



A Personal Journey down the Renewable Energy Road
By
Peter Gorr

Part 1: The Economy and the Environment
Two Sides of the Same Coin

It is a common misconception that what is good for the environment will be bad for the economy and vice versa. Nothing could be further from the truth. A strong economy and a healthy environment are inseparable.

We are experiencing a struggling economy with what I see as no solid strategy to correct the situation. Our economy has been moving away from manufacturing and towards services for many years. Financial services as a percent of GDP is at an all time high and higher than what is recommended. I, for one, do not feel secure with an economy that is built around managing other people's money in ever more creative ways. Recently every household's wealth has been negatively affected because of this. And what have we learned and how has our behavior changed as a nation?

Taking tax dollars and throwing them at the problem is not a solution. As well intentioned as this is and as appreciative as we are for infrastructure improvements, this is just a tactic to buy time while a real solution hopefully surfaces before the money runs out. Well the money has run out -- ask the unemployed if they feel the solution has been found.

A basic remedy for a downturn in an economy or, for that matter, a business seeking growth is to find or create a significant new demand to supply. Sounds simple but it is not. Certain criteria need to be met or we may experience another dot com-like bubble which offers a brief lift followed by an even more painful fall.

Fortunately we have an opportunity with all the right criteria sitting right on our doorstep. Unfortunately it is our assault on our environment and the imperative that we reverse the track we are on that has created this opportunity. We only lack the will and the necessary information. The opportunity is to transition our energy source from outdated, dirty, dangerous, largely foreign, and finite resources to state of the art, clean, safe, domestic, and unlimited resources. Jobs are not lost. They are transitioned and added to.

In simple terms the criteria necessary to initiate meaningful economic growth are the following:

1. Access to a large and growing market.

Energy is not only used by everyone, it is increasingly used by everyone and considered not a luxury but a necessity. There can be no stronger market than EVERYONE!

2. The current supply is inadequate or can be improved upon.

Here are a few descriptive terms that can be associated with current fossil fuel based energy sources:

acid rain, air pollution, black lung, cave-in, cancer causing, clean-up, climate change, diminishing, embargo, explosion, extinction, finite, foreign, greenhouse gas, habitat destruction, hazardous waste, meltdown, mountain top removal, radiation, strip mining, toxic spill, water pollution.

I'm sure many more can be listed. A supply with so many negative and undesirable attributes is ripe for replacement. There is an obvious opportunity to generate energy without most of these problems. It is rare in business to identify such an attractive opportunity for improving matters. But current energy sources have very formidable strengths. They have artificially low pricing (see item 3), a strong distribution network, and huge wealth that can be used to influence public opinion and political action. Who hasn't heard the fictional term "clean coal" and been led to believe that it is real?

3. The new alternative needs to be available now.

The good news here is that there exist many alternative energy sources without the negative features listed in item 2. New state of the art wind, solar, biomass, geothermal, and hydropower technology is available. But the bad news is that since there is not a level playing field for these technologies to compete on, they are struggling to gain meaningful market share – which drives innovation and lower prices as well as the associated jobs they create.

Since current energy suppliers do not factor in all environmental impacts into their cost structure (in economic terms this is known as a *negative externality*) their pricing is lower than it should be which provides them with a huge competitive advantage. These costs do exist but are being transferred to a future time and future payers; our children and grandchildren. The idea of a "carbon tax" or "cap and trade" is an attempt at monetizing some of these negative externalities. A cap and trade mechanism was implemented to reduce sulfur dioxide emissions from power plants, a cause of acid rain. It was highly successful and demonstrated how market forces can achieve cost effective environmental protection.

