THE ENERGY REVOLUTION

277 THINGS EVERY AMERICAN NEEDS TO KNOW ABOUT THE NEW ENERGY PARADIGM

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THE VISION of the Alternative Energy Association is to use progressive seminars, educational activities and marketing campaigns to raise the public consciousness of environmentally friendly and energy efficient methods, products, processes and technologies as our society transitions from fossil fuels to green energy.

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The Alternative Energy Association is proud to present

<u>THE ENERGY REVOLUTION – 277 THINGS ALL AMERICANS NEEDS TO KNOW ABOUT THE NEW ENERGY PARADIGM</u>.

This publication is a part of the AEA's continuing mission of promoting awareness of clean, renewable sources of power generation as alternatives to the use of fossil fuels for energy production.

This publication is provided to the public at no cost, and you are encouraged to pass copies of <u>The Energy Revolution</u> to all of your friends, family, business associates, teachers, and particularly you local, state and federal elected officials.

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INTRODUCTION

I don't have a pony tail. I don't hug trees.

I do not own a pair of Birkenstocks. I'm not some kook. Not that there is anything wrong with any of those things, but mainstream America has a tendency to view those people as "suspect" and out of touch with reality. Unfortunately, many of the traditional environmentalists are also viewed as alarmists and "Chicken Littles" running around talking about how the sky is falling.

As for myself, I have been a corporate lawyer for over 30 years. I have spent my life advising businesses of all sizes. I have represented everything from "mom and pop" businesses to major national and international corporations. I have been about as mainstream as it gets. All of the work I have ever done has been based on study, analysis and research. I have been studying energy issues for a number of years. Anyone who doubts the severity of the problems that we face has not done any homework on energy consumption patterns or energy reserves whatsoever.

We have a problem. A big problem. There is an elephant in the room that is just beginning to be acknowledged. We must respond. We must act. And we must do it now. It may already be too late to save America from a state of chaos.

I first became interested in our problem many years ago, during the OPEC oil embargo. My interest was fueled by a close relative, my uncle, a developer who started building passive solar homes and using solar hot water heaters in the 1970s in New Mexico. He was way ahead of his time, and it fascinated me.

Like many others, I sat in the gas lines in the 70s. The sad part of that whole situation, that few people realize, is that OPEC only reduced our supply of oil by about 5%. That slight reduction caused chaos in America. Few realize that the government had already printed gasoline ration coupons, and was prepared to begin a gas rationing system similar to the one that was used during World War II. Before it was implemented, OPEC opened the spigots again, and the crisis disappeared. They made their point, and they tested their strength. OPEC then fully understood the power that they held.

We must all understand that the problem is not that we will run out of oil in twenty, forty, or sixty years, but that with increased consumption and decreasing supplies, the next five percent reduction will not be artificial, and will not be quickly resolved as it was in the 1970s. In fact, we will probably never actually run out of oil completely, because at some point the cost of oil will be simply too high to justify its use.

We sit here today with about two thirds of the world's oil reserves in the Middle East. Other countries with large oil reserves are Venezuela and Russia. We are at the mercy of our enemies, and don't think they won't use it to their advantage. One third of the largest oil reserves are in Iraq. Let's be honest, that is why we are there. Not to steal their oil, but to just keep it flowing and to try to keep if out of the hands of the wrong people. This is no secret to our government, and not to anyone who has done some basic research. If you doubt this, ask yourself, did we send troops into Darfur? Did we send troops into Tibet? Of course not, there are no substantial reserves of oil in either of those places.

We don't have an energy crisis, we have a fuel crisis. It is a crisis we can solve, but it won't be easy. It will be an awesome challenge. The next president will face this challenge. And the one after him. It will be a greater challenge than landing a man on the moon, and sadly, a greater challenge than the aftermath of 9-11.

Where is Congress? The next time we are sitting in gas lines, no one will care that baseball players took steroids. People will care, however, that Congress spent months of precious time and energy trying to find out which baseball players took steroids, and not much time addressing the largest challenge our country has ever faced. Maybe they were trying to find out if we could use steroids to run our cars.

Congress will finally act when there is a groundswell. Without a grass roots movement it will be business as usual in Washington until it is too late to avert a disaster.

The purpose of this publication is to be an introduction and a basic primer for those who have not had the time to do any research on this topic. It is not meant to be an in depth treatise on alternative energy, but a quick study, a guide, that can easily and quickly be read by everyone, presented in "bite size" pieces. There is a huge amount of good, in-depth, information available on these subjects in the marketplace. One of the problems for most people is trying to figure out where to start to learn the basics about the issues and the problems. That is the purpose of this publication, to be a starting place for your energy education. You will have enough information after reading this to be able to pick up any publication on any of these subjects and feel like you are starting from a position of knowledge.

In the summary section I will offer my conclusion, reflections, and opinions. These are mine, and you should feel free to disagree and to develop your own view of our situation and its solutions. If I have stimulated you to focus on the issues and think about solutions, this publication has been a success.

CHAPTER ONE - OIL

Basic facts about consumption

1. The United States consumes 21 million barrels of oil per day (bbl/day), and 66% of our oil comes from foreign sources.

2. Each barrel of oil contains 42 gallons or 159 liters.

3. Each barrel of oil yields 19.4 gallons (or 75 liters) of gasoline.

4. About one-half of each barrel of oil is used for gasoline, with the balance used for the manufacture of thousands of other products.

5. Americans consume about 180 million gallons of gasoline per day.

6. The United States is the largest consumer of oil in the world.

7. The United States is responsible for 25% of all oil consumption in the world.

8. By 2030, the Energy Information Administration projects that overall energy consumption in the U.S. will increase by more than 30 percent, rising from 100.1 quadrillion Btu in 2005 to 131.1 quadrillion Btu in 2030.

9. Although we reached peak oil production in the 1970s, the United States is still the third largest producer of crude oil in the world.

10. Over Sixty per cent (60%) of the oil consumed by the United States is from foreign sources.

11. India has a population of 1.1 billion people.

12. India's economy is growing at a rate of approximately 9% per annum.

13. Oil consumed by India is expected to increase by 28% by 2013.

14. China is the second largest consumer of oil in the world.

15. China's oil consumption will double over the next ten years, with China increasing its use by 10% per year.

16. As of 2008, each Chinese resident consumes 1/6 of the energy consumed by each American.

17. The population of the United States is approximately 300 million, and the population of China is approximately 1.3 billion.

Who is OPEC?

18. The Organization of the Petroleum Exporting Countries is a consortium of 13 countries. They are Algeria, Angola, Ecuador, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, The Untied Arab Emirates and Venezuela.

19. OPEC controls the majority of the world's oil reserves and accounts for 40% of the world's oil production.

20. By reducing production, OPEC can create oil shortages, resulting in increased oil prices.

21. In the 1970s, OPEC tested its strength by reducing production by a mere five percent (5%), resulting in near chaos in the United States and other dependent countries.

