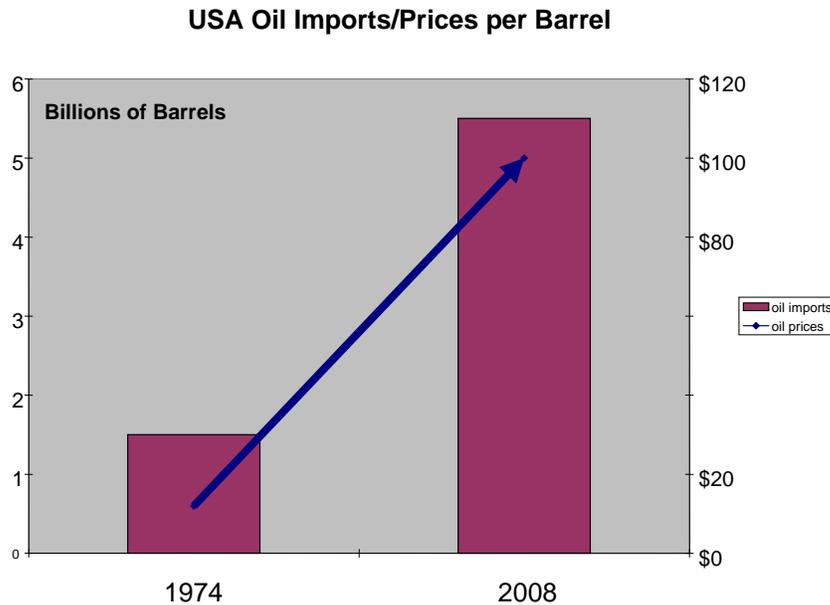


Introduction

This book is a “Call to Action” for the American consumer.

Since the 1974 OPEC (Organization of Petroleum Exporting Countries) oil embargo we have been promised Energy Independence and lower pump prices.



Instead we are paying 10 times more for oil and we are importing four times as much.

This current system is unsustainable. We face recession and inflation as we borrow trillions of dollars to finance an energy system that we don't own, that keeps charging us higher prices and is placing our troops in harm's way.

And this energy system's calculated health impacts attributable to emissions of EPA regulated air pollutants and Green House Gases is causing premature death, severe illness and threatens our water supplies, our farming capacity and our coastal cities.

If this were a fuel gauge we would be On Empty running out of time.

Why are we doing this? Our current energy system is not playing to our national strengths. We are technology driven innovators.

Given what we have accomplished with miracle drugs, computers and the Green Revolution that transformed world agriculture; why can't we have an energy system that supplies us with lower pump prices?

Why shouldn't energy technology innovation be the basis for vibrant job growth to pull us out of recession and restore our homes' real estate value?

And why shouldn't we be making money selling the world our technology solutions rather than paying someone else for their oil.

Here's the good news; we own energy technologies developed by our engineers that can achieve a sustainable economy of lower pump prices, Energy Independence and reduced air emissions.

So why are you not benefiting from these technologies? That is *the* question this book answers.

And you, the American consumer, are the foundation upon which the answers are built.

Here's why we have the power to create this type of change. The combined purchases of the American Consumer represent 75% of our country's Gross Domestic Product (GDP). We buy \$10 Trillion annually or 20% of the entire world's GDP (International Monetary Fund, 2006). This amount is approximately equal to *the combined* GDP of Germany, Japan, England and France.

And we continuously seek out the "New and Improved". In endless examples that range from flat screen TVs to concentrating laundry detergents; if we start buying something then the entire world responds with design innovations and mass production that supplies us with competitively priced quality products.

So the needed implementation step to realize a sustainable economy is for us to buy these technologies and fuels in such large quantities that it will drive down their costs to levels that are lower than what we now pay today at the pump or meter. In other words, **it is time for us to “vote” with our pocket books for the changes that our political votes have failed to achieve.**

Need an example that this vision of Energy Independence and lower pump prices is real?

Brazil is Energy Independent today and their pump prices are lower than ours. What has Brazil got that we don't? Nothing. That's the point of this book. We are the world's leader in agriculture. Brazil engaged our farmers in developing their own now world-class agricultural industry. The difference between us and them is that they made a national commitment, experienced about eight years of transition and now they are using less oil than in 1974. And they are paying less at the pump for a fuel that has a higher octane level than the gasoline you have in your car. Ironically, the engine technology they are using was pioneered by General Motors.

Want an example of how your purchasing power can enact energy technology change? One example is those “twisty” light bulbs that use less energy.

