

The Dark Side of Solar

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For good reason, solar power is incredibly popular today. It is considered a clean, renewable, environmental savior that has become more affordable by the year. It also provides the added social, economic and political benefit of reducing the monopolistic power of utility companies by moving us toward distributed, local energy production.

However, there is a dark side to solar energy that is just starting to get the attention it deserves. Namely, solar technology generates extremely “dirty” electricity, which can and does create health problems for solar system owners and their neighbors. I have already had dozens of families across the country contact me about this issue after they installed solar on their home.

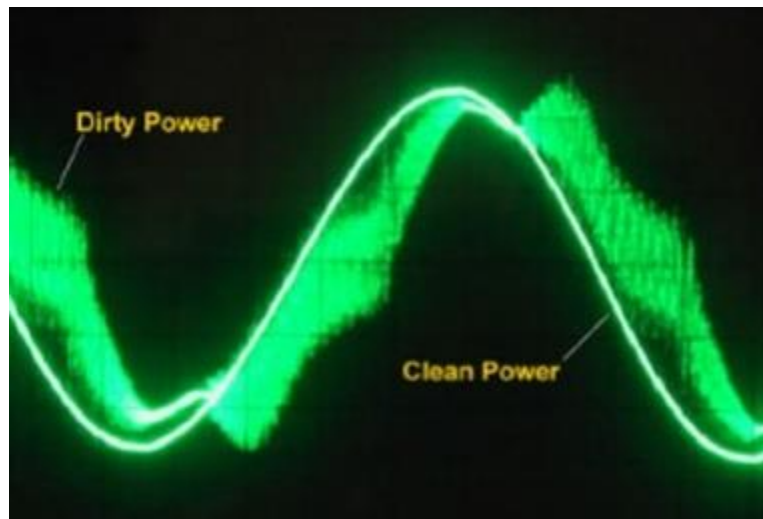
The importance of this issue is set to increase exponentially in the coming years. Current U.S. roof-top solar installations are at approximately 600,000 homes. However, as the [New York Times reports](#), an expected 3.3 million U.S. homes will have solar systems by 2020. This five-fold increase will lead to unhealthy levels of dirty electricity throughout our communities unless new solutions are utilized.

In this article, I explain the primary problems with current installation practices and provide effective solutions to install healthier solar systems.

A Fossil Fuel Industry Troll?

Before we move on, I want to allay any fears that I am a fossil fuel industry troll (I have actually been called this for speaking about the EMF problems of certain green technologies). The truth is that I have been an environmentalist for over two decades. My background is environmental engineering and I have spent years giving presentations throughout the country about environmental sustainability. In no way am I opposed to our switch to sustainable energy sources. In fact, I encourage it. I am simply pointing out that our current practices cannot be considered environmentally sustainable if they are harming people. True environmentalism includes the electromagnetic emissions of our technology, just as it does the carbon footprint. Those of us who care about our society's future must realize this so that solutions can be found.

What is “Dirty Electricity?”



Clean electricity is a pure 60 Hz sine wave (50 Hz in Europe). Dirty electricity has many higher frequency transients or harmonics piggybacking on the 60 Hz line. The engineering term for this phenomenon is electromagnetic interference (EMI). This EMI, typically in the KHz and MHz range, then radiates from the electrical wiring in your home and creates an electrostatic field that can interfere with the biological processes of your body. EMI is what you hear as static interference on your AM radio when you drive underneath a powerline. Common health issues related to years of exposure to dirty electricity include:

- Headaches
- Heart Arrhythmia
- Skin Rashes
- Fatigue
- Insomnia
- Decreased Cognitive Functioning
- Immune, Endocrine and Nervous System Dysfunction
- Cancer (See Dr. Sam Milham’s book “[Dirty Electricity](#)”)

People who experience electromagnetic hypersensitivity (EHS) can typically feel if a home has high levels of dirty electricity soon after entering. One or more of the above symptoms may appear and then subside once away the home. You don’t have to be EHS to know if a home has dirty electricity though. There are at least four technical methods to measure your home for dirty electricity, which I explain [in this article](#).

