

## Climate, Energy and Community: Vermont 2016

Alan K. Betts  
 Atmospheric Research, Pittsford, VT 05763  
[akbetts@aol.com](mailto:akbetts@aol.com)  
<http://alanbetts.com/writings>

This is a compilation of my 2016 columns from the Sunday Rutland Herald and Barre/Montpelier Time Argus. This series started eight years ago in January 2008; and an overview paper is available<sup>1</sup>. These columns go through the seasons, dealing with weather, climate, climate change, energy and policy issues. They blend science with a systems perspective, and encourage the reader to explore alternative and hopeful paths for themselves, their families and society. They are written so that a scientist will perceive them as accurate (although simplified); while the public can relate their tangible experience of weather and climate to the much less tangible issues of climate change, energy policy and strategies for living sustainably with the earth system. Other occasional opinion pieces are included.

I believe that earth scientists have a responsibility to communicate clearly and directly to the public<sup>2</sup>—as we all share responsibility for the future of the Earth. We must deepen our collective understanding, so we can make a collective decision to create a resilient future. *All my articles are available from my web-site, and can be freely reused under a Creative Commons license.*

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<sup>1</sup> Betts, A.K. and E. Gibson (2012), Environmental journalism revisited. *Environmental Leadership: a Reference Handbook*. Deborah R. Gallagher, Editor, SAGE publications Inc., Sept. 2012, ISBN: 9781412981507. Available at <http://alanbetts.com/research/paper/environmental-journalism-revisited/#abstract>

<sup>2</sup> Betts, A. K. (2011), Communicating Climate Science. *EOS Transactions*, 92, No. 24, 14 June 2011. Available at <http://alanbetts.com/research/paper/communicating-climate-science/#abstract>

**a) Reflections on a hot year****(January 10, 2016)**

<http://rutlandherald.com/article/20160110/OPINION06/160119998/>

In January I like to look back on the year that is past. So far the winter has been much warmer than the last two. We have the very strong El Nino in the equatorial Pacific to thank for this. I still have Brussel sprouts to eat from the garden, and fresh fall spinach as well as my spring spinach growing under glass. I have even been thinning spring lettuces for a month now!

This past year 2015 set a new record global temperature by a very large margin, shattering the myth that climate warming was slowing down. Undoubtedly the best news was the December climate agreement in Paris with the consensus support of 196 countries. Nations made commitments to reduce the burning of fossils fuels to try to restabilize the climate system. This is a daunting task, since we have waited so long, but at least we are now heading in the right direction, with clear targets and progress reviews every five years.

Grassroots democratic pressure helped a lot – many Vermonters went to Paris – and the moral clarity of Pope Francis was on the minds of many leaders. Fortunately these activists realize just how much work lies ahead for the rest of this century. Follow-through will be difficult for many leaders, as they slip back into local politics, election cycles and business as usual. Vermont can play a leading role.

So let us start by facing some truths that were necessarily ignored in Paris – in order to get an agreement. One basic issue is that the developed countries dream that climate change can be dealt with within the global market, and the economic, financial and technical framework that has made them rich and powerful. Yet this is the very framework that has accelerated climate change in recent decades. In addition, the necessity of a fossil carbon pollution tax was not even on the table.

The developing countries want to lift their people out of poverty, and their elites think in the same terms of consumer growth, centralized power systems and more cars that have fueled climate change. The rich nations are happy to profit from these expanding markets, and eager to add a lot of renewable energy systems to the mix.

But as Pope Francis said: our increased power has not been linked with deeper moral values, and a true sense of our common home and common destiny. One result is that the exploitation of the Earth and the exploitation of the poor by the wealthy are now intertwined. In Paris, the rich developed countries were reluctant to make agreements to share resources with developing countries. Sharing intellectual property rights on essential renewable technology would reduce their profits. So financial commitments from the rich to the poorer nations were small compared with the scale of the challenge.

Some were surprised at the about-face of China in the past year, but two of the reasons for this are salutary. The air pollution in Chinese cities from burning coal is so unhealthy that urban revolt is brewing. And China has realized that its future economic growth could be based on supplying the world with cheap renewable technologies for decades to come.

