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Alan K. Betts (<http://alanbetts.com>)

This is a collection of my 2017 articles in the Green Energy Times (<http://www.greenenergytimes.org/>).

This series started in 2016. These articles are largely edited or updated from articles I wrote for the Rutland Herald, sometimes with different titles and pictures.

They blend science and opinion with a systems perspective, and encourage the reader to explore alternative and hopeful paths for 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.

The politically motivated attacks on climate science by the incoming president have focused and sharpened my political commentary this year; since climate change denial may bring immense suffering to our children and life on Earth.

I believe that earth scientists have a responsibility to communicate clearly and directly to the public¹ –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 build a resilient future. *All my articles are available from my web-site, and can be freely reused under a Creative Commons license.*

Green Energy Times, 2017

Betts, Alan, The Growing Gulf between Science and Politics. Green Energy Times, February 15th, 2017.
<http://www.greenenergytimes.org/2017/02/15/the-growing-gulf-between-science-and-politics/>

Betts, Alan, Tackling Transport this Spring. Green Energy Times, April 21th, 2017.
<http://www.greenenergytimes.org/2017/04/21/tackling-transport-this-spring/>

Betts, Alan, Clarity and Courage are needed now. Green Energy Times, June 23th, 2017.
<http://www.greenenergytimes.org/2017/06/23/clarity-and-courage-are-needed-now/>

Betts, Alan, Be Grateful for Global Society. Green Energy Times, August 23th, 2017.
<http://www.greenenergytimes.org/2017/08/23/be-grateful-for-global-society/>

Betts, Alan, Warm Oceans bring Massive Floods and Storms. Green Energy Times, October 18th, 2017.
<http://www.greenenergytimes.org/2017/10/18/warm-oceans-bring-massive-floods-and-storms/>

Betts, Alan, Robbing our Children's Future. Green Energy Times, December 15th, 2017.
<http://www.greenenergytimes.org/2017/12/15/robbing-our-childrens-future/>

¹ 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>

The Growing Gulf Between Science and Politics



By Dr. Alan K. Betts

It is time to look back on 2016 and ahead at 2017. Last year was again the warmest on record, well ahead of 2015, which itself set a new global-temperature record. The sea-

ice cover, which is shrinking as the planet warms, is near record lows at both poles for the first time. New research continues to point to accelerating climate change and increasing extreme weather. Last year, U.S. communities were faced with costs of \$53 billion from extreme weather and climate disasters.

New England has had more snow than last year, but the winter has been relatively warm so far. We ate our last kale in mid-January, but a new crop of spinach is growing under glass, so we will soon be making salads.

A Yale Climate Communication national survey in November after the election shows that 70% of Americans think global warming is happening, 61% are worried about it, 65% see it as a threat to developing countries and 71% as a threat to future generations. Yet the new administration is pretending climate change is a hoax, because it is a threat to the fossil fuel industry and the libertarian economics that the president does not even understand.

So let us contrast these two worlds; the scientific world with its roots in reality, and the new political world, which is built on power fantasies that change daily, glued together by egoism, fear and a determination to continue the exploitation of the Earth and the poor.

In Washington, making America "great," "draining the swamp," and destroying America's standing in the world are all

pathetically jostling for attention. Indeed the swamp has been filled with alligators, and the new administration seems to be a chaotic mess. When false information is being rebranded as "alternative facts," all that is clear is that our government is now on sinking sands.

In my local store after the election, someone said, "You must be shattered to see everything you have worked for destroyed." I grinned, because the climate system is unaware of narcissistic tweets, even though these are a tragic threat to American values and world peace.

Reportedly, the US military has developed contingency plans to deal with 'illegal orders' from above. The New England states should do likewise to counter illegal and immoral federal policies. Recall that the real Tea Party started here centuries ago. Two issues need to be faced. The states must prevent the takeover of their National Guard by a would-be fascist federal government; and when they are blackmailed with "obey or lose your federal funds" extraordinary measures will be needed to cut funds to the central tax system.

