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HIDDEN TAXES

By George Harvey

Americans pay billions of dollars each year in hidden taxes. No one asked for them. No one voted for them. No legislature passed them into law. But they are real, and we all pay them, whether we like it or not. The really horrible thing about these hidden taxes is that they are increasing dramatically and could even cause an economic melt-down. I will give a couple of examples.

In the 1960s, it became clear that the insurance industry was exposed to dangers that could wreck it. Multiple weather events, such as two bad hurricanes in the same year, could leave it unable to pay claims promptly. Since this could cause economic havoc, the federal government decided to provide a guaranteed flood insurance plan. In theory, the plan was covered by premiums, so the taxpayer would not be stuck with any bills.

Over the course of time, however, it became evident that there were inherent flaws in the system. The experience was that 1% of all properties accounted for 30% of the flood insurance claims. Some properties were flooded multiple times, with combined payouts exceeding the value of the properties.

The congress acted on the situation, passing the Flood Insurance Reform Act of 2004 to address it. Among its provisions was a limit on the number of times a property could collect on claims at two times in any ten-year period. Once the second claim had been paid, the property needed mitigation to be qualified for guaranteed insurance. This act was passed by a strong bipartisan majority in the House of Representatives and unanimously in the Senate.

This is where things get tricky. You might think that the claims would decline when properties that were particularly vulnerable to flooding were removed from the insurance system. This, however, was not the case. In the years 1978 to 2003, the average payout was \$481 million, and the record high payout was \$1.3 billion. But in the years 2004 to 2016 that record was broken five times, the average payout was \$3.3 billion, and the record high payout became \$17 billion. This is a shocking increase in costs.

The increased costs can also be seen in the increasing amounts of premiums, which have gone up almost continually since 1978. In that year, the cost of premiums was almost \$82 million. Given inflation, we could expect that to have

Cont'd on p.23



Image: Flickr

Climate Change 2017. What Must Be Done?



The Rolling Stone Interview Dec. 22, 2016

By Dr. James Hansen, 11 January 2017

I do few interviews because of the time required and my difficulty in making things clear orally. The Rolling Stone interview by Jeff Goodell (<http://bit.ly/Rolling-Stone-interview>) was an exception, a testimony to his abilities.

An important number in the story was not right but is being corrected. It made me wonder how to make that number simple enough for people (including ourselves) to remember easily.

The number is the amount of carbon that we must somehow suck out of the

air, if we want to get back to 350 ppm CO₂ in the air by the end of the century, which is a first approximation, a first target, for what must be done to keep climate close to the Holocene range, the relatively stable climate of the past 11,700 years during which civilization developed.

(You may say, well that is a stiff requirement, so let's just allow climate to be hotter. But that would mean you are willing to accept a continually receding shoreline, with eventual loss of all coastal cities.

When that would happen is debatable – an inherently difficult nonlinear problem – but each new piece of evidence is pushing it sooner than the experts had been estimating. And remember that coastal cities include more than half of the world's large cities, likely many of the cities you love, with lots of history. Consider the implied humanitarian and economic debacles, with hundreds of millions of refugees.)

Back to the number: we showed in a 2013 paper (<http://bit.ly/2013-paper>) that we would need to extract 100 GtC1 to get back to

Cont'd on p.27

Hunting and Wildlife in the Northeast

By Thaddeus Rumple



Tagging a moose for study. Photo Credit: Lisa Bates, Maine Dept. of Inland Fisheries & Wildlife

An article in the December 15, 2016 issue of Green Energy Times, "Climate Change Has Impacts on Hunting Heritage in the Northeast," seems to have created a fair amount of interest, based on reader responses. We were contacted by a number of people, some of whom had direct

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LIBERATING SCIENCE - YOU CAN'T FIRE THE PLANET

By George Harvey

Many Americans think of science as beyond the reach of ordinary people or even local government. Where amateurs among our founding fathers enjoyed making exciting scientific discoveries and developing inventions, in our more recent history we came increasingly to regard ourselves as dependent on large organizations, especially the federal government. We thought this was quite proper because much as we appreciated and respected science, we were amateurs.

Now, however, other amateurs who have no respect whatever for science, or even truth, are running the country. Many of us feel there is nothing we can do but stand around and wring our hands.

There is something we can do, however. We can take charge. We can protect and

support both science and the scientists. We can do this effectively, as long as we accept truth as truth and facts as facts.

Those who are dismayed at our government abandoning the environmental and climate protections can take heart in an example from California. Governor Jerry Brown, speaking to a group of scientists, addressed a question about what that state could do if Donald Trump delivered on a promise to cut NASA's funding for climate research. His tone was defiant.

"If Trump turns off the satellites, California will launch its own damn satellite," he told them. "We've got the scientists, we've got the lawyers, and we're ready to fight."

It would not be the first time the states – or universities, non-profit organizations, and even ordinary people – took things

into their own hands. For example, when the United States Department of Agriculture (USDA) released updated hardiness zone maps in 2005, it was

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Late Breaking News

Sorry, Climate Change Did Not Slow Down.

On February 4, an article, “Exposed: How world leaders were duped into investing billions over manipulated global warming data,” appeared in the Daily Mail, a British tabloid. (http:// bit.ly/NOAA-busting) The title describes the contents of the article accurately, but, unfortu- nately, the article did not accord very well with the real situation.

Dr. John Bates, a NOAA scientist who had devised a set of rules for checking data, was upset because the administration had released data before it had been properly checked, in advance of the COP21 conference in Paris. Unfortunately, the Daily Mail took this a few steps further, implying that the data was flawed, and that NOAA deliberately manipulated information to discredit the idea that global warming had paused.

Many readers doubtless inferred that global warming had, in fact, paused, and that NOAA was guilty of fraud. And, in fact, those elements of the media that would like to slow action on climate change lit into the article as somehow being proof that climate change is a hoax.

The year 1998 set a record with a big jump in average temperatures. The year 2005 broke that record. That new record was broken in 2010, and that one in 2014. When COP21 was underway, we already knew 2015 would break the record again. And since then, 2016 set a new record. These observations indicate no slow-down. NOAA’s information has also been more rigorously validated by a number of scientific organizations.

At Green Energy Times, we genuinely wish climate change were a hoax. That would mean that we could relax. What fun that would be!

Unfortunately, the hoax is denial of climate change.

A Massive Solar Farm Is Planned For Hinsdale, New Hampshire.

Ranger Solar, with offices in Yarmouth, Maine, is proposing a solar farm in Hinsdale, NH. It would be the largest in New England, with a capacity of 65 megawatts. It is to be developed on about 400 acres of land that is zoned for industrial use. The array would be built at a cost of \$50 million, according to a company spokesman.

The town of Hinsdale, which is in the southwestern corner of New Hampshire, stands to benefit in a number of ways from the project. During the construction phase, the project would create about 185 jobs in the area. Once it is completed, which Ranger Solar hopes will happen before the end of 2019, it will pay the town at least \$500,000 each year in lieu of property taxes. At that point, the solar array will still have about three to six employees.

The solar farm will produce enough power to supply 13,000 to 19,000 average homes in the area, according to the company. The environment will benefit from the fact that it will offset approximately 25,000 metric tons of carbon dioxide emissions each year.

The Board of Selectmen voted unanimously to allow payment in lieu of taxes for the solar farm. Ranger Solar is now taking the development work forward with state agencies.

Climate Resistance Leaders

By Darren Springer

The U.S. election of 2016 was consequen- tial in many ways, including for our work fighting climate change. As I think about where we are in 2017, I have been thinking back to the start of my career in 2005.

That was a time when the EPA did not recognize the dangers of climate change. Coal accounted for half of our electricity generation. The LED bulb and cold-climate heat pumps were not available, and the Chevy Volt had not debuted. Vermont had one six- megawatt wind project, and solar electricity was not yet affordable to a broad clientele.

We can be proud of what we accom- plished since then, because of smart incen- tives, an historic clean energy stimulus package, rising fuel economy standards, new clean air pollution limits, actions by forward-looking businesses, and creative state energy policies, including Vermont’s.

Today, U.S. energy-sector carbon dioxide emissions are at their lowest levels since 1991. The burning of coal produces less than a third of our electricity. Wind energy is one of the top technologies being added to the U.S. grid. Solar provides enough power for over six million homes and has created over 200,000 American jobs.

In Vermont, we are using less electricity than a decade ago, thanks to improved effi- ciency. We have hundreds of megawatts of solar and wind power on the grid. We have over 17,000 clean energy jobs, and the sec- ond lowest electric rates in New England.

All of that said, I must admit back in 2005 I thought it would get easier to make progress on fighting climate change as

technology improved. But in many ways, it has become harder.

Solar panels and plug-in vehicles that looked “boutique” to fossil fuel competi- tors in 2005 are now making real gains in market share. The fossil fuel industry has already received more federal research dol- lars than wind, solar, hydropower, biomass, geothermal, and all energy efficiency technologies, combined. Now it is set to re- ceive over \$100 billion in additional federal subsidies over the next ten years.

Instead of ending those subsidies and investing in clean energy, the next Congress appears focused on rolling back Clean Air Act protections and fuel efficiency standards.

There is not much hope coming from politicians generally in Washington. But I was reminded at a recent gathering of hundreds of Vermont town energy and grassroots leaders that there is still hope here in Vermont and in communities across our nation. These committed citizens repre- sent what I think of as a network of “climate resistance” leaders, and by this I mean those opposing the polluters’ agenda in Wash- ington D.C. The good news today is that we have more businesses joining the clean energy economy and creating new jobs in the clean energy workforce. We have the technologies we need to cut greenhouse gas emissions.

Those technologies are getting more af- fordable by the day. Take the LED light bulb. The Department of Energy created the L Prize to promote investment in LED bulbs, and Philips won

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Notes from Dr. James Hansen 24 January, 2017



Climate guru James Hansen is considered by many to be the father of climate change awareness. We know that the daily state of the county has many concerned about what can be done. Dr. Hansen's own blog reflects his most up to date thoughts about current news, and it can help know what he is recommending. Here is a note from his January 24, 2017 blog posting:

No Interviews:

A lot of requests today for interviews, partly because of Keystone Pipeline being in the news.

On the surface, little can be said that isn't obvious from what has been said already.

Deeper down, the story is complex. I am fed up with both sides.

I am sore about the Obama Administration's lack of interest in a settlement of our legal case that could have committed future administrations to have a plan for reducing emissions, specifically reductions at least as steep as in the Deep Decarbonization plan presented by John Kerry at Marrakesh (80% reduction by 2050). This could have provided a mechanism to constrain irresponsible actions by later administrations.

Interview level comments are in my *Rolling Stone* interview by Jeff Goodell and my related remarks, titled: *Rolling Stone*. More useful depth requires that I finish writing *Sophie's Planet*, which I am doing now. [Sophie is Mr. Hansen's granddaughter. - ED]

[The *Rolling Stones* article is reprinted on page 1 of this issue of *Green Energy Times*. - ED.]

Clarification:

My "no interviews" note engendered some misunderstanding. It was a bit too brief.

My point is that we must ration our time onto the most effective actions.

The legal front becomes all the more important. We missed an opportunity with the last Administration. Now our work is cut out more clearly, with no time to lose.

The undergirding of the ultimate climate solution will be a rising carbon fee. Times of turmoil can be the best time to get effective change. Merits of a revenue-neutral rising carbon fee, for job creation, economic growth, bringing home production as transport costs rise – besides health and environmental gains from reduced pollution – must be made clear. On the long run, that's the most effective way to stop foolish fossil-fuel expansion.

There are an uncountable number of actions that can help. We need people to stay involved and more to get involved.

I did not mean that I was getting discouraged – on the contrary, we are more committed than ever. I want to make the broad story clearer, and I think that short interviews are not the most effective way to do that.

What Could We Do with a One-cent per Gallon-of-gasoline Carbon-pollution Tax?

By Rick Wackernagel

In Vermont – and elsewhere -- we need to accelerate adoption of low-carbon practices and technologies to achieve our climate goals. To increase adoption rates we need to address four main barriers:

- High upfront costs of energy efficiency and renewable energy.
- Limited financial resources.
- Lack of knowledge of low-carbon alternatives.
- Lack of confidence that low-carbon alternatives will perform as advertised.

A small carbon tax could significantly help us address these barriers. It could pay for cost-effective programs currently limited by lack of funds. A tax of \$1 per metric ton of carbon dioxide would cost less than 1¢ per gallon of gasoline and generate about \$5 million per year. Here are possible ways this tax could help.

- Reducing energy use in low-income households. These households have very limited capacity to pay for energy efficiency. Vermont's Weatherization Assistance Program (WAP) is the state's largest effort to help them, prioritizing households below 60% of median income. In some places, WAP has 3-year waiting lists. Vermont has a goal of getting 90% of its energy from renewable sources by 2050. At current funding, WAP could reach just 79% of these households that year. Adding \$2 million per year gets us to 88%. If research and development (R&D) efforts can reduce weatherization costs 10%, we can get to 93%.
- Relieving the shortage of Park & Ride (P&R) space. Eight areas of Vermont with high residential densities have no P&R areas within 10 miles. Eleven of 79 P&R lots are frequently over capacity. We could reduce the number of underserved areas by half and remedy the shortage of spaces at existing lots by 20% for a little over \$1.5 million.
- Reducing the cost of low-carbon technologies. Although costs of renewable energy have dropped, high upfront costs still plague low-carbon technologies. In the long term, these technologies are cheaper. In the short term, however, they take a lot of money. Vermont's Energy Action Network (EAN) estimates the upfront costs of investments needed to achieve our 90%-renewable-by-2050 goal at \$33 billion. R&D can reduce these costs. The public sector has an important role here. It can undertake R&D the private sector finds unattractive, for example, emphasizing

A possible allocation of revenue from a carbon-pollution tax of \$1 per metric ton of carbon dioxide in Vermont

Public infrastructure		
Park & ride lots	32%	\$1,582,000
Energy efficiency		
Weatherization Assistance Program	40%	1,995,000
Public-sector development & dissemination of low-carbon innovations		
Research & development - Low-carbon Technology-development Council	11%	570,000
Information, education, demonstrations, coaching & other dissemination	11%	552,000
Program management - planning, coordination, development, reporting		
	4%	200,000
Contingency		
	2%	101,000
Total		
	100%	\$5,000,000

low-cost practices and technologies.

► Niches for R&D in Vermont exist. These are in the form of combinations of unique need and resources. One need is thermal-efficiency upgrades, which EAN estimates will cost \$9 billion. One resource is Vermont's housing stock, among the oldest in the country. Vermont also has an abundance of skill, knowledge and motivation. Just as one indicator, roughly 1,000 building professionals attended Efficiency Vermont's 10th Building Better by Design conference this February. A technology-development council could be the means. Such councils have produced rapid innovation in East Asia. Drawing

members from public, nonprofit and private sectors, these councils identify and prioritize opportunities, and coordinate their development. To the building professionals above, we could add architects, engineers, physicists and other scientists from Dartmouth, Middlebury, UVM and VTC. If the only thing the council accomplishes is reducing the cost of thermal upgrades by 10%, we will come out \$880 million ahead.

- Informing, educating and

demonstrating. Recent pilot projects build familiarity with and confidence in low-carbon alternatives. Here are just three in and around Vermont.

► Solarize Upper Valley tripled installed photovoltaic capacities within a year in participating communities. The project director then developed a do-it-yourself Solarize toolkit. Now, technical specialists can remotely support communities running their own Solarize campaigns. Two specialists, costing \$270,000, could cover Vermont's remaining towns in three years. Meanwhile, studies show faster adoption after the campaign than before and diffusion into neighboring communities.

► Zero Energy Now converted 22 conventional Vermont homes into high-performance, energy-efficient homes with

photovoltaic power systems. The conversion produced an average return on investment of 9%. A statewide demonstration group of 50 homes would cost \$150,000, with homeowner incentives and site visits for prospective ZENers.

► Addison County Community Trust and Cathedral Square Corporation redeveloped a blighted mobile home park, into Vermont's first net zero energy affordable rental community, "McKnight Lane." It features modular homes constructed by VERMOD, based in Wilder, Vermont. This project replaced an uninhabitable mobile home park with much-needed new affordable housing. The owner pays the nominal energy costs, making the monthly cost for the low income residents very affordable. Each home includes a Sonnen back-up battery, which provides energy resiliency. Rent

for a VERMOD unit is significantly less than for an average manufactured-home assisted by the statewide weatherization program. A feasibility study for redeveloping other suitable mobile-home parks will cost \$130,000.

Financial assistance, lower-cost low-carbon alternatives, information and demonstrations add up to increased rates of adoption. A carbon tax can be a way to make adopting low-carbon practices and technologies easier, cheaper and less risky. These principles could support plans for other states.

Rick Wackernagel is an itinerant climate activist. Sources and budgets are available from the online version of this article.

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Affordable Electric Cars

Consider Used Options!

By David Roberts

Drive Electric Vermont

Plug-in electric cars are often praised for their low cost of ownership. Electricity costs less than gasoline to run on, vehicle reliability is good, and competitive prices offer smart consumers a compelling value. An added bonus is these cars have a much smaller environmental footprint over their lives compared to gasoline-powered options. As electric car adoption continues to grow, we are seeing more used cars enter the market. These are often available at a fraction of the cost of a new purchase and can further reduce household transportation costs.

The increased supply of used electric cars is driven by early adopters who leased electric cars to take advantage of tax credits, reduced the risk of depreciation, and allowed them to keep pace with new and updated models. This trend is expected to accelerate over the next few years, so several used electric cars are likely already nearby if you are in the market.

The table summarizes used electric car pricing and availability based on a search of Cars.com and Tesla.com in late January 2017. There were over 430 used plug-in vehicles advertised within 250 miles of White River Junction, Vermont. The table excludes a few low-availability models, such as the Ford Focus Electric and VW eGolf. Some buyers have looked further afield and had cars shipped from larger markets in the south and west, so broadening your search area could be worthwhile.

Used Electric Car Pricing and Availability

Cars.com and Tesla.com within 250 miles of White River Junction, VT

For those new to electric car technology, there are two basic types: Plug-in hybrid vehicles (PHEVs) are powered by either battery or gasoline and, generally, travel 10 to 50 miles on the battery before seamlessly switching to running on gasoline for extended range.

All-electric Vehicles (AEVs) are powered solely by a battery. Claimed range varies by model from 80 to 300 plus miles before recharging is needed. Range is reduced by cold temperatures, but vehicles can handle travel needs for most drivers.

Both varieties of vehicles can be charged by plugging into a standard 120V home

outlet overnight at about five miles of range per hour of charging. Access to 240V power can speed things up considerably to 10 to 20 miles of range per hour of charging depending on the vehicle and supply current. Some AEVs also include DC fast-charging capability which provides an 80% charge in 30 minutes. Fast charging is usually optional, so if this is important to you, make sure the vehicle you are looking at includes it.