The EPA has published a series of studies that detail the costs and benefits of the Clean Air Act since 1970. It is estimated that we will spend \$65 Billion in 2020 to address air pollution related effects¹. How less competitive would fossil fuels be if

these costs were factored in (and these are not the only ones). Regarding CO₂, another common by-product of fossil fuels, the Stern Report puts the cost of no action on the mitigation of climate change at 5% to 20% of global GDP. This is unimaginable. At a minimum, with proper action, we face a cost of 1% of global GDP due to the damage already done according to this report. Each tonne (metric ton or 2,205 pounds) of CO₂ we emit causes damages worth at least \$85². Keep in mind the US alone emits over 6 Billion tonnes of CO₂ per year. That is half a trillion dollars in damages that we foot the bill on. Each gallon of gas emits some 20 pounds of CO₂. These are some of those external costs which are being ignored by the producers to their gain and to everyone else's loss. These costs are being or will be paid by us but unbundled from the products that are the cause. They may show up in tax bills, health care costs, and insurance premiums or in other ways. This is unfair and deceptive.

Addressing our energy need is clearly a huge environmental protection imperative and a great economic development opportunity. It's ironic that certain political talking heads and elected officials who preach fiscal responsibility and job growth so actively oppose this. It mystifies me that conservatives reject anything related to protecting the environment as if they are immune to the perils and the costs of such a short-sighted approach. Everyone benefits from a healthy environment. It is not a liberal policy. It is a human policy.

This has been a macro economic view and opinion of the current economic and environmental situation and the basic steps needed to improve it. In the following parts, I will describe a more micro or street level view of these principles in action. Specifically, I invested in converting my home to solar generated electricity. What I am experiencing is a win-win-win-win scenario. I am supporting domestic job creation, my energy dollars are staying in the USA, I have increased my wealth and am protected from wildly fluctuating energy prices, and I am protecting the environment. Please join me on this journey.

Part 2: Selecting a Solar Energy System Walking the Walk

In part 1, I wrote on how the economy and the environment are inseparable and how developing a new clean energy based economy is a huge economic development opportunity. I feel an obligation that if I'm going to "talk the talk"; I need to "walk the walk". To that end in 2010, I began a project to transition one small slice of the world -- my home -- to new clean energy. I was curious to see if the anticipated benefits will actually be realized.

As an environmentalist, but more importantly, a parent and grandparent, my motivation for transitioning my home to solar generated electricity is that it is the right thing to do. I believed that I would need to spend a lot to do this and perhaps never see a breakeven point. But I couldn't place a price on my children's future. Yes, I was also feeling guilty. As an American I am among the worst CO₂ emitters on the planet. My children already face the prospect of a massive clean up and a difficult adaptation to climate change. This is now a certainty. The only question is how much. In fact, I'm surprised young people are not more vocal and actively in the streets and in the voting booths over this burden they face.

So I solicited bids for a Solar Photovoltaic (PV) system. Basically, solar options consist of solar panels (PV) that will generate electricity and thermal solar panels for heating water. I just went with a PV system. A great 3 minute video primer on solar can be viewed at <http://www.teachersdomain.org/resource/oer09.sci.ess.watcyc.solarhome/>.

As with any home improvement project, it is recommended that you take the basic precautions of selecting your contractor carefully and thoroughly educating yourself before signing on the dotted line. Thankfully there are several reputable and experienced firms available these days. So the criteria I used in selecting the supplier were the following:

1. The system should be properly designed to fit my site and to maximize benefits to me.
2. All equipment should be from a reputable manufacturer and must qualify as "Manufactured in USA".
3. I should be given plenty of hand-holding throughout the project including details of the process required for interconnections, permitting, and renewable energy credit generation and sale.
4. The supplier should have adequate experience and good references.
5. The pricing should be competitive (though it need not be the lowest).

While I feel every contractor I accepted bids from could have done the job and done it well, only one company fit all my criteria. This was a very important indication to me that they listened to and understood all my concerns and that they wanted to supply me with what I wanted rather than with what they wanted. This is Sales 101 but so often such a rare experience.

Here is a description of my system. Before I called in the first contractor, I read up on solar systems and the basic building blocks of such a system. They are not terribly complex but there are some different options to consider. I'm not going to cover this in detail. Simply put, the system consists of collectors (there are different options here both in size and design), inverters (collectors generate DC electricity that needs to be converted to AC, again a couple options to consider), mounting hardware, wiring and conduits. I also added a communications gateway so that I could see the output of my system via an ethernet connection to my PC and to a website for remote monitoring and analysis. All in all it is pretty basic. The big decision is how many panels and where to locate them on your home or property.