Sitting by the fire and dreaming of spring this January, we need also to dream how to transform our 'buy more' consumer society and growth economy into something sustainable that the Earth can handle. This will take vision, time and effort.

**b) Energy credits are a diversion****(January 20, 2016)**<http://rutlandherald.com/article/20160120/OPINION04/160129994>

There have been several articles in the last few weeks, discussing the sale of renewable energy credits (RECs) associated with solar arrays in Vermont to out-of-state utilities. They are written from a legalistic perspective that has little relevance to the global issue of transforming our fossil fuel energy system to renewable energy as fast as possible.

A solar farm generates electricity from a renewable source, the sun. RECs were created as a financial instrument to represent the environmental benefits resulting from not generating the same electricity from burning fossil fuels. A Vermont developer can sell the electricity generated to Green Mountain Power, while selling these RECs to a utility outside Vermont, so that another utility is effectively subsidizing solar power in Vermont. Very interesting you might say, and helpful to Vermont; but why would a utility in Massachusetts subsidize renewable power in Vermont, when it is getting no electricity?

Some New England states passed renewable energy portfolio standards telling utilities that some percentage of their electricity must come from renewable sources. But utilities do not have to actually build renewable generation facilities themselves — they can buy the credits from elsewhere. The idea in our market economy is that solar arrays will get built where it is cheapest — such as Vermont where land may be cheaper and farmers may need cash. So a utility can claim it owns renewable power, and that it has met its mandated renewable energy standards, even if it has actually built none. Readers will recognize this is one of the ways we avoid facing critical issues in our society, by creating instead face-saving legal and financial instruments. Another example would be purchasing carbon offsets on airline travel.

Does it matter to the Earth whether a solar array is in Vermont or Massachusetts? Of course not, what matters is how fast we can move away from fossil fuels, and we are not moving anywhere near fast enough. The buying and selling of RECs does not help the Earth at all. It is a delaying tactic, providing a fig leaf so that states can pretend they are making the transition, when they are not shutting down fossil fuel plants fast enough, and building renewable alternatives. No amount of honest or fictitious bean-counting can hide this critical and disturbing fact.

Consider a concrete example. I invested in 5 kilowatts of solar power in a community solar array in West Haven. The developers funded construction of this array in several ways. They sold shares to individuals like me; they collected a 30 percent tax credit (funded by taxpayers like you and me), and sold the RECs out of state. Green Mountain Power gets the electricity, and I get an electricity generation credit and group solar incentive credit, which over the year pays most of my electric bill.

Many sources have contributed to building this community solar array, with individuals like me being the major investors. The sale of the RECs has also made a smaller but significant contribution. Some other utility can pretend it has renewable power in its portfolio, simply

because it has bought the legal right to say this. But in reality the solar power is here in Vermont being integrated into our smart grid. If the New York or the New England grid goes down, Vermont has this local renewable power intact.

In decades to come Vermonters will be grateful that we started this renewable transition early. Yes, we can thank our neighbors for contributing a little towards it. But the Earth asks that states everywhere face reality and start building tangible renewable infrastructure on a massive scale — as well as investing heavily in energy-efficiency measures. In the meantime expect the coastal storms to get worse, and sea-level to rise a few feet this century and next.

### **c) Transforming transport in Vermont (March 6, 2016)**

<http://rutlandherald.com/article/20160306/OPINION06/160309656/>

On cold mornings in winter after a clear night when the temperature is zero or below, I need a balaclava, down jacket and no wind chill to walk down to the covered bridge in Pittsford. As the sun rises and is reflected off the snow and ice, I am reminded of the determined scientists who are studying the Arctic and Antarctic as they are being transformed by climate change. They live in cramped bunk-houses for weeks on thick ice. In the north, the sea-ice is shrinking and the methane release from the thawing Arctic tundra may soon accelerate the warming of the climate.

But in ten minutes, I can return to my wood stove and be warmed by the wood I cut and split a year ago. And the sunny afternoons that follow cold clear nights are often warm enough for me to work outside.

The January snow storm that dumped two feet of snow on the east coast cities went out to sea and missed Vermont. With little snow cover to reflect the sun, the winter climate has been rather mild. We have been eating spinach grown under glass all winter.

