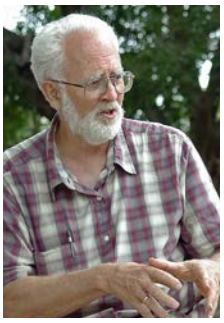
Pat's Story - 13 Years Studying Energy and CO_2 Emissions

"Part of my decision to continue this work is to make amends for my decades of consumption. I want my grandchildren to think of me as someone who made a strong effort on their behalf."

HOW THIS WORK BEGAN – Pat Murphy, November 15, 2015

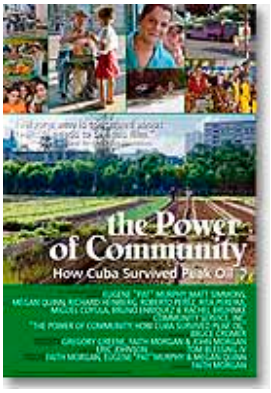


On June 1, 2015 I left my position as Research Director at the Arthur Morgan Institute for Community Solutions (CS), where I had served as Executive Director and Research Director for 13 years. CS was a small organization with minimal funding; so much had to be done by spirit, ingenuity and intelligence. Friends suggested I write about what led me to do my energy work and to summarize the high points of that time period. This document is in response to that request. It also describes my next efforts.

I first became involved with energy concerns when I met author Richard Heinberg in 2001 and subscribed to his MuseLetter in 2002. This was before his book *The Party's Over: Oil, War and the Fate of Industrial Societies* (2003), was published. Another book I studied extensively was, *Beyond Oil: The Threat to Food and Fuel in the Coming Decades* (1986) written by John Gever, Robert Kaufman, David Skole, and Charles Vorosmarty. At about the same time, I discovered the dieoff.org website, developed by Jay Hansen. It introduced me to a wide variety of thinkers including Richard Duncan, who wrote a seminal paper, "The Olduvai Theory: Sliding Towards a Post-Industrial Stone Age" (1996). During this time I discovered Colin Campbell's book *The Coming Oil Crisis* (1997). These sources, plus frequent communication with Richard Heinberg and Julian Darley, founder of Post Carbon Institute, helped to develop my understanding of energy supply limitations.

My wife Faith and I attended the second Association for the Study of Peak Oil (ASPO) in Paris in the spring of 2003, where I met Colin Campbell, founder of ASPO, and Fatih Birol, currently Executive Director at the International Energy Agency. Inspired by that conference, Faith and I held our first small conference on peak oil in Yellow Springs in the summer of 2003. In June 2004 Megan Quinn-Bachman joined us at Community Solutions as Outreach Director. The three of us put on the First U.S. Conference on Peak Oil and Community Solutions that year, followed by five more conferences on peak oil and climate change issues.

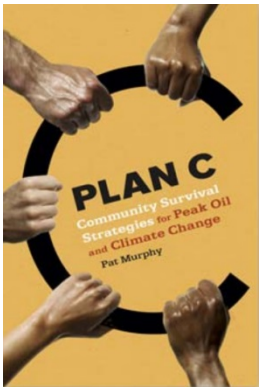
THE CUBA CONNECTION



At our first small conference, an attendee informed me that Cuba had experienced deep cuts in fossil fuel availability because of the collapse of the Soviet Union and the U.S. embargo. Faith and I visited Cuba in 2003 to evaluate that country's energy situation. This led to a breakthrough in my thinking, since what Cuba had accomplished, especially in the way of food production with minimal fossil fuel inputs, was remarkable. Megan, Faith and I traveled to Cuba in late 2004 to gather material for a documentary on the Cuban experience. This led to the production of the film *The Power of Community, How Cuba Survived Peak Oil* (2006), directed by Faith. We were interested in what could be learned from a country whose energy use was cut drastically, i.e. that was forced to curtail its energy consumption. We have continued our work with people in Cuba and early in