I'm fortunate to have a home that is well suited for solar. The back faces straight south, there is little shading, and there is enough roof space to accommodate my needs (see picture). Occasionally you hear complaints about the aesthetics of a solar system. Judge for yourself. I think it looks good and better than 2 or 3 satellite TV dishes hanging on the house.



My system consists of twenty eight 240 watt panels with micro inverters (one inverter per panel rather than one inverter for the entire array). So, total rated output is 6.72 kilowatts. This is a pretty good size system for a home. But my home is some 4,000 square feet and I have been averaging about 900 kilowatt hours per month. The system should deliver about 80% of my current demand. I under-sized the system for 2 reasons. First, I believe I can continue to reduce my electricity consumption through efficiency measures and second, and this is unfortunate, net metering rules will not compensate me for electricity I produce in excess of what I use. What is net metering? In simplest terms, when I generate electricity and don't use it I will feed it to the grid and my meter will go backwards. When I call for electricity in excess of what I am producing, like at night, my meter will run forward. I pay the net difference, if there is one at the end of the month. If I have delivered more than I have used, these credits roll over to the next month. But here is the kicker, at the end of a 12 month period, the rolling over stops and I start from zero again. So I have no incentive to produce more than I will use in a year since this would just mean providing free energy to a utility which will then sell it at full value. I encourage people to support state legislation when it arrives to remedy this limitation.

Another consideration is obtaining a building permit from the town. Here requirements and costs can vary. In Palatine IL I only require a standard building permit and it cost me \$428. The permit required that I submit engineering calculations verifying that my roof will support the weight of the system. An engineering firm was hired to perform this calculation. Cost here was \$750. Next Commonwealth Edison required an application for interconnection and net metering. Total cost was \$50. My contractor coordinated all of this for me.

So all in all this was not complicated, especially with a contractor who managed the permitting and interconnection details. There was some added cost but it was not prohibitive. There is an opportunity to simplify things even further and again please support state legislation that addresses these deficiencies. We should feel proud to live in a state that is pretty progressive regarding renewable energy. Currently Illinois has received a grade of B from an independent study of current state policies regarding net metering and interconnections. If minor new legislation is passed, Illinois could move to an A grade in both these categories³. This makes our state a more attractive place in which to live and do business.

Finally I should be eligible to sell RECs (Renewable Energy Credits). This was something I didn't know anything about until well into the process and it was a pleasant surprise. For every megawatt of energy produced I will own one REC. My system should generate 8 RECs per year. This is a little tricky to explain but a REC is a "certificate" tied to the environmental benefits of a renewable energy system. You might call them the "bragging rights" to clean energy. If someone who is trying to meet renewable energy mandates or goals wants to secure this claim without having a renewable energy system they can buy RECs. While I get the energy and savings, if I sell my RECs I cannot claim the environmental benefits, the purchaser now has that right. But I know these benefits are there and I get all the financial benefits so I'm happy to part with these certificates which may net me between \$100 to \$200 each.

In the next part, I will concentrate on the economics of my system. But keep in mind the benefits I am generating in addition to my personal financial gains. First, I created a good size job for a local contractor. Second, I purchased equipment all of which is manufactured in the USA. This is generating domestic job growth. Third, my energy dollars are staying in this country. Fourth, since my "fuel" is free and not controlled by any company or country I do not face inflationary or fluctuating energy costs or the threat of having this source shut off or held hostage. This is beneficial to national and personal security.

Part 3: The Economics of My Solar System Glow of the Sun or the Glitter of Gold?

When I discuss my personal experience with renewable energy technology the first question I am always asked is: “What does it cost?”. I don’t like to answer this without first asking some questions myself. For instance: “Why are you interested?”

