



# RE-VOLT!

Our Impending  
Energy Revolution

**Jeremy Gorman**

**Re-Volt!**  
**Our Impending Energy**  
**Revolution**

**By**

**Jeremy Gorman**



Strategic Book Group

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## Introduction

**E**nergy is what makes things happen. It comes in many forms. Your internal energy is the most critical. It gets you up in the morning and lets you accomplish things. The rest of your energy you buy.

Energy not only comes in many forms, it is used in many forms. We need energy for heat, light, food and for moving things. We need energy for communication and calculation. Each of these demands different forms of energy, so each will be best served by a different source of energy. So far man has not been very clever about his choice of energy sources for his different needs. For example, heat is best served directly by the sun, or by stored solar energy in fuels. Wind, water, wave and tidal energy are not well adaptable to heat production. Communication and calculation are better served by photovoltaic, wind or wave energy because they use the low voltages supplied by photovoltaic and wind sources. Making electricity from coal and sending it 100 miles to your computer is a wasteful enterprise. We can easily replace that system with practical sources close to home. *Re-Volt!* is the manual for matching the source to the need. That is how we will make the energy of the future effective for everyone.

Man has been increasing his energy demand since he first lit a fire about 30,000 years ago. We buy ever increasing amounts of coal, oil, electricity, gas and wood. As a result, those supplies are decreasing and their cost is mounting. We have cut down over half of the world's forests.

We have used up all of the easily accessible oil that nature left for us. And that's not all. Burning those fuels is changing our atmosphere. We are making the earth warmer. We face a dilemma.

Energy is the world's largest industry, with the possible exception of food, and food itself is a huge energy consumer. In the next thirty years the world is going to stand that industry on its head, as the cover of this book shows. This revolution will affect more people than the Industrial Revolution (about 2 billion people) or the Internet Revolution (almost 5 billion people). You will be involved, whether you like it or not. So join the fun. This book is your survival guide. It discloses, explores and explains not only present practices, but also how we got here and what you must do to make the coming change beneficial. Better still, *Re-Volt!* invites your ideas and your solutions to the problems we face. The problem is immense, but there is no problem too big to solve if we all get involved. Join in. You will be involved anyhow, so it might as well be by choice and in support of your goals and aims. If we do it right, it will not only be informative, it will be fun. If we work together, we will all be winners--even Big Oil.

Energy is everywhere. We are bathed in more solar energy every day than all mankind uses. In addition we have the energy of wind, rivers, geothermal, tidal and ocean currents. We ignore 99.9% of it. Why? We have had the science to use the energy of the sun, the wind, the tides, the streams and the geothermal energy in the earth for over 100 years. We need to build an alternate energy industry to supplement the current system and take control from Big Energy and put it in the man-in-the-street. We need to stop warming the earth. We need to keep the price of energy affordable. We can!

From the World War I until about 1980 the United States was the manufacturing dynamo of the world. Then American management decided that our labor costs were too high and they began shipping our manufacturing facilities overseas to capitalize on cheap labor in countries that suppressed their people. Since then, they have shipped at least 13 million U.S. jobs overseas. Those jobs will not come back, because we also gave away the manufacturing know-how that allowed us to out-produce any other workers in the world... That leaves 13

million Americans unpaid or underpaid as they take menial or part time jobs to support their families. That means that our U.S. market has declined by at least 10%. The unrecognized problem is that the low-paid workers in the foreign countries still can't afford to buy what they make, so their output has to come back to the U.S. to be bought by a smaller buying public. We shrank the world market by underpaying its workers. The executives, meanwhile, have never had it so good. Their salaries have more than tripled in that time. They are bleeding their own workers. They love globalization, because if we can't support them in the U.S. , they will move their headquarters to Bali, or Shangri La. Already Exxon Mobil pays no U.S. income taxes on their \$20 billion earnings because their earnings are either claimed to be in the Bahamas and Bermuda, or because they have finagled special tax relief for developing "New" sources of fuel. Their lowest paid U.S. worker pays more U.S. income tax than they do!

We have millions of creative unemployed people who want to work. Even a first grader can put those ideas together and ask "Dilemma? What dilemma? That's an opportunity!" Let's employ those millions in alternate energy instead of financing Al Qaeda and the Taliban with oil money. Let's use those new technologies to stop melting the polar ice cap. Let's make environmentally sound new products to sell to other needy nations and eliminate our outrageous trade deficit. Let's make small energy efficient cars that will sell anywhere in the world. Let's manufacture energy devices of value so our GDP increases and pays our monstrous national debt. Where *is* that dilemma?