For us all "relocalization" is an important strategy. Here in Vermont, we remember the strength of our communities after tropical storm Irene when some state

offices were under water. Towns that were cut off got to work the next morning to rebuild roads and help those in need. We can do it again, overnight if we have to. As the government in Washington becomes dysfunctional, New England must unite and act.

In December, I was in San Francisco with 23,000 earth scientists from around

the globe for the annual meeting of the American Geophysical Union. What a delight to be in a global community of men and women searching to understand the real world and eager to network and share all they have learned. The younger generation knows the challenges that



January 21, 2017 Women's March in Washington, D.C. in behalf of climate change. Photo: John Bos.

lie ahead, but their deep shared integrity will carry them. Those from overseas paid little attention to U.S. politics. The U.S. has surrendered global leadership to China and Europe, but all the work that needs to be done to build a resilient world still remains.

We cannot expect guidance or funding from Washington. It is time to expand our efforts to build resilient communities here, so we can face the future together with moral clarity.

Dr. Alan Betts of Atmospheric Research in Pittsford, Vermont is a leading climate scientist. Browse alanbetts.com.

Tackling Transport this Spring



By Dr. Alan K. Betts

It has been a warm winter in New England. Burlington had no nights in January below 0 °F, and the temperature reached a remarkable 70°F on February 26th. The biggest snowstorm came in mid-March with two feet of snow in many places, but the snow quickly melted with sunny skies and the approach of the spring equinox. I picked spinach before the snow fell, and within four days the snow had melted off the cold-frame.

I am asked how soon we can plant! Frost-hardy plants can go in as soon as your soil has thawed, but don't plant anything that a frost will kill until the maples leaf out, unless you are prepared to cover them well. The clear nights of spring make frosts likely, because the earth can cool rapidly to space at night, until the deciduous forests leaf out and put more water vapor in the air.

Politically the last two months have had a certain fascination. After the inauguration, plans to develop the coal industry replaced dealing with climate change by phasing out fossil fuels. Meanwhile, the same week China canceled plans to build 100 new coal-fired power plants and replaced them with a plan to install 130 GW of new solar power by 2020. To give you a sense of scale, this is a thousand times the large build-out of solar power

in New England in the last year or two. This illustrates in a nut-shell how climate change leadership shifted to China, while the U.S. stacked the new cabinet in Washington with fossil fuel advocates.

Our grandchildren will look back in horror and say "How could they sacrifice the Earth to protect the profits of the billionaires?" Well, our elected leaders pretend not to know that burning all our coal reserves will melt the icecaps, flood the coastal plains and wipe out half of life on earth. As Pope Francis pointed out in 2015, our use of power and our respect for creation is a deeply spiritual issue. We cannot serve both the Earth and money!

Transportation in New England uses a lot of fossil fuel so it is one of the big challenges we face to "decarbonize" our economy. A typical automobile getting 25 miles per gallon and driven 12,000 miles per year burns 480 gallons of gas and emits 4.3 tons of CO₂. A recent study showed that this melts an extra 140 sq.ft. of Arctic sea-ice every September. As the reflective sea ice shrinks, the warming of the Arctic accelerates, and we will soon face more amplifying factors like the release of methane, another stronger greenhouse gas.

I drive to meetings and to the grocery store, so how can I reduce the gasoline I use – only by shifting to electricity coming from solar power. For me this has taken a couple of years. First I invested in solar panels from a community array, providing 5.7 kW of peak power. Over the year,

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*Climate Forecast:
"Above average temperatures are forecast for this spring."*

80% of this power provides the electricity that powers our house and heats our hot water. The remaining 20% provides the power for a new Prius Prime plug-in hybrid, which we purchased last year.

The car's all-electric range is only about 25 miles, but that is enough to drive to my neighboring towns and back. The combination of an efficient hybrid car that gets 55 MPG and this modest all-electric range has surprised and delighted me. Even in the winter months, we have averaged 120 miles on a gallon of gas; which means we only fill up the 10 gallon gas tank every 1,200 miles. It is a far more efficient and comfortable car but using it will still emit almost a ton of CO₂ every year, and inexorably contribute to melting some Arctic sea-ice.