2015 Faith helped host a visit to the U.S. for Cuban energy specialist Mario Alberto Arrastía Avila.

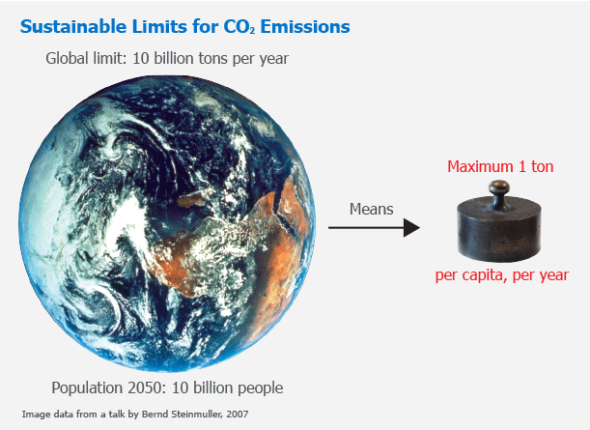
PLAN C



In January 2004, I published our first New Solutions report, "Community Resilience and Oil Depletion." This was followed by reports on Cuba, hydrogen, renewable energy, the industrial revolution, empire, and inequity. The March 2006 report included a discussion on numeracy, a skill needed to understand the constant shifting world of energy and CO_2 emissions. This was the beginning of a new analysis phase of my work. In June 2006 I wrote on the upcoming pluggable hybrid electric vehicle (PHEV) and in September 2006 laid out a long-range perspective on society and technology. In January 2007 I wrote about the difference between operating energy and embodied energy relative to buildings. The late Chris Plant of New Society Publishers asked me to write a book using the reports as a foundation. *Plan C – Community Survival Strategies for Peak Oil and Climate Change,* was published in 2008.

A CLIMATE PERSPECTIVE – MOVING FROM ENERGY TO EMISSONS

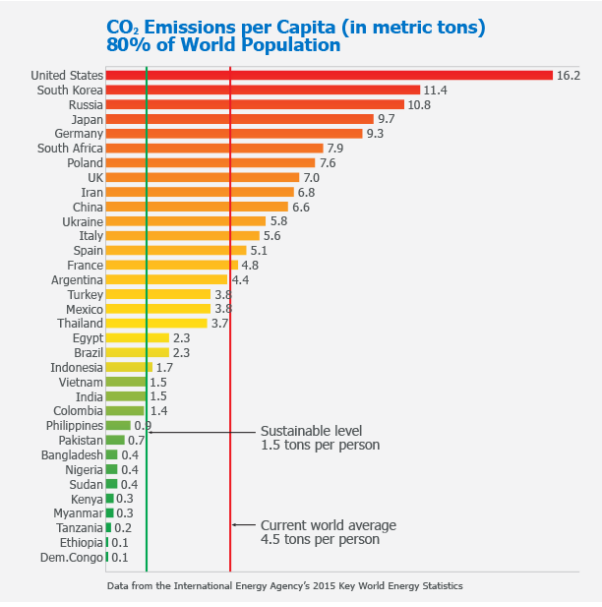
On completion of *The Power of Community* in early 2006 I became aware that climate change and the CO_2 emissions causing it, was probably a bigger issue than peak oil. This led to a shift in my focus.



In April 2007 I attended the Affordable Comfort Home Performance Conference in Cleveland Ohio. The keynote address was entitled *Reducing Energy by a Factor of Ten: Sustainable Housing Approaches in Europe,* presented by Dr. Bernd Steinmuller, building energy expert from Germany. The chart on the left (from his talk), illustrates the title. The talk also introduced me to the concept of Passivhaus (passive house), which has proved that buildings can be constructed to use 80% less heating and cooling energy.

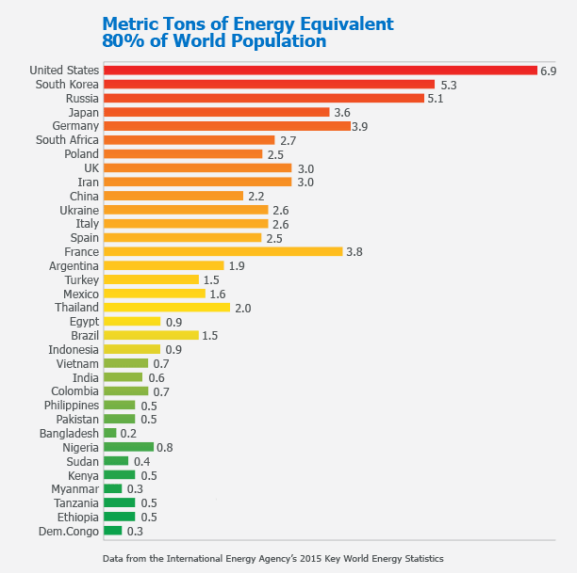
Another key Steinmuller graph showed the magnitude of the CO_2 cuts needed by the developed world, a reduction to one metric ton per person per year by 2050. The graph shocked me.