22. OPEC publishes an annual report which discloses future supply, forecasted demand and ultimate recoverable reserves of oil. In its 2007 report, OPEC stated that the conventional oil resource base is sufficient to satisfy demand increases over the projected period until 2030 at a price of $50-60 per barrel, increasing afterwards to account for inflation. Oil prices per barrel in July 2008 reached $145 per barrel.

23. The oil producing nations have consistently and intentionally vastly overstated their oil reserves, by constantly revising their estimated reserves upwards when no additional oil has been discovered.

24. The United States created the Strategic Petroleum Reserve (SPR) to avoid future short term interruptions of the supply of oil.

25. The SPR stores about 700 million barrels of oil in underground storage along the Gulf of Mexico. If all oil supplies were completely cut off, with rationing, this reserve could last up to 60 days.

What our government knows

26. In 2005, the US Department of Energy published a report titled "Peaking of World Oil Production: Impacts, Mitigation, & Risk Management."

27. Known as the Hirsch report, it stated, "The peaking of world oil production presents the U.S. and the world with an unprecedented risk management problem. As peaking is approached, liquid fuel prices and price volatility will increase dramatically, and, without timely mitigation, the economic, social, and political costs will be unprecedented. Viable mitigation options exist on both the supply and demand sides, but to have substantial impact, they must be initiated more than a decade in advance of peaking."

28. The Hirsch Report is the scariest 91 pages you will ever read, and it's not fiction.

29. According to the Hirsch Report, world oil peaking is going to happen, and will likely be abrupt and revolutionary.

30. According to the Hirsch Report, oil peaking will adversely affect global economies, particularly those most dependent on oil.

31. According to the Hirsch Report, mitigation efforts will require substantial time. A 20 year time frame is required to transition without substantial impacts. A 10 year rush transition with moderate impacts is possible with extraordinary efforts from governments, industry, and consumers.

32. According to the Hirsch Report, liquid fuels are the main problem, due to growth in demand, mainly from the transportation sector.

33. According to the Hirsch Report, late initiation of mitigation may result in severe consequences. It is a matter of risk management since mitigating action must come before the peak. Without massive mitigation more than a decade before the fact, the problem will be pervasive and will not be temporary. "The world has never faced a problem like this."

34. Government intervention will be required.

35. Economic upheaval is not inevitable. "Given enough lead-time, the problems can be solved with existing technologies."

36. In my opinion, we don't have enough lead time.

CHAPTER TWO – COAL

37. Coal is not all the same, and different forms of coal have different energy contents.

38. Coal is divided into anthracite, bituminous and lignite, with anthracite having the highest energy content.

39. Bituminous coal has about one-half the energy content as anthracite. Lignite has about half or less the energy content of bituminous coal.

40. Based on energy content, U.S. coal production peaked about ten years ago.

41. Coal provides about 25% of the world's energy production.

42. About 40% of worldwide electricity production comes from coal.

43. China is the largest producer of coal, and also consumes 36% of coal worldwide.

44. China is opening one new coal fired power plant every three days, according to recent estimates.

45. While China is producing and using coal in massive quantities, it has not revised its estimates of its coal reserves in over 20 years.

46. While the United States claims to have 27% of the world's total coal reserves, and a 250 year supply of coal, the reality is closer to a 50 year supply.

47. Coal is the dirtiest fossil fuel used by man, emitting mercury, caustic ash, radioactive uranium, thorium, carbon dioxide and other greenhouse gases.

48. Carbon capture and storage (CCS) is often referred to as clean coal technology.

49. CCS is a process where carbon dioxide is removed from the coal power plant emissions and injected into old oil and gas wells for storage. It is also referred to as "carbon sequestration."

50. CCS has not been widely implemented because it is an expensive process.

51. Since our biggest future concern is the availability of liquid fuel to run our vehicles, CTL technology (coal-to-liquid) is being developed.

52. CTL technology was first used in World War II by Germany since it had limited oil supplies but substantial coal reserves.

53. CTL technology creates synthetic fuel for use in vehicles and airplanes.

54. The bad news about CTL synthetic fuel is that it emits twice the greenhouse gases as ordinary diesel fuel.

55. CTL technology is extremely expensive. A CTL plant is under construction the United States which will cost over $1 billion.

CHAPTER THREE - ELECTRICITY

Watts, Kilowatts, Megawatts

56. A kilowatt is one thousand (1,000) watts, referred to as kW. A megawatt is one million (1,000,000) watts, referred to as mW. A gigawatt is 1,000 megawatts, referred to as gW. These terms are commonly used in the power business when describing generation or load consumption.

57. Watts measure instantaneous power while watt-hours measure the total amount of energy consumed over a period of time. For example, a one hundred watt light bulb is rated to consume one hundred watts of power when turned on. If such a light bulb were on for four hours it would consume a total of 400 watt-hours (Wh) of energy.

58. The term kilowatt hours, referred to as kWh, is a standard measuring yardstick when looking at consumption of electricity in your home, and means one kilowatt of power consumed for one hour.

Power Generation Basics

59. Power plants have a rated capability which describes how much power they can generate at peak load, or rated capability (for example, a 100 mW plant can generate 100 mW at peak load).

60. A power plant is designed to serve the peak load, but the actual load will vary.

61. Average production of power is lower than the rated capability. The ratio of a power plant's average production to its rated capability is known as “capacity factor.” For example, the 100 mW plant referred to above might have an average production of 75mW, giving it a 75% capacity factor.

62. “Load factor” is calculated by dividing the average load by the peak load over a certain period of time. Using our example of a 100 mW plant, if the load averaged 50 mW over a year, then their would be a load factor of 50%.

63. For power generators, it is important to know the load factor since knowing the peak and average demand of a power system is critical to proper planning.

64. Residential homes tend to have low load factors because people are home and using appliances only during certain hours of the day, while certain industrial customer will have very high load factors because they operate 24 hours a day, 7 days a week.

65. All of this is important because by generating power at the source of its use (your home, for example), we can reduce our local utilities need to build additional plants, and help to avoid brownouts and blackouts. This could be done primarily through the use of grid-tied solar photovoltaic (PV) systems, and in the appropriate locations, by small wind turbines.

Residential Consumption

66. There is a myth that one megawatt translates into enough electricity to supply 1,000 homes.

67. Residential electricity consumption varies generally by region in the United States. New England residents use the least amount of electricity, (averaging about 700 kWh per month) and the residents of the South using the most, (averaging about 1,200 kWh per month) generally due to higher use of air conditioning.

68. To really know how many homes one megawatt could power, you need to know the power plant's rating and capacity factors.

69. Most utilities use backup generation sources and electric energy storage to ensure that they are always generating enough power to meet the load demand.

70. Depending on your location, the utility's rating and capacity factors and the load demand, one megawatt can supply power to anywhere between 300 and 800 homes.