The more general issue is that it is still a typical car for four passengers weighing over 3,000 pounds. Where I grew up in England, there were networks of public paths connecting towns that had been used for centuries – on foot or on horseback. For the future, New England needs a new network of

small paved roads for lightweight electric cargo bicycles and tricycles. Even tricycles that are fully enclosed with a shell to keep out the weather are only a tenth of the weight of a standard car, so they are far easier and cheaper to power with solar electricity. But for safety reasons, they need a separate road network from heavy trucks and speeding cars. And yes, they will only go half the speed of cars - less than 30 mph. They could use heated seats in our winters, and there will be some snow-days.

But there are two fringe benefits that would benefit our health in the long term: some exercise commuting to work, and a closer connection to the landscape as we travel. This is of tremendous importance as our society must turn to the Earth for guidance.

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Alan Betts in his plugin-hybrid-electric car that is charged with the electricity from a community solar array. Courtesy photo.

Clarity and Courage Are Needed Now



By Dr. Alan K. Betts

After a cool March, the daffodils and forsythia bloomed relatively late around mid-April. But the maple trees bloomed early and leaf-out started in late-April, as if

they were unaware of the cool temperatures in March. A long period of unusually cool, cloudy, wet weather with very slowly moving jet stream patterns followed in May. Potatoes, broccoli, peas and lettuce are flourishing in our garden.

The most exciting aspect of giving talks on climate change this year is that a public awakening is underway. I have seen capacity audiences with a new intense enthusiasm. This took quite a shock, but now more people realize they must stand up, and they must act. For the faint-hearted, it helps that this is the final decade to drop our global emissions of fossil carbon, and still have an even chance of just squeaking below critical earth system thresholds.

The March for Science on Earth Day exemplified this. Most scientists never thought they had to stand up and be counted. They were a rather comfortable part of the Establishment; perhaps too comfortable in their academic worlds. Now they realize that they bear some real responsibility for the truth, not just in science, but a social responsibility for the truth in society. They must protect the concept of honesty against a corrupt political system; and make a lot more effort to reach out since we need a knowledgeable public. Otherwise the democratic enterprise collapses.

It has been a slow awakening. Too many scientists tolerated, for example, the substitution of profit for truth by the pharma-

ceutical industry. But now they watched in horror as the legal protections for clean air and clean water were denounced, simply because they interfere with the profits of those exploiting the Earth. It is deeply ironic that the Environmental Protection Agency itself is now threatened, as it was set up and strengthened by Republican presidents, who understood the need to protect and conserve our natural resources.

Now our phony conservative leaders would like to sweep it all away in their rush to the dark side. On June 1, they had a moment of triumph with the announcement that the U.S. will withdraw from the 2015 Paris climate change agreement. In reality, their ignorance of the global issues we all face just confirms the irrelevance of our national leaders. It is another call for states and citizens to wake up and act.

The wider conflict going on both in our society and around the world needs explicit discussion, because it must be faced consciously. It is a broad struggle for the soul of humanity that has been ongoing but continually changing since the catastrophe of World War I a century ago. One aspect in recent decades is the consolidation of po-

litical, economic and financial power in the hands of the elite. Underlying it are deeper, ego-based power struggles. These cannot be resolved without a change of mindset, because no amount of power and wealth will console and satisfy fearful egos.

What is happening is that many traditional patriarchal, libertarian, religious, racial, economic and financial frameworks are crumbling. Fear and desperation has

moral and intellectual collapse is illustrated by the fact that democracy, science and ethics were valued only as long as they served the interests of the powerful.

So it is not surprising that opposition is on the rise. Many are justifiably fearful of what they may lose. What is needed however is a conscious awareness that is rooted in a compassionate awareness that we must stand up for an inclusive view, where all people and all life on Earth matter, because we are all deeply connected.

Certainly, rooted awareness is a real threat to the fearful, egotistical plutocrats in power; but this should not be seen as yet another battle where the powerful could simply crush us. The moral and practical choices are so clear, that if we stand up in our communities and align ourselves with the Earth, their foolishness will likely crumble. But first we must confront the threat to the soul of democracy from thirty years of corruption by dark money. Next year will be the test to see whether democracy still stands across America.