Monetary incentives for new electric car purchases generally do not apply to used vehicles. There may be exceptions to this, so check online for information on incentives available in your area. Non-monetary incentives, such as access to carpool lanes, should be available regardless of whether you purchase a new or used electric car.

Model	Median Asking Price	Electric Range (miles)	Number Available
Plug-in Hybrid Vehicles (Electric + Gasoline)			
Chevrolet Volt	\$14,990	38	77
Toyota Prius Plug-in	\$15,000	11	86
Ford C-MAX Energi	\$15,140	19	46
Ford Fusion Energi	\$21,900	19	40
BMW i3 with REX	\$36,380	72	9
All Electric Vehicles (Electric only)			
Nissan LEAF	\$9,000	84	47
BMW i3	\$21,500	81	17
Tesla Model S and X	\$62,250	210-289	116

Electric cars have proven to be extremely reliable but getting a car checked out by a qualified mechanic before buying can help avoid any costly surprises. Electric car batteries are one of the most expensive components to replace. Fortunately, the batteries are engineered for eight- to ten-plus-year lifespans and the vast majority continues to work well. Smartphone apps are available for a few models that can connect with the on-board diagnostic systems to provide a detailed report of battery health.

Want more information? There are many excellent online resources and forums with information on electric cars and used vehicle pricing. Visit www.DriveElectricVT.com or just search for used electric cars in your area to get started.

David Roberts is the Drive Electric Vermont coordinator. He has driven an all-electric Nissan LEAF for the past four years and says, if you have to drive, drive electric.

China is Building Electric Buses

In early February, we got data on electric and hybrid-electric bus sales from China. Chinese sales of e-buses were about 115,700 for the year, bringing the number of e-buses in use, worldwide, to about 173,000.

The Chinese multiplied the number of e-buses in the world by three. This is another benefit for transitioning to a carbon-free future; by creating jobs to change our current infrastructure. Building these buses employed a lot of people.

The United States currently claims 400 electric buses, including all that are in use, all that are on order, and all for which money has been allocated for purchase. Fortunately, at least one new e-bus factory is being built in this country by BYD, a Chinese company.

We at Green Energy Times have an idea: Let's make America great again!

ELECTRIC BUS TRIALS IN VT AND NH

By George Harvey

In the December, 2014 Green Energy Times article, "Proterra's All Electric Bus" (<http://bit.ly/GET-Proterra>), we noted that the city of Worcester, Massachusetts had recently started running six Proterra buses. Since then, Worcester has reported that the buses have functioned as promised, with short charging times

and low operating costs. It is significant that the electric buses worked well in the cold New England winters. With that experience, the idea spread, and testing is currently underway in the Upper Valley of New Hampshire and Vermont, and in Burlington, Vermont.

The Burlington program arose from the Vermont Renewable Energy Standard,

which took effect in January, 2017 and changed the utilities' efficiency goals somewhat. James Gibbons, Director of Policy and Planning at the Burlington Electric Department (BED), explained, "The old mantra of efficiency is reducing use, but the new one is to reduce emissions."

A portion of the standard, Tier III, provides for utilities to engage in innovative strategic electrification, and encourages them to find new ways to reduce emis-

sions. "BED is proposing a custom Tier III electric bus program to address the transportation needs of Vermonters served by Green Mountain Transit Authority (GMTA), the University of Vermont and potentially other Burlington entities," Gibbons said. He noted that replacing a single diesel bus with an electric bus would displace 77 tons of CO2 annually.

BED's Tier III program would offer to a transit company incentives to use an electric bus, *Cont'd on p.6*

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SMART COMMUTING IN NH & VT

Transportation emissions are among the worst offenders that add to the rising CO₂ levels in our atmosphere. In recent months we have learned that our efforts have begun to reduce the detrimental air quality counts (NHDES), but as you may have learned from numerous other reports such as the International Panel on Climate Change (IPCC), <http://climatechange2013.org/>, global warming is still advancing faster than expected.

How do we get our emissions down now? By making new commuting choices!

LOTS OF CHOICES. Smart Commuting is all about knowing your options and planning ahead. There are many choices to get around in New Hampshire and Vermont. The first place to start in Vermont is "Go Vermont" for statewide choices to travel more efficiently. Whether getting around town, commuting to work or school, or planning a day trip, share the driving or ride with someone else to help save our planet and to save approx. \$2,000 annually. The statewide VT site also lists services for commuters, tourist, and shoppers.

In New Hampshire you'll find a similar site at "NH Rideshare" where you can find carpools, transit routes and schedules, bike and walk trails and links to statewide transportation information.

When carpooling, remember to use the local Park n Ride lots to meet your connections. Start your trip planning at connectingcommuters.org or nh.gov/dot/programs/rideshare/ for statewide choices.

IN NEW HAMPSHIRE

UPPER VALLEY RIDESHARE (UVRS) - Carpool matching, benefits and support for commuters in/out of Upper Valley. 802-295-1824 x208. uppervalleyrideshare.com.

ADVANCE TRANSIT (AT) - Free weekday bus for Lebanon, Hanover, Enfield, Canaan, NH, and Norwich and Hartford, VT. Dartmouth and DHMC Shuttles. ADA & Travel Training Services. 802-295-1824. advancetransit.com

CARROLL COUNTY TRANSIT - Services and connections to Belknap County. 888-997-2020 tccap.org/nct.htm

CITY EXPRESS - Serves Keene. 603-352-8494 hcsservices.org/services/transportation/cityExpress.php

COMMUNITY ALLIANCE TRANSPORTATION - Services for Claremont & Newport. 603-863-0003

CONCORD AREA TRANSIT (CAT) - Serves Concord 603-225-1989 concordareatransit.org

CONTOOCOOK VALLEY TRANSPORTATION (CVTC) - Monadnock Rideshare for the southwest region 877-428-2882 cvtc-nh.org

COOPERATIVE ALLIANCE FOR REGIONAL TRANSPORTATION (CART) - Serving the Chester, Derry, Hampstead, Londonderry, Salem and Windham, limited service to Plaistow. 603-434-3569 cart-rides.org

DARTMOUTH COACH - Services to Boston, Logan Airport and NYC 800-637-0123 dartmouthcoach.com

MANCHESTER TRANSIT AUTHORITY (MTA) - Manchester, with links to Nashua and Concord. 603-623-8801 mtabus.org/services/local-buses

NASHUA TRANSIT SYSTEM (NTS) - Buses and trolleys with bike racks. 603-888-0100 RideBigBlue.com

NH RIDESHARE - Your Source for Transportation Alternatives. nh.gov/dot/programs/rideshare/

WINNIPESAUKEE TRANSIT SYSTEM (WTS) - Services Belmont, Franklin, Tilton, Laconia. 603-528-2496 bm-cap.org/wts.htm

IN VERMONT

UPPER VALLEY TRANSPORTATION MANAGEMENT ASSOCIATION (Vital Communities) - Works with UV employers and communities to promote and improve commuting options. 802-291-9100 vitalcommunities.org/transport/index.htm

VERMONT PUBLIC TRANSPORTATION PUBLIC TRANSIT - Lists transit, ferries and more at aot.state.vt.us/PublicTransit/providers.htm

AMTRAK - Long distance train service. Discounts for AAA members and student advance card. (800) 872-7245 amtrak.com

CHITTENDEN COUNTY TRANSPORTATION AUTHORITY - Burlington bus service with links to Montpelier, Middlebury and commuter route to Milton. cctaride.org

CONNECTICUT RIVER TRANSIT - Services in Bellows Falls and Springfield. crtransit.org

GO VERMONT - Offers carpool matching and commuter connections in VT 800-685-7433 connectingcommuters.org

GREEN MOUNTAIN RAILROAD - Day trips from White River, Champlain Valley, Bellows Falls and Rutland. rails-vt.com

GREEN MOUNTAIN TRANSIT AGENCY - Local service in Barre, Montpelier, Grand Isle, Stowe and Lamoille. 802-223-7287 gmtaride.org

GREY HOUND/VERMONT TRANSIT - Long distance bus services. 1-800-231-2222 greyhound.com/

LAKE CHAMPLAIN FERRIES - Transport between New York and Vermont via Lake Champlain. 802-864-9804 ferries.com

MARBLE VALLEY REGIONAL TRANSIT - For Rutland, Killington, rural Manchester, Poulney and Rutland to Bellows Falls. City routes Free on Saturday. 802-773-3244 thebus.com/

RURAL COMMUNITY TRANSPORTATION (RCT) - Buses, vans, and volunteer drivers. Routes via The Jay-Lyn, The Highlander (Newport - Derby Line); The US RT2 Commuter (St. J. to Montpelier) and Free routes to rural areas. 802-748-8170 riderct.org

STAGE COACH - Commuter buses from Randolph and Fairlee to Dartmouth, Local village buses. 800-427-3553 stagecoach-rides.org

OUR PLANETARY GARAGE

AIR POLLUTION IS KILLING TOO MANY PEOPLE

By John Bos

There is a Sanskrit proverb that observes, "For breath is life, and if you breathe well you will live long on earth."

Breathing is the only autonomous system of the body that we can also control. This means that although the body governs our breathing, we can change how we breathe through conscious breathing practices such as pranayama.

Think about this in the context of new data compiled by sixteen scientists from eight international institutions who worked with the World Health Organization (WHO) which found that more than nine out of ten people on Earth - a mind-numbing 6.76 billion people - are breathing polluted air. The WHO analysis, which gathered data from 3,000 locations, using pollution monitors on the ground, modeling and satellite readings, found China to be the world's deadliest country for outdoor air pollution.

Air pollution is now claiming about 6.5 million lives each year according to the WHO report, with most deaths in China, India and other developing countries. That said, America does not get off easily. About 15% of the affluent cities in the U.S. from Los Angeles to New York City fail to meet air quality standards.

Air pollution is but one of the life-threatening impacts of human-caused global warming. Denial of global warming is not just an opinion, it has become a dominant mark of people's political identity. Putting that aside, I want to suggest an approach to understanding the importance of air quality for those who reject the conclusions of over 97% of the world's scientific community about global warming.

Here's a question: how dangerous is it to operate a gasoline engine in a closed garage? What happens is that carbon monoxide (CO) emissions reduce the amount of oxygen to the brain, causing CO intoxication, and lack of reasoning. CO concentrations reach the Immediately

Dangerous to Life and Health (IDLH) concentration of 1,200 parts per million (ppm) in only seven minutes when a small five horsepower gasoline engine is run in a 10,000 cubic foot room. Now consider the CO air impacts of a 135 horsepower automobile in a single car garage of 1,600 cubic feet.

If one can comprehend those scientifically demonstrable facts, here is a follow-up to this example. In 2014, some 260 million vehicles were registered in the U.S. This figure includes passenger cars, motorcycles, trucks, buses, and other vehicles, but NOT jet aircraft which emit massive amounts of air pollution.

While calculating the total number of motor vehicles on the planet is an inexact science, the number is growing rapidly. The automotive trade journal, Ward's Auto, has estimated that the vehicle count exceeded 1 billion sometime during 2010. Another calculation in July 2014 estimated that there were 1.2 billion vehicles on the world's roads, and that there would be 2 billion vehicles in service by 2035.

Our planetary garage is not big enough to prevent air pollution from killing people. This is why the Chinese government has announced plans to take up to 6 million vehicles that don't meet emission standards off the roads by the end of the year, in a bid to mitigate that country's air pollution crisis.

Petroleum powered vehicles are only one source of air pollution that we humans DO control. As a culture we are in deep denial about the irreparable damage we have visited upon our collective home. Earth cannot begin to reverse its slide into an uninhabitable climate without the help from those who live on it.

Breathe in, breathe out.

John Bos lives in Shelburne Falls, MA. He writes frequently about environmental issues and invites dialogue at john01370@gmail.com.

ELECTRIC BUS TRIALS IN Vt AND NH *Cont'd from p.5*



Advance Transit hopes to have their new electric bus out on Tuesday, Feb. 21st. Initially it will be working one of the hospital shuttles. Photo: Courtesy of Advance Transit.

for which BED could claim Tier III credits. Both the utility and the transit organization benefit. The details have not yet been worked out, but the expectation is that they will be soon. Gibbons said he had learned that GMTA is evaluating the total cost of owning so-called "clean diesel" and compressed natural gas buses, and BED's incentive for using an electric bus is an important consideration.

In the Upper Valley, Advance Transit (AT) will also test an electric bus. BYD, a

bus manufacturer, is helping by loaning it a bus for a month.

AT operates a number of bus routes that run through Upper Valley communities in Vermont and New Hampshire. A long-standing special feature of AT is that bus rides are free on all routes.

Chris Andreasson, AT's

Director of Operations, told us, "The big issue is with the colder weather. Will the bus keep the customers comfortable? How long will the charge in the battery last in cold weather?" With all the benefits of electric buses, companies need to know that they are as comfortable and reliable as those that are currently in operation.

Both of these programs are just now under way, and reports will doubtless come in over the next few months. We will keep track of progress.

PUBLICLY SUPPORTED SOLAR LOAN PROGRAMS: A GUIDE FOR STATES AND MUNICIPALITIES



photo: © Dennis Schroeder/NREL

On January 3, 2017, Clean Energy States Alliance (CESA) announced a new guidebook, which was written by Travis Lowder from the National Renewable Energy Laboratory (NREL) for CESA's Sustainable Solar Education Project.

States' policies and programs are now clearly the main driving force for renewable energy progress in the U.S. They can play an important role in spurring local lending for residential rooftop PV installations.

With this guidebook, Clean Energy States Alliance aims to help inform state and municipal officials about best practices and the various approaches to opening up the lending marketplace for residential

solar. The 30-page guide describes general factors that state and municipal governments should consider when assessing whether to launch a public solar loan program, explains various loan program design elements, and offers several case studies.

Download the guide at: <http://www.cesa.org/assets/2017-Files/Publicly-Supported-Solar-Loan-Programs.pdf>. Learn more about CESA at [cesa.org](http://www.cesa.org). NREL's website is [nrel.gov](http://www.nrel.gov).

pdf. Learn more about CESA at [cesa.org](http://www.cesa.org). NREL's website is [nrel.gov](http://www.nrel.gov).

Climate Resistance Leaders

Cont'd from p.2

the prize. They created a bulb 83 percent more efficient than an incandescent of comparable output, and one with the light output equal to a typical 60-watt bulb sold for around \$50 to \$60 when it went on sale in 2012. This year, an even more efficient LED bulb can be found for as little as 89 cents. When we succeed through policy and innovation in driving the price for clean technologies that low, everyone who wants to save money is going to buy them.

In Vermont over the last six years, the price for solar PV electricity gear has declined by 75 percent. Similar dramatic price declines are happening with battery storage technologies. Congress can try to roll back policies, but no one can roll back economic reality.

In Vermont, we have energy efficiency programs and a Renewable Energy Standard which will keep us moving forward. By continuing to lead, and by joining communities and states which share values similar to ours, we can keep the light burning for climate progress during the potentially dark years ahead. If the federal government withdraws from its role of recent years, that does not absolve our responsibility to do our part. If anything, it means we must fight harder than ever before.

President Kennedy once said, "We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard...because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win."

Today, we are counting on "climate resistance" leaders here in Vermont and across this country to harness the sun, wind, and water, and our technological innovation to protect our planet from climate change, not because it is easy, but because it is hard and necessary. We must accept the challenge, we cannot postpone action, and we must win.

Darren Springer was Chief of Staff in the Office of Governor Peter Shumlin. Previously, he served as the Deputy Commissioner for the Public Service Department and worked four years for Senator Bernard Sanders, as a Senior Policy Advisor for Energy and Environment and later as Chief Counsel. He has a J.D. from Vermont Law School. Springer lives in Burlington.

Solar in Your Community Challenge

DOE Offers Challenge, Opportunity to Advance Community Solar



The Department of Energy has launched a contest to promote innovative, replicable community solar projects. The "Solar in Your Community Challenge" is a great opportunity to get creative; it also offers \$5 million in cash prizes and technical assistance. Put your vision for a clean energy future to work and get involved as a team, an expert or a consultant. Applications are due March 17, 2017.

Approximately 50 "teams" across the U.S. will receive seed prizes of \$20,000-\$50,000 and up to 100 teams will receive technical assistance vouchers of a similar amount. Teams are groups of diverse stakeholders who are pursuing a solar project or a program that would make solar available to underserved groups, such as low- and middle-income households, tribes, non-profits, and state/local governments.

The focus on solar models is for low-income earners. These groups spend a far greater percentage of their income on energy than most people – and would benefit most from reducing their energy costs through a stable lower cost option like solar – that also includes the 30 percent renewable energy tax credit. While there have been innovative partnerships to foster greater access for those without a "tax appetite," developers partnering with municipalities, schools or nonprofits to pass on the investment tax credit that these groups cannot access by themselves, there is far more need and opportunity. This challenge could help open that door.

This challenge also provides the chance to help incubate other types of innovative community solar projects, such as the Mad River Community Solar Farm (MRCS) which is generating about 225,000 kWh a year for its member-owners. Members of the MRCS project purchased the number of panels

they estimated they needed and manage the array democratically as a limited liability corporation (LLC). Because there is no third party, the members get the full benefit of the tax credits and buying in bulk. It's a successful, innovative approach.

To help Vermonters learn more, the Vermont Energy and Climate Action Network (VECAN) recently hosted a webinar with staff from the Department of Energy to outline this opportunity. Find it on YouTube at <http://bit.ly/Solar-Comm-Challenge>.

VECAN also has many resources to get your creative ideas flowing, including a community solar toolbox on our website <http://www.vecan.net/going-solar-in-vermont/>. This contains information on siting solar projects, models of community solar, information about net-metering, success stories and other resources. One of the more unique resources is a set of documents produced by the Vermont Law School's Institute for the Energy and the Environment — a guide for direct community ownership and have model documents for operating a LLC and leasing land.

While there is some uncertainty about the future of this program with a new federal administration, SunShot representatives have indicated they plan on moving ahead as scheduled for now.

So, get creative! Think big! Consider putting a diverse team together – people with expertise in areas like finance, law, and community engagement – and see what kinds of community solar solutions you think will work for people with more limited access to the transition to clean energy.

More information is available at <http://bit.ly/2lwSlwh>, or call VECAN's AmeriCorps member Katie Emerson at 802-223-2328 x 118.



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Going Solar: Do Your Due Diligence

A SERIES: PART TWO OF THREE
— NET-METERING VALUE

By Jonathan Teller-Ellsberg

Read Part 1 in G.E.T., Issue # 41

It seems that it should be easy enough to convert expected solar production of electricity into the net metering value you receive. As a first approximation, you simply multiply the number of solar kWh expected by your cost of electricity.

However, there are many complications that arise. Among them are the following:

- Assumptions made regarding the future cost of electricity,
- The degradation rate of your solar panels,
- How solar production is valued by the utility, and
- Possible additions or subtractions from regular net metering.