The following is an image of one method to measure EMI – the Alpha Labs EMI Line Noise Meter. The ideal readings for this meter, which measures EMI frequencies from 2 KHz to 10 MHz, is 100 millivolts (mV). Most urban/suburban homes have readings around 400 mV before any EMI remediation. However, with an AC solar inverter installed, the readings typically jump to between 1,500 and 2,000 mV. This is much higher than you would want to be continuously exposed to. A video showing this can also be seen [here](#).



Daytime EMI measurements within a home utilizing an AC solar inverter. The readings were below 600 mV at night, showing that most of the EMI is from the solar inverter.

How Does Solar Technology Create Dirty Electricity?

The primary issue is the solar inverter. Solar panels generate direct current (DC) and the modern home requires alternating current (AC). The inverter basically chops up the DC in order to produce AC. In doing so, it creates other frequencies (EMI), in addition to the 60 Hertz AC current required for your home appliances.

This EMI then travels not only along all electrical wiring in your home, but also along most metal in the home, including the ground/neutral of your electrical system, and back up to the unshielded solar panels (where these harmonics radiate into the nearby environment). The harmonics will also travel out to the main powerline on your street and then migrate into any nearby homes that share the same transformer.

This means that one improperly installed solar system will pollute not only the local home environment, but many other neighboring homes. *Indeed, if we do not implement solutions to reduce this dirty electricity, one byproduct of the exponential rise in solar installations in the coming years will be a highly polluted electrical grid and the health problems that go with it.*



At right, a typical solar system inverter.

A Personal Story to Illustrate the Importance of this Issue

Before moving on to solutions, I want to share a personal story about solar technology and our understanding of environmental solutions.

About a year ago, a friend asked me to measure her house for EMF pollution. She had recently started renting the home and did not feel well when she was there.

When I arrived at the home, it appeared to be an environmentalist's dream. The roof was filled with gleaming solar panels and the driveway had multiple signs that read "Electric Car Parking Only." In Marin County, California this is certainly not an unusual site.

Upon entering the home I could tell something was not right as I got a tension headache within a few minutes. This is my body's usual sign that there is an EMF problem, but it was rare for it to happen so quickly.

I went about measuring the home and offered as many solutions as I could. However, it was clear that this home was not a healthy place to live. The reason was clear as I have now experienced this multiple times and have corroborated the experience with many other people. In short, the home was powered almost completely by solar technology and the installation practices were completely opposite of the solutions I outline below. As my measurement devices and our bodies confirmed, this home was filled with dirty electricity.

There was also a reason why my friend was renting the home. The previous owner had recently died of Non-Hodgkin Lymphoma. He was relatively young (in his 50's), very successful financially and an ardent

environmentalist. In fact, he did everything an environmentalist is supposed to do to protect the planet: he had a solar system, a Tesla and Prius in the garage, and a wireless smart meter on the house that would eventually enable the “smart home” to be controlled by his smart phone.

The problem with this kind of environmentalism is that it is ignoring the basic principle that *our bodies are electric*. At the deepest levels of our biology, we are electromagnetic. This is how our nervous system works. It’s how our cells communicate. Thus, by filling our lives with ever more artificial electromagnetic frequencies through solar technology, electric cars and wireless technology, we are robbing ourselves of health, vitality and potentially many years of life.

The truth is that our current view of environmentalism is incomplete. It blindly accepts any solution that is remotely related to reducing greenhouse gases, even if that solution is endangering our health. The inconvenient truth of our time is that the high amounts of EMF pollution created by our green technologies has the potential to directly affect each of us as much or more than climate change.

It may take a while for this realization to sink in because it will force us to reconsider many things we hold to be sacrosanct. However, I am quite hopeful that inventive solutions and new, safer technologies will be developed once we accept this new paradigm. For the time being, however, let’s look at how we can make one technology in particular – solar technology – safer for us all.



Roof-top solar panels are supposed to help our environment. However, panels radiate harmonic frequencies (dirty electricity) and can become a health issue when installed above bedrooms.

Can Solar Be Installed More Safely?

The good news is that there are solutions that help reduce the dirty electricity created by solar systems. The following steps will greatly improve our current installation practices and make solar technology safer and healthier for society.

Special Note: Even with the following techniques, AC solar systems are not recommended for someone who has already been injured by EMF pollution. Until the current technology improves, you will want to look at DC solar systems (see solution #8 below).