An engineer at GE named Ed Hammer invented these high efficiency light bulbs to help our country out during the 1974 energy crisis by reducing energy consumption that would save us money at the meter. Now 35 years later Wal-mart and The Home Depot and you, the American consumer, are working together to realize the energy and cost savings potential of these lights bulbs by buying millions of them and in so doing, driving their cost down through Mass Production to the same levels as the old, pear shaped energy-hog bulbs that Edison invented 100 years ago. You are saving enough money at the meter to pay for your purchase of these twisty bulbs in about three months and the combined purchases to date are estimated to have reduced our Green House Gas emissions of carbon dioxide by 1-2%.

Yet, at the time I am writing this book our country's energy policy is best described as "driving using the rear view mirror". Here are just a few examples:

High Oil Prices/Recession:

Our current economic drift toward recession is something we have experienced time and again after oil prices have shot up. Economist James Hamilton (University of California-San Diego, research funded by National Science Foundation grants) has documented that "...all but one of the US recessions since world war two have been preceded, typically with a lag of around three-fourths of a year, by a dramatic increase in the price of crude petroleum". The Federal government sending us "rebate checks" in the mail to stimulate spending is not a solution to an economy that is built upon an unsustainable consumption of foreign oil.

Societal Costs of Imported Oil:

Since the invasions of Iraq and Afghanistan the U.S. has incurred 30,000+ casualties and deaths (over 4,000 at the time I am writing this book) from having over a hundred thousand soldiers placed as "Boots on the Ground" in the Middle East.

The lineage of how we got to this point of having "Boots on the Ground" begins with our domestic oil production peaking in 1970. In other words after 1970 we began producing less oil than previous years and we began buying more from foreign countries. Was it just a coincidence that it was only four years after our oil production had peaked and was in decline that OPEC launched its oil embargo?

And it was on October 23, 1983 that we lost 241 of our bravest in the Beirut Barracks Bombing by suicide truck bombers; our first mass casualties tied to stationing "Boots on the Ground" in the Middle East to protect our national interest; and candidly that principal interest is oil.

Beyond the personal losses suffered by our military we now confront a staggering financial drain. The Congressional Budget Office estimates the War on Terror through

2017 which includes “Boots on the Ground” will cost our country around \$2.4 Trillion. Looking to a non-government source for insight; Nobel prize winning economist Joseph Stiglitz (now of Columbia University and formerly World Bank Chief Economist) estimates a cost of \$3 Trillion.

History suggests that this cycle of our ever escalating military involvement in the Middle East won't end until we figure out how to run our country on our energy and not theirs.

International Documentation of Global Warming:

Added to high pump prices and the societal costs tied to importing oil we now have the emerging environmental crisis called Global Warming. Polls say the majority of Americans believe the international scientific research that includes studies by some of our country's most distinguished government agencies and universities documenting that Global Warming is real, man-made and damaging. This research now points to a pending environmental crisis on a scale of economic and human suffering beyond anything the United States has ever experienced (including the infamous Dust Bowl of 1930-36 that caused major agricultural damage). Yet our Congress has yet to pass the first piece of legislation restricting the emission of CO₂ (carbon dioxide) which is the principal man-made Green House Gas that is causing Global Warming.

In summary, there is huge gap between our energy actions and our expectations for solutions to rising energy prices, Energy Independence and Global Warming.

And here are some telling numbers in terms our nation's financial commitments to finding answers:

\$1.5 billion

The amount the United States government spends a year on renewable energy research.

\$40.6 billion

The 2007 profits of ExxonMobil (world's largest oil company and world's largest company) earned on \$1 billion in daily revenues.

\$3 billion

The amount GE Energy Financial Services (GE is the company that is advertising "Ecomagination") has financed in renewable energy projects through 2007 with a 2010 goal of \$6 billion. GE's total assets are over \$650 billion.

\$3 Trillion

This is the size of our 2008 Federal budget. So our Federal budget for renewable energy research represents .0005 of total annual Federal expenditures, 4% of Exxon's annual profits and 1% of what we are annually spending to have "Boots on the Ground" in Iraq.

Can we conclude anything else other than we are not putting our money where our mouths are?

"Greenwashing" is a term that I found in the March, 2008 issue of National Geographic Magazine. My definition for greenwashing is the efforts by an individual, company or government to create a public image of environmental responsibility that masks the actual scale and results of their behavior. Check out *Condé Nast Portfolio.com* where this publication has created a list of their ten worst "greenwashing" companies and 11 of the most environmentally responsible.