You know what your electric rates are today, but what will they be in the future? Different installers use different assumptions of future electric rate inflation in their proposals. I have seen proposals using anything from 2.5% to 4.5% annual inflation on electric cost/value.

If you know the power of compounded interest, you know that changing this aspect of value projection can have a huge impact on how valuable the solar installation looks. Over the course of 20 years, the difference in overall lifetime projected value between the lower of those two inflation rates and the higher is roughly 25%. If the projection goes out to 30 years, which some installers do, then the increase in overall lifetime projected value from using the higher inflation rate compared to the lower is roughly 40%.

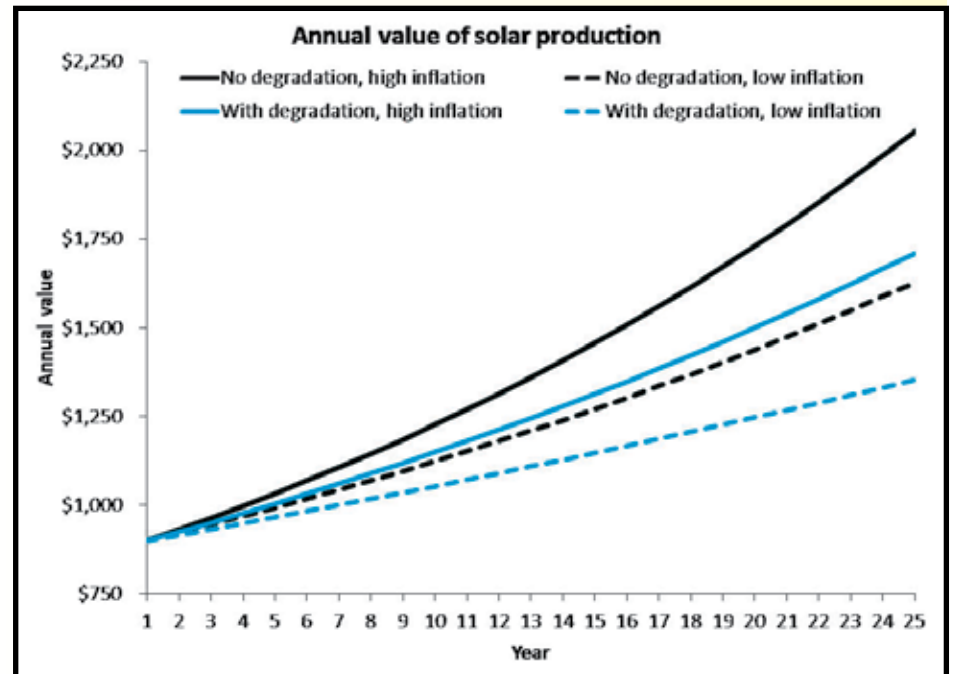
Vermont's residential electric rates have risen fairly consistently in the past, averaging 3.0% per year in the ten years from 2006 through 2015, though the most recent five years have seen a slowing of the trend.

In New Hampshire, things have been more volatile with some years seeing expensive spikes and other years meaningful reductions in cost. Over the past 10 years the annual average change in residential rates was an increase of 2.1%. Unlike Vermont, New Hampshire's most recent five year experience has been accelerating rate increases.

There is no one right answer as to the best or correct inflation rate to assume for future electric costs. However, it is essential that you know what assumption your potential installer is using, and that you compare different proposals with an understanding of the impact of different assumptions on this count. If possible, insist that all the installers giving you proposals use the same assumption for future electric rate of inflation.

All solar panels will decline in productivity over time. How fast they decline is referred to as the degradation rate. Long-term research by the National Renewable Energy Lab has found that the average degradation rate is 0.5% per year.

Any decent quality solar panel will come with a performance warranty guaranteeing that degradation won't be excessive. Typically, this will be for year-over-year declines of 0.7% or less, and overall 25-year cumulative declines of 20% or less.



A graph of predicted value using different assumptions of solar panel degradation (either none or 0.7% per year) and electric rate inflation (either 3.5% or 2.5% per year). Each case starts with production of 6,000 kWh in year 1 at a value of 15 cents/kWh. Over 25 years, the case assuming no degradation and higher inflation adds up to 26% more total value than the case that assumes degradation and lower inflation. Which is right? Only time will tell. CC BY-SA.

Has your potential solar installer built an assumption of solar panel decline into their projection of your system's long-term electricity production? If not, then they are giving you an inflated projection. Be sure to ask what degradation rate they use in their projections.

I recommend that, if they are not already doing it, you ask them to run the projections using the worst-case degradation allowed under the panel manufacturer's warranty. If the panels decline more slowly than that, it will be added frosting on your solar cake.

The value of solar electric production depends on your state's regulations and utility policy. Under plain vanilla net metering, each kWh generated by your solar array will be worth the same dollar value (in the form of savings) as the cost of a kWh that you receive from the utility.

With some utilities, that is exactly what

you get. For example, if a kWh from the utility costs a flat 15 cents, then each and every solar kWh your system generates will show up on your bill as a credit of 15 cents.

But it's not always that simple. Sometimes your rates from the utility vary depending on your overall monthly usage and solar production. This has been the case, for example, with Washington Electric Co-op (WEC) in Vermont. Some of your solar production might be credited at 22 cents per kWh, some at 10 cents, and some at 20 cents, depending on how your overall solar production during the month compares to your overall electric usage in the month.

Or the rate you are credited for solar might depend on whether the solar-generated electricity is used directly within your home or if it flows out to the grid to be used by neighbors. This is the

Cont'd on p.9

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Going Solar: Do Your Due Diligence

Cont'd from p.8

case with the New Hampshire Electric Co-op, where a kWh of solar production from a residential solar array might be worth 12 cents or might be worth 9 cents, depending on who used those particular electrons.

Or the rate you are credited for solar might depend on the time of day of production separately from whether or not you are using the energy directly.

And sometimes you may be charged a fee for grid services that depends on the amount of solar electricity you generate. Again using WEC as an example, there you have a "grid service fee" of 4.8 cents per kWh, but only on solar production above 255 kWh per month.

If your state regulations and utility policies include these kinds of complications, it will be difficult—approaching impossible—for an installer to provide a very accurate prediction of the value you will get from solar, even assuming a known number of solar kWhs being generated. At best, the installer can provide a good-faith rough approximation or range of likely value.

Even so, your installer should be able to explain how they calculated any estimated value and explain the features of your utility's rate structure that complicate the calculations. I have talked with telephone sales representatives from some of the large, national solar companies, and it was clear that they had no understanding at all of the nuances of rate structures and regulations in Vermont (where I live and work). As a result of their convenient ignorance, they promised me significant value from their solar array that was pure fantasy.

In most of Vermont, net metering has been supplemented by the "solar adder." With new regulations going into effect in 2017, the solar adder is being eliminated and replaced with two "adjustors," explanation of which is beyond the scope of this article. (Those who have gone solar in 2016 or earlier are grandfathered to retain their solar adder and avoid the adjustors.)

The key here is that these features can mean bonus credit on the electric bill above and beyond that from plain vanilla net metering. In the case of both the solar adder and the adjustors, the bonus credit

(if any) is provided for ten years, and is provided at a fixed value, even if the underlying electric rates change.

And yet, I have seen solar installer proposals that apply an assumed inflation rate to the adder as well as to the underlying electric rates. Further, the projected value shown in these proposals failed to end the solar adder after 10 years, instead including it out for the full 30-year projection used by that installer. In one instance that I have seen, this represented a bogus inflation of the lifetime solar value of over \$19,000!

In addition, this proposal also ignored solar panel degradation. Compared to an assumption of panel decline at 0.5% per year, the proposal was inflating projected solar value by an additional \$6,250.

The combined exaggeration of solar value in this instance, over \$25,000, was a full 37% of the supposed lifetime value being predicted. Talk about caveat emptor!

Jonathan Teller-Elsberg works for Solaflect Energy, a Vermont-based manufacturer and installer of solar trackers. He has a master's degree in Energy Regulation and Law from Vermont Law School.

To be continued in the April 15th edition of Green Energy Times issue # 43.



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A Guide to Residential Solar PV For Vermonters and others in New England

A new, free guide produced for the Vermont Public Service Department will help homeowners navigate the process of going solar.

Vermonters interested in installing a residential solar photovoltaic (PV) system have a new resource to help them move towards energy independence. "A Vermonter's Guide to Residential Solar" was produced by the nonprofit Clean Energy States Alliance (CESA) for the Vermont Public Service Department and is available for a free download <http://bit.ly/VT-guide-to-residential-solar>.

"Vermont has seen tremendous growth in residential and community-scale solar with over 6,000 installed net-metered solar projects in the state," noted Public Service Department Commissioner Chris Recchia. "As thousands more Vermonters explore the possibility of going solar, the Vermont Public Service Department is committed to providing quality information to help them navigate the process. It is our hope that affiliated agencies and organizations will help spread the word about this helpful new booklet."

There are many ways to build and finance a solar PV system. The guide can help residents decide whether doing so makes sense. The guide includes relevant information needed at different points during the decision-making and installation process.

- Reasons Vermonters choose solar
- The components of a PV system
- Opportunities, needs, and other considerations
- Ways to finance a solar system
- Solar savings and incentives
- Choosing contractors and reviewing contracts
- Solar system permitting
- After a system is installed

Appendices cover questions to ask a solar contractor, a project checklist, a glossary, and other resources.

The New England Solar Cost-Reduction Partnership is working to reduce the costs of solar deployment across five New England states by targeting non-hardware solar "soft" costs.



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Why Would You Go Off-Grid?

By N. R. Mallery



The author's off-grid home near Bradford, Vermont. The driveway is one half mile from a grid connection. The 3.8kW solar system with battery storage has supplied more than her household's electrical needs the majority of the time for nearly 15 years. Courtesy photo.

Interest in off-grid living, generating your own electricity through a renewable energy system, is starting to grow again, for a number of reasons. Just a few of the reasons are as follows:

You might want to go off-grid just to save money.

You plan to build in a location where the cost to bring in electricity from the grid is more costly than if you just went off the grid with a solar or perhaps a hybrid wind and solar, or solar and a micro-hydro system, depending on what you have available.

The cost of solar today has dropped so low that your payback time, if there is a loan, is much less than what most now pay for being connected to the grid. When your system is paid off, you have electricity with no utility bill. Imagine how much this can save you! In some situations this is break-even the moment the system is installed, because the solar system costs will likely be quite a bit less than the costs to bring in power from the grid.

But going off the grid is not just 'plug and play.' There is a responsibility for maintenance of the system. It is important to understand that for an off-grid system to work to your benefit financially, attention needs to be made to assure that everything is running smoothly. Most of the time it will be, but if there is a problem that is not attended to, neglecting to monitor the health of your system could be costly. These problems and costs in most cases can be avoided. Batteries require maintenance. The battery bank is your own personal power company. But, as you will see in the next issue of Green Energy Times, like solar applications which have no moving parts and can last 30 years or longer, so can a battery bank. If taken care of correctly, both can last for a very long time. Stay tuned for more about this in our April 2017 issue.

You might want to go off-grid for energy security.

Taking responsibility for your own energy needs through a renewable energy system gives you security that you not only have energy when you want it but also continuously — even when the grid goes down. Let's face it — power lines go down in storms, or you lose power for a number of reasons. In a massive outage, it can sometimes take a day or even a week or more to restore power to some of the more remote homes. And as we saw when Irene hit this area, sometimes whole towns are without power, and the creature comforts and necessities of life are suddenly gone. When this happens, the things we rely on every day, such as refrigeration, cooking, heating and cooling and even the reliance on our computers and

connection to the world are simply lost unless we have an alternative source for our energy needs. Sometimes a generator can help, but if there is no means to get fuel, that is temporary, as well. However, a renewable energy system with battery storage can pretty much assure the energy security that we have come to rely on so heavily today.

An off-grid energy system is your own personal power company. This means that those who live off-grid or even on the grid with battery storage which can be disconnected from the grid, have much greater energy security.

Surprising News for Off-grid Assistance

Green Mountain Power (GMP), which supplies electricity to about three-quarters of the people in Vermont, now has a program to help those who go off-grid, do so. They are the first utility to take this step. For a utility company to offer assistance to go off the grid may seem strange, and we might feel compelled to ask what incentive is there for an electric utility to help customers disconnect from it.

The answer is that by helping some customers go off-grid, GMP can reduce maintenance and even retire some electric lines. Also, helping a customer go off-grid is itself a service, for which GMP is actually paid. Each site is unique, so there is no standard price.

Those who live in GMP's territory and are interested in their help to go off-grid should visit <http://bit.ly/GMP-off-grid> or call Craig Ferreira at 1-802-747-6818 or 1-888-835-4672. For anyone else, many solar installers advertising in Green Energy Times can be very helpful.



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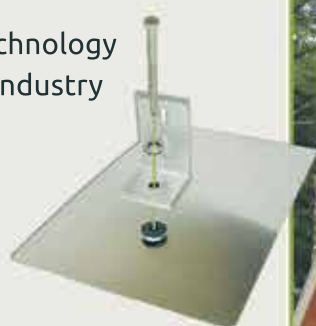
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An Off-Grid Solar Story from: **INTEGRITY ENERGY** EAST BETHEL, VERMONT



An off-grid solar system installed by Integrity Energy at Lake Champlain features nine SolarWorld 265-watt modules. Photos courtesy of Integrity Energy.

By George Harvey

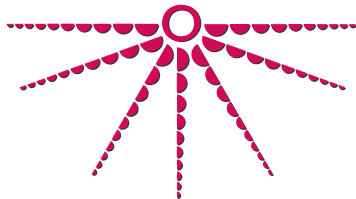
When Amos Post founded Integrity Energy in Bethel, Vermont in 2011, he had worked for groSolar for nine years, gaining experience with solar photovoltaic (PV) systems. He soon brought John Mattern, also a veteran of groSolar, to work with him. There was more to their backgrounds than just their years of experience with solar installation, however. Post had already received NABCEP PV installation certification, and Mattern had fourteen years of experience as a carpenter.

While Integrity Energy focuses on PV installations, it does just about any sort of these a customer might wish for at a home or business in Vermont or New Hampshire. The company can install a system on a rooftop or on the ground. It has experience with grid-tied systems, both with and without backup, and with off-grid.

Post says opportunities to do off-grid systems do not come very often, but inter-

est in such systems seems to be increasing, especially recently. He says people recognize the importance of resilience and see that they can be better prepared for power disruptions since solar costs are declining.

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Integrity uses the components that are judged best for the job. This tends to mean Canadian Solar or SolarWorld modules. For charge controllers, Post uses OutBack and MidNite. For inverters, he uses SolarEdge, SMA, and Fronius for grid-tied systems, and Outback Power and Schneider for off-grid.

Post said customers who opt for systems with battery power should understand that battery lifetime depends very much on how the batteries are maintained. "A battery bank that is only used in a grid-outage and spends the rest of its life in float (trickle charge to maintain 100% state of charge) will last significantly longer than a battery that is cycled heavily daily or not maintained properly," he said. "In general we tell people to expect 7 to 10 years from a well maintained and properly sized AGM bank and 10 to 15 years for a similar lead-acid bank."

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He elaborated, "People should know that it is a different lifestyle. People who are most successful living off-grid are very conscious of the energy they are using, and they know their systems – they have a good understanding of how the systems work. We tell our customers about batteries upfront, which is why we give them the two options of lead-acid and AGM. AGM needs nearly no maintenance. Lead acid batteries need to be checked regularly and refilled properly, and many people need to be educated about equalizing."

Cont'd on p.19



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ICE SKATING WITH SOLAR IS COMING TO WOODSTOCK, VERMONT

Woodstock's Union Arena to Go Net-Zero with Solar

By Barbara Whitchurch

"If you can make an ice rink net-zero, you can make anything net-zero," said Harold Mayhew, Woodstock Union Arena Board President.

As most Vermont readers know, Vermont has a statewide goal of being 90% renewable by 2050. There are myriad projects in the works that will help the state achieve that goal. But ice skating rinks do not customarily make that list, until now.

The Woodstock Union Arena is a popular place, with approximately 100,000 visits each year. Built in 2003, with 17,000 square feet of open space, the arena is open year-round -- and many local residents go there every week. In addition to skating and ice-related sports, the arena is available to rent for concerts, outings, antique shows, art shows, school graduations, theatre festivals, concerts, fundraisers, and sports practice. According to their website, the Union Arena, Inc. is a non-profit organization whose mission is "to offer affordable and accessible healthy activities for all families and the overall population of the region."

"The arena provides a sense of pride; a community gathering place to enjoy family, friends and visitors; and a place

to develop healthy activities," said arena manager EJay Bishop in an interview with the Valley Standard. "It's an economic engine that produces approximately \$2.5 million toward the local economy" -- and it is not supported by tax dollars at all. Not bad for a non-profit!

It costs a lot of money to run an ice arena, and a sizeable chunk of that goes to energy costs. Ice arenas are big, and they use huge amounts of electricity to run the equipment that makes and maintains the ice, not to mention the lighting, heating and ventilation.

Despite its popularity, this 13-year-old arena was in deep financial trouble three years ago. The Woodstock community has a shrinking youth population, and the realities of rising energy costs were pressing in. Harold Mayhew, a Barnard resident and architect who actually designed the original rink, became involved again several years ago when their energy bill had pushed the rink to the brink of closing. Mayhew has previously designed arenas, including the Kreitzburg Arena at Norwich University and the rink at Maine's Bowdoin College, which became the nation's first hockey rink to be certified by LEED (Leadership in Energy and Environmental Design), a building code standard

that rates buildings on their energy efficiency and other standards.

As many homeowners know all too well, as much as we may want to reduce our long-term expenses, it's challenging to balance our budgets with the costs of upgrading our structures. "They were having such a hard time

keeping the doors open, they couldn't afford to do any of the work to cut down on energy consumption," said Mayhew, who joined the Board of Directors in 2013 and later became president. Energy costs at about \$140,000 a year had reached about a third of the rink's total budget of \$500,000.

Under Mayhew's direction, the Board came up with the following four-tier strategy:

By reducing their heating, fuel and electricity costs to zero (commonly known as "net-zeroing" -- a fairly new verb in the lexicon), they could make the arena sustainable. This would not only help their budget but would benefit the environment by reducing their carbon footprint. In turn, it would make their programs more affordable for the Woodstock community. In fact, they anticipate a dramatic reduction in the costs of these programs

once they get to net-zero.

To even think about getting to net-zero, the arena needed to assess what they already had, and what they already had needed a lot of work. So, the first tier of the plan involved completely rebuilding their existing refrigeration plant (the thing that keeps the ice hard.). Encouragingly, since tier 1 was finished, they've realized a 12% annual savings, and they expect that number to go even higher as more of the tier 2 renovations are completed.