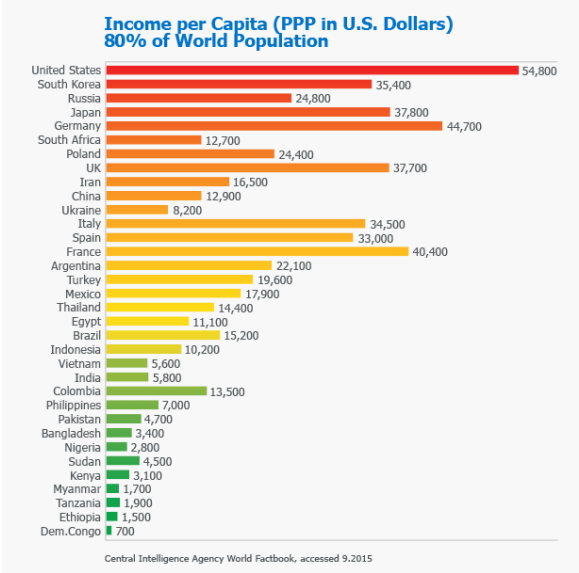
This led me to develop a similar graph, "CO_2 Emissions per Capita," to provide more detail. I selected the 38 most populous countries and their per capita annual CO_2 emissions. These countries generate 80% of the world's CO_2. The U.S., at the top, generates 16.2 metric tons per person per year.



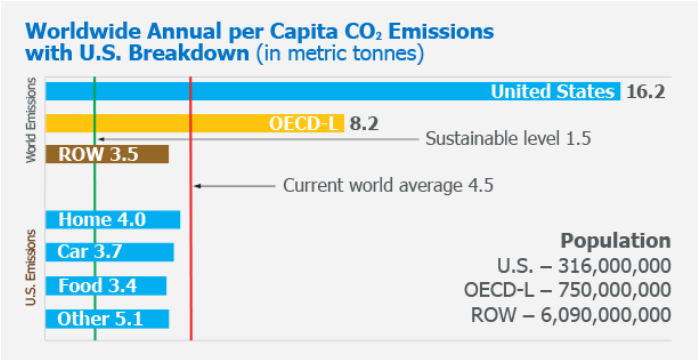
The International Energy Agency (IEA) in its yearly *Key World Energy Statistics* report publishes the source data I use for the previous graph, "CO_2 Emissions per Capita" and the "Metric Tons of Energy Equivalent" graph (below). I obtained the data for the "Income per Capita" graph from the CIA's *World Factbook*. The graphs are updated yearly; these graphs contain 2015 data. The two graphs below include the same countries as the CO_2 Emissions per Capita graph.

I have long been concerned about growing inequity in the world and realized that income is correlated to energy consumption, which these two graphs show.





I developed another graph that divided the world population into three groups, the United States, a subset of the Organization for Economic Development or OECD-L that excludes the U.S., Turkey, and Mexico; the third group is labeled "ROW" for the Rest of the World, and includes all other nations plus Turkey and Mexico. Turkey and Mexico were moved from the OECD to the ROW because they are essentially third world countries that provide labor to the U.S. and Europe.

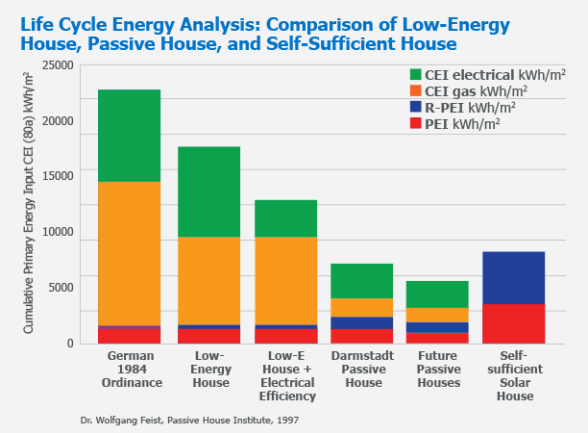


This chart has three components: CO_2 emissions per capita, population, and a four-part breakdown of U.S. emissions by category. The first two show how disproportionate the energy use of the U.S. and the OECD-L is, as contrasted to the six billion people living in poorer nations.

The breakdown of U.S. CO_2 emissions shows why I am focusing on curtailing energy consumption from our homes, cars and food. They represent 67% of our emissions and are subject to personal choice or actions. Understanding the source of the CO_2 can be empowering. With this data people can see how important it is to not wait for "government" in the climate

crisis. It shows that we must make different consumption choices and take personal responsibility for global warming.