71. Generating power at the point of consumption (like your home or business) is referred to as decentralized power generation or distributed power generation. Power generated at power plants and transmitted over the grid is referred to as centralized power.

72. Decentralized power generation via solar power or wind energy, reduces the reliance on "the grid", and creates a much more scalable, reliable, power system overall. In addition, it avoids the transmission loss of approximately 7% of the power that is inherent in distribution of centralized electricity.

73. According to the Energy Information Administration, world electricity generation will need to double by 2030.

CHAPTER FOUR - BIOFUEL

74. Biofuel can be broadly defined as fuel derived from plant material, primarily photosynthetic plants that capture solar energy. Many different plants and plant-derived materials are used to manufacture biofuel.

75. Analysts frequently look at "energy balance" to assess a biofuel. The energy balance of a biofuel is determined by the amount of energy that goes into the manufacture of fuel versus the amount of energy released when it is burned in a vehicle.

76. Studies that calculate energy balances for biofuel production show large differences depending on the biomass feedstock used.

77. The energy balance is more favorable for biofuels made from crops grown in subtropical or tropical areas since these crops have an increased yield of biomass due to a year-round growing season.

78. Energy balance value alone is not meaningful in evaluating the benefit of ethanol or any other biofuel. For an appropriate analysis, a product's energy balance must be compared with the energy balance of the product it replaces. Compared to gasoline, any type of biofuel substantially helps reduce fossil fuel and petroleum use.

79. The energy used for each unit of ethanol produced in 2008 has been reduced by about half since 1980. Measured in British Thermal Units or *Btu*s, ethanol uses 40% less *Btu*s to produce than gasoline.

80. The "food vs. fuel" debate has moved research away from corn and other materials that could be used for food production.

81. Proponents of corn ethanol argue that the corn that is used is not fit for human consumption and is used to feed livestock. In addition, the corn ethanol has a byproduct called distillers grains (DDG) which is used to feed livestock.

82. Every major auto manufacturer approves the use of ethanol blends up to 10% under warranty. Ten percent (10%) is the most common mix found at today's gas stations. Cars built since the 1970s are fully compatible with a 10% percent mix (E-10), and ethanol does not harm car or truck engines.

83. It is a myth that there is not enough land to grow crops for ethanol. This myth is also based primarily on corn, and doesn't take into account conventional celloulosic feedstocks such as switchgrass and similar materials. These feedstocks can significantly decrease the amount of land needed to grow energy crops.

84. Seventy five percent of all new cars in Brazil are flex fuel cars that can run on E-10 or on straight sugar cane ethanol. Brazil no longer has any need to import foreign oil, and has become energy independent.

85. While many researchers believe that many biofuels are non-scalable solutions to the current worldwide energy crisis, biofuels have the ability to provide some of the interim solutions to dependence on foreign oil by the United States, and approaches like the use of algae to create biofuels could ease our problem.

86. An analysis of the biofuel market by a well know petrochemist determined that we could only produce about 30 million barrels per day of biodiesel even if we planted four million arable acres of land, assuming that a feedstock like corn is being grown.

87. The first commercial algae to biofuel plant is scheduled to open in 2008.

88. The USDA recently completed a five year study which found that switchgrass can produce 540% more energy than was used to grow it and process it into cellulosic ethanol.

89. Cellulosic ethanol from switchgrass can reduce greenhouse gas emissions that are 94% lower than the greenhouse gas emitted by burning gasoline.

90. Land used to grow switchgrass does not need to be the most arable land, but can be marginal erodible land.

91. Biodiesel made from algae is getting a lot of attention. Growing algae does not have any impact on the consumable food market and can outperform the current feedstocks used to make ethanol and biodiesel.

92. Algae can produce 30-100 times the oil yield of soybeans.

CHAPTER FIVE – GREEN BUILDING

93. A key ingredient in the quest for energy efficiency relates to commercial and residential buildings.

94. In the United States commercial and residential buildings account for:
70% of electricity consumption,
39% of energy use,
39% of all carbon dioxide (CO_2) emissions,
40% of raw materials use,
30% of waste output (136 million tons annually), and
12% of potable water consumption.

95. Green building in new construction, and green retrofit in existing structures, results in economic benefits, environmental benefits and health benefits.

96. The value of green building construction is projected to increase to $60 billion by 2010.

97. Buildings are one of the largest consumers of natural resources. In the United States., buildings account for 39% of all CO2 emissions.

98. According to the Department of Energy, the construction market accounts for 14.2% of the $10 trillion U.S. Gross Domestic Product.

99. The green building products market is projected to be worth $30-$40 billion annually by 2010.

100. The three largest segments for nonresidential green building construction are office, education and health care. These segments will account for more than 80 percent of total nonresidential green construction in 2008.

101. The U.S. Green Building Council has approximately 100,000 actively engaged members.

102. The U.S. Green Building Council introduced the LEED Green Building Certification System in 2000. The "LEED for Homes" certification was introduced in December 2007.

103. The Leadership in Energy and Environmental Design (LEED) rating system consists of a "checklist" of standards with different versions of the rating system available for specific project types.

104. The LEED rating system addresses six major areas: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation and design process.

105. The different LEED versions have varied scoring systems which involve both prerequisites and credits in the six categories.

106. There are typically four levels of LEED certification: Certified, Silver, Gold and Platinum.

107. Professionals such as architects and engineers can become LEED accredited by taking a professional examination.

108. There are a number of other green certification processes and programs such as the National Association of Home Builders' (NAHB) Model Green Home Building Guidelines.

109. A non-profit entity known as the Green Building Initiative has also created a program known as Green Globes, which is a green building guidance and assessment program using software tools and a rating and certification system covering the categories of energy, indoor environment, site impact, water, resources, emissions, and project/environmental management.

110. Fresh water is a scarce and limited resource. Of all the water in the world, about 97% is seawater, 2% is polar ice and only a very small 1% is fresh water.

111. Buildings in the United States consume 5 billion gallons of potable water per day just through flushing toilets.

112. Buildings can obtain a 20% - 30% reduction in potable water usage by using low volume showerheads, low flow toilets, water efficient landscaping and the use of recycled greywater for irrigation.

113. A typical household in the United States uses 363 gallons of potable water per day. This amounts to over 130,000 gallons of water per household, per year.

114. Indoor water use accounts for 70 gallons per person per day, or over 25, 000 gallons per person, per year.

115. Clean water shortages occur because of overbuilding, drought, contaminated water sources or damage to water pipes.

116. By installing more efficient water fixtures and regularly checking for leaks, households can reduce daily per capita water use by about 35% to about 45 gallons per day.

117. If all U.S. households installed water saving features, water use would decrease by 35%, saving an estimated 5.4 billion gallons per day. This would result in dollar volume savings of $11.3 million per day or more than $4 billion per year.