Tier 2 will tackle the HVAC system (AC, ventilating, heating) and lighting, and tier 3 will install solar panels, to offset the cost of the energy demand. (The solar system will be installed by a local solar company, whom we are not free to reveal at this time.) Tier 4 will integrate all of the improvements together in two to three years' time. The net consumption will be reduced *Cont'd on p.39*




Above: Union rink and skaters; below is the Union Arena in Woodstock, VT. Courtesy photos: EJay Bishop, exec. director, Union Arena Community Center.





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Solar Power For A Signature

By George Harvey



The Tolemac solar array. Photo courtesy of Solar Source.

Frank and Kathy Grossman clearly enjoy doing beneficial new things. When they moved to Hollis, New Hampshire (near Nashua), one of the existing features of their home was a solar hot water system. With the passing time, they decided to upgrade and expand that system. The new system, now five years old, provides not only hot water but heat to the house, reducing fuel consumption to about a third of what it had been.

Still looking for ways to make things better, they started considering options for building a solar array on their land. A net-metered array can reduce a family's electricity load to nearly nothing, but a

larger array can sell power commercially. They wanted a payback on the system in a reasonable time, but they did not feel a need for huge profits. They considered their options, and came up with a novel solution.

They decided to build a large enough array to do group net-metering for their family and friends. With a little calculation, they found that they could pay the system off in ten to twelve years, even if they gave a fairly large amount of its power away for free. Frank Grossman echoed his wife's feelings when he said, "It is payback to society, rather than directly to us."

They approached friends and relatives,

telling them they did not need to invest money or take on any obligations to get ongoing benefits from the solar array. All they needed to do was to sign up for group net-metering. The Grossman family would get solar power with a reasonable investment payback. The group would get 45% of the output of the 163.8 kilowatt system, just for signing.

Even when things are easy, they are not always so easy. Hollis had no zoning for solar arrays. This did not mean they could just go ahead. It meant that a new ordinance had to be crafted.

Frank Grossman filed his first documents with the town in November, 2015. Planning board members wanted more than just a description of what was to be done.

Some wanted documentation on the array, with drawings and an engineer's official stamp. The original plan had not anticipated that board members would need to be educated.

The town's decision-making process produced inconsistent results. Some work

was started, with an understanding that it was appropriate, only to have a town official decide that it needed to be altered. An existing underground electric line needed to be relocated, but after work on retrenching had begun it had to be stopped and relocated again, resulting in loss of time and money.

In some cases, the town asked for upgrades on the plan. One neighbor objected that the solar array would be unsightly and reduce the value of a house that had been bought as a retirement investment. When the Grossmans offered to put up a fence so the array could not be seen from a road, the town wanted a staggered line of over fifty white pine trees. And so the trees were planted.

In March, a new zoning ordinance was brought up for a vote by the citizens, and it passed. The array could go forward. The array was the last to do so under a state law limiting the overall amount of group net-metered solar to two percent of the peak demand.

It is the nature of solar power that it can be installed quickly, once things are all approved. Solar Source of Keene, New Hampshire completed the Tolemac Solar array in short order, and it is one of the prettiest we have seen. It went online on January 20, 2017.

Pictures of the array's progress can be seen at <http://www.tolemacsolar.com/>.

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Renewables Progressing in Mass.

By George Harvey

In December, the Massachusetts Clean Energy Center released the 69-page "2016 Massachusetts Clean Energy Industry Report," providing information on how clean businesses are performing in the state. Its information is very encouraging. (<http://bit.ly/MA-clean-energy-report>)

The report says clean technology is an \$11.8 billion industry in the U.S., and in Massachusetts, accounts for 2.5% of the gross state product. There are over 105,000 clean technology jobs in the state, an increase of 45,000 jobs since 2010. This growth rate is much higher than the general increase of employment in the state. Notably, the jobs tend to pay rather well, provided by small, locally-owned businesses.

One sub-sector of clean technology that has stood out in particular is solar power. In 2015 and 2016, 63% of all renewable energy jobs in Massachusetts were directly related to solar power. The numbers of these jobs grew 22% during the time, making solar power an important employment area for the state. A third or more of these jobs were entry level, so many people entering the job market can find positions. According to the Solar Energy Industries Association, Massachusetts was ranked as the number six state in the United States for installed solar capacity at the end of 2015, with 1020 megawatts (MW) installed.

The solar industry has suffered from some problems in 2016. The year saw an additional 52 MW installed, as the state dropped to the number 10 spot for total solar capacity. This fact may be easy to misconstrue, however, because of events that will undoubtedly change the energy landscape of the state. In fact, when the year closed, the site solarpowerwatch.com rated Massachusetts as the best state in the country

in terms of its policies for solar power.

During the course of 2016, the state's legislature was very active on the subject of renewable energy generation. It produced a bill requiring 1,600 MW of offshore wind power plus an additional 1200 MW of land-based renewable power. Governor Charlie Baker, a Republican, regards climate change as a clear threat to the state, as well as the world, and when the bill reached him on August 8, he signed it.

Another legislative action undertaken was a mandate for energy storage. In August, the Commonwealth adopted a goal to decide whether to set a procurement target. It is the third state in the United States to set a procurement target, after Oregon and California.

In September, Massachusetts published a report, State of Charge, which provided a set of recommendations on policy for growing storage capacity. The report concluded that storage would increase energy security while reducing both carbon emissions and consumer costs. In December, the Massachusetts Department of Energy Resources issued its announcement, saying it is prudent to have a goal on energy storage. The department has until July 1, 2017 to adopt targets for procurement.

Importantly, other technologies are also being supported by the state, its institutions, and its businesses. Scientists at Massachusetts Maritime Academy began testing an underwater turbine at the Cape Cod Canal in Buzzards Bay. It is technology they believe could represent a fundamental change in power generation. The machine centers on an oscillating set of blades. Mass Maritime's scientists say it is a "hydro-kinetic energy solution."

We hope for more good news from Massachusetts.

MORE RENEWABLES IN NYS

Projects will leverage nearly \$1 billion in private investment and add enough electricity to power more than 110,000 homes.

NYS' 50% renewable by 2030 goal is getting ever-closer.



Hecate Energy is developing a 20 MW solar PV project in Greene County, NY. Photo: Hecate Energy.

On January 12, 2017, Governor Andrew M. Cuomo announced \$360 million in awards for 11 large-scale renewable energy projects throughout the state in his State of the State address. These projects provide strong support for the Clean Energy Standard that requires that 50% of New York's electricity will come from renewable energy sources by 2030.

The awards will leverage almost \$1 billion in private sector investment for clean technology projects such as wind, solar, fuel cell and hydroelectric installations. The projects are expected to generate enough clean, renewable energy to power more than 110,000 homes each year and reduce carbon emissions by more than 420,000 metric tons, equivalent to taking more than 88,000 cars off the road.

The 11 projects include two wind farms, one utility-scale solar farm, seven hydro projects, and one fuel-cell project, reflecting the strength and diversity of New York's clean economy under the Governor's Reforming the Energy Vision (REV) strategy. Once operational, these projects will add over 260 megawatts of clean, renewable energy for use in New York State.

Due to the robust response to the solicitation and the approval of the Clean Energy Standard, which calls for the development of renewable and clean energy sources under REV, the amount of the solicitation was increased \$210 million, from \$150 million to \$360 million.

The 11 large-scale renewable energy projects include:

CAPITAL REGION

- Hecate Energy Greene County, Greene County: Hecate Energy LLC will build a 50 MW solar facility in Coxsackie.

CENTRAL NEW YORK

- Fulton Unit 1, Oswego County: Brookfield Renewable Energy Group, will install a new 890 kW high-flow turbine-generator at a hydroelectric facility in Oswego County.

- North Division Street Dam Hydroelectric Facility, Cayuga County: The City of Auburn will upgrade equipment, increase capacity and restore operation of the hydroelectric facility, resulting in a new capacity of 1.12 MW.

MID-HUDSON

- Swinging Bridge, Sullivan County: Eagle Creek Hydro Power LLC will add 0.85 MW to an existing hydroelectric facility in the town of Lumberland, resulting in a total installed capacity of more than 7 MW.

- Regen DG Project, Westchester County: Bloom Energy Corporation will install a 1.05 MW fuel cell at Regeneron Pharmaceuticals, Incorporated in Tarrytown.

MOHAWK VALLEY

- Belfort Unit 3, Herkimer County: Brookfield Energy Marketing LP upgraded its existing facility in Beaver River with two modern high-efficiency runners, resulting in a total installed capacity of 2.4 MW.

NORTH COUNTRY

- Number Three Wind Farm, Lewis County: Invenergy Wind Development LLC will build a 105.8 MW wind farm in the towns of Lowville, Harrisburg and Denmark.

- Glen Park, Jefferson County: Northbrook New York LLC, a subsidiary of Cube Hydro Partners, LLC: Upgraded equipment at existing hydroelectric facility, resulting in a total installed capacity of more than 32 MW.

- Tannery Island Hydro, Jefferson County: Ampersand Tannery Island Hydro LLC installed and upgraded new

Cont'd on p.15

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Nation's Largest Offshore Wind Farm Gets Green Light

By Kit Kennedy, EcoWatch

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New York State made clean energy history on January 25, 2017, when the Long Island Power Authority (LIPA) approved a contract for the nation's largest offshore wind project, which will be located in the waters off Eastern Long Island. The approval is the first step toward meeting a historic commitment announced by Gov. Andrew Cuomo earlier this month to put in place enough offshore wind power to light 1.25 million New York homes within 13 years.

It is proof positive that New York means business when it comes to clean energy. With his commitment to add the 2,400 megawatts of offshore wind by 2030, Gov. Cuomo has now positioned New York State to be the leader in realizing the infrastructure, jobs and economic development benefits of the emerging U.S. offshore wind industry.

Here are the latest details. The board of the Long Island Power Authority (LIPA), the area's public power provider, voted to approve a power purchase contract with Deepwater Wind, the U.S. offshore wind developer that built the nation's

first offshore wind project off Rhode Island, which began commercial operation in December. The LIPA contract will enable Deepwater to finance the 90-megawatt South Fork project by guaranteeing a buyer for the project's electricity.

The South Fork project would be the second—and biggest—offshore wind power project in the country, following the 30-megawatt (MW) Block Island Wind

Farm in Rhode Island waters. The South Fork project would power 50,000 homes in Long Island's South Fork region, helping to meet peak demand in the area. It would deliver electricity via an underwater cable directly to East Hampton, helping the town meet its ambitious goal of getting 100 percent of its electricity from clean sources by 2030.

Deepwater Wind has already secured a lease for the project from the federal government but still needs to go through the federal and state permitting and environmental approval process. Because the project will be sited 30 miles from Montauk, it will be beyond the horizon and therefore invisible from shore, which will avoid any possible complaints about visual impacts.

Protecting Marine Ecosystems
In terms of ecosystem and wildlife issues, Deepwater Wind has already shown its commitment to protecting the marine ecosystems. It has worked with the Natural Resources Defense Council (NRDC) and other environmental organizations to develop plans to protect critically

endangered North Atlantic right whales, which migrate up and down the East Coast. At its Block Island project, the company successfully put these protective measures in place. We intend to work with Deepwater to replicate similar ecosystem-protection measures for the South Fork project, assuming the project moves ahead.

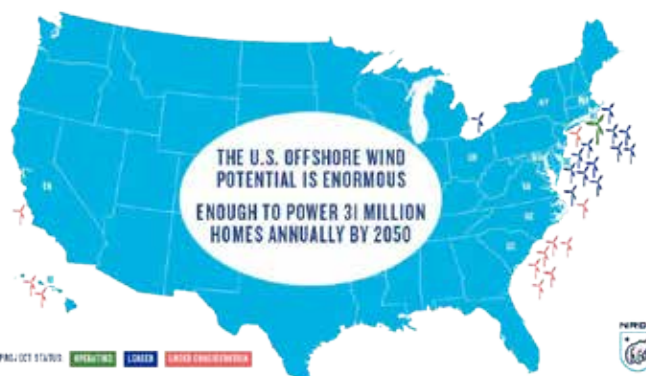
Big Benefits

Scaling up offshore wind power in New York, beginning with this LIPA project, can bring a host of benefits to New York's electricity grid, as described before. The jobs and economic potential of offshore wind are huge, as well. A SUNY Stonybrook study found that a single, 250-megawatt offshore wind power project could create 2,800 jobs and generate \$645 million in local economic output, while a companion study found such a project could be built with "essentially no impact" on consumers' electric rates. In fact, the U.S. Department of Energy (DOE) estimates that by 2050, with the right policies in place, the offshore wind industry could support 160,000 jobs nationwide.

The LIPA vote also means that 2017 is already shaping up to be a pivotal year for U.S. offshore wind, as developers aim to build on the success of the nation's first offshore wind project by pursuing plans for a dozen or more projects up and down the East Coast.

In December, bidding for the leasing rights to a federal offshore wind energy area south of Long Island went through 33 rounds of bidding before the Norwegian developer, Statoil, won the auction for a record \$42 million. The U.S. Department of the Interior's Bureau of Ocean Energy Management, which manages federal ocean energy resources, announced the nation's next offshore wind energy lease auction, which will be for 122,000 acres off the North Carolina coast. Meanwhile, Massachusetts has committed to build 1,600 megawatts of offshore wind power over the next decade, and Maryland is moving forward with plans to put 870 MW of offshore wind in place.

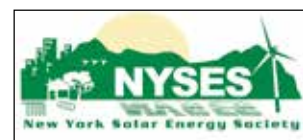
Gov. Cuomo's support for the South Fork project and his commitment to developing 2,400 MW of offshore wind



power as part the plan to get 50 percent of New York's electricity from renewables by 2030 are a testament to what bold state leadership on climate and clean energy can achieve. In this new era, we'll need this state leadership more than ever.

Kit Kennedy oversees many of the Natural Resources Defense Council projects relating to energy efficiency, renewable energy and global-warming solutions.

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MORE RENEWABLES IN NYS

Cont'd from p.14

equipment resulting in a total installed capacity of more than 1.8 MW.

SOUTHERN TIER

- Eight Point Wind Energy Center, Steuben County: NextEra Energy Resources LLC will build a 101.2 MW wind farm in the towns of Greenwood, Troupsburg and West Union.

WESTERN NEW YORK

- Burt Dam Incremental Hydro, Niagara County: Ampersand Olcott Harbor Hydro LLC recently upgraded equipment resulting in a total installed capacity of 600 kW.

Support for these new projects is being provided by NYSEERDA. The weighted average award price for this solicitation is

\$24.24 per MWh of production over the 20-year terms of the awarded contracts. NYSEERDA's previous ten Main Tier solicitations for large-scale renewables have resulted in approximately 2,152 MW of new renewable capacity at 70 locations throughout the state, generating more than five million MWh of renewable energy every year. The power generated from these 70 projects is expected to provide enough clean power to supply over 825,000 homes per year, representing a total of \$1.24 billion in investments in the Main Tier program.

Learn more about Reforming the Energy Vision (REV) at www.ny.gov/REV4NY. For more about NYSEERDA's programs, visit nyserda.ny.gov.

One Less Bill.



Here's what you can be doing while your solar system is paying your electric bill:
Play with your kids • Ride your bike • Hike • Fish • Hunt
Go out on the lake with a friend • Kayak • Nap

Call us today to plan for your installation this summer • Purchase your system with no upfront costs!

REVOLUTIONSOLAR.COM • 607-441-0367

FEDERAL

FEDERAL INVESTMENT TAX CREDIT

The federal investment tax credit (ITC) for most technologies, including solar, wind, heat pumps, and fuel cells, is 30% of expenditures. For commercial geothermal generating systems, microturbines, and combined heat and power the ITC is 10% of expenditures.

USDA RURAL DEVELOPMENT PROGRAM

USDA Rural Development Program - Rural Energy for America (REAP)

Finance the purchase of renewable energy systems, and make energy improvements; energy audits. Funding is awarded on a competitive basis; grant funding cannot exceed 25% of eligible project costs and combined loan guarantees and grants cannot exceed 75% of eligible project costs.

Applicants include Feasibility studies/regular REAPs: agricultural producers and rural small businesses. Energy audits and renewable energy development assistance: local governments, tribes, land grant colleges, rural electric coops, public power entities. Grant must be used for Construction or improvements, purchase and installation of equipment, energy audits, permit fees, professional service fees, business plans, and/or feasibility studies. Find more at www.rurdev.usda.gov/NH-VTHome.html or call 802-828-6080 in VT or 603-223-6035 in NH

BIOREFINERY ASSISTANCE PROGRAM

USDA Rural Development offers opportunities to producers to develop biofuels through the Biorefinery Assistance Program. The program provides loan guarantees for the development, construction, and retrofitting of commercial-scale biorefineries.

The Biorefinery Assistance Program was established to assist in the development of new and emerging technologies for the development of advanced biofuels and aims to accomplish the following:

- Increase the energy independence of the United States
- Promote resource conservation, public health, and the environment
- Diversify markets for agricultural and forestry products and agricultural waste materials
- Create jobs and enhance economic development in rural America

For more information go to www.rurdev.usda.gov/BCP_Biorefinery

REGIONAL

NEW ENGLAND GRASSROOTS ENVIRONMENTAL FUND

MODEST GRANTS ARE AVAILABLE FOR COMMUNITY-BASED ENVIRONMENTAL WORK IN CT,MA,RI,NH,VT,ME

- Must be volunteer driven or have up to 2 full time paid staff or equiv.
- have an annual budget up to \$100,000
- "Seed" grants of \$250-\$1,000 and "Grow" grants of \$1,000-\$3,500
- Go to www.grassrootsfund.org/grants/ or call 802-223-4622 for more info.

VERMONT

CLEAN ENERGY DEVELOPMENT FUND

The Small Scale RE Incentive Program, administered by Renewable Energy Resource Center (RERC), provides funds to help defray the costs of new solar thermal and advanced wood pellet heating systems. For more information: www.RERC-vt.org or call (877)888-7372

SOLAR THERMAL INCENTIVES – PER RATED CAPACITY OF SYSTEM

- \$0.40 per kWh/year for residential and commercial customers
- \$0.80 per kWh/year for Special Category customers

***special customer category limited to municipalities, non-profit housing authorities, public schools, and non-profit hospitals and health care centers. All incentives are subject to availability and may change.*

Pellet Heating

- Advanced wood pellet heating systems -- \$2500 3000 per boiler (+\$500 if an audit is completed and +\$500 if the system includes at least 20 days' worth of pellet storage).

- Custom Rebate \$1.25/ft2 of heated space, \$60,000 max or \$80,000 max for public/non-profit sector

- **Details at www.RERC-vt.org or call (877)888-7372**

VT TAX CREDITS

- Vermont offers an investment tax credit for installations of renewable energy equipment on business properties. The credit is equal to 24% of the "Vermont property portion" of the federal business energy tax credit from 2011 to 2016. For solar, small wind, and fuel cells this constitutes a 7.2% state-level credit for systems and for geothermal electric, microturbines, and combined heat and power systems, this constitutes a 2.4% state-level tax credit.