Long overdue, and exacerbated by our "let the other guy do it" attitude, the vast world of alternate energy is finally beginning to come into its own here in the United States. It has already begun in many other countries. Burning stored solar energy resources is so easy that we have neglected other sources of energy. Most of our energy comes from the sun, which bathes this earth with six times as much energy every day as all mankind uses. We ignore, neglect and undervalue 99.9% of that immense resource as a matter of routine daily life. Wind, waterfalls, wood, and fossil fuels—these are natural sources of solar energy. Nuclear, tidal, ocean currents and geothermal energy are sources of non-

solar energy. We will use them all. Our insatiable demand will force us to. *Re-Volt!* explains all that in detail. It is your guide to the creation of an entire new alternate energy system to supplement the one we already have. It offers creative solutions to the use of all those alternatives. It also invites the reader's ideas. We are all going to be involved. Let's enjoy the process.

Many of us think that some great cosmic flash will come along and solve our energy problem. No Way! There will be hundreds, perhaps thousands of alternate energy sources that fill little energy niches formerly filled by oil, coal or gas. That is as it should be because energy, which is used everywhere, exists everywhere. Current supplies have been so easy, that we ignored an overwhelming supply, while complaining about rising fuel prices. The science for using these alternate sources has been around for over 100 years, but the technology to capitalize on it is retarded, leaving a growing gap between demand and supply. Oil, coal and natural gas are wonderful resources, but they are finite. We have used more oil than we have discovered for over thirty years, and our demand is increasing while the supply is decreasing. We don't know if we will run out of fossil fuels in 5 years or 500 years, but we know that we will!

What is this energy revolution? Many of us think that it will be the utilization of alternates to the burning of fossil fuels. They are half right. The real revolution will be the transfer of *control* of energy from a few profit-driven corporations to the man in the street. Note that it is not the transfer of all energy sources from those huge organizations, but *control* of energy. They will continue to supply 40% to 70% of our energy. That is as it should be. They have been extremely effective and creative. That is why they gained their position of dominance. However, dominance is an invitation to abuse. The massive energy industry has abused that dominance in the past, and will do so in the future, unless we make a concerted effort to wrest that control from them. Do you want to pay \$8/gal for gasoline in 2016? You won't if you help establish alternatives that can be generated in smaller amounts almost anywhere. Rather than create a few massive alternate energy companies, we need to create thousands of small alternate energy companies that employ you and

your neighbors. That will keep the energy companies in line. When OPEC arbitrarily raises prices again (and they will) customers can say, “Forget it! I’ll make my own or get it someplace else.”

Over 95% of our current energy supply is sun-derived. Oil, gas and coal are stored solar energy created over millions of years by living creatures. Green plants used solar energy to convert atmospheric carbon dioxide, the raw material or ore, into living things. At death a slow decaying process forms fossil fuels. When we burn those stored energy materials we put that carbon dioxide (CO<sub>2</sub>) back into our atmosphere where it absorbs heat and causes global warming. Man has created an exponential increase in energy demand that has gotten out of control. That increase is destroying that delicate environmental balance that spawned essentially all present life forms. If our outrageous demand continues to be out of control, we will cause a major environmental change worldwide, like the one that destroyed the dinosaurs, the dominant earth species 60 million years ago. As the current dominant species, do we want to be next?

*Re-Volt!* has three major objectives:

1. Look at our current energy supply and examine its flaws and potentials.
2. Analyze and capitalize on our myriad alternate energy resources and develop a new system to supplement our supplies. We should develop an alternative source for every kind of the energy we use.
3. Restore the balance of our largest energy raw material, atmospheric CO<sub>2</sub>, to the 280 ppm that spawned all current life forms on the planet.

*Re-Volt!* does not take a “good guy, bad guy” approach to our current energy source. We all are the bad guys. We have created an outlandish energy demand and didn’t bother to look at its basics. Energy suppliers answered that call and did it well. We all made the mistake of looking for the easiest rather than the best sources of energy. Those sources were not the cause of our profligate and wasteful use of energy—we were. Energy suppliers just capitalized on our shortsightedness. It’s time we faced up to our error. We may be forced to.

# Chapter 1

## Energy is Everywhere

**T**hanks to Al Gore's marvelous *An Inconvenient Truth* we are all finally aware that energy is a critical resource that is abused, misused and wasted. But there is more to Al's message, although it seems less obvious to most of us. Energy is *our* issue! It is not Al Gore's, or Uncle Sam's. It is not GM's, or Con Edison's. It is yours—and mine. Man has been quite creative about energy, and has developed ever better sources of energy. But it is important to note that we have without exception chosen the easiest route to energy--not the best. Prehistorically, we burned wood. Then along came coal and eventually oil. In each instance, we overemphasized the easy, and discounted the others.