CHAPTER SIX - WIND POWER

118. At the end of 2007, wind power produced just over 1% of world-wide electricity use. In 2007 it accounted for approximately 19% of electricity production in Denmark, 9% in Spain and Portugal, and 6% in Germany and the Republic of Ireland.

119. Globally, wind power generation increased more than fivefold between 2000 and 2007.

120. Wind energy is plentiful, renewable, widely distributed, clean, and reduces greenhouse gas emissions when it displaces fossil-fuel-derived electricity.

121. By networking wind farms, the issue of wind's intermittence is eliminated. Linking wind farms reduces the effect of windless days at individual sites and eliminates the chance of a windless hour during the year.

122. In 2007, the United States added 5.2 gW of new wind installations, more than double its installations for 2006. The new wind projects account for about 30% of the entire new power-producing capacity added nationally in 2007.

123. Total installed wind capacity in the United States at the end of 2007 reached 16.8 gW.

124. The European Commission set a target of 40,000 megawatts (4gW) by 2010, and met that goal five years early, largely due to Germany's installation of wind power.

125. Germany has more wind capacity installed than any other country in the world.

126. Germany has a population of approximately 82 million and has installed wind capacity of approximately 19 gW.

127. The United States has a population of approximately 300 million and has installed wind capacity of approximately 16.8 gW.

128. China added 3.4 GW to its total wind capacity in 2007, and amount that was 154% higher than the previous year.

129. China's new wind capacity in 2006 grew by 167% over 2005.

130. By 2020, China plans to have at least 30 gigawatts of wind power capacity, but it's been suggested that with sufficient motivation they may be capable of generating 170 gigawatts by that time.

131. China is the largest producer of wind turbine generators.

132. Spain added 3.5 gW of wind power to its total capacity in 2007.

133. When the wind industry first began to develop in California in the early 1980s, wind-generated electricity cost 38¢ per kilowatt-hour. Since then it has dropped to between 4¢ and 6¢ per kilowatt-hour, on parity with both coal and nuclear but without the environmental problems.

134. It has been estimated that by 2020, many European wind farms will be generating electricity at 2¢ per kilowatt-hour, making it cheaper than all other sources of electricity.

135. In the United States, wind power generation grew 27% in 2005, 26% in 2006 and 45% in 2007.

136. Way back in 1991, even before technological advances in wind turbines, the Department of Energy stated that three wind-rich states (North Dakota, Kansas, and Texas) had enough harnessable wind energy to satisfy all of America's electricity needs.

CHAPTER SEVEN – SOLAR POWER

137. The largest source of energy emanates from the sun. Radiant energy from the sun at the orbit of the Earth is 1,372 watts per square meter. A total of 343 watts of solar energy per square meter over the surface of the planet at the top of the atmosphere is the result. Thirty per cent (30%) of the 343 watts is reflected back out into space, with the rest being absorbed. This energy is free and continuous.

138. Industry commentators have stated that is amounts to 970 trillion kWh of energy every day.

139. The fastest growing segment of solar energy is photovoltaics (PV), a process where photons of light are converted into electricity in a semiconductor.

140. Solar power has grown about 25% per annum for the past 15 years.

141. Growth in solar power has been about 30% for the years 2005, 2006 and 2007.

142. The growth rate of installed PV in the United States in 2006 was 33% above 2005, and the worldwide increase for that time period was 50%.

143. The four largest producers of PV cells are Germany, Japan, China and the United States. China passed the United States in 2006.

144. The solar hot water systems and solar electricity systems of the 1970s have undergone thirty years of radical improvement, and higher efficiencies, lower costs and greater durability have arrived.

145. Germany is by far the biggest proponent of solar power, primarily due to government incentives. Consequently, Germany has been consuming over one-half of the world supply of solar panels, with 960 mW of new installations in 2006, or 55% of the world's installations.

146. Government incentives in Germany require that utilities pay producers of solar power for power that they put back into the grid. Utilities must pay more to the solar power producers for their power than customers pay to the utility for grid power.

147. While the government incentives in Germany appear to be excessive, they actually help the local utilities by reducing the strain on the grid, and keep the utilities from having to invest millions in new power plants.

148. Japan, the world's largest exporter of solar technology, reports that production costs of PV are reducing by eight percent (8%) per year.

149. California reports that its costs of PV production are reducing by five percent (5%) per year.

150. Industry analysts predict that the cost of PV production will decrease by 40% by 2010.

151. Traditionally, PV cells have been made from silicon. Recent development involving thin film solar cells does not require silicon as an ingredient, which creates the potential for production at much lower costs.

152. The minimum profitable performance level for silicon PV cells is approximately 14% efficiency. In the 1990s, PV cells had an efficiency level of 12 to 15%. Today, those levels are 14 % to 24% and are increasing. Recently developed PV cells have achieved efficiencies of up to 40%.

153. An aggressive plan was unveiled in Scientific American in January 2008, which could provide 69% of all electricity in the U.S. and 35% of total energy including the transportation section by 2050.

154. The plan involves creation of a new power supply system, as well as transmission and storage, based in the Southwest with power distributed across the entire U.S.

155. Implementation of this plan would eliminate 300 coal fired and 300 natural gas fired power plants.

156. Greenhouse gas emission as a result of this plan would be reduced to 62% lower than levels existing in 2005.

157. The technology exists today to implement this plan, it is not dependent upon further technological developments.

158. The cost of this plan is less than the tax subsidies that wer paid for th U.S. telecommunications structure over the pat 35 years.

159. On a comparative basis, the cost of implementation of this plan would be about 15% of the total cost of the war in Iraq and Afghanistan.

160. The U.S. spends about $12 billion **per month** in Iraq and Afghanistan, and this plan would cost $10 billion **per year** for about 40 years. If we funded this system the way we have funded the wars in Iraq and Afghanistan, we could pay for the system in less than three years.

161. The plan would create millions of jobs and stimulate the economy.

CHAPTER EIGHT - GEOTHERMAL ENERGY

162. Along with solar, another green energy source is geothermal power from the earth.

163. Geothermal power is derived from the heat of the earth, which is used to create electricity.

164. To create geothermal energy, typically two holes are drilled into the ground and water is injected into one hole and harvested out the other as steam. The steam is then used to turn a turbine which creates electricity.

165. Although geothermal power can be generated almost anywhere on the earth, in the United States most of the geothermal plants are located in the western states.

166. Geothermal energy has been used in the United States since the 1920s, but began a resurgence in the 1960s.

167. There is enough geothermal energy available to produce all of the electricity needs of the United States.

168. The typical geothermal power plant operates at about 90% efficiency, which exceeds that of all other power plants using different sources.

169. A geothermal power plant can generate electricity for about five cents ($.05) per kWh.

170. The downside is that geothermal plants are expensive to build, and financing for these plants is difficult to obtain.

171. Installed geothermal capacity in the United States in 2007 was approximately 2.8 gigawatts, with another 2.5 gigawatts under development in sites in California, Nevada, New Mexico, Texas, Utah and other western states.