Sadly we have recently passed Federal legislation that is a classic example of greenwashing. It was passed on December, 2007 and labeled the *Energy*

Independence and Security Act of 2007 but it neither achieves Energy Independence nor National Security. This legislation will reduce our oil demand by about 1.5 billion barrels in 2032 (24 years from now!). But in 2032 it is estimated that our country will still be importing at least 4 billion barrels of oil, hardly the definition of Energy Independence.

While the intriguing question is “Why” this type of national legislation was passed and represented to us as delivering Energy Independence this book will attempt to avoid politics and instead focus upon consumer driven solutions.

This book’s focus is upon the good news that there are technology solutions being implemented today in a global energy technology revolution. Here are some examples of “early adopter” countries implementing programs toward mass production of one or more of these sustainable energy technologies:

China now has over 400 solar manufacturing companies; eight of them are listed on our stock exchanges!

France has always led the world in its percentage of nuclear power generation with 80% of their electricity sourced from this fuel which emits zero green house gases. Now France is targeting to increase wind powered electricity generation from 810 MWs (2006) to 25,000 MWs by 2020 and increasing its photovoltaic (PV) power from 32.7 MWs in 2006 to 3,000 MWs by 2020. And if you were wondering about costs; France’s electricity is cheaper than the United States and based upon this price advantage France sells electricity to other countries.

Here’s a telling example; Abu Dhabi is an Arab country in the Persian Gulf surrounded by the world’s largest natural gas and oil fields. This country has launched a multi-billion dollar commercialization of innovative renewable, alternative and sustainable energy technologies. Their efforts include the world’s first graduate school dedicated to renewable energy (designed in collaboration with MIT, as in the Massachusetts Institute of Technology!), the launch of a clean-technology investment fund and the ground breaking of Masdar (“the source” in Arabic) City; a six square kilometer district designed

by Foster + Partners (international architectural firm headquartered in London) that will be the world's first zero carbon, zero waste city completely powered by renewable energy including the world's largest photovoltaic system.

So the obvious question is how does the United States rank in adopting technologies that can lower our pump prices, deliver Energy Independence and solve Global Warming?

Here's the *Bad News*; we are lagging behind in implementing these alternative energy technologies even though many of these fuels and technologies are inventions originated in the United States and their start-up funding was supplied by the United States' venture capitalists. (That's right, it's our technology and our money but other countries are more aggressively realizing the benefits.)

Here's a telling example; Yale University does an annual survey of 149 countries in the world and ranks them based upon an "Environmental Performance Index". You can find this ranking at:

http://www.photius.com/rankings/environmental_performance_index_2008.html.

The good news is that we are better than China but we lag behind such countries as Slovakia, Croatia, Albania, RUSSIA! and Malaysia.

And the major reason is *Consumer Economics*, not a lack of technology solutions.

This is a key point; our technology has matured past 1974 when our car engines were fueled by mechanical carburetors and computers were big boxes located in the basement of buildings operating through punch cards. Today there are sustainable energy technology solutions that hold the potential for us to drive fast, fun cars (or full size SUVs) that use no gasoline or 70+% less than our current vehicles. Today there are sustainable technologies in electricity generation that offer zero emissions and prices that are competitive with electricity generated by burning coal or natural gas.

The two reasons you are not buying these solutions:

1. A Lack of Pricing Clarity
2. Barriers to Entry.

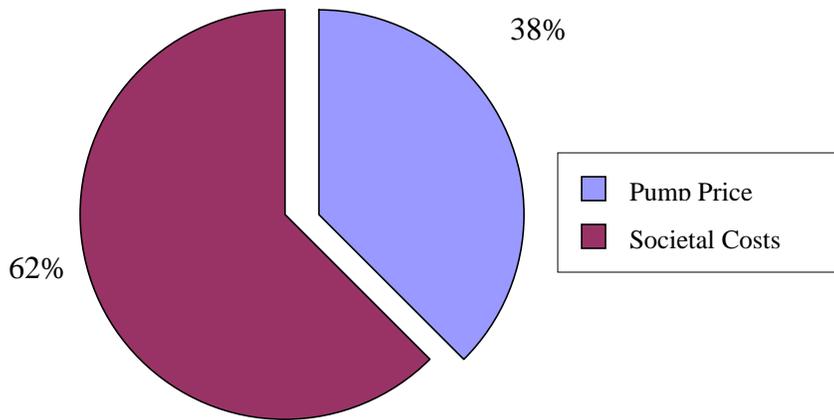
What is Pricing Clarity? It is “apples to apples” comparison shopping. It is what we do everyday when we comparison shop between Wal-Mart, Amazon.com and Costco.