*An Inconvenient Truth* revealed to all of us that the energy problem we face is not entirely new, and is much more complex than most of us believed. It comes in three forms. First our demand exceeds our current sources of supply. Second, that current supply is literally changing our earth's atmosphere, perhaps fatally. Third, the expense, not only financially, but politically, is out of control.

Let's take a look at demand. Our current fossil fuel usage (U.S. figures) is outrageous:

U.S. Energy Consumption

| Source   | U.S. Annual Usage  | Energy Produced       | CO <sub>2</sub> Emitted |
|----------|--------------------|-----------------------|-------------------------|
| Oil      | 1.215 Billion Tons | 43.6 Quadrillion Btu* | 3.74 Billion tons       |
| Coal     | 1.128 Billion Tons | 37.2 Quadrillion Btu* | 3.90 Billion Tons       |
| Nat. Gas | 0.417 Billion Tons | 19.7 Quadrillion Btu* | 1.15 Billion Tons       |

\* British Thermal Unit-heat required to heat a pound of water 1° F

That's 11 tons of fossil fuel each year for every man, woman and child in the United States. It also represents 8.3 Billion tons of CO<sub>2</sub> emitted (27 billion tons worldwide). Take note of a major difference between greenhouse gas (CO<sub>2</sub>) emissions from our various energy sources. Coal produces 4774 Btu per pound of CO<sub>2</sub> emitted, while oil produces 5836 Btu (a 22% increase) and natural gas 8560 Btu per pound of CO<sub>2</sub> emitted (a 79% increase). Those are significant differences.

Important facts:92% of that coal and 26% of that natural gas makes electricity. Because of other sources, including hydroelectric power (6%), nuclear power (19%), and wind power (1%), only 48% of our electrical energy comes from coal, our worst polluter. Note that electricity is not a source of energy, but a carrier of energy. It is our most popular method of moving energy from one place to another.

A word about the significance of the greenhouse gas emissions:The earth's atmosphere contained 1.4 trillion tons of CO<sub>2</sub> for at least 60 million years. All life on earth grew up in and adapted to that delicate balance. I call it a delicate balance, because life continually generates CO<sub>2</sub> as things die, decay or get burned and as animals breathe. But trees, plants and algae constantly take atmospheric CO<sub>2</sub> and create new living things out of it using the energy from sunlight. Starting about 700 years ago, man began cutting down the trees and burning fossil fuels in huge volumes. We screwed up that balance and, just in the past 100 years, have increased the atmospheric CO<sub>2</sub> by 540 billion tons—a 39% increase in one century. Do you really believe that the plants and animals that

live in this atmosphere could completely ignore such a major change in a vital source of their livelihood? Carbon dioxide forms an acid in water and in the blood. There is a remarkably sensitive balance in your system. As the blood CO<sub>2</sub> increases (called hypercapnia), the acid increases and your blood vessels dilate to allow more blood to flow and supply more oxygen and flush out the extra CO<sub>2</sub>. Changes of ten parts in a million will change the acidity enough to cause that process to begin. Man has increased the CO<sub>2</sub> of the air you breathe by 100 parts per million in the past century. It seems probable that such a change will change the chemistry of your body substantially. Are we about to cause serious physiological changes in people and animals all over the world?

We are incredibly wasteful of energy. We waste as much as we use. (Yes, that includes you.) We could reduce our energy usage by 20% without missing a single TV show, a single meal, a single ride to work, or causing our homes to get uncomfortably cold. Energy has been so cheap that we didn't really consider its cost.

By far the easiest way to obtain energy is to burn something. Nature has been storing solar energy for billions of years, and it is easy just to light a fire and live off that stored energy. There was plenty of it when the world contained half a billion people. So mankind was casual and profligate in its use. Each of us demanded more and more. When you build a fire in an open pit, fully 95% of the heat you produce is wasted and just heats and pollutes the atmosphere. However, the forest was full of trees, so we just cut down some more.

We got a few warnings long ago that this was not the best way to get your energy. Easter Island completely denuded its environment, and the culture just disappeared somewhere between 700 and 1700 AD. It had consumed all its natural energy resources and could no longer sustain itself.

We got another warning in Greenland. The Norse established a culture on Greenland in 985 AD. It had essentially the same fate in 1425 AD as had Easter Island. In that instance, however, they went back to Norway.

We didn't learn. We continued on the easy route--burn up all that stored energy, and the devil take the hindmost. The problem is that the

devil will! And it looks like, after 6000 years, we will be the hindmost!