172. The United States obtains about 1/3 of 1% of its electricity from geothermal power plants in five states.

173. The outlook for geothermal power in the United States has brightened since the Energy Policy Act of 2005 created a production tax credit.

174. China, Russia, Mexico, Japan, Italy and other countries have begun to build geothermal power plants in recent years, although the United States remains the world's largest producer of geothermal energy.

CHAPTER NINE - TRANSPORTATION

Cars, Trucks and Trains

175. There are approximately 210 million cars in the U.S.

176. The useful life of an automobile in the U.S. is 17 years.

177. Transportation accounted for 33% of oil consumption in the U.S. in 1971 and over 60% today.

178. Passenger cars, SUVs, light trucks and minivans ("light duty vehicles") account for over 45% of the U.S. transportation sector's oil consumption.

179. The International Energy Agency predicts that light duty vehicles will account for an increase in global oil to 32 million barrels per day in 2030.

180. The International Energy Agency projections for light duty vehicles assumes average fuel efficiency of 25 mpg in 2030.

181. If average fuel efficiency for light duty vehicles were 40 mpg, the global oil demand be 20 million barrels per day, not 32 million barrels per day in 2030.

182. If average fuel efficiency for light duty vehicles were 60 mpg, the global oil demand would be 13.4 million barrels per day, not 32 million barrels per day in 2030. This would be possible with improved hybrid technology.

183. Road transport, which includes light duty vehicles, medium and heavy trucks, buses and two and three wheel vehicles, accounted for 25% of global oil consumption in 1971 versus 40% in 2002, and was responsible for 2/3 of the oil consumption between those years.

184. If government and commercial vehicle fleets, followed eventually by the mass market, would acquire hybrid vehicles and help work on greater efficiencies, some industry analysts predict that oil consumption could be reduced from 21 million barrels per day to 16 million barrels per day by 2030 in the U.S.

185. There are approximately 1.4 million buses in use globally, which travel 50,000 to 100,000 miles each per year.

186. Fuel consumption for buses is between seven and nine miles per gallon.

187. Medium and heavy duty trucks consume about 25% of the transportation sector's total fuel consumption.

188. Medium and heavy duty trucks are used for freight transport and delivery and average between 50,000 and 100,000 miles each per year at a fuel efficiency of four to ten miles per gallon. Most of these vehicles run on diesel fuel.

189. Estimates of light duty vehicles hybrid's penetration of the market vary widely from the International Energy Agency's estimate of 0.7% by 2030, to some industry analyst's estimate of 72% by 2030.

190. The International Energy Agency estimates fuel efficiency in 2030 of light duty vehicles to be 25 miles per gallon, while some industry analysts foresee 62 miles per gallon in 2030.

191. While today's hybrids are more fuel efficient than existing vehicles, the future will see plug-in hybrids that are even more efficient, with some estimates of 50% greater fuel efficiency than standard hybrids.

192. Forty percent (40%) of Americans travel 20 miles or less per day for work, school and personal needs, and sixty percent (60%) travel 30 miles or less per day.

193. The traditional problem with electric vehicles and hybrids have been the cost, size, life and storage capacity of the batteries.

194. In today's hybrid vehicles, the battery pack, cooling system and battery control unit represent 30% to 50% of the total cost of the vehicle.

195. The dominant battery system used today is the nickel metal hydride battery (NiMH), rather than the lead acid auto battery. Nickel metal hydride batteries have approximately twice the energy density and three times the power density of lead acid batteries, and a much lower environmental impact.

196. Energy density of a battery affects the vehicle's potential range. Power density of a battery affects the ability to accelerate.

197. Lithium ion (Li-ion) batteries are the next generation of batteries and have greater energy density than nickel batteries as well as greater power density.

198. While automobile companies say contend that batteries are holding back the hybrid revolution, the U.S. Department of Energy has deemed both NiMH batteries and Li-ion batteries to be "mature" and researchers have demonstrated their application in hybrid vehicles.

199. Unlike NiMH batteries, lithium technology is not controlled by one company, and lithium can be combined with a variety of other compounds to produce batteries.

200. The future of American transportation will be the plug in hybrid that runs on a combination of electricity and an alternative fuel, not gasoline.

201. Plug-in hybrids generate 40-65% less greenhouse gas emissions than gasoline fueled vehicles and 7-45% less than conventional hybrids.

202. Transporting freight by rail is approximately 8 times more fuel efficient than trucking.

203. Rail is the cheapest form of transportation for freight as well as passengers (with the exception of two wheeled vehicles, such as motorcycles).

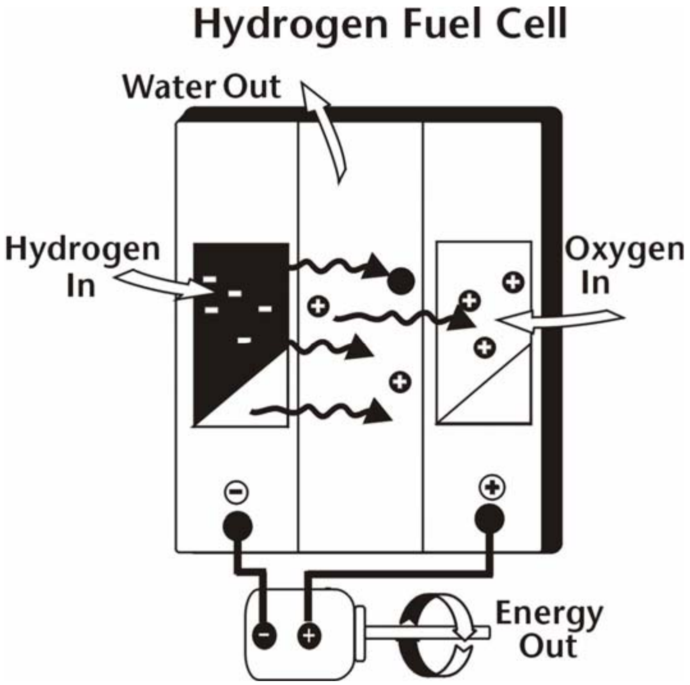
204. Switching freight from diesel powered trucks to electric rail could result in a savings of as much as 20 to 1.

205. Most railways in Europe and Japan are electric.

206. The French railroads have not used one drop of oil to power their trains in the last twenty years.

207. Only four U.S. cities have an electric trolley system: San Francisco, Boston, Dayton and Seattle. Between 1922 and 1955, GM, Standard Oil and Firestone bought streetcar systems in 80 cities, dismantled them, and replaced them with buses.

CHAPTER TEN - HYDROGEN



208. Hydrogen is never found unattached to something else, it is naturally bound to other elements.

209. Energy must be used to separate hydrogen so that it can be used as a fuel.

210. We have not yet solved all of the technical problems of generation, transportation, storage and consumption of hydrogen on a large scale.