1.) Panel Layout is Important. The worst place to put your solar panels is on the roof above bedrooms and places where you and your family spend a lot of time. As I mention above, the harmonic frequencies travel back up to the panels and radiate into the nearby environment (the panels are not shielded for these types of frequencies). For this reason, if possible, the best area to place solar panels is above the garage, on an outside deck, on the ground or in the backyard far away from the home.

The same goes for the inverter. These devices not only produce dirty electricity, but they emit high magnetic and electric fields that radiate into surrounding areas. It's best to not put the inverter on a wall near your kitchen, bedroom or living room where your family may spend a lot of time. Place the inverter on a garage wall or, even better, away from the home on a shed or detached wall.

As with all EMF pollution, distance is your friend. It is often the least expensive and most effective method to reduce and eliminate artificial electromagnetic fields. So, keep the offending sources as far away as possible from where you spend most of your time.



This is solar array in the Black Hills of South Dakota is the perfect way to place panels.



If you have a big yard with lots of sun, a placement like this is ideal.



Placing the panels away from the home on the ground is preferred.

2.) We Need a Cleaner Inverter. The inverter is the primary reason that electricity produced by solar systems is filled with unhealthy EMI. Unfortunately, solar inverters on the market today are not designed to create healthy electricity. Such an inverter could be made, but in conversations with experienced electrical engineers, it would cost \$8,000 to \$11,000 and there is not yet a profitable market for such a high priced device (today most inverters cost \$1,500 to \$2,500).

However, with the growing popularity of solar and the increasing awareness of the importance of electromagnetic pollution in our homes, this market may appear in the coming years. Furthermore, if major companies such as Tesla or Sun Power were to tackle this engineering problem, then economies of scale could bring down the cost of a healthy solar inverter within the reach of the average solar customer. This is the ultimate solution for safer solar power in our society, but it will take an educated consumer to demand this shift.

You should know that many solar installers and inverter companies may tout their products as “clean power.” However, this is simply untrue and they may be praying on the increasing public awareness of how dirty solar power actually is. Even the German-made SMA Sunnyboy inverter creates relatively high amounts of harmonics (this was the inverter on my friend’s home above). The supposedly cleaner Sunnyboy products emit EMI levels that are only 10% lower than the other inverters I have measured.

Fortunately, along with proper solar panel placement, there are several methods that will help you reduce the dirty electricity produced by the current generation of solar inverters.

3.) Use a Whole-House Powerline Filters. Until healthier solar inverters come to market, whole-house powerline filters are a possible strategy to reduce the dirty electricity produced by the inverter. Implementing powerline filters is possible for most homes with solar systems. However, in order to truly filter the harmonics, there are quite a few things to take into consideration and the costs can run into the thousands of dollars.

In researching this article, I talked with numerous engineers, EMF consultants and powerline filter companies. There are multiple strategies used by professionals around the country and explaining the benefits, costs and techniques required another whole article. You can contact me to discuss how to implement commercial grade filtering of your solar system EMI.

If you properly filter the solar inverter harmonics and the harmonics coming from your neighbors on the grid, then you only have in-home sources of dirty electricity left to reduce. These are typically dimmer switches, CFL & LED lights, and certain electronics in your home. Once you clean up these sources of dirty electricity, your home should be well on its way to having a healthy electromagnetic environment.

4.) Reconsider the use of [Graham-Stetzer](#) and [Greenwave](#) Filters. These basic powerline capacitors have become popular the past few years. Some people do feel better with these devices and several EMF consultants get good results with them. However, other people actually end up feeling worse once they are plugged in.

The primary reason for the mixed results is that the capacitor (they aren't really "filters"), while partially cleaning the electric field component of harmonics, is actually increasing the magnetic fields on the home wiring and making these magnetic fields dirtier. The capacitors appear to be moving the harmonic frequencies from the electric field component (voltage) to the magnetic field (current). Thus, whether they make you feel better or not is primarily based on whether your body is currently more sensitive to electric or magnetic fields. In homes with wiring errors, the capacitors will actually make the magnetic fields much more problematic. Over time, this could lead to health problems and your eventual sensitization to magnetic fields. This article and this video explain this issue in more detail.