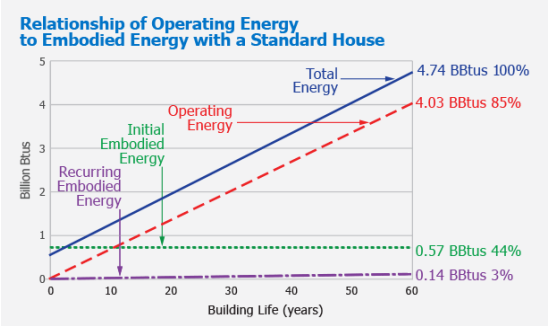
Major Break Through: Life Cycle Assessment and Home Energy Use



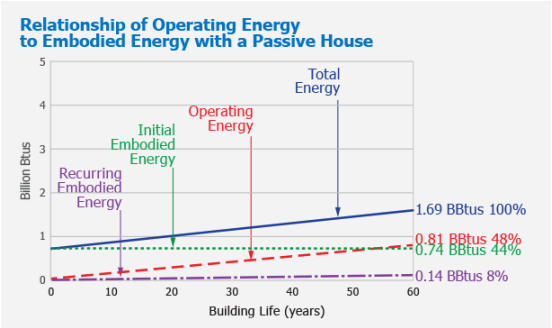
Before I learned about the passive house method of building, my focus was on reducing building heating and cooling energy use by 50%. I had been a custom homebuilder in California, and understood complex buildings. Passive house and all the analysis used to develop the method opened new doors for me.

LIFE-CYCLE ENERGY ANALYSIS
Comparison of Low-Energy House, Passive House, and Self-Sufficient House, Dr. Wolfgang Feist, Passive House Institute, 1997

The concept of Life Cycle Assessment was critical to my understanding of the specifications for passive house. Wolfgang Feist, its founder, explained the concept in an early paper from his Passive House Institute. It showed that adding large amounts of insulation, made by using fossil fuels, resulted in an even larger decrease in fossil fuel based heating and cooling.



I realized it would be fairly easy to break down a building's energy use and CO_2 emissions into its different parts; construction (embodied energy), ongoing maintenance, and ongoing operating of a building (operating energy).



I devised two charts for homes. The first one shows that the operation of a building consumes the bulk of the energy used and generates most of the CO_2. It makes it clear why the passive house approach focuses on reducing the ongoing energy used to operate a building rather than the energy used to build it. In the second chart I show that operating energy (the red dotted line) is greatly reduced when the initial embodied energy (construction – green line) is increased.

To illustrate the passive house way of building and remodeling, my wife and I produced the film *Passive House Revolution* (2013) film to explain the history and the underlying concepts.

The result of learning about passive house was a breakthrough for Faith and me. It showed that for about 10% more construction cost, an 80% cut in heating and cooling energy was possible. The approach is simple – make the envelope (walls, ceilings [or roofs] and floors) much thicker so they can hold much more insulation. Make this envelope airtight and install energy recovery mechanical ventilation and very high performance windows and doors.

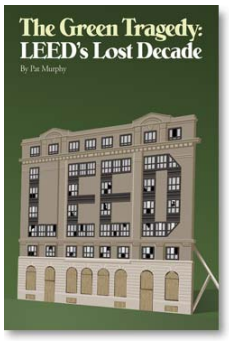
Cost Comparison – 2,400 sq. ft. Home

	Standard	Green	Passive
Sales Price	$270,000	$277,650	$297,000
Energy Saving (%)	0	20%	80%
Cost Increase %	0%	2.80%	10%
Cost Increase in $	$0	$8,500	$27,000
Monthly Mortgage	$1,700	$1,748	$1,870
Monthly Energy Bill	$150	$120	$30
Mortgage & Energy Bills	$1,850	$1,868	$1,900

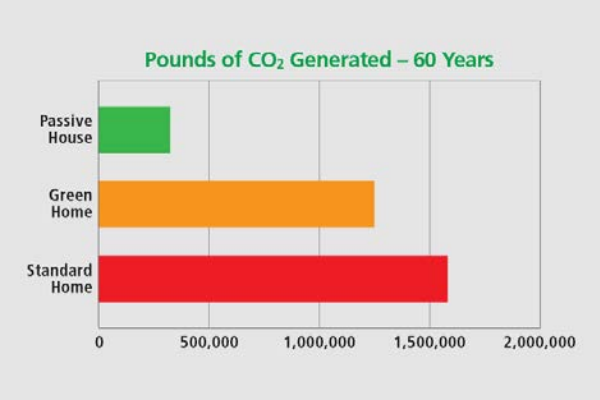
This is not a panacea – materials and training to do this are not well developed in the U.S. as yet. It also means a higher purchase price. However, lower energy bills will offset the higher construction cost. It could mean building a smaller house if cost is a consideration.