The value someone places on a renewable energy system can generally be determined by how they answer 4 key questions. First, how important is it to you to protect the environment? Second, how important is spending less on energy? Third, how important is it to support domestic economic growth? And fourth, do you prefer to lead or follow your neighbors in changes to your lifestyle?

How a person answers each of these questions will reflect what they place value on and what they are willing to invest. So for a seller of systems, it is critical to understand a potential buyer’s motivation. For me, the environment, the economy, and becoming a leading example of responsible behavior were the prime motivations. I didn’t think wealth creation was even a consideration but, as I will show, it is also a strong reason.

Now let me review the economics because this is the area that surprised me the most, pleasantly I might add, and is misunderstood. First you need to have adequate capital to undertake this kind of project, just as you would for any other home improvement. I have a home equity line of credit at 2.5% so it made sense for me to tap that. The total cost I faced was \$47,428. Your first reaction I’m sure is OUCH! Hold on. Before I get into the details let me say I wish I could find more investment choices like this.

The economics are a little challenging to detail because it is not just a matter of computing a breakeven point by dividing total cost by annual energy savings. A renewable energy system has value as a hard asset, generates RECs (Renewable Energy Credits explained in Part 2) that can be sold for revenue, and may qualify for tax credits and rebates in addition to the energy savings.

Here is a summary of the costs and rebates/credits:

Installed System Cost:	\$46,200
Permitting & Interconnection:	<u>\$ 1,228</u>
Total Costs:	\$47,428
30% Federal Tax Credit:	(\$14,228)
30% State Rebate:	(\$14,028)
Total Owner Out-of-Pocket Cost:	\$19,172

How often do opportunities to spend \$19,000 for over \$47,000 worth of goods happen? While I still have to come up with \$19,000, my net worth has been increased by over \$25,000. This is what makes my analysis different from so many others. I focused on my net worth change while most everyone else I encounter seems to just focus on the cash outlay. Actually I have very little cash. Cash is not a good place for your money if you are seeking growth. I like to put my money to work. Consider: Are stocks cash, are bonds cash, is a house cash? No, they have cash value and we tend to describe them in these terms. We typically convert much of our cash into value bearing instruments and this is how I view this investment. I received \$47,000 worth of value for \$19,000! I wish I had a larger roof!

This is not the end of the analysis. The system's value will depreciate over time and since it carries a 25 year warranty I used this length of time. Offsetting this depreciation are the energy savings and the revenue generation in the form of the sale of RECs. Here the payback is cash which further enhances my net worth. The following are the estimates I used in starting the project:

Annual Electricity Savings:	\$ 950
Annual REC Sales:	\$ 1,600
Annual System Depreciation:	<u>(\$ 1,848)</u>
Total Annual Gain:	\$ 702

Taking all the added home value, cost, rebates, tax credits, revenue, and savings results in an estimated net worth growth in year one of \$26,772. Over succeeding years, assuming a certain level of electricity price inflation, continued REC sales, etc. my net worth inches up even more than the system depreciation takes away, keeping me attractively positive throughout the life of the system. I estimate the contribution to my net worth in year 10 will be \$36,050 and the system would still have 15 years of warranty remaining. Also to be as thorough as possible I take into account the potential growth (estimated at 5%) of my initial \$19,000 if I invested it somewhere else.

