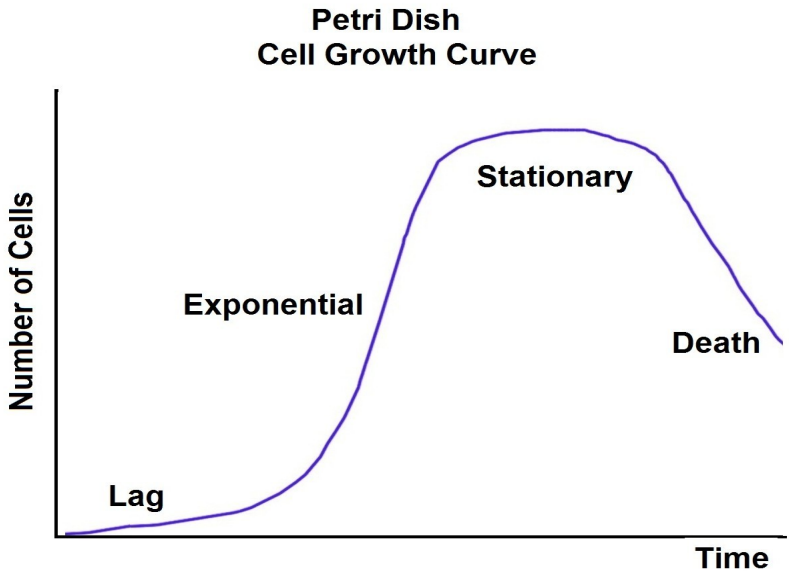

Figure 16: Petri Dish Growth Curve

We can see how this model compares to the environment provided by the planet. We are sustained by our environment and the resources it provides. Some of the resources available to us are renewable others are, like the agar, limited. If we restrict ourselves to limited resources that put toxins into our environment as we consume them, we are subject to consequences similar to what we observe in the Petri dish. We will grow until growth stabilizes due to toxins or limited resources.

Our planet is not a Petri dish and this is an over simplification. But still, there is a lesson to be learned here. This graph can be compared to those we see from the EIA (Energy Information Agency), the IEA (International Energy Agency) and other sources such as BP (British Petroleum).

We can see over and over again in these graphs, the Lag, the Exponential, the Stationary Peak and the ultimate death or decline. It is all quite predictable. Our planet is vast, as are its resources. We are not limited to one agar in one Petri dish. We can go from place to place and repeat the curve over and over, but ultimately, in the end, there is a limit.

The Root of All Evil

We have in the U.S. many troubles. We seem to believe that each symptom of the failing oil economy is a unique problem requiring a specific solution. I believe that all of our troubles are symptoms of a single problem. That problem is energy.

In a healthy society, perhaps a utopia, three square meals a day should be available to everyone, along with a clean comfortable home or apartment, education, gainful employment, health care, access to information, freedom of association, and freedom to travel.

It is abundant, cheap energy that powered our economy and allowed us to approach the Utopian like life style that so many Americans have been able to enjoy for so long. As an increasing number of Americans begin to lose one or more of these benefits of modern American life, we are thrown into divisive turmoil, as we try to find the reason for our diminished quality of life.

We go day to day without giving thought to how much oil we import or how much it costs. We passed the turning point without notice. As oil imports rise we take it in stride. We are five percent of the world's population, yet we consume 25 percent of the world's daily production of oil. We do this without giving any thought as to how the rest of the world views our disproportionate consumption. How should the rest of the world view the fact that we, five percent of the world's population, account for 50 percent of the world's military spending? Perhaps they should be grateful that we pay for their energy security, or should they? That may depend on whether they are an oil importer or an oil exporter.

We have been seduced by oil. In our current state of seduction we are deaf and blind to the consequences of our inaction.

As a Gulf fisherman from Louisiana said, *"You've got two choices on shrimp these days. You could have shrimp from the gulf with the BP oil in the head or you've got your choice of shrimp from the Pacific that glow in the dark."* We take it all in stride. Nothing is sacred except oil. We will sacrifice any treasure for our continued

access to oil. Our forests, our mountain tops, our water, our Gulf, our beaches, our tundra, our parks, our wildlife, even our own health, they are all expendable in exchange for oil in particular, and fossil fuel energy, including uranium, in general.