It also became clear that the cost of retrofitting a house to such a performance standard is much higher than the 10% cost increase of a new building. Nonetheless the knowledge that it can be done had a very powerful impact on me.

THE GREEN TRAGEDY AND "GREEN"



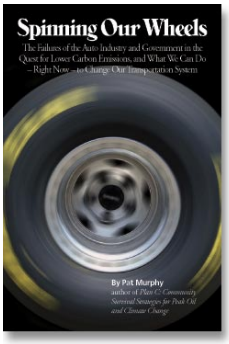
As part of my work I have monitored all the various options for reducing energy use in buildings. Most green or energy savings programs have set goals far below that of the passive house 80% reduction, typically in the 15-30% range. There are two problems with this. The first is that most new houses will have to be retrofitted at some point, at a greater cost than if built to a high standard initially. Secondly many of the other methods of energy efficient building don't meet their stated goals for a 15 to 30% emission reduction.



The use of the word green is very popular. It is assumed that if it's "green" it must be good for the environment. The best example of the use of the word "green" is LEED by the US Green Building Council (USGBC). LEED performance numbers can often be misleading. I self-published a small book, *The Green Tragedy: LEED's Lost Decade (2009)* exploring the limitations of LEED. The argument in The *Green Tragedy* is that energy efficiency has been sacrificed in LEED for other useful but less important environmental considerations that do not help with climate change.

Green building is an imprecise and vague concept. To see its CO_2 impact, I summarized the green and energy efficient building programs from 2000-2014 (chart on right). It includes energy efficient residences built as well as conventional residences built in the same period. The result shows that green and energy efficient buildings represent less than 10% of the new buildings and less than 2% of the existing building stock. As noted earlier, most of these programs are attempts to cut building energy 15-30% compared to existing building codes; this is not sufficient to meet the 80% cut in emissions needed by 2050.

Energy Savings 2000-2014		
	2000-2014	2014
Market Share-Housing Units Completed		
Conventional Total %	90.3%	86.0%
Green Total %	1.1%	4.5%
Energy Efficient Total %	8.6%	9.5%
Energy Savings-Housing Units Completed		
Conventional Total (0.0% estimate)	0.0%	0.0%
Green Savings (25% estimate)	0.3%	1.1%
Energy Efficient Savings (15% estimate)	1.3%	1.4%
Energy Savings Total %	1.6%	2.6%
Energy Savings Total US Stock (118 million homes)		
Conventional Total - % of stock	14.7%	
Green Total - % of stock	0.2%	
Energy Efficient Total - % of stock	1.4%	
Energy Savings-US Total Housing Stock 2014		
Conventional Total (0% estimate)	0.0%	
Green Total (25% estimate)	0.05%	
Energy Efficient Total (15% estimate)	0.2%	
Energy Savings Total %	0.26%	



PERSONAL TRANSPORT – THE CAR

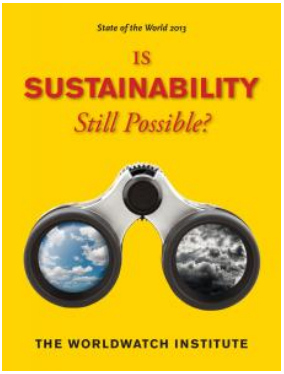
Houses last 60-100 years, far longer than cars, which typically have a 12-14 year lifespan. Thus a new car technology with better mileage can provide a much quicker societal change than building with new technology.

My wife and I have always purchased small cars, Hondas and Toyotas, with the highest miles per gallon (MPG). In 2004 we purchased a 2002 two-seater Honda Insight hybrid and a year later purchased a 2001 Toyota Prius hybrid. I had been following the development of hybrid cars and these two had the best MPG ratings.