Some EMF consultants will utilize four of these capacitors together near the main electrical box where the home is tied to the grid to reduce the harmonic frequencies coming into your home. They will have an electrician wire in two new circuits and two new outlets specifically for this reason. Provided you do not react to these capacitors, this is likely the safest way to utilize them. However, plugging them into random sockets throughout a home in order to reduce the dirty electricity is not a strategy I recommend.

5.) Reduce Electric and Magnetic Fields in Your Home. I recommend that everyone have their home measured for the four types of EMF pollution, which I describe [in this article](#). This one step is the best thing you can do to ensure your family is not affected by EMF pollution. You can measure this yourself or have an EMF professional come to your home.

Measuring your home is especially important if you have a solar system. The reason is that electric fields (and magnetic fields to a lesser extent) are a very efficient delivery mechanism of the solar inverter EMI to your body. Thus, if you already have high electric fields in your home, they will become even more dangerous with solar technology because the fields will now have additional frequencies within them that can affect your body. Northern California EMF Consultant Michael Neuert states that the solar system harmonics being added to already high electric fields within a home is 90% of the problem for his clients with solar technology. Thus, addressing the electric fields can significantly help with this problem.

The good news is that both electric and magnetic fields can be remedied. Magnetic fields are typically caused by home wiring errors, stray current, or by items like the Stetzer and Greenwave capacitors mentioned above. Electric fields are reduced primarily by turning off circuit breakers and/or by using EMT conduit with compression fittings (shielded electrical wiring) or MC Cable. If you are doing any sort of remodel or new home construction, I highly recommend that you use MC Cable or EMT conduit over the more commonly used Romex wiring. MC Cable is only 25% more expensive than Romex, but reduces the electric fields in your home by almost 90%. EMT conduit with compression fittings and twisted electrical wiring is the very best low-EMF solution, but will take more labor to implement. This wiring technique will ultimately reduce the health impact of your solar system.

6.) The Truth about SolarCity: Solar lease companies like [SolarCity](#) are happy to offer you zero-down solar energy where you are essentially buying electricity from their solar system, which is on your home, for the next 20 years. The issue here is that you are entering into a complex contract that is very difficult to break or modify if anything goes wrong. I know multiple people in California who signed these

contracts and a few months after installation realized that the dirty electricity from the solar system was making them ill.

Their options were either to pay huge cancellation fees or move. In some cases, the SolarCity customers actually had to sell their home and move. SolarCity would not acknowledge that their systems were not installed with human health in mind. The company's sales department and engineers would only give the standard answer that "our systems meet all federal and state regulations." Of course, these regulations are meaningless as they are not meant to protect human or animal health from long-term, non-thermal EMF exposures. It is now well known that FCC safety regulations are obsolete and the regulatory agencies have been captured by the industries they supposedly regulate.

Another very important point with solar leases is that if your home has a serious EMI problem, ***you will have to disclose it should you ever sell the home.*** This could make it difficult to sell your home and cost you money down the road. If you own your solar system, you could simply turn the system off if necessary. You can't do this with a leased system.

With systems that you do not own, it can also be very difficult to make the adjustments like those outlined in this article. Doing so will invalidate the warranty. Furthermore, systems like SolarCity's have a pulsed microwave radiation component that is used to communicate with the panels (for efficiency during daylight hours) and to communicate the energy usage and other data back to the company. In Arizona, solar lease companies are actually installing a second wireless smart meter at the inverter. These components could have been wired. People who are increasingly concerned about additional EMF exposure will not appreciate that these wireless components cannot be turned off without invalidating the warranty.

Finally, with [Google being a major investor in SolarCity \(now owned by Tesla\)](#), these leased solar systems will also likely be part of Google's increasing presence in the "smart home" and "Internet of Things" market to collect and control your valuable personal home data (Google also owns Nest, maker of the wireless thermostats, fire detectors and security cameras). Thus, both privacy and health can be an issue with these leased systems.



Image Credit: David McNew / AFP

Unveiling of the Tesla Powerwall Battery Pack

7.) Will the new Tesla Powerwall Battery Produce Cleaner Electricity? I applaud Tesla for their innovation, but, unfortunately, the new home battery will not make solar power any less dirty. The [Tesla Powerwall](#) was announced in 2015 as a way for solar system owners to store the excess energy they generate during daylight hours to use at night. This sounds like a great idea and was announced with much fanfare. However, unless you want to or need to go completely off-grid or you have a solar system big enough to power all your needs (very unlikely), the current economics of the battery just don't add up.