Pricing Clarity is the foundation of our free market system. It enables us to make informed consumption decisions that maximize our welfare. In other products like flat-screen TVs or tires we have excellent Pricing Clarity.

Not so for gasoline even with the numbers of competing retail gasoline stations to choose from. Here is one simplistic but telling example:

If the \$2.4 to \$3 Trillion financial cost for fighting the War on Terror were included in our price of gasoline (*rather than being paid for out of taxes and national debt financing*) then the price per gallon would be an ADDITIONAL \$3-5 (in other words, pump prices of \$6-8+ per gallon).

"Real" Pump Price Cost Components



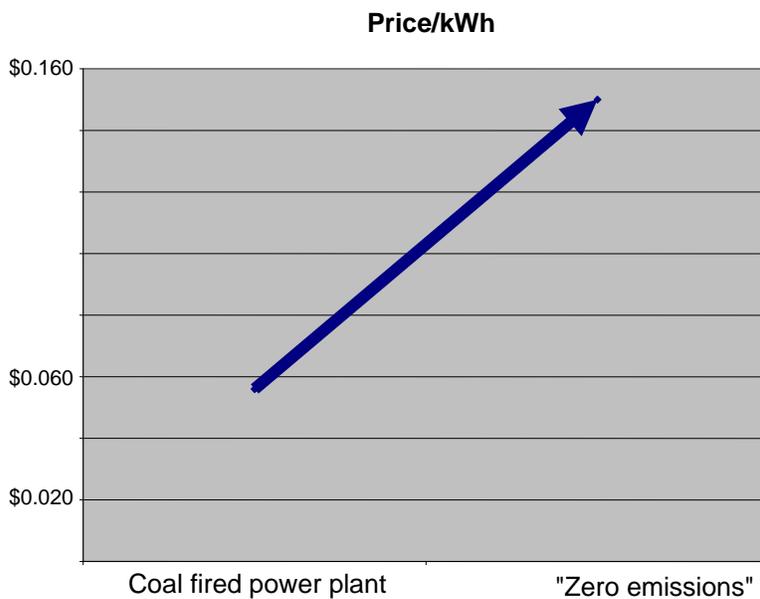
If this Pricing Clarity were reflected at the pump ***then consumers rather than politicians*** would decide if having "Boots on the Ground" protecting someone else's oil fields is our country's preferred national security policy vs. buying sustainable technologies like hybrid cars or ethanol fueled engines, or in mass transit, or the ever increasing range of other alternatives to burning gasoline produced from imported oil.

A similar example can be developed for the use of coal in producing electricity. Approximately 52% of our electricity is produced by burning coal because it is the cheapest fossil fuel. But is it really?

Coal fired electric power plants are a major source of Environmental Protection Agency (EPA) regulated emissions as documented in a 2003 U.S. EPA report that estimated coal fired electricity plants generated 59% of the total U.S. emission of sulfur dioxide and 10% of total nitrogen oxides. Coal fired power plants are also the source of approximately one-third of the United States' CO₂ emissions.

The electricity industry is now studying the cost for “zero emissions” coal fired power plants that would not emit EPA regulated pollutants and that would sequester (store forever) CO2 emissions.

These studies are pointing to prices three-times higher. And tellingly, the Department of Energy has withdrawn funding of the first such proposed “zero emissions” coal fired power plant because costs were rising dramatically beyond industry cost estimates so prices three-times higher might be low.



Again, if we saw in our electric bills the “real” price of coal fired electricity that includes the cost of obtaining zero emissions it would alleviate price confusion and enable comparison shopping between ZERO AIR EMISSIONS electricity generating options. With this Pricing Clarity coal’s current price advantage disappears with nuclear and wind powered electricity becoming the least-cost zero air emissions price leaders and with centralized thermal solar power plants located in the Desert Southwest having at least cost parity, if not lower cost advantage, compared to coal fired power plants.

Time out. If all I am suggesting is raising the price for gasoline or electricity then you are through reading. The key benefit of Pricing Clarity is that it “opens the door” to the Mass

Production of sustainable energy technologies, and as we have experienced in the Mass Production of all other products, lower prices.