Tier III programs

- Additional incentive offers may be available through your local utility provider, contact your utility for more information.

EFFICIENCY VERMONT Lighting (must be ENERGY STAR®)

- ENERGY STAR LEDs supported by Efficiency Vermont incentives available at Vermont retailers for as low as \$.95.

Home Efficiency Improvements

- improvements: air sealing, insulation and heating system upgrades - up to \$2,500 in incentives - using participating* contractors

Appliances (must be ENERGY STAR)

- Dehumidifiers - mail-in rebate
- Clothes Washers - \$40 rebate for CEE Tier 1 qualifying models, \$75 rebate for CEE Tier 2, 3 or ENERGY STAR Most Efficient
- Refrigerators - \$40 rebate for CEE Tier 1, \$75 for CEE Tier 2, 3 & ENERGY STAR Most Efficient
- Clothes Dryers - \$50 to \$400 rebate on select ENERGY STAR electric models

Heating/Cooling

- LP/Oil boilers & furnaces - \$500 rebate*
- Smart Thermostats - \$150 mail-in rebate
- solar hot water - \$950 rebate post installation
- heat pump water heater - \$600-\$800 point of purchase discount

- central wood pellet boilers (excluding outside wood systems) - \$2,000
- circulator pumps - \$50-\$600 point of purchase discount
- cold climate heat pump point of purchase discount

Residential New Construction

- enroll in Residential New Construction Service – up to \$2,000 in incentives and free home energy rating and expert technical assistance throughout construction and eligible for ENERGY STAR label
- Washington Electric Coop and Vermont Gas Systems customers may also receive additional incentives (contact EV*)

Other Opportunities To Save

- Advanced Power Strips – coupons at register at participating retailers*
- Pool Pump – up to \$600 rebate on qualifying ENERGY STAR models
- Meter Loan – borrow "Watts Up" meter to measure the electric consumption of your appliances
- Commercial Refrigeration Evaporator Fan Motors - \$60-\$100 each w/ point of purchase discount

1. **all rebates/incentives subject to availability, limits and may change – for complete incentives and requirements, and for participating retailers/contractors, visit efficiencyvermont.com or call 888-921-5990*

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Public Utilities Commission

Commercial Solar Rebate Program

Category 1:

≤100 kW AC incentive levels for PV systems:

- \$0.70/watt (lower of AC and DC) for new solar electric facilities (Step 1 application received prior to September 1, 2016);
- 0.65/watt (lower of AC and DC) for new solar electric facilities (Step 1 application received on or after September 1, 2016);
- Expansions to existing solar systems are not eligible.

≤100 kW AC equivalent incentive levels for solar thermal systems:

- \$0.12/rated or modeled kBtu/year for new solar thermal facilities fifteen collectors in size or fewer;
- \$0.07/rated or modeled kBtu/year for new solar thermal facilities greater than fifteen collectors in size; and
- Expansions to existing solar systems are not eligible.

Category 2:

> 100 kW AC and ≤500 kW AC incentive level for PV systems

- \$0.55/Watt AC for new electric facilities.
- Expansions to existing solar systems are not eligible.

Contact CISolarRebate@puc.nh.gov or at (603) 271-2431.

Note: The C&I Category 2 solar rebate program currently has a waitlist.

For C&I solar program details, go to: <http://www.puc.nh.gov/Sustainable%20Energy/RenewableEnergyRebates-CI.html>

PACE

The state also has passed PACE (property-assessed clean energy) enabling legislation which will allow towns to use the PACE mechanism to finance clean energy projects through property taxes.

Visit <http://cpace-nh.com/index.html> for more information.

Residential Solar PV Rebate Program

- Rebates for solar electric/thermal projects 10kW (or thermal equivalent) or less
- New Solar PV = \$0.50/Watt DC or 30% of total project cost, whichever is less. Max \$2500.
- Expanded Solar PV = \$0.50/Watt DC or 30% of total project cost, whichever is less. Max \$2500.

Contact jon.osgood@puc.nh.gov

Residential Solar Water Heating Rebate Program

- \$1500 - \$1900 per system based on annual system output

Commercial Bulk Fuel-Fed Wood C&I Pellet Central Heating Systems

- 40% of the heating appliance(s) and installation cost, up to a maximum of \$65,000. An additional 30% up to a maximum \$5,000 is available for thermal storage. Systems must be 2.5 million BTU or less

Residential Wood Pellet Boiler/Furnace

- 40% of installed system up to \$10k
- Must meet thermal efficiency and particulate emissions standards

Contact barbara.bernstein@puc.nh.gov

www.puc.nh.gov – Sustainable Energy or tel. 603-271-2431 for more information and current program status

LOCAL INCENTIVES

Some towns provide property tax exemptions for renewables – visit www.bit.ly/NHtownRenewablesTaxBreaks

- These are offered on a town-by-town basis.
- The state also has passed PACE (property-assessed clean energy) enabling legislation which will allow towns to use the PACE mechanism to finance clean energy projects through property taxes.

Visit <http://www.nh.gov/oep/programs/energy/pace/index.htm> for more information.

Renewable Energy Incentives Offered Through the NH Electric Co-Op

PLEASE Check for UPDATES with NHEC.

Incentive programs discontinued for 2017:

- Commercial Solar Thermal (Hot Water)
- Residential Solar Thermal (Hot Water)
- Commercial Solar PV
- Residential Solar PV.

Residential and Commercial Heat Pump Water Heaters

- \$500 for 50 gallon units and \$600 for 80 gallon units
- up to \$500 per ton on Energy Star® certified units

Planned for the 2017 Program Year: EV Incentives for Electric Vehicles

PAREI

To explore the possibility of a solar installation. Plymouth Area Renewable Energy Initiative. www.plymouthenergy.org

While we at Green Energy Times try to keep things up to date, incentives are always changing. Be sure to check with the appropriate sources for the latest information.

- WWW.NHSAVES.COM
- WWW.NHEC.COM

NH HOME PERFORMANCE WITH ENERGY STAR

Sponsored by all NH electric and natural gas utilities in partnership by the U.S. Dept. of Energy. Fuel-blind eligibility using the Home Heating Index (BTUs of heating fuel / conditioned square feet / heating degree days). Must provide at least 12 months of heating fuel history. Once qualified, eligible homes get a \$450 value comprehensive energy audit for \$100 (rebated if improvements installed), and 50% instant rebate for eligible weatherization improvements up to a \$4,000.

Visit www.nhsaves.com/residential/ret-rofit.html for more information and an online Home Heating Index calculator

NH ENERGY STAR HOMES

Incentives for builders of new homes who meet ENERGY STAR guidelines. Incentives include HERS rating fee paid by the utility, rebates for ENERGY STAR lighting, appliances and heating systems, and \$800 - \$4,000 additional incentive depending on the HERS score.

Visit www.nhsaves.com/residential/homes.html for more details.

NH ENERGY STAR APPLIANCES & LIGHTING

Mail-in rebates for ENERGY STAR-rated clothes washers (\$30), room air conditioners (\$20), room air purifiers (\$15) and refrigerators (\$20).

Visit www.nhsaves.com/ for more information and rebate forms.

Instant rebate coupons ranging from \$1 to \$7 for ENERGY STAR-rated CFL and LED light bulbs purchased through qualifying NH retailers.

Visit www.nhsaves.com/residential/es_lighting.html for more information.

NHSAVES Lighting and Efficiency Catalog

Extensive catalog of efficient lighting products, from stylish lamps to hard to find specialty bulbs. Catalog includes other efficiency items such as smart strips, power monitors, and water-conserving devices

Offered at discounted pricing for NH electric utility customers, and fulfilled by EFI.

Visit catalog.nhsaves.com/ for an online version of the catalog.

2014 ENERGY STAR® Residential Heating, Cooling, & Water Heating Equipment Rebate

Rebates of up to \$1,500 on high efficiency Furnaces and Boilers, \$200-\$500 rebates on Mini Split Heat Pumps, up to \$800 rebates on water heaters, rebates on programmable and Wi-Fi thermostats

Program details and application at www.NHSaves.com/heatingcooling

Other NH Electric Utility Programs

See also individual utilities for additional programs and variations. NH electric utilities may offer low or no interest on-bill financing for energy efficiency projects.

Visit www.nhsaves.com/resource/ for individual utility contact information.

Business Programs

Includes programs for: small and large business, new equipment and construction, seminars, lighting incentives and catalog, and low and no interest financing programs.

Visit www.nhsaves.com/ for information about NH business incentives for electricity efficiency.

NH Weatherization Assistance Income-Eligible Programs

Home Energy Assistance and NH community action Weatherization Assistance Program. Financial assistance paying fuel bills, and free weatherization improvements for qualified applicants. Funding from U.S. Dept. of Energy, NH utilities.

Visit www.nh.gov/oep/programs/weatherization/index.htm for application criteria, FAQs and local program contacts

MASSACHUSETTS

Commonwealth Solar Hot Water (SHW) Programs

- Applicants must be served by National Grid, Unitil (Fitchburg Gas and Electric), Eversource or a participating Municipal Light Plant community

- Homeowners are eligible for a base rebate amount of the lesser of \$4,500 or 40% of the installed cost. The system may also be eligible to receive additional funding ("adders") which increase the amount of the rebate. Adders are detailed in the program manual at http://files.masscec.com/get-clean-energy/residential/commonwealth-solar-hot-water/SHW_Program_Manual_Small_Scale.pdf

- Visit <http://www.masscec.com/programs/commonwealth-solar-hot-water>

MASSSAVE HEAT LOAN SHW

Through this loan program, customers may borrow at 0% interest the costs of a Solar Domestic Hot Water and/or Thermal Heating system. Apply through receiving the MassSave Energy Audit. You can borrow up to \$25,000 at 0% interest for a 7 year term.

Energy Efficiency

After conducting a free residential Energy Audit, residential customers are eligible for up to \$25,000, commercial loan up to \$100k at 0% interest heat loan with terms up to 7 years to cover the following energy efficiency improvements: attic wall-basement insulation, high efficiency heating systems, high efficiency domestic hot water systems, solar hot water systems, 7-day digital programmable thermostats, Energy Star replacement windows Available only to utility customers of W. Mass Electric, National Grid, Berkshire Gas, Nstar, Unitil and Cape Light Compact

www.masssave.com/residential/heating-and-cooling/offers/heat-loan-program Please call 866-527-7283 to schedule a free home energy assessment.

ENERGY EFFICIENCY

After conducting a free residential Energy Audit, residential customers are eligible for up to \$25,000, commercial loan up to \$100k at 0% interest heat loan with terms up to 7 years to cover the following energy efficiency improvements: atticwall-basement insulation, high efficiency heating systems, high efficiency domestic hot water systems, solar hot water systems, 7-day digital programmable thermostats, Energy Star replacement windows

Available only to utility customers of W. Mass Electric, National Grid, Berkshire Gas, Nstar, Unitil and Cape Light Compact

Visit www.masssave.com/residential/heating-and-cooling/offers/heat-loan-program Please call 866-527-7283 to schedule a free home energy assessment.

MASSACHUSETTS SOLAR LOAN PROGRAM

Mass Solar Loan focuses on connecting homeowners who install solar PV systems with low-interest loans to help finance the projects. The \$30 million program, a partnership between the Massachusetts Department of Energy Resources (DOER) and MassCEC, will work with local banks and credit unions to provide financing to homeowners interested in solar electricity. DOER's program works with banks and credit unions to expand borrowing options through lower interest rate loans and encourage loans for homeowners with lower income or lower credit scores. Since 2008, the solar electric industry in Massachusetts has grown into a robust economic sector with over 1,400 businesses and 12,000 workers, with enough solar electricity installed in the Commonwealth to power more than 100,000 homes.

Mass Solar Loan will continue to grow this sector, while allowing more homeowners the ability to achieve the cost savings and environmental benefits of this clean, renewable energy source. www.masssolarloan.com. The most updated loan principal buy down rate based on household income can be found at www.masssolarloan.com/loan-support-incentives.

DEPT OF ENERGY RESOURCES

Solar renewable-energy credits (SRECs) associated with system generation belong to the system owner and may be sold via the Department of Energy Resources (DOER) SREC 2 program. Systems sized under 10kW single phase or 25kW three phase have an extension until the new incentive program starts in 2017. Note: appropriate, approved Data Acquisition System monitoring must be utilized for PV systems >10kW in order to qualify to sell SRECs.

Next solar incentive information can be found at <http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/rps-aps/development-of-the-next-solar-incentive.html>

MA State Income tax credit for residential solar hot water or PV systems are eligible for a one-time 15% off system cost, capped at \$1000 max tax credit.

No sales tax on residential solar hot water or PV system.

There is no increase in property tax assessment for residential solar hot water or PV systems for 20 yrs.

MA SREC II POLICY

Massachusetts' Solar Renewable Energy Credits Program, SREC II prioritizes sites, by using an SREC factor based on the type of installation. The credits provided for energy produced by a system are calculated by multiplying the factor times a full credit value. Full credit is given for residential, parking canopy, emergency power, or community-based systems, or any other system of less than 25 kW. Larger systems get a factor of 0.9, if they are building-mounted or at least 67% of the power produced is used at the site. If a larger system meets neither of these criteria, but is built on a landfill or brown-field site, or if it is less than 650 kW, then it gets a factor of 0.8. Systems that qualify for none of the foregoing get a factor of 0.7. On Jan 8, 2017, these factors will be reduced by 20% until the new incentive program starts. Expect a new incentive program in late 2017.

http://bit.ly/Mass_SREC_II.

MA State Incentives can be found at: www.masscec.com/get-clean-energy

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH

Welcome to the 2016 New York solar incentive and rebate information: 121 programs and incentives at:

<http://programs.dsireusa.org/system/program?state=NY>

Programs and Services from NYSEDA:

<https://www.nyserda.ny.gov/All-Programs>

New York State Energy Research and Development Authority.

- Business & Industry
- Communities & Governments
- Partners & Investors
- Cleantech & Innovation
- Residents & Homeowners

DISCOVER YOUR HOME'S ENERGY WASTE

Getting a home energy assessment can help you take control of your energy costs. It can identify where your house is using the most energy and which improvements would have the biggest impact on your bottom line. Heating and cooling costs frequently account for 50% of residential energy bills. Identifying your energy waste can lead to big savings.

Visit: <https://nyserda.energysavvy.com/> to get an energy assessment.

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NY-SUN

<http://ny-sun.ny.gov/>

NY-Sun is structured around customized Megawatt (MW) Blocks targeted to specific regions of the state. To learn more, see the Megawatt Block Incentive Structure.

Residential and Small Business

<http://ny-sun.ny.gov/Get-Solar/Residents-And-Small-Business>

Commercial and Industrial

• <http://ny-sun.ny.gov/Get-Solar/Commercial-and-Industrial>

Community Solar

• <http://ny-sun.ny.gov/Get-Solar/Community-Solar>

Find a Commercial/Industrial Solar Installer

• <http://ny-sun.ny.gov/For-Local-Government/Local-Government>

Find a Residential/Small Commercial Solar Installer

• <http://ny-sun.ny.gov/Get-Solar/Find-A-Solar-Electric-Installer>

Financing Options

• <http://ny-sun.ny.gov/Get-Solar/NY-Sun-Financing>

Clean Power Estimator

• <http://ny-sun.ny.gov/Get-Solar/Clean-Power-Estimator>

NY-Sun is structured around customized Megawatt (MW) Blocks targeted to specific regions of the state. To learn more, see the Megawatt Block Incentive Structure.

The Megawatt (MW) Block Dashboard provides real time information on the status of block and current incentive levels by sector and region. Block status is updated as applications are submitted, so click the refresh button to see the current status.

<https://www.powerclerk.com/nysuninitiative/dashboard.aspx>

Financing Clean Energy in Vermont

By George Harvey

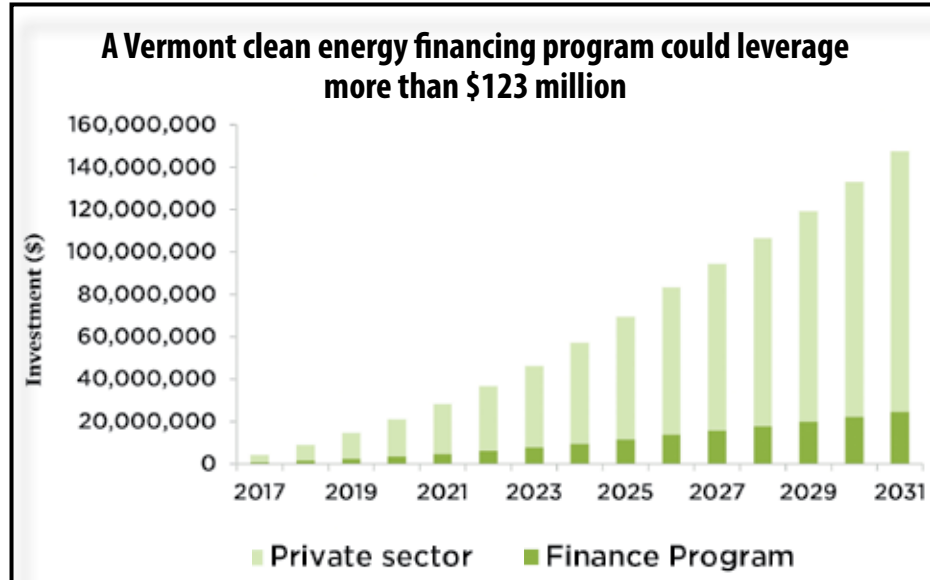
Small steps can lead to important results.

In December, The Union of Concerned Scientists (UCS) published a study, "Financing Clean Energy: A Powerful Tool for Driving Investment in Vermont's Economy." (<http://bit.ly/ucs-financing-clean-vermont>) It made a suggestion about how to provide for clean energy investment, on the local level, by a single investment of \$7 million by the state. The initial investment is leveraged through creation of a revolving fund, with the public funding leveraging private funding.

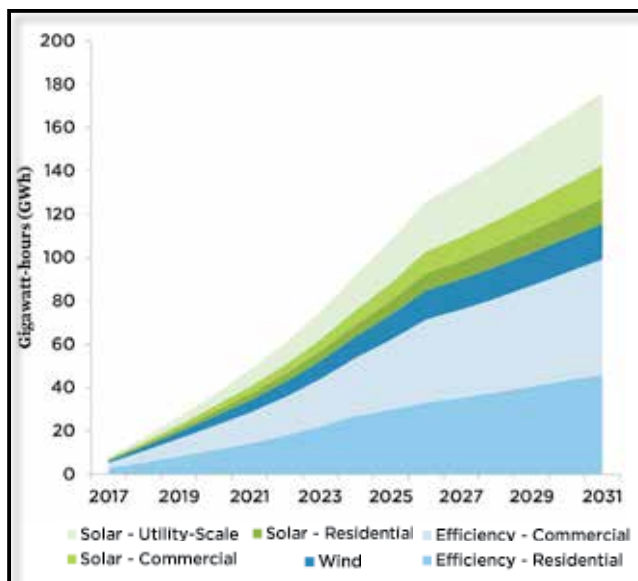
The revolving fund would make loans to provide incentives for renewably sourced energy and efficiency. The loans are repaid to the fund, with interest, over a period of a few years.