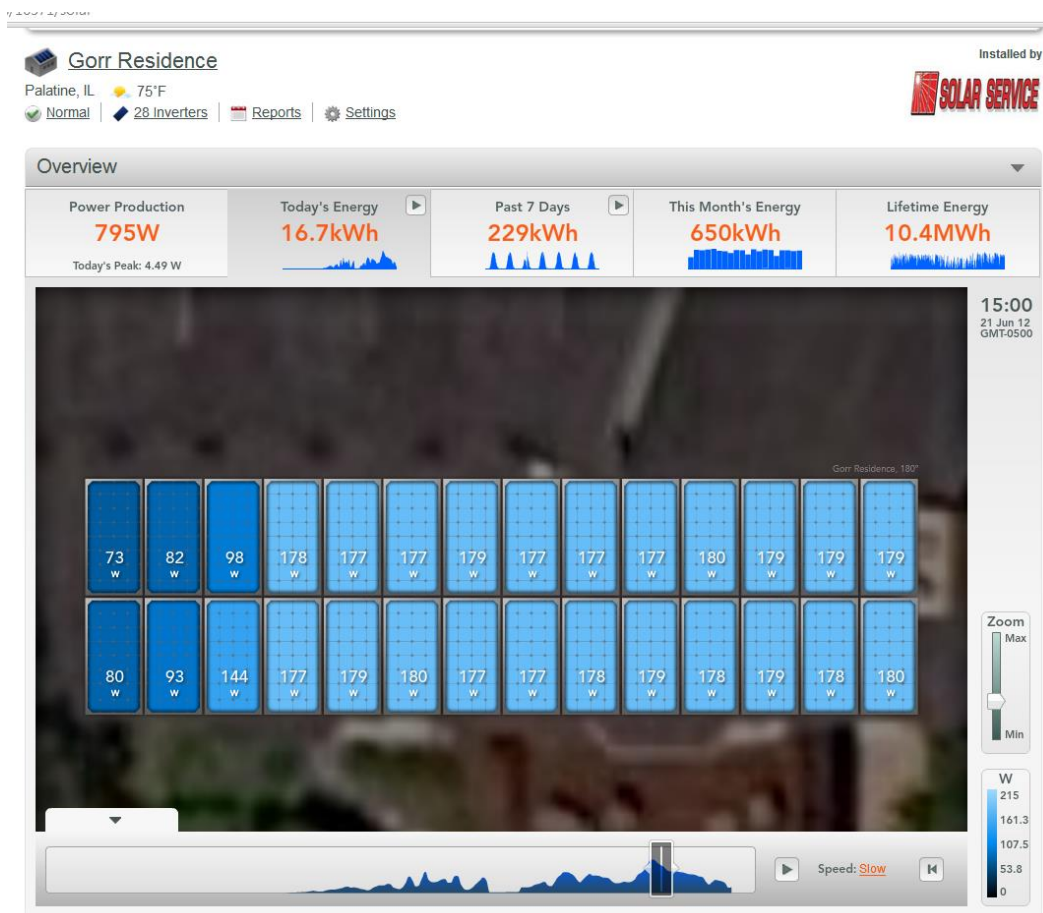
Now some may say, but solar systems are so attractive only because of these rebates and tax credits. Partially that's right so what are you waiting for? I didn't write these rules but I'm certainly not going to ignore an opportunity when I see it. Even with these rebates and credits renewable energy still finds it hard to compete because fossil fuels also receive cost advantages and subsidies some of which were discussed in Part 1. I consider these rebates and tax credits as leveling the playing field a little but it is still far from level for renewable energy. What was not discussed in Part 1 on this subject is that fossil fuels receive 2.5 times the level of federal subsidies as renewable energy (with most of the renewable energy subsidies going to corn ethanol)⁴. Remove corn ethanol from the equation and fossil fuels receive 6 times the benefits as renewable energy sources. Also I agree that this is not a desirable means of managing this energy market. Eliminate all the tax advantages, subsidies, and rebates while making sure all production costs are accounted for in pricing and let's see how things play out. My prediction is that fossil fuels will become just that...fossils. Pollution is a type of waste. Waste is a sign of inefficiency in a business and a real cost. If these costs associated with pollution (and the Supreme Court ruled that carbon emissions are a form of pollution) were reflected in the price of fossil fuels (as I argued they should be in Part 1 of this series) I believe you would see a competitive landscape that would start to favor renewable energy. Furthermore as innovations drive costs down, they will get us to a world that I hope to see: one of clean and cheap energy.