But I was still unprepared on the last day of January when mosquitos started hatching in the house. The next morning, February 1st, it was 50 degrees at sunrise for my morning walk and blowing a stiff wind. Two days of rain soon followed, the ground melted, and I was able to start digging under my rye cover crop on February 4th. Relatively mild weather continued until Valentine's Day when temperatures plunged to below -15 degrees, before rising again.

Awareness is spreading in Vermont that our energy system must change, so what do we need to do? We know how to retrofit our houses so that it take less energy to heat them in winter. The transformation of our electrical energy system to renewables is under way. Much of what is needed could be largely completed in less than ten years if we made the effort.

It is time to tackle transportation, which uses so much fossil fuel in a rural state like Vermont. Industry would like us to buy a lot of electric cars, so we can continue to commute alone. Electric cars with a 200-mile range at a reasonable cost should be available by the end of this year. But we should think about how to start the shift from using heavy single-occupancy-vehicles to get around. We have not made a change this big for a century, when trains and then automobiles replaced horse and buggy.

Uber has shown how taxi services can be improved by networking. Now we need networked passenger vans and private cars on our highways, so that I can easily get a ride from Pittsford to Burlington on Route 7. It seems that this would not be difficult to set up. China is leap-frogging over Uber, and rapidly developing a broad Web-linked transportation system.

Another revolution would be light-weight electric vehicles, derived from tricycles, rather than cars. Add an all-weather aerodynamic shell, and with only 10 percent of the weight of a car, it is much easier to get adequate range using lithium batteries. Yes, commuting would be a little slower, as they are currently limited to about 20 mph, unless the rider pedals as well. However, the cost in both dollars and damage to the Earth is far less.

One fringe benefit of using an electric trike to commute would be that exercise improves health and productivity. Our sedentary existence is a huge drain on our physical energy and medical finances. We should start planning and building a real bike network in Vermont, so these light-weight efficient vehicles do not have to share the highways with trucks. In Europe, Germany has started down this path.

Globally, tens of millions of electrical bicycles and tricycles are now sold annually, but this county is largely ignoring this shift. We dream of 'solving' climate change without really changing the way of life that created it! Standing in the rain in early February reminded me of my youth in England, when I would have been amazed and delighted to have an electric tricycle.

**d) Embrace Change this Spring****(May 8, 2016)**<http://rutlandherald.com/article/20160306/OPINION06/160309656/>

When the Earth becomes vibrant again with life in spring, we welcome the change, and many feel a surge of joy and gratitude. The winter was so mild that daffodils bloomed in March in Pittsford, but it was too early, and the flowers were killed by the return of ten-degree temperatures one night.

When there is little snow to reflect the sunlight, winters are ten degrees warmer. This past winter set record new temperatures globally, and we can expect a much warmer world in coming decades as the climate changes. Globally, December was very warm, January broke that record, and then February broke the record again by such a huge margin that even climate scientists were surprised. It was so warm that in the Arctic night, the sea-ice extent stopped growing a month early at a new record low in February.

For a gardener, but not for skiers, the warm winter was satisfying. The ground in my garden in Pittsford was unfrozen for parts of January, February (for the first time) and almost all of March, so I was able to dig my cover crop of rye grass. Unprotected spinach survived the winter for the first time. Under glass, lettuce and spinach thrived, and started growing by the end of February, giving us lots of greens for our daily salads. At the beginning of April, I planted some hardy seeds, and now peas, beets, chard and radishes are growing well.

Can we embrace a changing climate, a changing Earth, with the same joy and gratitude as we welcome spring? This is not so easy. Because we fear change, many turn to denial. But we are an integral part of the interconnected life on Earth, so we must try, or we too will slip into denial, fear or even despair at the changes ahead. And that is much too bleak.

The political season is in full swing with a presidential election ahead, and for the first time one party is discussing climate change. The electorate is very angry with the failure of the federal government to address what they see as the real issues. But perceptions of reality differ widely, and accusations and blame are flying in many different directions. Yes, the political system works to further the interests of the rich and powerful at the expense of the poor and the Earth itself, and this must be challenged. But few look at the whole picture, where we all share responsibility for the future of the world we have created from our dreams and sense of entitlement.