As the fund gets repaid, its value grows, and it is able to provide incentives for more projects. The revolving fund could provide a total of \$23.5 million as incentives over a fifteen year period, value arrived at both by calculation and through experiences of programs in other states, notably New York and Connecticut.

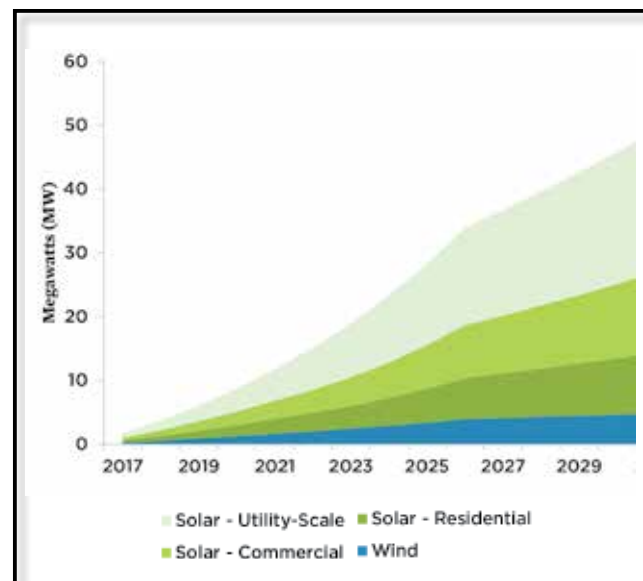
The incentives draw private funding at a rate of about five to one. This means that the \$23.5 million of loans would produce private investments of about \$122.5 million during fifteen years. The sum of these two, \$146 million, represents the total impact of the program, in terms of funding for renewable energy and efficiency. Not included in this amount of money is the reduction of costs to the ratepayers of the state, because solar power produces lower electric



Graphs from the Union of Concerned Scientists.



After 15 years, investments from a clean energy financing program would generate or save 176 GWh of electricity per year.



A Vermont clean energy finance program could support nearly 50 MW of solar and wind power by 2031.

costs, or savings in lower fuel bills.

One effect of the program would include elimination of 115,000 tons of carbon dioxide emissions, over fifteen years, the equivalent of taking 21,300 cars

off the road. Another would be installation of approximately 50 megawatts (MW) of renewable generating capacity, which could include solar, wind, and small hydro power.

We might point out that this study is not suggesting that we give up other efforts, some of which would almost certainly have much greater effects. For example, the Vermont Standard Offer Program, which was started in 2005, has already put 126,000 MW of renewable capacity online. In fact, a single new project just announced for Hinsdale, New Hampshire, is considerably larger than the entire program the UCS is recommending. That, however, misses the point.

The investment for the UCS program would be very modest but could produce meaningful results. The electricity from 50 MW of solar power would depend on setting up a revolving fund of \$7 million, using public money, but it would suffice for the annual needs of about 8,200 households. So \$850 provides enough electricity to supply one household for as long as the sun shines on the panels.

At the same time, the energy saved through efficiency and produced by the renewable power would equal 176 gigawatt hours per year, or about 3.2% of the state's needs. The amount of money this would save for residents of the state would come to \$14.6 million per year, on an ongoing basis, roughly twice the single initial public investment.

There are certainly more impressive programs in terms of the amount of power produced, the number of people served, or the carbon dioxide emissions avoided. The program recommended by the UCS would produce an amount of renewable energy significantly smaller than a single solar installation recently announced for Hinsdale. Dwelling on these facts, however, detracts from the major point here. A very small initial public investment can produce meaningfully large, long-term results.

TESLA AND PANASONIC MAKING SOLAR CELLS IN BUFFALO, NEW YORK

By Green Energy Times Staff

With its acquisition of SolarCity, Tesla now makes solar cells and modules in addition to electric cars and batteries. It has entered into a partnership with Panasonic to begin manufacturing photovoltaic products in a facility in Buffalo, New York. A new product expected from the Buffalo plant, not offered by others as yet, is the solar roof shingles Elon Musk announced last year.

The original plan to set up manufacturing in Buffalo had been put forth by SolarCity. The new plan commits Tesla to the same goals SolarCity had. The company intends to employ 1,400 people in the Buffalo area, including 500 in manufacturing jobs.

Panasonic is putting up the capital for the Buffalo operations and will provide technological and manufacturing expertise. For its part, Tesla is committing to long-term purchases of solar products from the plant, which it will



Rendering of the Tesla-Panasonic solar factory in Buffalo. Image by SolarCity.

undertake to sell. Tesla and Panasonic have been developing a close working relationship, including building the Gigafactory in Nevada, which has just started mass production of lithium-ion batteries.

The partnership of Tesla and Panasonic also develops new photovoltaic technology in a plant in Fremont, California. Products from the Buffalo plant are designed to work seamlessly with other products of Tesla and Panasonic, including with the Powerwall and Powerpack battery systems.

Production of finished photovoltaic products in Buffalo will begin in the summer of 2017. The plan is to expand production until it reaches one gigawatt of solar capacity per year in 2019. The initial products will be high-efficiency solar cells and modules. Once these are being produced, solar shingles will be produced, as well.

Corporate Sustainability

Look Who Is Leading the Way

By Hope O'Shaughnessey

As global sentiment continues to build for a more sustainable planet, corporations are increasingly adopting more sustainable business practices. The Paris Climate Agreement provided a renewed spark and metric for the transition. As global businesses continue to improve their bottom lines, tying sustainability goals to that movement has helped the momentum.

Two significant leaders in this transition include Apple and Google. At the start of 2017, Greenpeace heralded Apple as the top company committed to 100% renewable energy with Google and Facebook following closely behind. Apple has held this green leadership spot for three years in a row.

It makes sense that Apple tops off Greenpeace's list of top renewable leaders. A December 2016 article in The Guardian indicated that Apple achieved 93% renewable energy in 2015. Apple did not slow down, however, and continued to grow its green energy goals beyond that. Apple has also begun insisting that its suppliers use green technology and move toward zero waste, as well. It would appear that their goals go way beyond 100% renewable. Apple

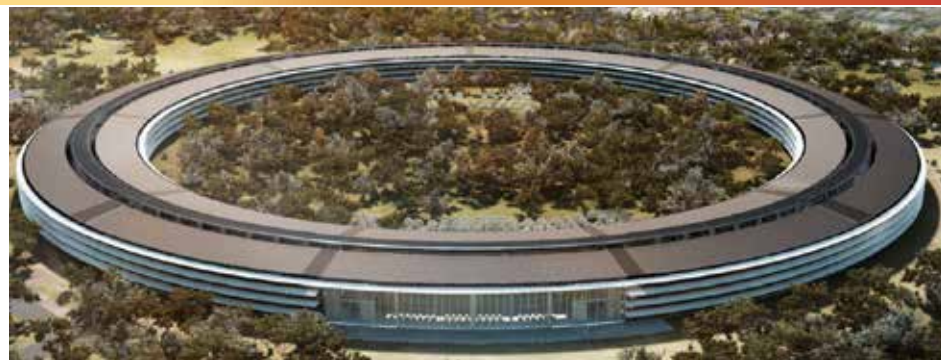
is the true leader for corporate sustainability. (<http://bit.ly/apple-leads>)

Google will be a strong rival to Apple with its goal to use 100% renewable energy by 2017, according to a December 2016 New York Times article. The same article quoted Google's Joe Kava, senior vice president of technical infrastructure, as saying, "We are the largest corporate purchaser of renewable energy in the world," and "It's good for the economy, good for business and good for our shareholders." (<http://bit.ly/renewable-google>)

The Christian Science Monitor reported that many major retailers are also developing solar capacity in order to stay profitable and improve the health of the planet. A recent article said, "42 companies have installed upwards of 320 megawatts (MW) of photovoltaic (PV) capacity at more than 750 locations across the U.S., according to the Solar Energy Industries Association and OilPrice.com. Walmart, Costco and Ikea are among the companies who support renewable energy and depend on solar the most." The top ten retail giants in terms of installed solar capacity are



Google's logo is spelled out in the heliostats (mirrors that reflect sunlight) at the Ivanpah solar electric generating system in the Mojave Desert near the California-Nevada border. Photo source: gadgetsnow.com.



At around 5MW, Apple's new solar roof could make it among the biggest in the US. Photo: 9to5Mac.com.

Walmart, Costco, Kohl's, IKEA, Macy's, McGraw Hill, Johnson & Johnson, Staples, Inc., Campbell's Soup, and Walgreens. (<http://bit.ly/biz-leaders>)

Large scale retailer Walmart is also joining the race to meet carbon goals. The Solar Energy Industries Association's (SEIA) fifth annual Solar Means Business report indicates that Target and Walmart and Costco are among top retailers installing solar. The report says Target installed 147.5 MW and Walmart installed 145 MW. (<http://bit.ly/solar-2016>)

IKEA, a socially aware company for awhile, is now furthering its role as a green leader with new wind farms installations. IKEA Canada, according to Wind Power Engineering and Development (WPED), announced in February a multi-year contract with Apex Clean Energy to manage the 88 MW Wintaring Hills wind farm in Alberta, Canada. This will add to IKEA's wind resources since, according to WPED, IKEA U.S. also bought two wind farms from Apex in 2014 (the 165 MW Cameron Wind facility located in Cameron County, Texas and the 98 MW Hoopeston Wind facility located in Hoopeston, Illinois).

(<http://bit.ly/ikea-apex>)

Finally, a January Forbes article pointed out that renewable energy will continue to draw businesses and their interests. In the Forbes piece, guest editor Micah Remley, Senior Vice President and General Manager of Software, EnerNOC, pointed out that, "... investors are continuing to push for more sustainability data from businesses, and this is for one simple reason – research continues to create a strong link between energy and sustainability performance and overall financial value." (<http://bit.ly/remley-ren>)



Many major retailers are making renewable energy efforts, not only for the good for the environment, but because they make good business sense. Photo courtesy of WalmartStores.com.

OFF-GRID WITH INTEGRITY ENERGY

Cont'd from p.11

Integrity Energy generally uses Rolls batteries for backup storage. The battery systems they have installed were mostly in a range from twenty to thirty kilowatt hours, though they have installed much larger ones.

When we asked Post specifically how he felt about using fossil fuel sources for backup, for instance a propane generator, he said, "The preference would be to harvest energy from renewable sources first and then use fossil fuels as a backup. With the evolution of PVs, battery technology, building efficiency measures and smart consumers, I'm hopeful that we will be able to drastically reduce the amount of outside sources of fuel that we need to use in the future."



An off-grid solar system at Lake Champlain includes an Outback VFX3524 inverter, Outback FM80 charge controller, DPW top of pole rack and eight Rolls S460AGM batteries. The installer was Integrity Energy of East Bethel, VT.

One of the more noteworthy of Integrity Energy's installations was actually rather far out of our area, in Savannah, Georgia. It was an 87.5 kilowatt system with 307 SolarWorld 285-watt modules, Solaredge P300 Optimizers, and eight Solaredge nine-kilowatt inverters. In this case, the building, a multi-unit housing facility, was converting to LED lighting and air-sourced heat pumps.

Post takes pride in the ability to perform solar installations of high quality at reasonable prices and in his company's polite and efficient ways of working.

Their website is www.ienergyvt.com.

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FACED WITH FEDERAL CLIMATE-CHANGE DENIAL, 2,500 Industry Leaders Commit to Green Building

As the federal government slips into climate change denial, sustainable energy practitioners in the northeast are increasingly committed to building more healthful, more durable, and more energy efficient buildings and communities. Organizers of the BuildingEnergy Boston Conference + Trade Show expect 2,500 professionals from every field in the building trades to attend, sharing best practices for building and for climate change mitigation. The conference will be held on March 7-9 at the Seaport World Trade Center in Boston, Massachusetts.

"NESEA has been holding conferences for architects, engineers, and builders for more than 30 years," said conference co-chair Heather Nolen, of Steven Winter Associates. "We've built a reputation as a one-stop venue for all things related to sustainable energy in our buildings. Conference topics provide attendees with techniques ready for immediate use on current projects and provide inspiration for future endeavors."

Jennifer Marrapese, Executive Director of the Northeast Sustainable Energy Association (NESEA), which hosts the conference, remarked, "What separates this year's conference from those in the past is that we've reached far beyond our single-family, residential roots to address much larger buildings and communities. As the urgency of mitigating climate change increases, we'll be there to answer the call."

This year's program has unprecedented diversity. It features over 60 sessions and workshops and presents 100 exhibitors. Sessions focus on buildings of all types and sizes. There are several case studies of high performance building projects on college campuses, including techniques used to engage occupants in their operation.

Conference Co-Chair Stephan Wollenburg, an independent energy consultant in Worcester, MA, explained, "The most effective way that we, as professionals, can mitigate climate change is to ensure that our largest buildings are as efficient as possible. But it's not just about the buildings anymore. Our sessions go beyond energy. They address the whole system – from how much energy it takes to produce and transport our building materials, to how our buildings are designed to operate in the context of a smarter and cleaner grid, to whether



The opening plenary session, examining whole-systems focus, will be given by Dr. Craig Jones, of Circular Ecology. Courtesy photo.

building occupants know how to operate their buildings to minimize their environmental footprint."

The opening plenary session, examining whole-systems focus, will be given by Dr. Craig Jones, of Circular Ecology. Dr. Jones is an embodied energy, carbon footprint, and Life Cycle Assessment (LCA) expert. He was listed as number 14 on Building Design's list of the most influential people in UK sustainability in 2012. He provided data to carbon footprint the construction of the London 2012 Olympics. He tailored an embodied energy and carbon database for the \$22 billion Masdar City in Abu Dhabi, which aspires to be the first zero-carbon, zero-waste, and car-free city. Dr. Jones' session will provide a visual overview of how our own local consumption can have unexpected impacts – even on the other side of the world.

Other conference themes include the following:

- Water, water everywhere: How to heat water efficiently, how to conserve it, how to build for resilience where flooding is a growing threat. In one session, world-class expert Gary Klein will offer a hands-on opportunity to learn how best to configure a DHW system for energy efficiency.
- Occupant behavior: A building is only as efficient as its occupants. The conference

features several sessions to ensure that energy efficient projects perform as intended, and that the occupants know how to optimize the building for efficiency and comfort.

- Community-scale solutions: Several sessions focus on scaling energy efficiency and resiliency for communities and neighborhoods. In one session, "Boston Women Leading Change" will dive deep into ideas and solutions they generated from a trip to Copenhagen. These include storm water management, wind energy, transportation planning, district heating, and social resiliency.
- New technologies: The trade show floor will feature the latest in sustainable energy technologies. These include energy storage solutions, charging technologies for electric vehicles, and more. Two "lightning round" conference sessions will feature practical information on products and services.

Additional sessions will be given by Patrick Deegan of DAC Technologies, Thomas RC Hartman of C&H Architects,

Stephanie Horowitz of Zero Energy Design, Declan Keefe of Placetaylor, Katrin Klingenberg of PHIUS, Andrea Love of Payette, Bill Maclay of Maclay Architects, Ty Newell of University of Illinois, Christopher Nielson of Bruner/Cott, Karl Rabago of Pace Law Center, Marc Rosenbaum of South Mountain Co., Cooper Schilling of Kieran Timberlake, John Straube of RDH Building Science Laboratories, Paul Torcellini of NREL, Kohta Ueno of Building Science Corp., solar pioneer Steven Strong of Solar Design Associates, who installed photovoltaics on the White House in the 1970s and again in 2014, and many more.

The BuildingEnergy Boston Conference + Trade Show is the region's leading event for professionals and practitioners working to build a more sustainable world. It is hosted by the Northeast Sustainable Energy Association (NESEA). NESEA was formed in 1974 with a mission to advance the adoption of sustainable energy practices in the built environment by connecting professionals to each other and to information. NESEA serves 10 northeastern states. (www.NESEA.org)

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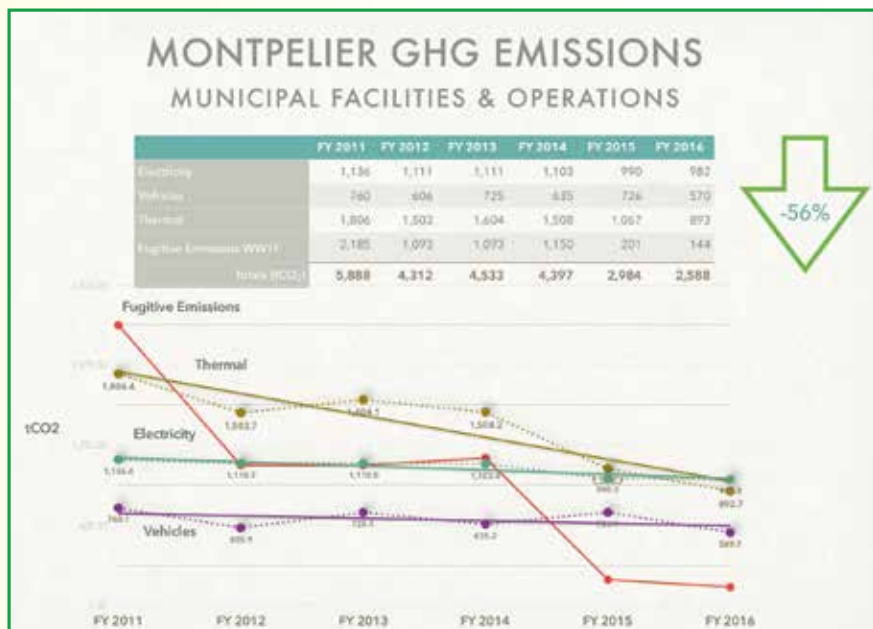
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Montpelier Makes Progress Towards Net-Zero 2030 Goal

By Kate Stephenson, Montpelier Energy Advisory Committee Chair



City of Montpelier greenhouse gas emissions from municipal facilities and operations 2011-2016

In 2014, Montpelier's City Council adopted a bold and audacious goal—that the city would be completely “net-zero” by the year 2030—and be the first state capital to produce or offset 100% of its energy use with renewables. In the three years since establishing this goal, Montpelier has made good progress, but there is still much to do. Led by the Montpelier Energy Advisory Committee (MEAC), an all-volunteer group of local residents, the city has been working to both reduce overall energy use through energy efficiency measures as well as increase renewable energy generation.