Is solar right for everyone? Of course not and it need not be. I believe the best market for solar right now would be the top 10% of US households. Why? They have an average net worth of over \$1 million not counting their homes so they certainly have the resources, are always looking for good investment opportunities, and are probably the worse energy consumers and carbon emitters because of their lifestyle. So we could take a nice bite out of carbon emissions by transitioning these households to renewable energy and guess what, they become wealthier in the process. The rich get richer. Well this time we all stand to benefit.

Part 4: Year One Results Promises Made, Promises Kept

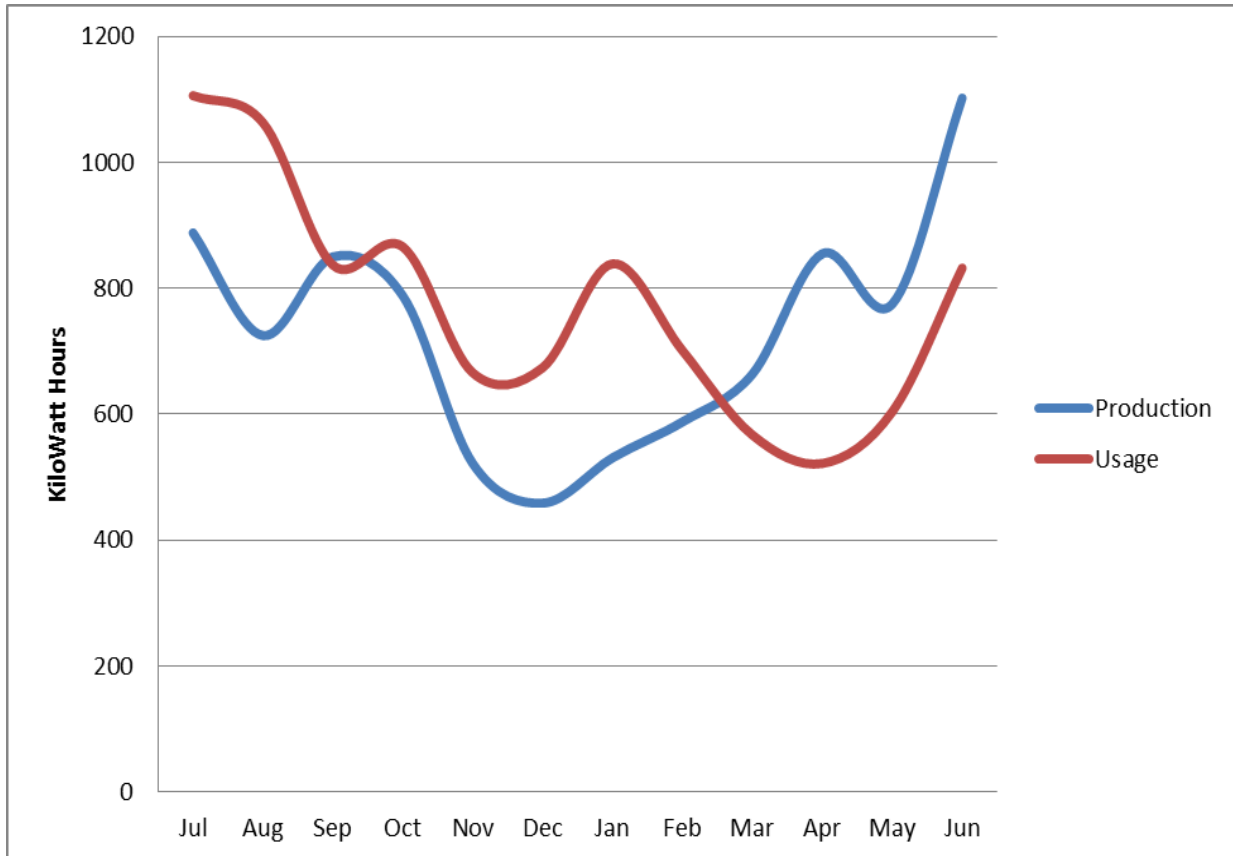
In this concluding part I want to review actual production and usage results as well as review once again why a move to a new energy portfolio for this country is so right. Up until now everything presented relating to system performance was based on estimates and projections. It is just over a year that my system has been in operation and, simply stated, it has performed better than promised.