But change is coming whether we like it or not – the Earth is so much more powerful than our civilization. Our dream of unlimited human power that came with the discovery of fossil fuels and then nuclear fission is a mirage. We have to make the giant shift to both the acceptance of our responsibility for the future; and the realization that we must create a sustainable path for our civilization that recognizes our integral, inseparable relation with the Earth itself. And for this to work, we must create and accept new paths with gratitude and joy in the heart, rather

than grudgingly regret that the dream has faded. Unfortunately the denial of climate change is a recipe for collapse rather than a source of hope.

So it is spring and easy to start working with the earth. Go out and plant seeds, watch them grow and realize that working with the earth and each other is a joyful process. Start to dream where we might go this year as communities cooperating with the soil, the sun, rain and wind and the natural world. Can we and our families come closer to the Earth and its renewable resources so we can embrace change? And do share what you grow and what you learn with your neighbors.

*Dr. Alan Betts of Atmospheric Research in Pittsford, VT is a leading climate scientist. Browse his columns at [alanbetts.com](http://alanbetts.com).*



*Figure 1. Courtesy VERMONT Fish & Wildlife. Moretown Elementary School first- and second-graders had an incredible opportunity to help Vermont Fish & Wildlife staff and volunteers stock the Winooski River in Waterbury with trophy brown and rainbow trout. The children made a bucket brigade from the hatchery truck in the parking lot to the edge of the river. They passed five gallon bucket after five-gallon bucket, filled with beautiful trout, down to the river's edge where the trout were released into the river. In preparation for the trip, the children learned about the life cycle of trout. Upon returning to the classroom, the children spent time writing poetry about the beautiful fish.*



**e) Earth ignores politics.****(June 19, 2016)**<http://www.rutlandherald.com/article/20160619/OPINION06/160619541/>

There has been a lot of flooding across the planet this spring. Perhaps because storm systems are traveling across the landscape less quickly and raining in the same place for longer. The day-to-day patterns of weather are so complicated that it is hard to see clearly how the global climate is changing. In addition, the seasonal changes are very large in New England, and the variation from year to year can be huge as global patterns shift. Just recall the last two winters.

Traditionally the climate of a region was defined in terms of the average seasonal cycle of temperature and precipitation over thirty-year periods, and changes from one period to the next were small. Now the climate is changing much faster than it did fifty years ago, as greenhouse gases are accumulating in the atmosphere, and the weather is changing with it. The future is always uncertain, but now it is becoming more uncertain. This is a big challenge for society.

We know in broad terms what we must do. Slow down, double the energy efficiency of our society and industry, and replace fossil fuels, which contain carbon that was removed from the air 300 million years ago, with renewable sources of energy.

Perhaps even harder for us is the patience, courage and persistence needed to follow this path for more than a generation in the face of chaotic climate extremes. We want instant results, instant gratification, but we are dependent on a planet that moves slowly. The Earth is still processing and trying to digest all the greenhouse gases we dumped into the air over the past hundred years. It is warming up slowly, storing heat in the oceans, evaporating more water and slowly melting icecaps to counter the fact that it is being heated by the sun, but it cannot cool as fast to space as it used to.

These are changes we have to accept because the Earth is far more powerful than human civilization. We have to work with the planet as it struggles to maintain ecosystem stability in the face of staggering pollution of the air, land, streams and oceans from our thoughtless disposable society.

It was our unmanaged technology that created this, and a century ago we were too excited by new possibilities and wealth to understand the consequences. It seems this is still true for many! Reports from scientific committees have been mapping the consequences in ever-increasing detail for nearly 40 years, but we keep ignoring them, hoping that the Earth will somehow ignore our pollution. But it cannot, and it is time to use our technology creatively, and move to a zero-waste economic system based on renewable energy.

It is futile to protest that this might cost a little more in the first decade, when the downstream costs of our present economic path, estimated to be over a thousand trillion dollars, will bankrupt our children as well as life on Earth. This is the frame of reference of one of the presidential candidates who made millions while bankrupting his casinos!