211. Hydrogen fuel cells are electrochemical devices like batteries. Fuel cells use hydrogen and oxygen to create electricity without combustion.

212. As long as hydrogen and oxygen are available, hydrogen fuel cells never lose their charge, unlike batteries.

213. There are two common methods of producing usable hydrogen today: electrolysis and steam reformation.

214. Electrolysis uses electricity to extract hydrogen from water.

215. Steam reformation uses steam to create hydrogen from natural gas.

216. Electrolysis presently uses more energy to free the hydrogen than it creates.

217. Steam reformation is an expensive process and has the unattractive feature of using natural gas, another fossil fuel that has finite limitations, and produces carbon dioxide emissions.

218. Hydrogen is the smallest element and therefore is very difficult to contain. Storage is a major issue with hydrogen gas, as it will find a way to escape. Tanks, particularly where they connect, will leak.

219. Another problem with hydrogen is its reactive nature. Hydrogen has a corrosive effect upon metal and tends to make metal brittle.

220. Building the required infrastructure for hydrogen in the U.S alone has been estimated to cost $600 billion.

221. Due to the problems of storing and transporting hydrogen, it is probably better suited for production and use on a single site as opposed being used in vehicles.

222. One company as created a residential fuel cell technology that produces hydrogen which is then converted into electricity and heat, and used on site to provide hot water and electricity needs to a home.

223. Replacing America's vehicles with hydrogen powered vehicles, even if possible, would require not only replacement of 210 million vehicles, but hundreds of thousand of miles of pipeline, about 90,000 service station pumps and everything else related to generation, transportation and storage.

CHAPTER ELEVEN – NUCLEAR POWER

224. Nuclear reactors use Uranium 235 as fuel.

225. Uranium 235 represents less than 1% of all uranium on earth.

226. In nuclear energy plants, a chain reaction is generated that breaks the Uranium 235 atoms releasing heat. The heat generated by the reaction is used to turn water into steam and the steam is then used to turn a turbine and create electricity.

227. Approximately 6% of the energy produced in the world comes from nuclear power.

228. About 75% of the power used in France is generated by nuclear reactors, making it the nation that is most dependent upon nuclear power.

229. About 11% of the energy generated in the U.S. comes from nuclear power.

230. China has announced plans to build 32 nuclear plants by 2020.

231. There are a little over 400 nuclear reactors in the world today, with about 100 of these operating in the United States.

232. Many reactors are reaching the end of their useful life and were not designed to operate indefinitely.

233. Uranium demand is expected to increase 3% annually through 2018, and demand is expected to outstrip supply during that period.

234. There are presently about 100 nuclear power plants either in planning or under construction.

235. It has been estimated that simply to replace existing capacity, that the replacement ratio requires building at least two reactors per year for the next 50 years.

236. The ability to bring nuclear reactors online is limited by specialized building materials, skilled labor and the lengthy approval process involved.

237. Obtaining approval to build a nuclear reactor in the United States takes between 20 and 30 years.

238. Nuclear power is further limited in the United States by a lack of desire by American communities to have a reactor built nearby and by the security risks inherent in storing and using nuclear material.

CHAPTER TWELVE

CARBON CONTROL SYSTEMS

239. There are two major approaches to reducing our dependence on fossil fuel while simultaneously responding to the challenge of global warming.

240. The first approach is called "cap and trade" which is a system for emissions trading.

241. Under the cap and trade system a government agency sets a cap or maximum on the amount of emissions that are allowed to be generated. Businesses that emit carbon dioxide are allowed a certain limit that they cannot exceed without being penalized in some way.

242. For companies that reduce their emissions below the limit allowed, carbon credits are created which equal the unused portion of their allowance.

243. Efficient companies can sell their carbon credits to companies having trouble meeting their emission standards.

244. The effect of this system is to give an incentive to clean renewable energy companies and to provide a penalty to the polluters.

245. A popular type of carbon credit is the Renewable Energy Credit (REC) also called "green tags." Green tags represent 1000 kWh of clean renewable energy and can be sold in the open market.

246. The other approach to reduce our dependence on fossil fuel is a carbon tax.

247. The carbon tax approach is simply to implement a tax on the burning of fossil fuel based on its carbon content.

248. Proponents of the carbon tax believe that a tax would crate an immediate incentive to reduce carbon emissions, would be less complicated than cap and trade, would be easier to administer, and would apply to all industries and not be as focused on the utility companies, like cap and trade.

249. Carbon trading markets have been created in the United States and Europe, although they are presently voluntary systems.

250. There are presently a variety of systems and no standardization has yet been created, so there is no one system that has been adopted by all users.

251. While carbon emissions trading is still developing and struggling to finf a system that is acceptable on a universal basis, it is the fastest growing specialty in the financial services area.

252. Analysts have stated that carbon will be the world's biggest commodity market in a decade.

SUMMARY

In this publication, I have set forth a series of basic facts and information, from which you can draw your own conclusions. At this point however, I will list a series of my own opinions, ideas and conclusions based on those facts.

253. The New Energy Paradigm is a Chinese buffet. There is no one solution to the energy situation that the world faces today. There are multiple alternatives and combinations of various alternatives that will be used by innovative people to meet the challenge that faces us.

254. The biggest short term emergency is the liquid fuels market. If you don't believe me, read the Hirsch Report.

255. Repeat after me: "Energy Independence is a national security issue." Stick it to the terrorists, stop buying foreign oil.

256. Automobile companies contend that there is no market for hybrids or electric cars. The marketplace has demonstrated otherwise. GM's introduction of the Chevy Volt is simply Detroit's method of appeasing its critics by offering a small, expensive, two seat specialty car while conducting business as usual. The other "hollow hybrids" offered by Detroit as nothing more than greenwashing. Simultaneously with the release of the Volt, GM is releasing the new, big gasoline engine Camaro, proof that they still don't get the message.

257. The government offered a limited tax advantage to purchasers of hybrid vehicles. The limited amount of this incentive prevented most hybrid purchasers from getting any tax incentive at all. This, or a similar incentive, needs to be expanded immediately.

258. The auto companies will soon come to Congress looking for a bailout. The answer should be "only if you change all of your models to plug-in hybrids."

259. A vehicle that delivers over100 miles per gallon of gasoline is achievable with existing technology. A lightweight, but strong composite material, plug-in hybrid would use electric power for its local, daily trips of under thirty miles, which accounts for 60% of the average American's daily usage. If Americans drove plug in hybrids, and replaced the backup gasoline engine with an engine that runs on natural gas, they would never use gasoline.

260. Electricity storage through advanced battery technology, is a reality today. Improvements to this technology are being made constantly.

261. Electricity generated for consumption on site, (primarily by wind and solar) referred to as decentralized electricity will become more widespread as incentives are increased.

262. Efficiency is a key ingredient in the mix, and there also need to be tax incentives for individuals who add more insulation to their homes and take action to retrofit existing structures to be more energy efficient. Some power companies presently provide small rebates, but additional assistance needs to be given to individuals and businesses.