With my communications gateway connection and online monitoring I have very detailed information to source. Here is a screen shot of my system near the end of a day in June 2012. I can view each panel's production in real time as well as historically. The slightly darker panels show some shading starting as the sun goes down behind some trees. There are many reports I can pull down as I actively manage my energy usage and production.



Recall I designed my system to deliver 80% of my historical electricity usage. It has delivered over 94% through a combination of a couple of things. First, it was estimated that I would see just less than 8 megawatt hours of energy per year. I produced over 8.7 mwh. This is weather dependent and will vary but not by much. Second, I continue to seek energy efficiency measures as I move to more than meet my home electricity demand and make room for adding an electric plug-in vehicle to my electricity demand mix. If I can replace the thousands of dollars I pay filling a gas tank with the electricity I produce, well, that's seriously green in more ways than one.

The following chart shows my system performance and my usage. The 12 month window I am using is June 22, 2011 through June 21, 2012. This is when my net metering began. Where the red usage line is below the blue production line, I was producing more energy than I used and it was “stored” for me by ComEd (through the net metering program). Where the usage was in excess of production I either called for my stored energy, if it was there, or paid ComEd for electricity.



In terms of dollars and cents, if I did not have this system I would have been billed \$924 for the electricity my home used. Instead I paid just \$53 for electricity from ComEd, a savings of \$871. Since I remain connected to the grid, I do pay the delivery service fee monthly. What I have affected is only the cost of the electricity supply.

Following is the first bill I received that showed an excess of energy. Note a few kWh of energy is being held and will rollover to the next month if I need it.

Issue Date October 5, 2011								
Meter Information								
Read Date	Meter Number	Load Type	Reading Type	Previous	Meter Reading Present	Difference	Multiplier X	Usage
9/16		In Flow	Total kWh	Actual	Actual			582
9/16		Out Flow	Total kWh	Actual	Actual			595
Service from 8/1/2011 to 9/16/2011 - 30 Days				Residential - Single				
Electricity Supply Services								\$0.00
Electricity Supply Charge				0 kWh	X	0.07136		0.00
Transmission Services Charge				0 kWh	X	0.00765		0.00
Purchased Electricity Adjustment								0.00
Delivery Services - ComEd								\$17.12
Customer Charge								14.26
Standard Metering Charge								2.86
Distribution Facilities Charge				0 kWh	X	0.01946		0.00
IL Electricity Distribution Charge				0 kWh	X	0.00126		0.00
Taxes and Other								\$0.56
Smart Meter Program								0.15
Environmental Cost Recovery Adj				0 kWh	X	-0.00003		0.00
Energy Efficiency Programs				0 kWh	X	0.00160		0.00
Franchise Cost				\$16.50	X	2.46600%		0.41
State Tax								0.00
Municipal Tax								0.00
Total Current Charges								\$17.68
Current Month Rollover				13 kWh				

What a great feeling of liberation to finally shed myself of the guilt and expense of using dirty energy. This is an emotion I did not anticipate and it has become the most valued. I no longer consider the use of energy as some evil and to be avoided practice although wasteful behavior should always be avoided. Rather it is now a welcomed part of making life comfortable and prosperous. As I became more aware of climate change and its impacts, just turning a light on became something I felt guilty about. What a way to live. Now I flip on a light and it doesn't matter. Land use is no more than was already occupied by my home (compare to power plants, oil and gas wells), there is no water use (compare to fracking and nuclear), I produce no pollution (compare to any fossil fuel), and no CO₂ emissions (ditto), I'm not using up limited resources (ditto again), and it is not costing me anything more than I have already spent (my fuel is free and unlimited).