The Earth does not have a convenient bankruptcy court. Melting the icecaps, after ten thousand years of stability, will drown our coastal cities and ports. Shifting the climate of Vermont to that of northern Georgia will wipe out our forests, as well as our skiing. Extreme weather, spreading floods and droughts will bring misery, starvation and millions of refugees.



I am glad Vermont is leading New England in many ways, but the legislature failed to pass a carbon tax this year. I am glad climate change issues are in the election campaign, but the US Congress is still trying to destroy the beauty of our planet in deference to rich lobbyists and its nihilistic political creed.

It is time to wake up with a sigh, look at the green landscape of summer, the farms and crops we love, and build the communities we need.

## **f) End of the Field of Dreams**

**(June 22, 2016)**

<http://www.rutlandherald.com/article/20160622/OPINION04/160629906>

John McClaughry has the freedom to believe what he wishes and his opinion piece denying the importance of ongoing climate change does just that. I know that when personal identities are based on political doctrines, it is hard to see the evidence clearly. This is why fact-checking is essential.

He is annoyed that a number of state attorneys general have taken up the case against corporations like Exxon for deliberately deceiving the public and their investors for more than thirty years. Exxon knew that burning fossil fuels is driving accelerating climate change, and saw this was a clear challenge to their business model. It was Exxon that silenced their own (honest) scientists, when they agreed with the 1979 National Academy of Science report that warned the US government. It was the Virginia attorney general that tried unsuccessfully to silence Michael Mann, a great scientist, because the compelling evidence that recent temperature rise was unprecedented in the past thousand years was incompatible with his political beliefs.

But McClaughry believes the fantasies he reads on the web that are written to confuse the public, and delay the transformation of our energy system because it threatens the profits of the fossil fuel industries. And then he makes the absurd claim that his skeptics are dedicated defenders of science! This is the big lie at its most infamous.

Let us role the clock back nearly thirty years to see how far we have come. In the 1980's, scientists warned the Reagan administration that refrigerant gases were destroying the ozone layer, which protected life on this planet. Reagan did not accuse them of being alarmists. Instead he listened, and with Riley at the EPA and widespread support, the Montreal protocol was negotiated and signed by every nation. The 1988 vote in the US Senate for this binding international agreement was 98-0. Read the signing statement by Reagan (<http://www.presidency.ucsb.edu/ws/?pid=35639>). Pin it to your wall and shed a few tears over the dysfunctional state of the Senate today.

The Montreal protocol, improved further with the Clean Air Act Amendments under the administration of George H. Bush, was the greatest environmental triumph of the last century, signed by the last Republican presidents who understood evidence and science. We don't hear about this successful global environmental regulation anymore from either Republicans or Democrats. But without it we would now be deep into an ozone catastrophe with no way out.

What happened was that when his party lost an election, Gingrich attempted and failed to destroy the integrity of the US government. But mythology and dishonesty became the norm, facts and science were fabricated to justify political ends. The Republican Party got trapped in its web of deceit until we have now arrived at the end of the road. Their leader is a totally dishonest and incompetent bully, who truly is

an alarmist who manipulates people's fears. Someone that could really destroy the United States and its government if elected. Sadly the field of dreams has become the swamp of nightmares.

But to pretend that somehow it is scientists who are the 'alarmists', when the integrity and honesty of science remains one of our greatest strengths in the face of political corruption, makes me chuckle over my coffee. But not for long – I cannot ignore the critical climate issues we face this century.

### **g) Please tell me the weather**

**(August 7, 2016)**

<http://rutlandherald.com/article/20160807/OPINION06/160809726>

Much of the northeast is experiencing drought this summer. It is patchy because a lot of summer rain comes from scattered thunderstorms. Despite periods of drought and heavy rain, our garden here in Vermont is growing well this summer. In part this is because I have watered the whole vegetable garden twice, and a few crops more frequently. There has been one unexpected but delightful change in our local ecosystem, perhaps because of the warm winter. This spring and summer there have been so few mosquitos that weeding is a delight, and it is pleasure to eat dinner on the lawn in the evening. It is such a contrast from some recent years, when I wore a net over my head in the garden.