But summer is coming, so don't stop

planting because we need to feed each other. Let us cultivate the strength and vision of our communities.

Dr. Alan Betts of Atmospheric Research in Pittsford, Vermont is a leading climate scientist. Browse alanbetts.com.



The March for Science in Washington, D.C. on Earth Day, 2017. Photo source: Union of Concerned Scientists (UCS), www.ucsusa.org.

been rising as groups fight for the survival of their threatened mindsets. Finally we have in Washington a pathetic but desperate parody of the patriarchal system, which is willing to jettison everything rather than face themselves and their responsibilities to either the people or to the Earth. Their

Be Grateful for Global Society



By Dr. Alan K. Betts

Our cool season garden has grown well in June and July with so much rain. By the summer solstice, the last of the head lettuce that had wintered over was gone,

but many more rows planted this spring headed up as the weather warmed. By late June we were eating broccoli every night and then peas; delicious with chard and shiitake mushrooms from the Rutland Farmers Market. It has been very satisfying to localize our food supply in the past ten years and to share some of what we grow with others.

This past week, I have been at the European Weather Centre in London, discussing the improvements they have made with their global forecast model and strategizing on the next developments. I have been working with them for thirty years, and it is always a delight to come to an international institution with clear goals that is run by scientists with little political interference. Not surprisingly, their forecasts have been the best in the world for decades. They are systematically taking on the responsibility of analyzing all the global environmental data, identifying weather extremes as they occur daily, forecasting floods on a global scale and calculating the sources, sinks and transports of CO2 around the globe.

Here in the U.S., NOAA struggles with political interference, which has often squeezed budgets and personnel. A few weeks ago, I read about a threat to cut funding for hurricane forecasting. Perhaps the supreme leader is dreaming of building a Great Wall to keep hurricanes out? Our current administration is of course annoyed that NOAA's climate simulations don't support their "alternative facts." The new EPA administrator, Scott Pruitt, living in a dream world, says that he "does not agree that carbon dioxide is the primary driver of global warming." I doubt he has looked at the science that shows that if you remove all that pesky carbon dioxide from climate models,

the Earth quickly freezes over! Fortunately, hurricane forecasts from the European Centre model are steadily improving, as they couple atmosphere and oceans more tightly on ever finer scales.

Of course, this administration came in with the confused notion of demolishing as much of the federal government as possible, and they are succeeding by making it simply dysfunctional. This is a

pathetic reminder of how doctrinal interference with science weakened the Soviet Union fifty years ago. There is nothing here that will make America great again: it will simply speed up the coming implosion, unless we the people wake up and act soon.

Fortunately, this is happening across America as cities and states are taking responsibility for climate change and the transformation of our energy system. Fourteen states, including Vermont, have joined

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Climate Forecast:

"Expect temperatures above average into fall."

the U.S. Climate Alliance to uphold the commitments of the 2015 Paris agreement. In New England, we have a good chance to address together the issues of sustainability and social justice, and implement useful long-term strategies. But it will require a lot of effort.

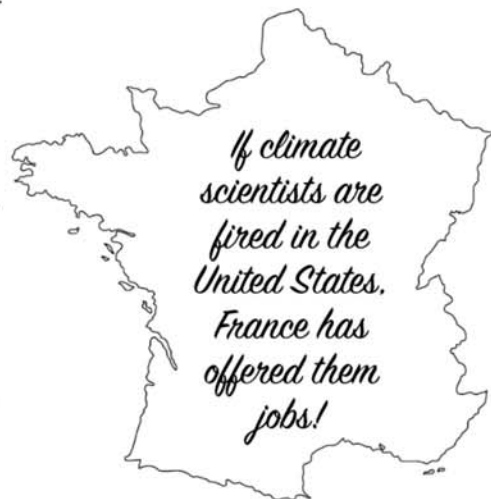
The people will have to lead, because the national Republican and Democratic parties are too mired in past doctrine and indebted to wealthy interests. Pay attention to the radical change that just happened in France. There a democratic revolution replaced the old left and right political parties in a single year with a new visionary political party and president. If climate scientists are fired in the United States, France has offered them jobs!