The U.S. spent a decade on hydrogen car technology. When Obama was elected, the country began a focus on electrification of transport, creating plug-in hybrid vehicles and battery electric vehicles. I wrote a New Solutions report on this in 2007 and then self-published the book, *Spinning Our Wheels: The Failures of the Auto Industry and Government in the Quest for Lower Carbon Emissions, and What We Can do-- Right now-- to Change Our Transportation System.* In my last New Solutions report *The New Saviors! – Plug-In-Electric Vehicles – Are They Hype or Reality?* (2010), I explained why buying a car with the highest MPG – a Prius – would make the most difference in reducing personal car CO_2 emissions.

All my reports on the history of the electrification of transport can be viewed under the "Car" section of this website. It also contains my yearly plug-in electric car sales status update.

WORLDWATCH: *STATE OF THE WORLD 2013 - Cuba*



In 2012, the Worldwatch Institute asked us to write a chapter for their *State of the World 2013: Is Sustainability Still Possible?* The book was divided into three sections. The last section, "Section 3: Open in Case of Emergency," contained our chapter, "Cuba: Lessons from a Forced Decline." Faith had visited Cuba in 2011 and 2012 in preparation for her next film, *Earth Island: Cuba, Community and Climate Change*. Those trips provided the latest data for the Worldwatch chapter. Worldwatch was beginning to understand the need for unconventional approaches to sustainability. View chapter at: http://blogs.worldwatch.org/sustainabilitypossible/wp-content/uploads/2014/02/SOW2013-30-Murphy-and-Morgan-.pdf

MY COMMUNITY OF YELLOW SPRINGS

In 2005, I began attending Village Council meetings on a regular basis. In 2007 I lobbied for an Energy Task Force to review a proposal by the village manager for a $3.5 million new substation for the village's electrical power system. This proposal was based on a projected increase in per capita electricity consumption. Along with other community members, I argued that the idea of a steady increase in per capita energy consumption was no longer viable with the CO_2 issues that the world was facing. The task force was formed and recommended against a new substation. The village council rejected the substation proposal. The Energy Task Force became the Energy Board, on which I served for four years. It has continued to this day, responsible for many energy improvements including an update to more efficient street lighting and adding insulation to the roof of the village's administration center.

I was part of two other groups in Yellow Springs that lobbied for canceling contracts for coal-generated electricity. The two groups focused on two different projects, the Prairie State coal plant and the Meigs County Coal plant. The Village withdrew from these two projects and one of the power plant projects was eventually cancelled. Yellow Springs began buying renewable energy whenever possible.

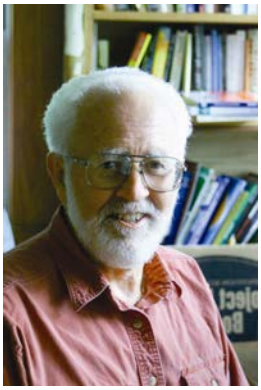
Yellow Springs continues to serve as a model for a community that places a high priority on renewable energy. In conjunction with Antioch College and the Village Electrical Utility, 3,300 individual solar panels were installed on the old Antioch golf course in July 2014. This "solar farm" will generate 1.2 million kilowatt hours yearly.

WHAT COMES NEXT?

Although I had planned to retire at some point, recent dire information relative to climate change has caused me to rethink that decision. The world situation is much more dangerous than I originally envisioned, when the problem appeared to be a limitation on energy supply. The rejection of the Keystone XL pipeline by President Obama on November 6, 2015 reinforced a growing awareness that fossil fuels must remain in the ground or under the oceans. Pope Francis' encyclical *Laudato si'* published on June 18, 2015 had a major impact on me.

On November 10, 2015 the World Energy Outlook report was published by the International Energy Agency. The report concluded that we cannot limit the Earth's temperature rise to 2 degrees centigrade under the current plans. I decided to focus my efforts on promoting the concept of curtailment, trying to find ways to inspire and motivate people to reduce their energy use. This implies a reduction of our material standard of living. I acknowledge that this is frightening to most people. As my brother-in-law John Morgan said, "Whatever we've gotten used to we now feel we are entitled to."

My concern grew after the United Nations Climate Change Conference held in Paris, December 2015. Cutting back or cuttailing our fossil fuel energy use is an unpopular position. Our culture has become dominated by consumerism, which has had many deleterious effects, particularly a long term increase in inequity worldwide. At the same time over consumption of cheap fossil fuel based food has affected our environment and our health. Consuming more and more throwaway goods is adding to landfills and contributres to the possibility of runaway climate change. It is becoming more clear that we will have to reduce our standard of living to have a livable planet.



Part of my decision to continue this work is to make amends for my decades of consumption. I want my grandchildren to think of me as someone who made a strong effort on their behalf.