Last month I visited the European Weather Centre in England, which provides the best 10-day forecasts for the planet. For 30 years I have worked with scientists there to improve the modeling of the transfer of heat and water from land to atmosphere, since this affects the weather. Computers have improved so much that these forecast models can calculate changes in pressure, temperature, wind and precipitation every hour everywhere on the globe for points that are only 5-10 miles apart for one to two weeks ahead.

So now I am asked: "Weather forecasts have become pretty good for even next week, but what I really want is a forecast for the next two months, so I can make plans for my work, my crops and my vacation." This is much more difficult modeling challenge. Every day, we measure the state of the atmosphere with surface weather stations, weather balloons and instruments on perhaps a hundred satellites, and all this data goes into models for the global weather, running continuously on some of the largest computers available. One hundred forecasts may be run out for the next 2 weeks. For the first few days, they are very similar, because they remember the measurements they started from, so we know with some certainty what the weather will be. But as complex jet-streams and storms develop, the hundred forecasts spread apart, and after 2 weeks we cannot be sure what will happen.

When we run fifty forecasts for the coming season, these too spread out a lot within a month. The Earth does have some long term memory, the energy stored in the oceans, and the moisture in the soil that came from last month's rain, the snow cover in winter and ice in the Arctic that keeps temperatures below freezing by reflecting sunlight. These do influence the weather patterns for months. But the global jet stream patterns that strongly influence weather can change every week, so it is harder to predict their pattern a month ahead.

Seasonal forecasting still needs improvements in our models. The official 3-month outlook for August-September-October from NOAA is that the northeast will be warmer, but precipitation will be average.

The corresponding seasonal forecast from the European Weather Centre is that the northeast will be both warmer and drier than average. If this happens, the drought will continue.

On the political front, some Vermont candidates for governor support a carbon tax on fossil fuels to nudge the energy system to become more efficient, and accelerate the development of renewable energy resources. In Canada, this helped the economy of British Columbia, and Alberta is now following the same strategy. On the national front, one party drifts still further into a fantasy world, where devastating the planet's climate and ecosystems to satisfy its financial sponsors will somehow save America's ego.

Yet despite establishment resistance, the stunning speed of renewable energy development with the rapid fall of the price of solar panels and lithium batteries is accelerating change. Global carbon emissions could peak as early as 2020, so keep pushing for values that will bring us a sustainable future.

## **h) Getting right with the planet**

**(September 25, 2016)**

<http://rutlandherald.com/article/20160925/OPINION06/160929737>

In a letter to the American Meteorological Society in 1976, I argued that if earth scientists, who had at least some understanding, did not accept some responsibility for the Earth, who would? Certainly not the political and economic system that had only short-term interests.

Forty years have passed, and now we see a very sophisticated network, funded by a group of libertarian billionaires, has bought control of the Republican Party in the US Congress and many state legislatures. Part of their doctrine is that climate science is a hoax. How has this happened and what motivated this fraudulent claim?

The 'libertarian' ideology is that government has a very limited role: primarily to protect wealth and property, and preserve the rule of law. It helps if you can also write the laws! The libertarian political agenda believes that the freedom to exploit the earth and its resources, should not be limited by environmental regulation. This brings it into conflict with the Earth's ecosystem on which life depends, because the impact of our industrial society is now global.

Environmental regulation of the massive waste streams from society and industry are viewed with hostility. Global regulation to limit the burning of fossil carbon to protect the future of the earth's diverse ecosystem is a clear threat to their fossil fuel assets. So it was a good business plan to use one percent of their wealth to take over Congress, and subsequent tax cuts largely paid for this investment. Indeed their opposition to climate science, and their claim that climate change is a hoax, can be viewed as simply propaganda that is driven by their fear of government regulation, and the need to protect their wealth, assets and property at all costs. As Pope Francis pointed out last year: the exploitation of the Earth and the poor are now inseparable, and both are immoral.

The trouble with this plan is that the Earth is far more powerful than our primitive self-centered ideologies. In fact, preventing or simply delaying a smooth transition to an efficient sustainable society, based of renewable sources of energy, greatly increases the risk that our societies will collapse in the face of climate extremes. And that rising seas will flood the coastal cities as the irreversible melting of the ice-caps accelerates.