We live in a global world where we can be grateful that others take their responsibilities seriously. The new global analysis from the European Centre, which goes back forty years, will be freely available to all scientists to help us understand our changing climate. We need to understand how and why heavy rain, flash flooding and more severe storms are becoming more frequent as the climate changes. On July 1st, Vermont had major flooding once again, while Maine experienced five tornadoes. The good Vermont news was that the recently finished flood diversion

culvert under U.S. Route 7 built to protect Brandon, VT after Irene saved the town from another disastrous flood. Across the U.S., however, extreme weather and climate disasters caused \$53 billion in economic damage in 2016.

But despite all our rain this summer, my year's supply of garlic is harvested and dry. When I get home, there are potatoes to be dug, and no doubt prolific squash and tomatoes..

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Warm Oceans Bring Massive Floods and Storms

By Dr. Alan K. Betts



As individuals we are all very concerned about our children's future. In contrast, our society ignores the misery that climate change will bring to the

future of all children, as well as much of the life on Earth. This odd disconnect, which so many can rationalize away, reflects a clash of values that we avoid discussing. Society runs on an economic system where money and profit rule, and the future is discounted. With this strange logic, the future rapidly becomes devalued compared to our greed for present wealth. Life on Earth in the future, including our children's lives, is treated as nearly worthless.

We love our children and are proud of our individual freedom, but we have been fooled to tolerate an immoral economic system, where the rich and powerful can exploit the Earth, the poor, and our children. Yet still we chant its mantra of endless material growth.

The truth is just the reverse. Climate change exposes our current economic system, based on exploitation and profit, as both valueless and almost useless for dealing with the future. This is hard for us to grasp. Yet we must because the Earth does not discount the future. It just stores the energy from the sun that cannot escape to space as we burn more fossil fuel, and add greenhouse gases to the atmosphere. It takes time for the oceans to warm and the ice-sheets to melt, but they are warming and melting, and sea-level will rise for

centuries. Inexorably climate change will accelerate on our present path.

The warmer ocean drives stronger storms. The flood of biblical proportions that Hurricane Harvey brought to Houston is a bitter reminder. Some will claim it is just another five hundred year flood (the third in three years). Politicians still pretend that climate change and the warming of the oceans is a myth. But the Earth cannot forget, and fittingly this flood struck the coastal oil industry of Texas. But tragically the poor suffered the most.

We can retreat from the coasts, and the damage to our fossil fuel industries benefits the Earth for a brief moment; although the conscious choice of an escalating carbon tax would be much better. However the damage to our forests and food supply, and the increase in extreme weather, floods and droughts from a warming climate will bring much hardship. This will expose the

brutal cruelty of our present administration, whose primary goal seems to be to protect the value of fossil fuel assets, regardless of the hundreds of millions of people and species that will die later this century.

Then came Hurricane Irma which strengthened to a category 5 storm. Over the warm oceans, it became the strongest storm ever recorded in the Atlantic. It was approaching St. Thomas where my daughter and grandchildren live. With maximum winds nearing 180 mph, I helped them move to a safer location, where they huddled, terrified. I spent hours glued to the Puerto Rico radar, watching as the eyewall grazed the northern shore, doing immense damage. After five days, they were evacuated safely

to Puerto Rico by a catamaran bringing in emergency supplies. But after a brief week of recovery, they had to look for another safe shelter as Hurricane Maria approached

Puerto Rico as a category 4 storm, doing immense damage. As it crossed the island, power and communications were destroyed. I know my daughter is alive from a brief garbled voicemail, but I do not know where they are on the island.

Irma went on to batter Cuba, Florida and Georgia, where millions lost power for weeks. With no air conditioning, people suffered in shock. But when will they realize that like us in the northeast, resilience means well-insulated homes cooled by efficient heat pumps run on solar power?