Vision of Things to Come

We will never run out of fossil fuels, but we will exhaust our capacity to bring fossil fuels to market at our current daily rate of consumption. When that happens, if we are prepared, our lives will slow down. If we are not prepared, life as we know it, will come to a stop.

It will take 10 or 12 days to travel 1,200 miles in a car. This will not be the norm. Most people will take high speed rail. There will still be air travel, but it will be very expensive and most people will never travel by air in their entire life time. Hybrid trans-oceanic ships using wind, solar and electricity combined with backup fossil fuel generators will move slowly around the globe. Modern warfare as we know it, will be too expensive to wage. People will work at home or close to where they live. Industrial farming will give way to local farms and gardens. More of the population will be dedicated to growing food if only part time. Our value system will change. Consumption, waste and an economy based on growth will give way to efficiency, repair, reuse, conservation, human dignity and respect for all life and mother earth. Currency will be gold and silver or paper redeemable for gold and silver or electronic credits redeemable for gold and silver. Natural resources will give way to mining former landfills for wasted minerals from the past.

The alternative is a world very much like the one we live in now, for an elite few. The rest of the population will be indentured servants to the elite, without economic means to do anything but serve their masters for their meager sustenance. The day workers will live in darkness at night and the night workers will have enough light to perform their duties. Currency will be gold and silver or paper redeemable for gold and silver or electronic credits redeemable for gold and silver. Natural resources will give way to mining former landfills for wasted minerals from the past.

The Transition is Underway

Today in 2011, we are in a transition that began in 1973. We saw then a need to move to renewable energy and began the process. But at the same time, the wealthy elite have been acquiring economic and political power necessary to economically oppress the middle class and the poor. We can see spending increase on unfunded wars, as taxes on the wealthy are reduced by cuts in tax rates, or eliminated by loopholes while social programs are cut and power shifted to the wealthy by attacking unions.

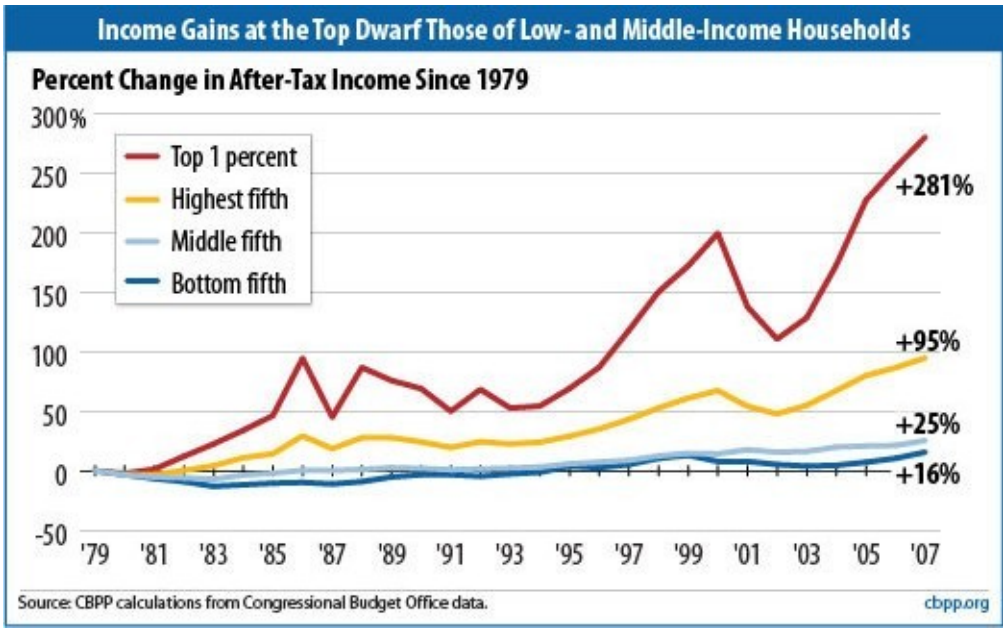

Figure 17: The Rich get Richer while the everyone else assumes more of the tax burden.