Americans began considering alternate sources of energy somewhere around the Civil War. A few “nutcases” suggested that we had better look for other energy sources. But coal and later oil were so easy, and there was so much of it, that those oddballs were disregarded and even mocked. Despite this, however, windmills were a major source of power on many farms for over 100 years. Windmills were mostly used to pump water, or mill grain, but they were a substantial source of renewable energy. In 1859 oil was discovered in Pennsylvania. That began a major change that ultimately completely dominated the energy industry—even dwarfing the use of coal, which had been used for over 800 years. There is no doubt that oil was the most cost effective energy source and so it dominated the energy industry worldwide.

In 1859, there were less than 2 billion people on earth. Many of them lived in warm climates that didn’t need much energy, at least not for heat. Mankind went crazy building coal and oil-fired plants everywhere. Efficiency? Pollution? Who cares? We have an unlimited source of energy. Why not use it?

The problem was that it was not unlimited and pretty soon we were looking for oil all over the world. Demand grew exponentially, but supply did not! Enter international politics. Some countries in which Americans had discovered oil decided that they had an opportunity to capitalize on our outrageous demand for oil. Why not nationalize the oil wells and charge more for the oil. The Organization of Petroleum Exporting Countries (OPEC) was formed by five nations in the 1960’s. They began nationalizing oil supplies and grew to 13 nations by 1972. They agreed to an oil embargo in 1973 for the purpose of raising the price of their oil. By then they were a major source of worldwide oil. Since OPEC’s embargo we, as a nation, have made some improvements in our energy efficiency, but we still have a long way to, go. In fact, despite the embargo, our U.S. imports rose from 45% of our oil consumption in 1973 to 65% in 2006. Meanwhile, OPEC representatives meet regularly and set the price of oil arbitrarily to their advantage.

Efficiency is not the whole story. We just turn up the heat or drive ten miles to the shopping center. That must stop. We have to learn about

energy conservation—a concept we neglected because energy has been so cheap. That will take a massive public education program. It will also find lots of opposition among the people it affects.

The OPEC embargo gave us fair warning in 1973, and we listened briefly. But as soon as the price came down again, we abandoned our efforts at alternate energy. How could we have been so, stupid? They had already showed us what their intentions were, but we didn't want to listen. We threw away 35 years.

So it happened again in 2006. The price of oil began increasing, slowly at first, but increasing rapidly in a short while. But we had given away our opportunity, and we were paying \$700 billion per year for oil from antagonistic foreign governments. We had not developed the alternatives we began in the 1970's, and had become even more dependent upon oil. The oil companies loved it. OPEC loved it. They thrived on it. They exercised political power and disrupted trade. They invaded our financial system. They challenged our international efforts and called us bad names. In fact they ruined our worldwide reputation. And we let them!

Can we learn this time? Of course we can, but remember; this is our task—not our government's or our oil companies. When gasoline was \$4.50/gal, and many people couldn't afford it, altruistic Exxon Mobil recorded the largest corporate profits in the history of mankind. There is the message! The task is ours---it is not the governments, and it certainly is not Exxon Mobil's. It is not even Al Gore's. We must seize the sources of energy and bring them back to the people. That is the goal of *Re-Volt!* I hope to be able to stimulate every one of us to take it seriously. This will be your Re-Volt! It will not be hard. Energy is in your back yard already. All you need to do is learn how to use it.

There is another facet to this. Nature has distributed energy everywhere. Sunlight falls all over the earth. Water is pretty largely universal—so much so that we call water-deprived places deserts. Forests grow on every continent except Antarctica. However, we get almost all of our energy from small pockets of energy rich materials. Most of the energy that you use comes from hundreds of miles away, while at the same time we ignore the energy that is in our back yard.

Isn't it about time we took a close look at that process? Is this really the best way for us to get powered up? Why ship oil from Saudi Arabia to New England when energy abounds in New England? We have gotten off track. Actually the commercial interests that supply energy have led us off track. That must change, but it won't happen by itself. Big Oil will oppose all such effort and they will use some of their profits to underinform or even misinform you to make sure that change does not occur. Shall we let them?

Don't get me wrong. Big oil is not a bad guy! He is a commercial guy whose primary purpose is to make money. The better he is at supplying our energy the more money he makes. Who can blame him for advertising what he has to sell? It is *our* job to find other sources. Big oil will not unless they can make money on it. They already own much of the oil sands in Canada and much of the oil shale in the American west.