The "Demand Pull" chart shows our "chicken and egg" situation. In a perfect world technology and fuel solutions should emerge out of research and arrive with price advantages to foreign oil and it would be great if they also solved Global Warming. Economic history says this will not happen. What is happening today in the United States in terms of these technologies is similar to water rising behind a dam. We have all these sustainable technologies and fuels behind the dam of Pricing Clarity that if let loose will begin their path into Mass Production and lower prices at the pump and meter. But the key is breaking the dam created by our current lack of Pricing Clarity.

Computers provide a compelling example. In 1975 Bill Gates and Paul Allen wrote the first computer language for personal computers (PC) and in 1976 Steve Wozniak designed the first Apple computer. Five years later in 1981 the International Business Machine Company (IBM), who had a virtual monopoly on computers through their main frame technology, introduced their PC. Suddenly suppliers like Microsoft and Apple had a direct path to consumers and consumers had Pricing Clarity in choosing between competing PC suppliers and main frame computers. Early adopters rapidly emerged in Corporate America and our educational institutions so that by 1986 30 million PCs were in use in the United States and the "rest is history" of ever increasing performance and ever lowering prices. And the key *commercial* event wasn't the technology coming out of the laboratory in 1976; it was the Pricing Clarity gained by the American consumer starting in 1981 that enabled Mass Production and dramatic price reductions by 1986!

And the other key element in this PC example was the removal of Barriers to Entry that advantage one technology vs. another (or one company vs. another). Eliminating Barriers to Entry is the second step for unleashing the American Consumer's purchasing power and its ability to drive now prices.

Here's one example of a Barrier to Entry for sustainable technologies. Try finding an ethanol fueling pump in California, Texas or Massachusetts. A key element in Brazil's path in achieving Energy Independence was the government mandating a national grid of ethanol pumps. Today Brazil has 29,000 ethanol pumps that now allow Brazil's automobile drivers to choose between gasoline and ethanol. The United States' government will need to do something similar to Brazil's actions if alternative fuels like ethanol, biodiesel or hydrogen are to provide consumers with price competitive automobile fuel choices and Energy Independence.

Here's a supporting example. The Governor of California mandated that the State's automobiles have flex fuel engines capable of using ethanol (bought from GM!) but the fact is the State's automobile fleet is still burning gasoline. Why? The State doesn't have a network of ethanol fueling stations.

Another example is the challenge in trying to install and connect a solar power system on your roof. Here's a telling question; which is easier to install on your roof, a Direct TV satellite receiver or a solar power system? Except for a very few states like California the process for installing a roof top solar system is complex enough that it is a Barrier to Entry. In California the utilities regulated by the Public Utility Commission must provide "net-metering" in a timely and cost effective manner that enables a roof top solar system to spin the meter "backwards" while the utility still provides a customer with 24/7 electricity service.

So if Pricing Clarity and removal of Barriers to Entry are the critical paths for enabling consumer access to technologies and fuels that can lower pump prices, achieve Energy

Independence and solve Global Warming then the obvious question is what specific actions does a government enact?

There are actually a number of paths outlined in Chapter Thirteen, Energy Pricing. While politics will determine the ultimate solution some basic understanding of Economics including the “numbers” about our fuel and technology options are fundamental to understanding the pro’s and con’s of our policy alternatives.

And that’s the goal of this book; to give you the really big, important “numbers” that define the problems and their solutions. And to understand how to enact these consumer-driven, market-based solutions requires an understanding of some very basic concepts of Economics and Systems Thinking. *Don’t stop reading.*

I know the profession of Economics has become very sophisticated in its mathematics and modeling and this “sophistication” is unlikely to be of much interest to you. But what you need to know is actually pretty much common sense. So with sensitivity toward the entire Economics profession and the University of Florida where I earned my Economics degree; the following is a “layman’s language” primer that will enable your understanding:

Supply and Demand

The price you pay for something is established through marketplace interactions between informed consumers and competing suppliers, with an emphasis upon the words, *informed and competing.*

As identified by Adam Smith, the founder of Economics in his aptly entitle book, *The Wealth of Nations*, government has a role in ensuring that consumers are informed, and that suppliers are engaged in true competition. He saw government as having a critical role of preventing suppliers from harvesting higher profits earned through restricting

competition or conspiring to manipulate prices higher by restricting supply.

Income Effect:

If your income goes up you can consume more, if it goes down, you can't consume as much. This applies also to a country, and the world.

This is a big one regarding oil prices. The reason why oil prices are so high is that the world is wealthier and this wealth is being used to buy cars and other end-uses that demand more oil. I have quoted some oil prices that might now appear either low or high as you are reading the book. If there is a global recession or lower world wealth then the price of oil might now be lower than what I have referenced in the book. But the key point is that the world is getting wealthier (especially China and India) and world oil demand is going dramatically higher over the long term. So don't take too much comfort if the price at the pump has gone down, it won't stay there.