We have from an article in Vanity Fair "Inequality, "Of the 1%, by the 1%, for the 1"%, *"It's no use pretending that what has obviously happened has not in fact happened. The upper 1 percent of Americans are now taking in nearly a quarter of the nation's income every year. In terms of wealth rather than income, the top 1 percent control 40 percent."*

Read The 30-Year Growth of Income Inequality.

There may be a spark that ignites the fire of indignation among the masses, that changes our direction, but at this point we are deeply divided. It has been said, *"you can fool half of the people half of the time"*. Well, that might be just enough to change our government and our way of life. We have the Patriot Act. What next? The media in general and TV in particular belongs to the corporate elite. They use double speak and double think to get the people they are oppressing to vote them into power. It turns out that Big Brother is not the government, but corporations using government as a means to an end.

Corporations use the media to mislead and misinform. They never lie. *"Right here in North America"* is used frequently in Corporate Oil commercials. "Where do Americans get two thirds of the oil they rely on? Right here in North America." The implication is that we can achieve foreign oil independence using oil from right here in North America. A good deal of oil from "right here in North America" is imported. Our top two suppliers are Canada and Mexico. More stable than the Middle East, but still imported.

One third is domestic, one third is imported from North America and one third is imported from the Middle East and elsewhere. Two thirds of our oil is imported. That's the truth.

“The oil industry provides 9.2 million jobs, right here in North America.” The unstated implication being we don't need renewable energy to create jobs.

The “We agree” commercials, talking about renewable energy, say “It has to work on a big scale, it has to work in the real world, it has to be affordable.” Is this designed to show support for renewable energy, or cast doubt?

The first ones to fall victim to corporate propaganda are corporate employees. No one wants to bite the hand that feeds them. No one wants to believe their paternalistic employer would mislead them. These easily persuaded employees are great advocates for their industry. They speak to friends and family with authority. After all they are industry insiders who should know better.

As the transition to the solution, sustainable energy and electric transportation, begins, we will hear corporations in dying industries tell us that the alternatives are too expensive, even as the cost of recovering fossil fuel rises. We are told the solutions won't scale, even as they drill ever increasing numbers of wells to recover shale oil from wells that deliver only 500 barrels of oil per day. They try to duplicate production numbers of the past at a cost of about $10 million per well. The fossil fuel industries have there own problems of scale, as EROEI declines for fossil fuels.

On March 03, 2011 we have this by Patti Epler from the Alaska Dispatch,“Oil fracking could be next big thing on North Slope”. They are planning 200 wells per year for the next 15 years, peaking at one million barrels per day. That's a lot of oil. It is also a lot of wells and a lot of money, at $10 million per well, over a long time. As production there increases, it has to make up for declines elsewhere.

The status quo, in this case, relies on a diminishing EROEI. The solution requires large numbers of very low producing wells at the cost of water, chemicals and energy resources, that no longer scales well for the daily fossil fuel production rates required.

An ancient description of Corporate America and the American Consumer.

"It must be considered that there is nothing more difficult to carry out, nor more dangerous to conduct, nor more doubtful in its success, than an attempt to introduce innovations. For the leader in the introduction of changes will have for his enemies all those who profit under the existing order of things, and only lukewarm supporters in those who might be better off under the new."

Niccolò di Bernardo dei Machiavelli, *"The Prince and The Discourses"*,
Chapter 6, written in 1513, the same year Juan Ponce de Leon landed in Florida.

A House Divided

A marginal majority can not lastingly impose its will on half the people. The wealthy minority uses its economic power to manipulate one half the divided voters against the other. The wealthy are successful because they pander to the needs, desires and aspirations of the opposing sides, to make over the opposition in their own image, assimilate and absorb the opposition, and eliminate diversity.