Aaaahh. There's the rub! Oil and coal companies don't own the shale oil, or the oil sands. In fact they don't own the oil in their own oil fields, or the coal in their mines. What they do own is the right to mine and exploit them. Those are natural resources. They belong to the earth. We have had some confusion about that for about 100 years, since the oil companies convinced our government to give them a depletion allowance for the oil they drill. They are depleting a natural resource and should instead be charged a depletion tax for the declining natural resources on which they have a license to make a profit. That is one reason oil has been such a bargain, and a major reason for our profligate use of it.

Big Oil didn't create that oil. Nature developed a method of storing solar energy. With the intercession of chlorophyll, living plants use some of the energy in sunlight to convert water and carbon dioxide from the air into sugars, starches, cellulose and other organic tissues from which living creatures are assembled. When they die, they are processed by trillions of microbes into "fossil fuels"—the name we give to organic matter that can be burned to release the solar energy that they have absorbed. The coal, the oil, and the natural gas were made out of the carbon dioxide from our atmosphere. Burning them returns that carbon dioxide to that atmosphere. That seems like a normal cycle. The least we

can do is to make good use of that energy we extract in that burning process. We don't. And worse, we continually destroy the very trees that make that conversion for us. Remember Easter Island?

Man gets carried away with his projects. We are burning hundreds of times as much organic matter as nature is creating. That is at least in part because we keep cutting down nature's trees that clean our atmosphere for us. The net vegetation content of the earth is declining, because we are so profligate in our use of energy. In the past energy has been so cheap, that we didn't bother to be careful or efficient in its use. We waste more than we use. We are profligate in our reproductive process as well, and the human population of the earth has exploded. As energy became more available, we created more humans to use it. We overdid it. We are returning far more carbon dioxide to the atmosphere than the remaining plants are consuming. The carbon dioxide content of the atmosphere was about 280 parts per million for at least a million years--probably much longer. In one century, man has changed that. We brought the carbon dioxide from 280 to 390 parts per million in one century. In doing that, we discovered something. Carbon dioxide is a sunlight absorber. As it increases, things get warmer. The carbon dioxide retains more of that solar heat. For at least one hundred million years nature, which is remarkably adaptable and flexible, built our current ecosystem. And generations of its inhabitants adapted to that system. Suddenly, at least on a geological scale, we have changed that ecosystem. It already has caused remarkable changes. We are melting the polar ice caps, which apparently had a much greater influence on our climate than we realized. Whole species are dying, and others are moving. Ocean levels are beginning to rise, and to threaten low-lying coastal areas. Worldwide about one hundred million people live within 25 feet of sea level. A 20-foot rise in the oceans would cause untold human displacement and misery.

Some claim that these are normal changes caused by nature. Please note, however. We had a major climate change once before. It completely wiped out the dominant creatures of this earth--the dinosaurs. As the dominant species on earth today, we ought to at least consider that. Are we next? Suppose we aren't the cause of the climate change. Working to

stop it certainly won't hurt. It might employ thousands of our currently unemployed. If we are a contributing factor, such action may well save millions of lives and perhaps the whole race of man. Considering our past history I'm not sure that man's extinction would be such a bad thing for this earth.

We are now in a serious recession of our own making. This book contains many ideas for helping us out of that recession. These are not the only ideas. They may not be the best ideas. They are largely confined to energy production and use. Most important, they are stimuli for your ideas—the ones that will employ us, make us energy independent and pollution free. The ones that will bypasses the carbon cycle and change us from a burning society to a society that goes directly to the sun for much of our energy. One that bypasses Big Oil, The Grid and Enron. It can be done. It will be done *if* we all join in and do our part every day. It is a fertile field. It is a sponge for ideas—your ideas. We literally have a world to save. The caveat is not “Yes they can”, or “Yes you can”, but “Yes *we* can!”

It may be worthy of note. The characteristic of man that has set him apart from all other creatures is his ability to cooperate. Almost everything we see and use in life today is a result of the cooperation of man. Buildings, roads, automobiles, computers, cell phones---even grocery stores and shopping malls, are the result of our working together. Why do we spend so much of our time fighting? Getting together to revamp our energy supply will require cooperation. Look at this, though. Cooperation is fun. We meet wonderful new people and learn fascinating new things together. Have you a better idea? Let's hear it.

While addressing cooperation, please take note. At the end of every war we always have a negotiating session to settle the terms we fought over. Grant and Lee at Appomattox was a famous example. Why don't we negotiate first, and eliminate the war part of that equation? We continually say that we don't want to talk to Iran or to North Korea. Why not? Isn't that better than fighting with them? *Re-Volt!* is about cooperation. Let's eliminate the fight.

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