Another deep issue we face is that their web of lies undermines democratic society. For the most part the scientific community stays above the fray with the naïve hope that more research and clear simplified explanations of climate science will eventually be heard. Instead, the increasing din drowns their reticence, and scientists who speak out are vehemently attacked as part of a fictitious global conspiracy.

So let us step back and look for a way forward. Even more so than 40 years ago, the Earth, earth scientists and all of us have a common interest. The Earth with a certain beauty and grandeur is simply absorbing and adapting to a changing atmosphere and oceans, and climate change is accelerating. The earth's ecosystem in all its richness and complexity is adapting to change as fast as possible. But many life-forms will go extinct, and new ones will emerge.

We set this in motion, but almost none of it is under our control. All that we can do is slow down the pace of change by rapidly shifting from fossil fuels to renewable sources of energy, so that the Earth as well as our societies will have more time to adapt.

As scientists we study with honesty and integrity the evolution of a system that is far more complex than we can imagine. It is a global challenge, so we reach out to the global network of scientists that we trust: to share what we understand, and what we find puzzling. Every month new facets emerge that add insight into this amazing web of life that we are part of.

Every month my neighbors ask for my help and guidance. We long for simple answers as we face an uncertain future, but the truth, like reality itself, is complex. We must all look beyond our fears, dreams and ideologies to the Earth itself for guidance, because the Earth gets its stability by being fully connected.

### **i) Externalizing the Costs (November 12, 2016)**

<http://rutlandherald.com/article/20161112/OPINION06/161119877/>

The extreme weather has been cruel around the globe this past summer. For months the Earth has set new global temperature records. There has been severe flooding in many places; record temperatures in the Middle East and devastating fires in California. More lie ahead this century, as our society struggles to reconcile past and future ways of doing things.

Let's consider where we get the electricity for all the appliances and gadgets that are now central to our lives. Historically the rise of our industrial society was powered by fossil fuels, which were viewed as an amazing source of power laid down a few hundred million years ago that was now ours to exploit. We were grateful as engines replaced horses, our lives speeded up and we became rich with possessions. We did not think of the fossil fuels as millions of years of stored sunlight. Until 40 years ago, we were oblivious of the fact that burning them in a century or so would change the atmosphere, and upset the stable climate that life on Earth has enjoyed for the last 10000 years.

When Vermont was settled, our power came from dams on rivers and windmills that ground flour and pumped water. We grew crops to feed ourselves, our cattle and draught animals. All this energy comes from the sun, which drives the weather with the wind and the rain. Every year it is renewable. We now have much bigger dams on rivers, and we must make choices between free-running rivers that support

more fish, and dams that produce more power. We also have to accept that in dry summers with less flow in the rivers, we will get less power.

As the technology has got much cheaper, we now have fields of solar panels converting sunlight to electricity. A field of corn converts only a few percent of the sun's energy into the crop during the growing season. A solar array converts an astonishing 15-20% of sunlight directly to electricity, whenever the sun shines. Of course there is less sunshine in the winter and none at night, so we need electrical storage if this is a primary source for our power. Fortunately the price of battery storage is also falling rapidly. Last year, 43 megawatts of new solar arrays were installed in Vermont, but some argue that large solar farms are an ugly industrial transformation of the Vermont landscape.

The power from the wind goes up steeply with wind-speed, and the area swept by the turbine blades. To supply sufficient power, wind turbines must go on high elevation ridges in Vermont, where the winds are stronger. Again the technology has advanced greatly, and newer turbines stand 500ft tall and generate 3 megawatts of power with sufficient wind. Of course there are windy days and calm days, so electrical storage is again needed. But large wind turbines on Vermont's hills are also described as industrial eyesores. In addition, under some wind and atmospheric conditions, the low frequency sound vibrations from turbines can carry to nearby houses.

Old nuclear power plants are closing across the US, and few new ones are being built because they are so costly, and the risks of failure are huge. And no-one wants to discuss their legacy of radioactive waste, and the plutonium that must be stored safely for a thousand generations. Even the small Vermont Yankee reactor, now in shutdown mode for the next fifty years, has left the state with enough plutonium to build a few hundred nuclear weapons. We did not plan for this.