A healthy, successful democracy must be based on principles that encourage, develop and sustain diversity. Each of us needs a healthy natural environment and economy to survive and thrive, in which we can enjoy our lives, liberty and the pursuit of happiness.

There are personal values and community values. Our common community values must be limited to those that support the kind of natural and economic environment that allows all of us to hold and live by our personal values

Passing laws that make it illegal to pursue personal values different than our own is not the purpose of government. We can't all be Fundamentalist Christians or Muslims or Catholics. The constitution is clear about this.

The constitution is silent on issues like Gay Marriage or Abortion and many others. Citizen John's ability to enjoy his life, liberty and his pursuit of happiness is not impaired by citizen Mary's decision to choose. Citizen John's right to organize, fund advertise or otherwise peacefully persuade Mary and others like her is acceptable and very different from passing laws making a persons right to choose illegal.

This document is not about any of these personal values nor is it intended to advocate for any point of view on these issues. It is about energy and transportation and how these personal issues have been used to polarize and distract voters from the central issue.

Regardless of your personal point of view, don't let personal values distract you from fundamental common community values essential to our democracy and general wellbeing. Here is a list of some polarizing personal issues not relevant to the economy and our common future wellbeing.

1. Gun Rights
2. Gun Control
3. Euthanasia
4. Death Penalty
5. Gay Marriage
6. Don't ask don't tell
7. Abortion
8. Right to life
9. Right to Choose
10. Separation of Church and state
11. School Prayer
12. Death Panels

These issues are important, extremely important, but should not be made the most important, and used to distract us from the central issue of our time. Energy, and the transportation that accounts for half of its consumption, drives our economy. When polarizing personal issues are used to obfuscate the central issue destroying our economy, we are in danger of losing the wellbeing and liberty that permits us to consider them at all. A jobless, homeless, poorly educated and physically ill population has no time to consider issues like Gay Marriage and Euthanasia.

Conclusion

The sun will always shine, the wind will always blow, the earth's core will always provide heat, ground water temperatures will remain stable enough to drive heat pumps, the tide will always ebb and flow, and the waves will always rise and fall and break against the shore. There will always be rushing and falling water. Most of these forces are not continuous or unceasing. They come and go. Some like the sun and the tide are cyclic and predictable. The wind and the waves are not reliably predictable. Geothermal and Hydro are continuous and reliable.

Fossil fuels are limited resources. We can understand and anticipate their limits. As we exhaust easily recoverable resources, the cost of recovery rises. As prices rise, demand is destroyed and, to a degree, we will find a new equilibrium at lower consumption rates and higher energy prices. This process will change our lives profoundly.

All sources of energy come from the sun, even fossil fuels. Renewable sources of energy are not alternatives, to fossil fuels and uranium, they are the only lasting sources of energy. It is our responsibility to conserve precious fossil fuel resources for the future by minimizing their consumption now, by shifting our primary dependence to renewable sources of energy that will always be with us.

Corporations are driven by profits, not what is best for the future of the nation or the planet. Even as resources are exhausted and recovery becomes expensive, there are profits to be made. Even with poor quality wells, there are enormous profits to be made by drilling large numbers of them. As prices rise, even low grade *expensive-to-produce* oil is profitable.

We need to embrace renewable energy now while we have the fossil fuel energy and a healthy enough economy to develop, produce and install renewable energy solutions. Blindly pursuing the status quo until we can no longer produce fossil fuel resources at the daily rate required to maintain a healthy world economy will leave us unable to make the transition.

We need to take action before we reach the point of no return. The sooner we make the transition the longer we will have fossil fuels.

"our window of opportunity is slowly closing...at the same time, it probably requires a spiral of adversity. In other words, things have to get worse before they can get better. The most important thing is to get a clear picture of the situation we're in, and the outlook for the future--exhaustion of oil and gas, that kind of thing...and an appraisal of where we are and what the time scale is. And the time scale is not centuries, it's decades." -

Marion King Hubbert 1988

One year before he passed away.

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"Our ignorance is not so vast as our failure to use what we know."
M. King Hubbert

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