Cutting municipal energy use

Montpelier has made remarkable gains in energy efficiency while maintaining excellent services and saving money. Municipal operations and facilities consumed just over 46 billion BTUs in FY2011. By FY2016, this had been reduced to 39.7 billion BTUs; a 14% reduction. There have been important efficiency gains across all three sectors of electricity, thermal and vehicles. In particular, Montpelier schools and the wastewater treatment facility are achieving phenomenal gains in energy efficiency. In addition, the extraordinary increase in efficiency at the wastewater facility has been achieved over the same period in which the volume of wastewater processed has more than tripled. Even the city's consumption of diesel and gasoline has been reduced in the past five years by 16% and 31% respectively.

1MW of municipal solar installed

The City of Montpelier is now getting the majority of its electricity from renewable energy sources with the completion of a 500 kW solar photovoltaic array in Montpelier and a second 500 kW array in Sharon, VT. This innovative Power Purchase Agreement through local solar developer Novus allows the City to invest in renewable energy with no upfront cost and savings on its electric bill from Day 1. The city and school district expect to save \$40,000 to \$50,000 a year for the first ten years of the contract.

56% reduction in municipal greenhouse gas emissions

One exciting achievement is that Montpelier has achieved a 56% reduction in annual GHG emissions from municipal facilities and operations. There are two sectors that helped the city achieve this important decrease in GHG, while concurrently delivering significant financial savings. The first was switching from dispersed old boilers burning heating oil, to a wood chip-fueled district heat system (a district heat system heats more than one facility). The district heat plant burns wood chips that are both a renewable fuel and are net-zero carbon under both international and national scientific standards. The second was harvesting and flaring fugitive methane at the wastewater facility. In the past, the methane at the Montpelier Water Resource Recovery Facility was left to escape into the atmosphere. But starting in 2012, the WRRF started harvesting the methane in the spring, winter and fall, and combusting it to heat the primary digesters and the filter press building, thereby replacing fossil fuels. In 2015, they began flaring the surplus methane in the summertime, rendering the powerful GHG into bio-generated carbon dioxide. Overall, the process has multiple benefits, scoring significant GHG reduction, energy efficiency, and economic returns for the city.

We recommend that you read more about the Net-Zero Montpelier Plans on p.31 in this edition of Green Energy Times.



500kW photovoltaic array in Sharon, VT. Courtesy photo.

Upper Valley Towns Moving... Toward 100% Renewable Energy



Over 125 people participated in this aerial art photo in Hanover, NH to show their support for 100% renewable energy. Photo: Rob Strong.

By the Sierra Club Upper Valley Group

A future powered by 100% clean, renewable energy is technologically and economically feasible. As the prices of installing solar and wind equipment continues to fall and the renewable energy job market continues to grow, people -- and cities, too -- are increasingly choosing to invest in renewable energy technologies.

In coordination with other groups, the Sierra Club, our nation's largest grassroots environmental organization, launched the “Ready for 100” campaign in January 2016 to influence cities, regions, and states to commit to having 100% of their electricity come from renewable sources by 2030, and for transportation and heat as well by 2050. Twenty cities in the United States have committed to becoming powered by 100% renewable energy, the most recent being St. Petersburg, Florida. Other cities include Park City, Utah; San Diego, California; and East Hampton, New York. No commitment looks the same. Some cities are committing only to renewable electricity, while others are committing to renewable transportation and heat as well. In some cases, a mayor or the city council has decided first to commission a study of how the city can reach an 100% goal. The Los Angeles City Council, for example, unanimously approved a measure instructing the Los Angeles Department of Water and Power to study an equitable transition from fossil fuels.

A major priority of the Ready for 100 campaign is that any transition to renewable energy be equitable and just. Both nationally and locally, the Sierra Club wants vulnerable communities and individuals to have equal access to clean-energy related economic opportunities, including employment, resources, and infrastructure.

When the Sierra Club Upper Valley Group learned about this campaign, they were immediately interested in bringing this effort to our region. The Upper Valley is now one of many regions across the country working with the national Sierra Club and each other to achieve this ambitious goal. The Sierra Club Upper Valley Group launched their campaign this past August with an aerial art photo on the Dartmouth College green. Over 125 people from 23 different towns demonstrated their support for 100% renewable energy by participating in this photo. Support continues to grow.

The Sierra Club Upper Valley Group has many community partners on this project, including other organizations, energy committees, and staff members from various towns. Last summer, two employees from the Town of Hanover and one of the Co-Chairs of Sustainable Hanover traveled to California to join the “North American Dialogue,” a unique opportunity for municipalities to share information about their budding transitions to 100% renewable energy. Twenty cities from the U.S. and Canada participated. After returning, the Hanover representatives not only continued their renewable energy work in town but also began sharing this information with community leaders across the Upper Valley. In January, they gave a presentation about their experience to leaders from Hanover, Lebanon, Plainfield and Grantham, all in New Hampshire.

On December 14, Hanover reached a major milestone -- the Sustainable Hanover Town Committee voted to endorse a goal of 100% renewable energy by 2050. (You can find the resolution on the Town of Hanover's webpage.) They then brought their resolution to the Hanover Select Board on January 23rd where members posed many thoughtful questions, expressed support, and recommended that the resolution be brought to a vote at the May town meeting.

Many towns throughout the Upper Valley have joined this effort. The Sierra Club Upper Valley Group has been coordinating with members of a few local energy committees to support their work. Members of both the Plainfield (NH) and Cornish Energy Committees are organizing a series of events to increase community awareness of climate change, the financial benefits of renewable energy, and the technological and economic feasibility of a 100% renewable energy system.

There are many ways to get involved with this campaign. There are several teams that meet regularly. The Sierra Club group also hosts a study group twice a month to learn more about how to make this transition to 100%. Everyone is welcome to attend team meetings and the study group.

If you'd like to learn more about the campaign in the Upper Valley, please email allyson.samuell@sierraclub.org.

All Progress is Local: CLIMATE ACTION IS UP TO CITIES AND STATES NOW

By Ben Jervey, Institute for Energy and the Environment, Vermont Law School

If President Donald Trump sticks to pledges he made on the campaign trail—and so far he is proving to do just that—the federal government won't be taking any action to reduce national greenhouse gas emissions. More likely, federal agencies and Congress will be implementing policies that strongly encourage the combustion of fossil fuels. With a federal government that will be playing defense against 'decarbonization' and clean energy development, a number of American cities and states are setting out to prove that local and regional government is where climate progress really happens. In fact, some influential leaders are certain that cities and states can lead the way to significant nationwide emissions reductions, even under a Trump administration.

Michael Bloomberg, former mayor of New York City and currently U.N. Secretary General Ban Ki-moon's special envoy for cities and climate change, told the China General Chamber of Commerce that even the U.S. pledges to the Paris Agreement are safe. "I am confident that no matter what happens in Washington, no matter what regulations the next administration adopts or rescinds, no matter what laws the next Congress may pass, we will meet the pledges that the U.S. made in Paris," Bloomberg said. "The reason is simple: Cities, businesses and citizens will continue

reducing emissions, because they have concluded — just as China has — that doing so is in their own self-interest."

Data gathered by ICLEI: Local Governments for Sustainability backs up Bloomberg's confidence. ICLEI examined the greenhouse gas emissions inventories for 116 local governments in the U.S. that collectively represent roughly 14% of the U.S. population, including seven of the ten largest American cities. Achieving the goals set by these cities would result in emissions reductions by mid-century equivalent to shutting down 86 coal-fired power plants. While these 116 pledges alone wouldn't get the U.S. to the national goals pledged to the Paris Agreement, ICLEI is actively working with more than 825 cities, counties, and regional associations that represent more than 141 million Americans—or nearly half of the national population—and the organization is confident that they represent vast untapped potential to take action and formalize emissions reduction commitments.

The hundreds of cities that are actively engaged in climate mitigation strategies but have yet to formalize commitments have some great examples to pull from around the country. Cities as diverse as Atlanta, Georgia, Cincinnati, Ohio, Minneapolis, Minnesota, and Portland, Oregon have already committed to emissions

reductions goals equal to or stronger than current U.S. national commitments in both the medium and long terms—each plans on 28% to 30% reductions by 2030, and 80% reductions by 2050.

At the state level, the potential is just as large. Last year, for instance, California lawmakers voted for 40% greenhouse gas cuts below 1990 levels by 2030 and are also supporting a raft of vehicle emission standards tougher than the rest of the country. More broadly speaking, California's Secretary for Environmental Protection, Matt Rodriguez, told reporters at the recent COP22 meetings in Morocco that ten to twelve U.S. states representing 30% of the country's economy—including California, Washington, New York, Oregon, Massachusetts, and Vermont—are set to actively oppose Trump's plans to rescind climate and clean energy policies. Meanwhile, a total of 36 states have already developed climate plans and renewable energy targets.

Additionally, when the Clean Power Plan, the centerpiece of President Obama's climate policy, was put on hold by the Supreme Court in February, at least 19 states stated their intent to continue decarbonization and CPP compliance planning, despite the uncertainty of a federal mandate.

At the time, Minnesota Governor Mark

Dayton said: "We shouldn't need a federal edict to understand how vital it is that we keep doing everything in our collective powers to reduce harmful greenhouse gas emissions, improve energy efficiency, and advance Minnesota's clean energy economy."

And what if Trump opts to pull out of the Paris Agreement or the UNFCCC process entirely? Cities and states are considering ways to formally represent the interests of the majority of Americans that believe the U.S. should honor its climate commitments to the international community.

California senate leader Kevin De Leon said at COP22 that lawyers were examining ways that the state—which would be the world's sixth largest economy if it were a country—could formally join the UNFCCC and ratify the Paris Agreement.

Speaking of cities taking a similar tact, Bloomberg said, "If the Trump administration does withdraw from the Paris accord, I will recommend that the 128 U.S. mayors who are part of the Global Covenant of Mayors seek to join in its place."

"Washington will not have the last word on the fate of the Paris Agreement in the U.S.," Bloomberg continued, "Mayors will, together with business leaders and citizens."

Ben Jervey is the Climate and Energy Media Fellow at the Institute for Energy and the Environment at Vermont Law School.

**Links available in posted article on the Green Energy Times website: greenenergytimes.org.*

Plymouth, NH Regional High School Envelopes Energy Efficiency Upgrades

School Administrative Unit (SAU) 48 in Plymouth, New Hampshire has just completed a \$2 million energy retrofit project at Plymouth Regional High School. The project was designed by Energy Efficient Investments of Merrimack to have maximum energy savings as part of an energy performance contract with SAU 48.

One of the largest components of the project was upgrading the heating system to eliminate the aging oil-fueled heating system. Froling Energy completed this part of the project by installing a propane boiler in one boiler room and a biomass boiler in the other. The existing boiler rooms are far apart and are joined with well-insulated piping inconspicuously placed above hall and classroom ceilings. This allows either boiler to be used to heat the school.

The main heating source is a new Viessmann biomass boiler that was installed at the south

end of the building near the service center's garages. This location had the advantage of having open space outdoors, adjacent to the boiler room where a large dry chip silo could be installed. The silo is 19 feet in diameter and over 24 feet high.

The peaking and back up boilers are a pair of Viessmann high efficiency condensing propane boilers that replaced the less efficient, aging boilers that had served the school for a few decades.

Other aspects of the school's efficiency project include:

- Retrofitting all existing fluorescent light fixtures to Philips LED.
- New AAON energy recovery ventilators for the science wing.
- Installation of two Daiken mini-splits A/C for the principal's office.

- Installation of six energy-efficient Power-smith transformers.
- New walk-in cooler controls for existing coolers and freezers.
- Weatherization includes air-sealing and insulating by Energy Efficient Investments.
- HVAC control updates.

It is too early to know the exact savings for heating the school. However, in a short time, the lighting retrofit has resulted in a kWh savings of 45%! Jon Francis, Facilities Director at PRHS stated, "The school's electric savings for the first two months post construction are on pace to be more than \$60,000 per year. This is far in excess of what was projected." The operating cost savings will be substantial.

The project benefited from a \$325,000 grant from the NHPUC which supported the installation of the biomass boiler system.

Additional incentive funding was obtained through the New Hampshire Electrical Co-op's New Equipment and Construction Program. The remaining costs were then covered by a fifteen-year bond taken out by SAU 48.

With all the money spent, it may be surprising to report that local school taxes will not rise as a result of this project. This is because the annual debt payments for the project are less than the estimated annual energy savings. Therefore, the entire project is tax-neutral—or better.

SAU 48 plans to implement similar energy efficient measures at other district schools in the next few years.

Eric Sandberg from EEI, Jim Van Valkenburgh from Froling, and Michelle Harrison of Green Energy Times contributed to this article.



Left: The Froling Energy crew stands by the new 42 ton wood chip silo which is 19 feet in diameter and 30 feet high. Rt: The new Viessmann Vitoflex 300 wood chip boiler with a maximum heat output of 2.4 million BTUs/hr. Photos courtesy Froling Energy.



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Global Warming Hiatus Disproved Again

By Robert Sanders, Media relations, Berkeley News | January 4, 2017



A NEMO float, part of the global Argo array of ocean sensing stations, deployed in the Arctic from the German icebreaker Polarstern Bremerhaven. (Photo courtesy of Argo)

A controversial paper published two years ago that concluded there was no detectable slowdown in ocean warming over the previous 15 years — widely known as the “global warming hiatus” — has now been confirmed using independent data in research led by researchers from UC Berkeley and Berkeley Earth, a non-profit research institute focused on climate change.

The 2015 analysis showed that the modern buoys now used to measure ocean temperatures tend to report slightly cooler temperatures than older ship-based systems, even when measuring the same part of the ocean at the same time. As buoy measurements have replaced ship measurements, this had hidden some of the real-world warming.

After correcting for this “cold bias,” researchers with the National Oceanic and Atmospheric Administration concluded in the journal *Science* that the oceans have actually warmed 0.12 degrees Celsius (0.22 degrees Fahrenheit) per decade since 2000, nearly twice as fast as earlier estimates of 0.07 degrees Celsius per decade. This brought the rate of ocean temperature rise in line with estimates for the previous 30 years, between 1970 and 1999.

This eliminated much of the global warming hiatus, an apparent slowdown in rising surface temperatures between 1998 and 2012. Many scientists, including the International Panel on Climate Change, acknowledged the puzzling hiatus, while those dubious about global warming pointed to it as evidence that climate change is a hoax.

Climate change skeptics attacked the NOAA researchers and a House of Representatives committee subpoenaed the scientists’ emails. NOAA agreed to provide data and respond to any scientific questions but refused to comply with the subpoena, a decision supported by scientists who feared the “chilling effect” of political inquisitions.

The new study, which uses independent data from satellites and robotic

floats as well as buoys, concludes that the NOAA results were correct. The paper was published Jan. 4, 2017 in the online, open-access journal *Science Advances*.

“Our results mean that essentially NOAA got it right, that they were not cooking the books,” said lead author Zeke Hausfather, a graduate student in UC Berkeley’s Energy and Resources Group.

Long-term climate records

Hausfather said that many years ago, mariners measured the ocean temperature by scooping up a bucket of water from the ocean and sticking a thermometer in it. In the 1950s, however, ships began to automatically measure water piped through the engine room, which typically is warm. Nowadays, buoys cover much of the ocean and that data is beginning to supplant ship data. But the buoys report slightly cooler temperatures because they measure water directly from the ocean instead of after a trip through a warm engine room. [See Chart 1]

A new UC Berkeley analysis of ocean buoy (green) and satellite data (orange) show that ocean temperatures have increased steadily since 1999, as NOAA concluded in 2015 (red) after adjusting for a cold bias in buoy temperature measurements. NOAA’s earlier assessment (blue) underestimated sea surface temperature changes, falsely suggesting a hiatus in global warming. The lines show the general upward trend in ocean temperatures. (Zeke Hausfather graphic)

NOAA is one of three organizations that

keep historical records of ocean temperatures — some going back to the 1850s — widely used by climate modelers. The agency’s paper was an attempt to accurately combine the old ship measurements and the newer buoy data.

Hausfather and colleague Kevin Cowtan of the University of York in the UK extended that study to include the newer satellite and Argo float data in addition to the buoy data.

“Only a small fraction of the ocean measurement data is being used by climate monitoring groups, and they are trying to smush together data from different instruments, which leads to a lot of judgment calls about how you weight one versus the other, and how you adjust for the transition from one to another,” Hausfather said. “So we said, ‘What if we create a temperature record just from the buoys, or just from the satellites, or just from the Argo floats, so there is no mixing and matching of instruments?’”

In each case, using data from only one instrument type — such as satellites, buoys or Argo floats — the results matched those of the NOAA group, supporting the case that the oceans warmed 0.12 degrees Celsius per decade over the past two decades, nearly twice the previous estimate. In other words,

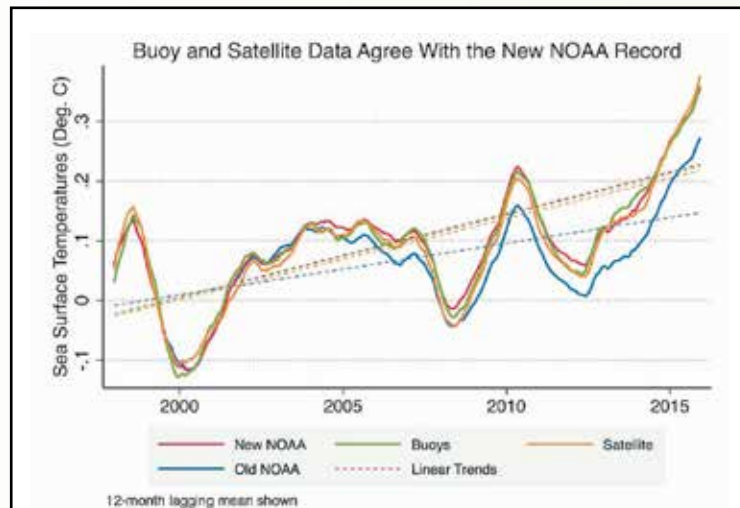


CHART 1: A new UC Berkeley analysis of ocean buoy (green) and satellite data (orange) show that ocean temperatures have increased steadily since 1999, as NOAA concluded in 2015 (red) after adjusting for a cold bias in buoy temperature measurements. NOAA’s earlier assessment (blue) underestimated sea surface temperature changes, falsely suggesting a hiatus in global warming. The lines show the general upward trend in ocean temperatures.