From a technical standpoint, the Tesla Powerwall will store the DC electricity produced by the panels and even store energy from the grid. The system will then send the DC through the inverter to produce the AC that your homes utilizes. The adjoining diagram shows how this will work. To this system I would add a professional powerline filter between the inverter and the electrical box. If Tesla, and their sister company SolarCity, would also work on producing a good powerline filter and a clean inverter, they would truly have the market cornered and our entire society would have cleaner, healthier electricity.

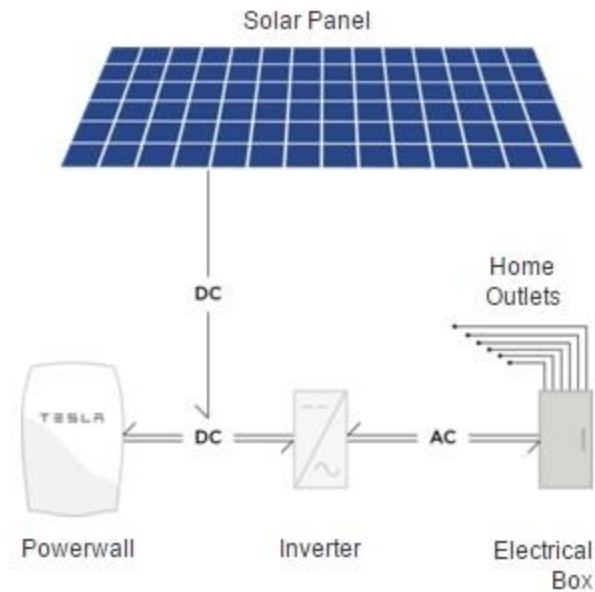


Image Credit: Tesla Motors

It's best to add a high quality AC powerline filter between the inverter and electrical box. You could also add DC filter between the solar panels and the inverter. This would reduce harmonics traveling back up to the panels.

8.) Use Direct Current (DC) in Your Home. One way to bypass the inverter EMI issue completely is to use only direct current in your home or have a separate DC line from your solar system and get your AC needs from the grid. Many small appliances, lights and items such as vacuum cleaners can run on DC. I know several people who have been injured by EMFs who have healthy off-grid DC solar systems and use propane and a generator to operate the more power intensive items that normally need AC electricity. This is the best way for EMF-injured people to utilize the many benefits of solar technology without further diminishing their health. While DC electric and magnetic fields are not completely benign, they appear to be much less damaging to human health than AC fields. Designing a DC system (or a low-EMI off-grid AC system) is quite complicated. Feel free to contact me for additional resources.

9.) Your Electric Meter Counts. Most utility companies will say you don't have a choice in the electrical meter that is placed on your home – especially if you have a solar system. However, resourceful people can always find ways to get the meter they want. Your options are typically an analog meter, a non-transmitting digital meter and a wireless "smart" meter. For health and privacy reasons, you want to have either an analog or non-transmitting digital meter. If the utility company won't budge and forces one or even multiple wireless smart meters upon you, then, for the time being, use a [Smart Meter Guard](#) and aluminum shielding on the inner wall to reduce the microwave exposure in your home. The wireless smart meter programs are a classic environmental boondoggle and may eventually be rolled back as society wakes up.

One final note about electrical meters: If you live in an area with wired smart meters (PLC or TWACS technology), you likely already know what dirty electricity is. Your electrical wiring is filled with frequencies that transmit all customer electrical use data to the utility company. This type of smart meter technology is one of the worst for human health because the entire electrical grid is polluted with EMI. The upside is that the filtering techniques mentioned above may help or you can go off-grid utilizing these healthier solar installation techniques.



Solar is going to be a part of our energy future. If we are wise, so will healthier installation practices.

Hopefully with the above solutions, increased environmental awareness and inventions that are still to come ([Elon Musk](#), let's build a healthier solar inverter before sending people to Mars), solar energy will fulfill its incredible promise. It can be both healthy for the environment, and safe for humans and animals. As this knowledge becomes mainstream, solar power can spread even faster than it is today. This will lead to a society that is both sustainable and healthy, which should be the ultimate purpose of any technological revolution.