Substitution

Effect:

If the price of one good or service goes up you have an incentive to find and buy a lower priced alternative.

Price Elasticity

(Inelasticity):

Change takes time. So if the price of something goes up it might take a while for you to change your consumption to something cheaper.

But if your income goes up at the same time the price of something you buy increases then you might not change

your consumption even though you pay more; the Income Effect overwhelms the Substitution Effect.

Economies of Scale

(Mass Production):

Think flat screen TVs and computers. The more something is produced the better the manufacturers get at making it and in a competitive market the manufacturers will lower their prices to maintain a competitive price against other competing manufacturers.

Barriers to Entry:

Throw the lower prices to consumers' benefits of Economies of Scale/Mass Production out the window if an existing manufacturer (or industry) can keep a competitor from entering the market.

Boiling Frog:

This is a Systems Thinking concept where if you throw a frog into boiling water it will jump out. If you put a frog into a pot of tap water and slowly bring it to a boil the frog dies. Get it? Our frog has been slowly cooking over the last 35 years since the oil embargo and we now find ourselves paying ten times higher prices, using four times more of someone else's oil and falling into a recession.

Tragedy of
the Commons:

Comes from our Agricultural Age when towns were built around a grassy central park open to grazing. The Tragedy of the Commons was that because grazing was a "free common good" everyone used it and the over grazing killed the grass. If you don't see the connection then please go outside on a warm smoggy day in an American city and breath deeply.

And you need some basic “numbers” definitions:

Billion A billion is a thousand million. The United States consumes 7.5 billion barrels of oil. This is equal to 232 billion gallons. How much is that? You would need a swimming pool approximately 5 feet long, 5 feet wide and six feet deep to hold the oil *every* American adult annually consumes.

Trillion A trillion is a thousand billion, or 100,000 million. So our national debt is \$9.3 trillion and there are approximately 300 million men, women and children in the United States. That means the share of the national debt held by every man, woman and child is around \$30,500 (on top of your mortgage, credit card, car and other debt).

Or here’s another statistic, the War on Terror is costing close to \$3 trillion or about \$10,000 for every man, woman and child in America. Oh, by the way, our national income (our Gross Domestic Production) is \$13 Trillion which if divided by every man, woman and child is \$46,000 per year per person.

Metric Ton 2,205 pounds, so when you hear that the United States is producing almost 6,000 million metric tons of CO₂ (carbon dioxide, the principal Green House Gas) annually that means for every man, woman and child the U.S. is emitting 44,000 pounds a year or 120 pounds per day per person. The next time you are on an elevator think about how you would view CO₂ emissions if CO₂ had the smell of rotten eggs.

Here's another "Ton" example to digest. Quoting the National Mining Association; "On average, each person in the U.S. uses 7,442 pounds of coal annually." That works out to THREE metric tons per man, woman and child in the United States.

Megawatt (MW)

An electricity industry term that is equal to 1,000,000 watts or 1,000 kilowatts (kW) and your typical electric light bulb is 25-100 watts.

A watt is the measure of electric generating capacity or electrical power. An industry rule of thumb is a MW of fossil or nuclear fuel generated electricity serves about 1,000 homes. The United States has approximately 350,000 MWs of coal fired electricity generation.

And a kilowatt hour or kWh is an amount of energy equal to using a kilowatt of power for an hour.

BTU

British Thermal Unit is the amount of heat it takes to increase the water temperature one degree for one pound of water (I promise, this is the last definition I will give you that you really didn't want to learn about.) A BTU is how we measure amounts of natural gas and if you look on your natural gas bill you will see you are billed at a BTU rate.

So with the basics of Economics and energy definitions behind us; jump into this book.

I have tried very hard to keep this book as short as possible while providing all the "core" facts and numbers in the hopes its size will encourage readership.

I guarantee that by the end of the first two chapters you will clearly understand Energy Independence and its technology solutions. The same with Global Warming by the end of Chapter Four.

Succeeding chapters provide valuable numbers on a range of fuels and technologies that should help overcome the confusing “media outreach” (greenwashing) from vested interests regarding their fuel or technology.

And the last three chapters provide the *Consumer Economics* for achieving Energy Independence, lower energy prices and a sustainable environment/economy. And it outlines how we can achieve something this revolutionary in the same time period (eight years) that it took the U.S. to put a man on the moon.