263. A simple, but effective, thing that every person can do is to change from incandescent light bulbs to compact fluorescent light bulbs (CFLs). CFLs use only about 20% of the electricity as incandescent lights and last 8,000-15,000 hours versus 1,000 hours for an incandescent light. The Department of Energy says that incandescent lights use about 10% of the electricity consumed in the U.S. today. CFLs

make sense economically and energy wise.

264. As we discussed above, China has a population of more than four times that of the United States, representing 20% of the world population, compared to 4.5% for the United States. A person in China consumes 1/6 of the oil consumed by a person in the United States. China's oil consumption is increasing by 10% per year. Factoring in the 1.1 billion population of India, or approximately 17% of the world population and even assuming an unlimited supply of crude oil, oil production facilities are simply incapable of keeping up with growing demand.

265. China is everywhere. China produces the most coal in the world. China manufactures more wind turbines than any other country. China consumes more oil than any other country except the U.S., and that will change shortly. While the Congress and the State of Florida debate offshore drilling near the Florida coast, China is planning to drill for oil in the area between Florida and Cuba. China is a major owner of one of the largest seaports on the Eastern Seaboard (Freeport, Grand Bahama Island, Bahamas). China is everywhere, and it will only get worse.

266. According to the Energy Information Administration, world electricity generation will need to double by 2030. To satisfy this need, we must add more solar and wind power, not coal fired power plants.

267. There will be government intervention and gasoline rationing in the United States in the near future.

268. Many American households will own an NEV (Neighborhood Electrical Vehicle) in the near future. Vehicles such as "street legal' golf carts will become commonplace.

269. I have seen it stated many times that for every dollar spent to improve efficiency of appliances and buildings, you would have to spend $9 on solar power to achieve the same thing. Efficiency is a key ingredient of our future sustainable energy lifestyle. Through the use of efficiencies using "green retrofit" on existing buildings, the U.S. could cut electricity consumption and carbon emissions in half within 20 years.

270. Carbon taxes would be difficult to implement in the U.S. since Americans hate taxes and even hate the word "tax." Remember that "tax" is the reason why we don't sing God Save the Queen in America today.

271. The solar plan presented in the January 2008 issue of Scientific American, or a similar plan, needs to be implemented as soon as possible.

272. Most Americans do not realize that solar is a viable energy source.

Solar technology since the 1970s has advanced far beyond what people think. The best analogy would be that if you told someone they could fly across the Atlantic in an airplane, and they had only seen the Wright Brothers' first airplane, they would dismiss your comment and think you were crazy. People need to understand that today's solar technology is a Boeing 757 compared to the "Wright Brothers" solar technology of the 1970s. Solar works and we need it now. Congress must pass more tax incentives for solar power and the states must pass state legislation similar to the incentives used by Germany.

273. Early versions of the Energy Independence and Security Act of 2007 contained a substantial incentive for residential solar power, with a 30% tax credit available. The prior incentive, a 30% tax credit with a $2,000 cap, was not even reinstated in the final version. No incentive whatsoever for solar was included in the new law, and even the minimum incentives of the old law expire at the end of 2008.

274. A number of states are studying the incentives for solar power that were implemented in Germany and are crafting proposed legislation that is being introduced into state legislatures. Once the first few states implement these laws, many others will follow and America will start to see some the benefits of solar power. Utility companies are primarily regulated by states as opposed to the federal government, so we may not have to wait for Congress to act to get some beneficial activity in the solar power area.

275. I am not a big fan of government intervention in anything, but unfortunately, at this point, without tax incentives and subsidies, we cannot solve the largest economic problem this country has ever faced. Whether we like it or not, whether we want it or not, there will be substantial government intervention. The later that intervention comes, the more drastic it will be.

276. Hydrogen technology will not be sufficiently developed in time to avert the crisis. There may be a hydrogen economy in our future, but it will not be in our short term future. For the moment, forget hydrogen.

277. It is now mid-2008. You will live in a different world in five years. Will it be a world of war, terrorism and chaos based on an economic energy crisis? Or will it be a world that has addressed its energy needs and begun to deal with the problem?

The decision is yours.

EPILOGUE

I stood on the beach near Canaveral Pier in Cocoa Beach and watched the launch of Apollo 11 in July of 1969. I felt the earth shake under the thunderous roar of the Saturn V rocket as it left the earth on that beautiful sunny day in Florida. A few days later, sitting in living room of a friend on Key Biscayne with the young girl who would later become my wife, we watched as Neil Armstrong became the first human to walk on a celestial body other than the earth. Those were heady times in America.

Years later, I finally realized how difficult this task was and how brave men like Neil Armstrong were, when I learned that the onboard computer of the Lunar Excursion Module had less computing power than the Macintosh computer released by Apple in 1981. At that time, the Mac seemed like nothing more than a toy.

What audacity John F. Kennedy had to set a goal of sending a man to the moon and returning him safely to earth within a mere decade. Such a feat was hard to comprehend in 1960, when very few people even had air conditioning in their homes or cars, and no one even had a color television.

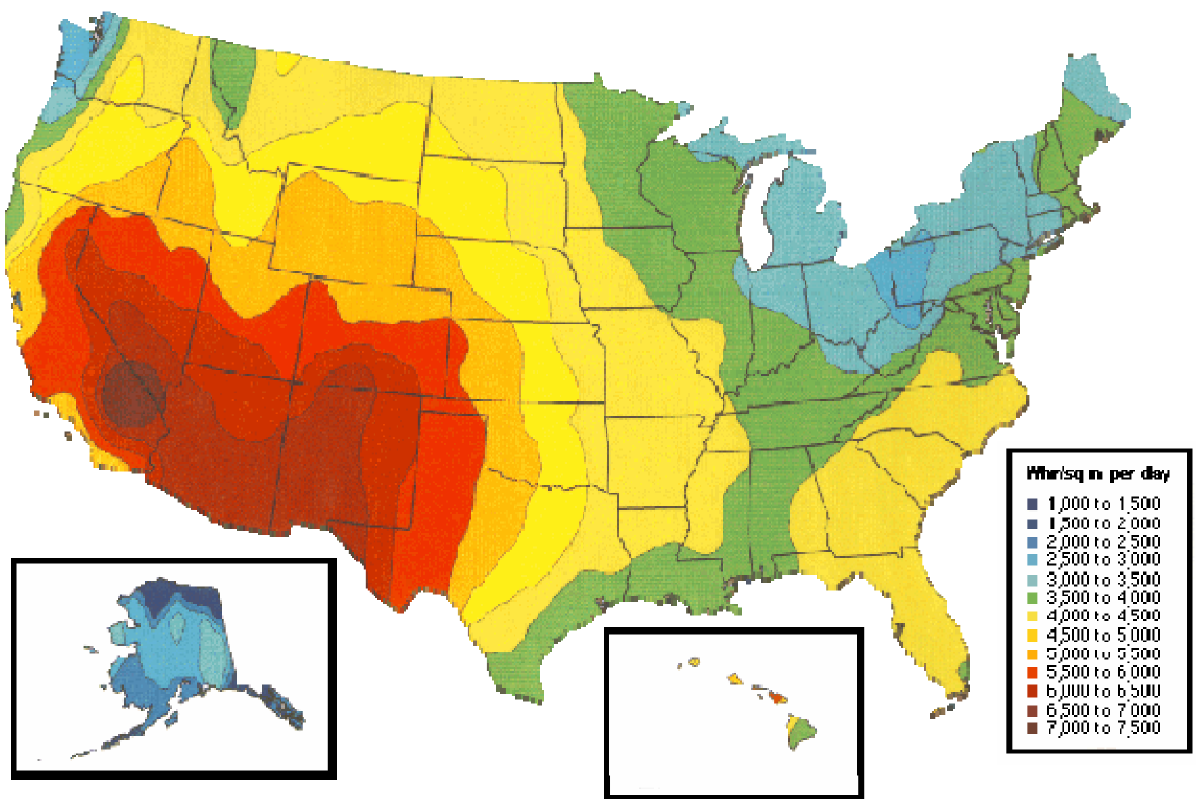
As Americans living through those times, we know that we are capable of accomplishing any goal, not matter how daunting. I know that America can meet this challenge, because I have seen her do it. The issue is not our ability, but our focus. We are at our best under pressure, and necessity is truly the mother of invention. We all need to encourage our local, state and federal officials to join the grassroots movement, and provide incentives, just as they have done for industries like telecommunications, farming and, of course, the oil companies.