This illustrates the conflicts that we must face and resolve in society. We want the products of our industrial world: appliances, cars, cell phones, computers and the web, and the employment that goes with them. But we don't want to see or live near the industrial infrastructure that supports our lifestyle. Electricity should come silently from a wall socket as it always has. If it comes from burning coal and destroying mountains in W. Virginia, they are not our mountains; and we can avoid going there and seeing the destruction. If electricity comes from burning fracked gas mined elsewhere in the US; well it is not our water that is being polluted. We can piously argue that wind turbines will kill some birds and bats, but ignore the staggering deaths of wildlife on our roads, and the birds killed by domestic cats.

These choices are difficult for us all. Our sense of entitlement encourages us to believe we are free to choose the gadgets we like (that have been successfully marketed), while hiding from the price that people elsewhere and the planet itself are paying on our behalf. The economists call this externalizing the costs. Our economy has indeed grown by freely dumping all the waste streams from our industrial society into the air and water, or simply by burying the trash.

More food for thought and discussion this winter as we recover from the fall elections! Meanwhile, my brussel sprouts and kale are delicious, I have boxes of winter squash, and the woodshed is full.

## **j) Toward Solidarity, Community**

**(December 31, 2016)**

<http://www.rutlandherald.com/article/20161231/OPINION06/161239939/>

The day after the election was dreary, but the vegetable garden was still vibrant. My cover crop of rye grass was growing well, and I had spread crushed leaves in other places. As I write in late December, a few nights have been so cold that I have moved the remaining Brussel sprouts and kale to a protected porch with their roots in water. I still have small lettuce and spinach under glass that I hope will survive till March.

This weekend I suggest you make very special long-lasting New Year resolutions that will give you strength and hope for the year ahead! Solidarity and community will have a whole new meaning this coming year.

The election showed the dark side of the American dream: the arrogance of power, the self-indulgent sense of entitlement and the weird myth of exceptionalism, masked as ‘greatness’, which has been both a strength and weakness of this country. We saw different aspects on both sides and the darker side won. The country rebelled against the rich political elites, and neo-liberal global market capitalism. They elected a demagogue, who encouraged fear and hatred in order to get elected.

Many people are angry and suffering. To quote Naomi Klein: “Under neoliberal policies of deregulation, privatization, austerity and corporate trade, their living standards have declined precipitously. They have lost jobs. They have lost pensions. They have lost much of the safety net that used to make these losses less frightening. They see a future for their kids even worse than their precarious present.”

Where this will lead us is still unknown. From the perspective of the global environment, the situation seems at first bleak. The triumph of the beliefs that we have unlimited power, climate change is a myth, and global treaties should be canceled could be a disaster both for the US and the world. It could lead to global sanctions against the US. This political revolution might even lead to chaos and the collapse of the US economy, which would also be bleak. Most likely we will have to survive four years of national paralysis, so start planning regular events, so we can build locally more inclusive communities.

A smooth transition to an efficient renewable energy economy now looks far less likely, although market forces will continue to drive renewable energy in New England, especially here in Vermont. Remember to send your legislators letters of thanks and encouragement for the New Year!

We must hope that the rest of the world will rise to the challenge and move forward with the Paris agreement without the US if necessary. We are ceding global leadership to China, which is taking over the manufacture of the many components of the global renewable energy transition. This will not make our next government happy, but the Earth will be grateful. We can also be grateful that our temporary insanity is not the end of the world.

Keep your sense of humor and be creative with new diktats from Washington. Create elegant solar stickers, “Installed in Vermont” to go over the “Made in China” stickers. When you reorganize your mission statements to emphasize that you are providing jobs for Vermonters, stress that you are using Vermont sunlight to power our homes and protect the climate for our children. Add the asterisk and fine print that says “This will keep Vermont great”. I suggest someone catalog the nocturnal tweets: so we can all find a hopeful tweet to chant - should the thought police come. Plan to build some tiny passive solar rooms hidden within your solar arrays for the next underground railroad.

Above all, reconnect with the Earth, and plant more crops in our local soil: it will help keep us all on track. In a month you can plant spinach and lettuce seeds under glass, to sprout in March when you need consolation. It will be a long struggle to reclaim our humanity in the face of darkness, but remember the sun is shining on us all, and we know what we have to do!