Also I was able to sell the RECs (defined in Part 2) I produced from July 2011 through December 2011 for \$200 each or \$835. I hope to sell all my RECs in 2012 for \$125 each but won't know until the end of the year. But I put \$1706 into my pocket with potential for more. If I sell these 2012 RECs, then the first year of operation will have netted me \$2,456 in combined savings and REC sales. Using straight line depreciation of my system as mentioned earlier of \$1,848, I am \$608 positive. I originally estimated \$702. Pretty close and I'm thrilled. Recall, I never expected this project to yield positive cash flow until years from now if ever. I did it for all the other reasons. And remember with that electric vehicle in my future, at \$4 per gallon, I'll add over \$2,000 to my savings.

I went into this project to prove to myself and others that there are better ways to live. Not just responsibly but economically. With such a strong case whether you talk the environment, the domestic economy, or the personal economics, then why such an uphill battle for renewables to be a bigger part of our energy portfolio?

I believe the answer, and it may surprise you, is the lack of applying free and fair market capitalism principles to energy. Please note, “free and fair”, not just “free”. Ironically it is usually big corporations, their beneficiaries, and their bought and paid for politicians that argue for free markets (little to no regulations) but not for fair markets. Behind the scenes these corporations aggressively fight anything that levels the competitive playing field. What is more central to capitalistic principles than competition? Understand what all companies seek, but would never admit, is securing a monopoly position in the market. This shifts the power from the consumer to the producer. This power gives producers control of pricing and supply which in turn generates massive wealth that can be used to influence public opinion and government policy.

Case in point, I am now an energy producer as should be my right in a free market. But there is no market for my energy besides my own home. It’s the law! I cannot sell my excess energy production. It is prohibited. Under net metering rules if I have excess energy at the end of a mandated 12 month period, ComEd just takes it. In my first year, ComEd took 430 kWh from me without as much as a “thank you”. That is more than half a month’s electricity usage for me. Is that a free market? Someone is certainly getting something for free but I don’t think that is how it is supposed to work. Is it a fair market? I feel robbed and believe I was but the law says it is OK.

Why is this important beyond what is basic fairness? While I am producing energy for my own consumption, there is a possibility that I may reach a point where I consistently produce more than I use in a year. Why can’t there be an exchange for me to sell my excess energy at market rates? Wouldn’t this be good for society, good for investors, good for small business development, etc.? The answer is simple; it would be stepping on current large electricity producers’ toes. In fact if such a market had existed I might have bought a larger system to create a revenue stream for me but state law prohibited it. Any wonder who wrote (or more precisely “bought”) that law. Shouldn’t we be doing anything and everything to find and open new and dynamic markets that would stimulate demand, supply, innovation, and the economic growth that accompanies such events?

In conclusion, I couldn’t be happier with my decision to go solar but at the same time it opened my eyes to the fact that the energy companies have such a strangle hold on everyone’s energy dollars and energy behavior that breaking that grip is largely beyond the capacity of most individual consumers. Until that grip is freely and fairly eliminated, a future of less expensive, clean, and unlimited energy will be kept from the majority of residents. It’s irresponsible, it’s anti-American, and it’s anti-free market capitalism. But no, I’m not joining the Tea Party, they should be joining us.

¹ U.S. Environmental Protection Agency, Office of Air and Radiation, *The Benefits and Costs of the Clean Air Act from 1990 to 2020*, Summary Report, March 2011.

² Stern, Nicholas, *The Stern Review of the Economics of Climate Change*, 2006, HM Treasury, London.

³ *Freeing the Grid, Best Practices in State Net Metering Policies and Interconnection Procedures*, December 2010, Network for New Energy Choices, New York, NY.

⁴ *Estimating U.S. Government Subsidies to Energy Sources: 2002-2008*, Environmental Law Institute, September 2009.

About the author: Peter Gorr lives in Palatine, IL and is a husband, parent, and grandparent. He is a retired business executive and holds a MBA from the University of Chicago in Marketing and Statistics. He is Chair of the Executive Committee of the Northwest Cook County Group of the Sierra Club and on the IL State Chapter Executive Committee where he chairs the Solar Committee and Governance Committee. He is also on the Board of Directors for the Illinois Solar Energy Association and a Board Member of Friends of Busse Woods.