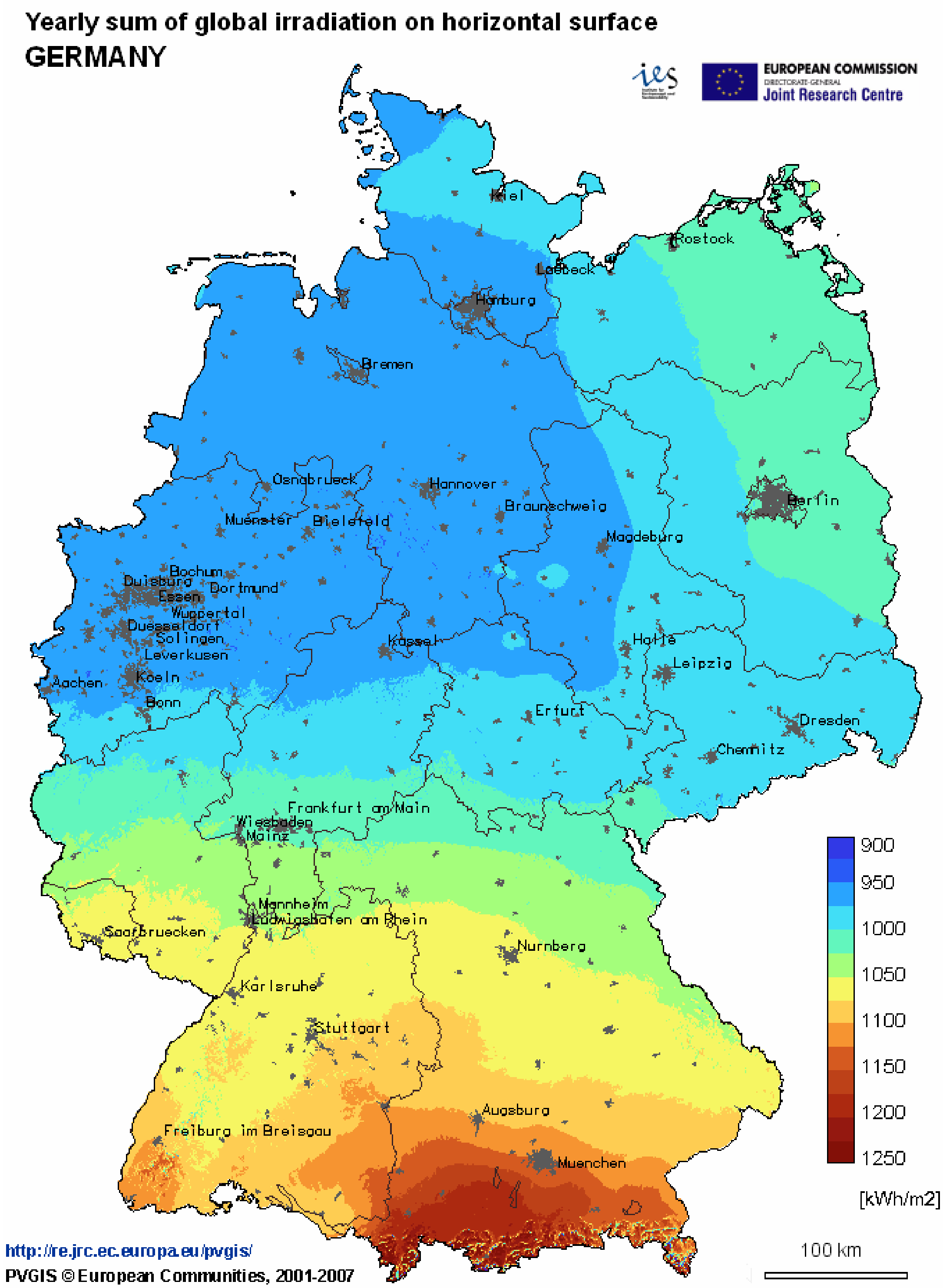
Together we can meet the challenge.

SOLAR RADIATION COMPARISON BETWEEN GERMANY AND

THE UNITED STATES

When you compare the two images below, you quickly see the enormous difference in the amount of solar radiation (which translates into solar power efficiency) between the United States and Germany. The highest amount of solar radiation in Germany equates to the lowest amount of solar radiation in the United States, yet Germany has more installed PV systems than any other country, and purchases one-half of all of the solar panels manufactured in the world.




Yearly sum of global irradiation on horizontal surface
GERMANY
EUROPEAN COMMISSION
Joint Research Centre
Kiel
Rostock
Luebeck
Hamburg
Bremen
Osnabrueck
Hannover
Braunschweig
Berlin
Muenster
Bielefeld
Magdeburg
Bochum
Duisburg
Dortmund
Essen
Wuppertal
Duesseldorf
Solingen
Leverkusen
Kassel
Halle
Leipzig
Aachen
Koeln
Bonn
Erfurt
Dresden
Chemnitz
Frankfurt am Main
Wiesbaden
Mainz
Mannheim
Ludwigshafen am Rhein
Saarbruecken
Nurnberg
Karlsruhe
Stuttgart
Augsburg
Freiburg im Breisgau
Muenchen
900
950
1000
1050
1100
1150
1200
1250
[kWh/m2]
100 km
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