Climate science has been subject to extraordinary scrutiny, because so much is at stake. Dealing with climate change requires fundamental changes in our political, economic and financial system, and society doesn't want to face this. Protecting wealth and profits now is more important than the future of our children and of life of Earth. Denial is the only way that the rich and powerful can try to hide from the savagery of this strategy.

For 50 years I have studied weather and climate science. Long ago in what we call the Carboniferous period, lush vegetation in a tropical hot-house climate removed CO₂ from the atmosphere for millions of years, and laid it down in the oceans to produce the fossil fuels. As CO₂ in the air fell, the earth cooled and eventually the icecaps formed. If we burn all these fossil fuels this century, we will push the Earth once again back to a hothouse climate with disastrous consequences. Right now we are wasting our time and our resources. It is time we changed course, and made the rapid shift to an energy efficient society, powered by renewable energy.

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The eye of Hurricane Irma as it grazes the northern shore of St. Thomas on September 6, 2017 as a strong category 5 storm. Warning boxes are shown near the eye. Puerto Rico is to the west and St. Croix to the south. Credit: National Weather Service Puerto Rico/Virgin Islands Radar.

Robbing Our Children's Future

By Dr. Alan K. Betts



The weather this past summer was a wake-up call. It was exceptionally warm across the western United States, and there was little rainfall across the

Northwest. The result was widespread forest fires, which filled the cities with smoky, polluted air. In the south, Hurricane Harvey gave near-record summer precipitation and extreme flooding. Across the warm waters of the Caribbean, two powerful hurricanes, Irma and Maria, did immense damage to a dozen islands including Puerto Rico. Their recovery will be very long. Some islands such as Barbuda have simply been evacuated. Much of Puerto Rico still has no power. Without power, modern society crumbles, and basic survival depends on cooperation and the sharing of resources.

Our society has not put aside the money to rebuild after these disasters, which will only increase as the Earth gets warmer and extreme weather increases. The increase in the greenhouse gases, triggered by the burning of fossil fuels, reduces the cooling of the Earth to space. So, vast amounts of heat are now being stored in the oceans, and, inevitably, stronger storms develop when conditions are favorable, as they were this summer.

In October, I discussed the paradox that although we as individuals are deeply concerned for the lives of our children and grandchildren, we support an economic system that places little value on their lives, because it discounts the future.

Investments in an energy efficient society powered by renewable energy are often rejected as "not cost-effective." A closer look shows that this means not cost-effective for the present bottom line. If we ask whether

billion dollars now on this transition will save 50 billion dollars in damages later this century. Since national governments have conflicting interests, it has been proposed recently that the global insurance industry could manage a global levy on carbon emissions to fund adaptation costs and the low-carbon transition. This would lower their insurance risks.

What we need is economics where we really value the future of the Earth, and the future of our children and our grandchildren.

The 2015 Encyclical by Pope Francis mapped out the corruption and immorality of our present economic system, where the exploitation of the Earth and the poor have become inseparable. The Catholic church, and some Protestant churches, are now giving this more careful attention. Not surprisingly, our economic system is still avoiding this issue, so it is up to us all to speak up!

I am indebted to Joanna Macy for another insight. We are encouraged to become happy isolated individuals addicted to consumerism, escapism and the media. The mass media as a rule will not show us, as isolated individuals, that runaway corporate capitalism is on a path to destroy much of life on Earth. But as communities with courage, determination, caring and creativity, whether secular or communities of faith, we can face this reality, and together search for a sustainable alternative. I know this will not be

easy, but there is almost no limit to what we can do for the sake of each other and the Earth..

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Evacuees wade down a flooded section of Interstate 610 in Houston as floodwaters from tropical storm Harvey rise Aug. 27, 2017, in Houston. Credit: AP Photo/David J. Phillip

this energy transition is cost effective for the future of our children, the answer is absolutely yes. Staying with an inefficient fossil fuel energy system is a catastrophe for both our children and the Earth.

Economists estimate that spending a

Yet, I often see articles claiming that renewable energy is a bad investment: that we are wasting money on the transition away from fossil fuels. This is phony economics where we ignore the present and future costs of accelerating climate change.