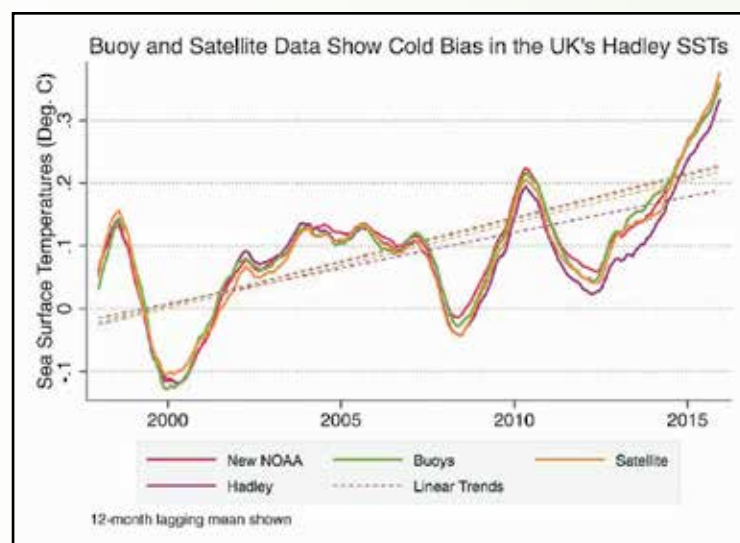


CHART 2: Berkeley’s analysis of ocean buoy (green) and satellite data (orange) and NOAA’s 2015 adjustment (red) are compared to the Hadley data (purple), which have not been adjusted to account for some sources of cold bias. The Hadley data still underestimates sea surface temperature changes. (Charts : Zeke Hausfather graphics)

the upward trend seen in the last half of the 20th century continued through the first 15 years of the 21st: there was no hiatus.

“In the grand scheme of things, the main implication of our study is on the hiatus, which many people have focused on, claiming that global warming has slowed greatly or even stopped,” Hausfather said. “Based on our analysis, a good portion of that apparent slowdown in warming was due to biases in the ship records.”

Cont’d on p.38

HIDDEN TAXES

Cont’d from p.1

increased by a factor of 3.6 since then. Add increased population, and the figure might have gone up by a factor of five, reaching about \$420 million. What it did, however, was to increase steadily, reaching nearly \$3.45 billion. Instead of a factor of five, it went up by a factor of 42.

It is not just in the insurance programs that we see our society taxed. Only a small fraction of properties damaged by floods have flood insurance. In the Louisiana flood of 2016, nearly 80% of property owners were uninsured, a portion typical of the country. In St. Helena Parish, only one percent of properties had insurance. The costs of uninsured losses are covered by property owners, by banks, if the mortgages are not paid off, and by the economy in general. The average payout of \$3.45 billion is only a fraction of the actual cost to the economy, and if it is proportionate to the rates of insured properties, the economic costs have gone to

over \$17 billion in an average year.

The outlandish increase in costs associated with floods came about mostly because of events we can name. Among them are Katrina, Ike, Irene, Sandy, and Matthew. Massive storms are increasing in number and strength, and this is because the weather is changing with rising global temperatures. We are already paying, heavily, because of climate change.

In another example, we can get much clearer data on the costs of pollution from fossil fuels. The American Lung Association in California (ALAC) did a study of the



Image: fabiusmaximus.com

medical costs associated with fossil fuel use in ten states, most of which are in the Northeast. As it happens, the per-capita cost turned out to be highest in Vermont, a place people think of as having fresh and pure air. These costs come to \$330 million per year for the state, ALAC says, or about \$480 per Vermonter per

year, or \$2,400 for a family of five. The costs here are hidden in high medical insurance rates and high taxes. The other states had lower costs because people in them drive less, but they were not lower by much.

This is another example of a hidden tax we all pay to support the fossil fuels industry, apart from what we all pay to use its products. ALAC calculated the cost at \$1.30 per gallon of gasoline, a tax not paid at the pump, but nevertheless imposed by use of fossil fuels, with no social benefit. (I am prepared to argue that we do not need fossil fuels for any purpose, not even fueling jet aircraft economically.)

These are just two examples. We have had extensive agricultural losses due to drought, such as has happened in California. Wildfires and invasive pests are destroying forests. Cities have to spend money defending themselves from rising seas, as we can see Miami’s campaign to raise its streets at a cost of over \$400 million.

The good news is that renewable energy is now getting cheaper than fossil fuels and has already achieved that goal in many cases. So, we can eliminate the hidden taxes we have to pay while we reduce our energy bills — permanently.

New Precipitation Models for New York State

Extreme precipitation projections to help the state with planning



Cornell University
Cooperative Extension
Dutchess County

January 17, 2017

– Hurricanes Irene, Sandy, and Lee are examples of extreme precipitation events that have caused destruction and deaths in New York State. In 2009 alone, 175 total flooding events in New York State led to \$32.82 million in property damage. The state is also still recovering from the \$42 billion dollar toll of Superstorm Sandy, among others. Climate change is resulting in an increase in the frequency of heavy rainfall events.

To help New York State communities plan for effects of climate change, new graphics are now available showing the increased likelihood of heavy precipitation events. These graphs, called Intensity Duration Frequency (IDF) curves, show anticipated increases of storm events from two- to 100-year intervals, and are projected into the future as far as 2099. They can be found at <http://ny-idf-projections.nrc.cornell.edu/>. These products are designed for use by municipal officials, researchers, planners, highway departments, and other decision-makers who need to take storm events into account. These IDF curves display how precipitation events are being affected by New York State's rapidly changing climate.



Beacon train station, Beacon, New York. Photo: C. Klocker

In New York State, average summer and winter temperatures have been increasing since 1970 (2° F in summer and 4° F in winter). We are also expected to experience more extremely hot days and fewer cold winter days per year. These changes are affecting the water cycle, resulting in climatic effects such as an increase in the frequency and intensity of extreme precipitation events in the northeastern U.S. These changes could negatively impact society and lead to further distress for the State of New York.

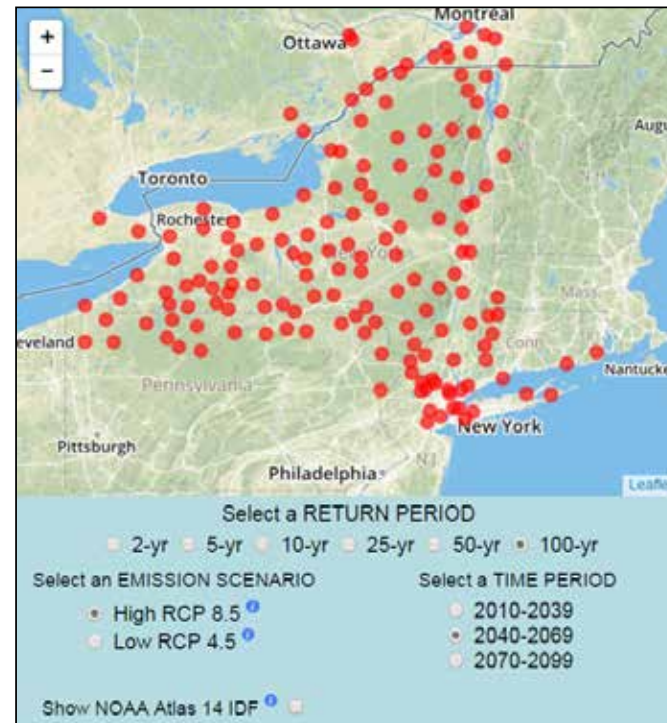
In preparation for these impacts, the Department of Earth and Atmospheric Science at Cornell University has formed a partnership with the New York State Energy Research and Development

Authority (NYSEDA) to 'downscale' global climate model outputs and create extreme precipitation projections that will ultimately be incorporated into climate-change adaptation planning for New York State. Christopher M. Castellano and Arthur T. DeGaetano completed this project through the Department of Earth and Atmospheric Science at Cornell University.

Communities can use these projections to aid in planning for more resilient communities by understanding the increased likelihood of major precipitation events. Flood levels may be reassessed, floodplain maps and codes may be adjusted, and culverts and bridge crossings may be altered to account for the likelihood of extreme weather. The website allows users

to examine specific data throughout New York. Users can choose different locations, return periods (e.g., a "100-year" storm event), and greenhouse gas emission scenarios. Information is presented in several types of maps and charts to visualize how severe a storm event may be expected in different parts of the state.

Interested parties should take a look at the website to familiarize themselves with these models and better understand expected changes in our climate. <http://ny-idf-projections.nrc.cornell.edu/>. A short video also helps explain the models: <https://vimeo.com/187831975>



Map of weather station locations used for modeling. <http://ny-idf-projections.nrc.cornell.edu/>.

WARNING!

Climate Research News from UMass Amherst

By George Harvey

Climate change is not uniform. This is a fact that needs to be repeated often, because so few people understand. Different parts of the world will warm more than others. Different seasons and different parts of the day warm more than others.

Here, in the Northeast, the average temperature has increased about 2° F, but the greatest increase has been for the temperature of the night of the coldest part of the winter. This is the coldest temperature of the year, and it is of particular importance because it is what kills off both perennial plants we might wish to have and pests we want to avoid.

The U.S. Department of Agriculture's Hardiness Zone Map divides the U.S. into zones based on the coldest night's temperature, by steps of 10° F. The one issued in 2005 showed that about half the country was in warmer zones than in 1990. The map was withdrawn shortly after it issued.

The latest maps from the Arbor Day Foundation show the warming continu-



Lake Pleasant Drive, Staatsburg, NY. Photo courtesy of C. Klocker.

ing. The greatest change is in the northeastern quarter of the contiguous states. The states of Vermont and Kentucky are almost entirely in different hardiness

zones than they were in 1990. (<http://bit.ly/arbor-day-zone-changes>)

The deer ticks that have moved farther north, bringing Lyme disease to parts of the Northeast where it had been unheard of only thirty years ago, are driven by climate change. Other pests, such as woolly adelgids, have also moved in, undeterred by winter cold.

A new research paper from the Northeast Climate Science Center at the University of Massachusetts Amherst (UMass) shows that our area of the world will probably see greater-than-average increases in temperature. While scientists across the world have called to limit increases to 2°C (3.6° F) and have much preferred to limit the increase to 1.5°C, the UMass researchers foresee increases in the United States to be greater than in most of the rest of the world.

For the Northeast, they see a rate of change about 50% higher than world averages. In other words, if the world can limit increases to 2°C, we will go up 3°C (5.4° F). The effect of this on that coldest night of the winter will almost certainly be much greater. And, of course, that means more worries than just Lyme disease.

The researchers said wetter winters will accompany the higher temperatures. With higher temperatures, however, this does

not bode well for the ski industry. Nor do higher temperatures look good for a number of other traditional agricultural products of the area, such as maple syrup.

The scientists say that the COP21 Paris climate agreements are not sufficient to stop climate change at 2°C. In order to do that, we will have to do much better than achieving the goals we have set. One report from the United Nations said we are set to see increases of 2.9°C to 3.4°C, unless we can do better.

Meanwhile, however, we have a political process that is dominated by a party whose elected members in

Washington, D.C. deny the importance of climate change.

We could dwell on the curious fact that their election was arguably funded by the one group of businesses that is inextricably linked to climate change. We can do better than that, however. The states, local governments, and people of the United States can have a deep effect on the entire issue of climate change and government simply by refusing to buy their products. We can be more comfortable and save money in the process.

"The Northeast may see a rate of change 50% higher than the world averages, much sooner than expected – perhaps as soon as the next 10-20 years."

Hunting and Wildlife in the Northeast *Cont'd from p.1*



A deer at night. Photo: lwctoys, Wikimedia Commons

experience with the subject, and others passed on information that appeared in other publications.

The first response came from Nate Harvey of Marlboro, Vermont (the author's brother). He typically spends two or three days each week tracking animals, mostly in the Northeast. "The beds where moose sleep in the snow are often a bloody mess," he said, "with ticks the size of your finger tip covering the ground."

The problem the moose have is that they never had to deal with large numbers of ticks in their evolutionary past, so they have no instinct to groom themselves. White tailed deer have this instinct, which is why they do not share the problem that moose have. Ticks have come into the countryside where moose live, because climate change has made it possible for them to survive the coldest winter temperatures.

To understand how a small change in the average temperature could cause such trouble, we need to know that climate change does not happen uniformly. In the Northeast, the average temperature has increased only about 2° F. While that may not seem like much, the temperature increase has been greatest on the coldest nights of the winter, which are now about 10° F higher than they were only thirty years ago. That difference is enough to allow winter ticks, deer ticks, woolly adelgids, and a host of other pests to survive much farther north than they did in the past. So moose are killed by ticks, humans in Vermont and New Hampshire get Lyme disease, and stands of hemlocks are dying in Massachusetts.

One reader, an avid hunter, suggested we look at a broader geographic area. He said he had hunted many times in the area of the George River, in Northeastern Quebec. He recounted the sight of seeing a herd of six or seven thousand caribou swimming across the George River. That must have been quite a sight.

There were over 800,000 caribou living in the area of the George River twenty years ago, but the number has fallen to below 9,000 this year. There are many reasons for the decline, and while illegal hunting is clearly one of them, climate change is another part of the problem.

Loss of habitat is a big part of the problem. The hunter talked about commercial forests, describing the destruction brought about by an operation in New Brunswick. In that case, a large area was clear cut. This was followed by covering the land with an herbicide to prevent deciduous trees from growing back, so the forest would be uniformly filled with the fir trees the foresters wanted. With only a single type of tree, the forest had no diversity of resources for wildlife, so there are nearly none.

If we cannot do better, then we are in much worse trouble than we thought.

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.

Vermont Research Climate Change News

Uncertain Politics, Legislation, Renewable Energy, Rail, Moose Study...

by Kirsti Blow



Lake Champlain. Credit: Wikimedia

In light of the uncertain political atmosphere that poses a threat to Vermont's climate, a report by the Union of Concerned Scientists reveals how clean energy could work financially for the state. With the basis of existing wind and solar power, the report argues that market demand will drive the expansion of renewable energy—a \$7 million initial public investment could swell to \$148 million over 15 years with the help of the private sector.

To their part, the state government has passed further legislation concerning Vermont's energy throughout the past year. The major renewable energy sitting bill

was passed in April of 2016, and granted municipalities the jurisdiction to determine the preferred sites of energy projects. Most notably, the bill requires the Public Service Board to create new wind turbine noise level standards, because of complaints from residents.

These energy developments are crucial, as Vermonters have continued to prove their desire to maintain the state's natural areas. In fact, four trail networks alone account for \$29.6 million of the state's economic activity, according to a report by the Vermont Trails & Greenways Council. The figure includes trail tickets and rentals, as well as other likely purchases, such as craft beer at a brewery or lunch at a local restaurant. The report also indicates that 325 jobs directly stem from trail networks.

In terms of wildlife, moose have been the target of persistent research seeking to understand their susceptibility to winter ticks. Spearheaded by New Hampshire and Maine wildlife conservation organizations in 2014, results have marked something of an epidemic; one moose was found carrying 63,000 ticks, with the "lethal" limit said to be about 50,000 ticks per animal.

The Vermont Fish and Wildlife Department issued a press release detailing the study, asserting that the warmer falls and earlier springs associated with climate change are

causing a spike in winter tick populations.

Moose will often rub against trees in an effort to rid themselves of the parasites, exacerbating the blood loss and stripping them of their insulating fur. In this manner, many moose die of hypothermia. The state's moose population has now dwindled from 5,000 fifteen years ago to roughly 2,200 today.

Vermont has pledged to join the study, and thirty cows and thirty calves will be captured in the Northeast Kingdom this month to be fitted with a GPS monitoring system. Seventy-five percent of the \$578,000 study will be federally funded by the Pittman-Robertson Wildlife Restoration Act. Up to 60 moose are planned to be tracked through 2019, and researchers will analyze their causes of mortality, as well as reproductive rates, in order to begin organizing conservation efforts.

Vermont Research Climate Change News is a summary of recent research related to energy and climate change.

Kirsti Blow is a sophomore Public Communication major at University of Vermont. Kirsti writes the briefs for UVM's Vermont research newsletter published by the Center for Research on Vermont. Learn more at <http://www.uvm.edu/~crvt/>. Kirsti is also a local musician in the Burlington area.

WEATHERIZE UPPER VALLEY Sees Strong Kick-Off Launch

By Sarah Brock



Left: Julia Lloyd Wright and Danny Bonta - hanging the banner for the Weathersfield area kick-off. Below is the Randolph team kicking-off the launch for their area.



More than 130 Upper Valley residents turned out last month for a series of Weatherize Upper Valley Kick-Off events in Norwich, Randolph, Royalton, and Weathersfield.

The events marked the beginning of Weatherize Upper Valley, a five-month campaign to help residents in 14 Vermont towns (Bethel, Braintree, Brookfield, Cavendish, Hartland, Hartford, Norwich, Randolph, Reading, Royalton, Sharon, Thetford, Weathersfield, and Windsor) save energy and stay warm by air-sealing and insulating their homes.

The Weatherize Upper Valley campaign aims to double the number of homes in the region participating in Efficiency Vermont's Home Performance with ENERGY STAR® program each year. This would mean 150 homes committed to weatherization projects by the end of May.

According to Efficiency Vermont, these projects cost, on average, \$7,800 and result in average energy savings of 26%. However, many attendees at last month's events were surprised to learn that the real benefit of weatherization is comfort.

"Before we did this weatherization work, this was a pretty drafty 1860s farmhouse," explained Norwich resident Alan Berolzheimer at a January 18 event in Norwich. "The transformation has been very noticeable—we don't feel cold drafts along the floor, the central part of the house holds its heat longer, and it's all around a lot more comfortable."

Over a dozen home energy champions—homeowners who have already weatherized their homes—turned out at the events to share their stories with friends and neighbors.

Weatherization projects in Vermont are more affordable than ever this spring. Efficiency Vermont offers rebates up to \$2,500 to help participants cover the cost of these improvements. At the same time, more and more residents are choosing to finance their home energy projects through special, unsecured, low-interest energy loans like the Heat Saver Loan and the NeighborWorks Energy Loan, with rates between 0 % and 4.99 %.

Weatherize Upper Valley adds additional financial incentives for residents in participating towns. The program's partner contractors are offering free home consultations and quotes to encourage residents to participate. Residents who sign a contract with a partner contractor by May 31 are also entered to win up to \$2,500 toward the cost of their project, in addition to available rebates.

To date, more than 200 residents have signed up to participate in Weatherize Upper Valley, with more than 35 already in the process of completing a free home assessment with the program's contractors.

Readers can learn more at VitalCommunities.org/Weatherize.

Weatherize Upper Valley is a program of Vital Communities, a nonprofit serving 69 towns in the Upper Valley region of Vermont and New Hampshire. Program partners include seven local contractors (5 Star Energy Tech, Building Energy, Montpelier Construction, Peachtree Builders,

Solsaa Building and Energy, Van de Ven Construction, and Vermont Foam Insulation), over 50 volunteers, and Efficiency Vermont. The program is made possible by funding support from Jane's Trust Foundation, Canaday Family Foundation, Harris and Francis Block Foundation, Efficiency Vermont, Catamount Solar, Dead River Fuels, and JAM Fuels.

Sarah Brock is the Energy Program manager for Vital Communities, a nonprofit that brings people together to find solutions to regional challenges in the Upper Valley.

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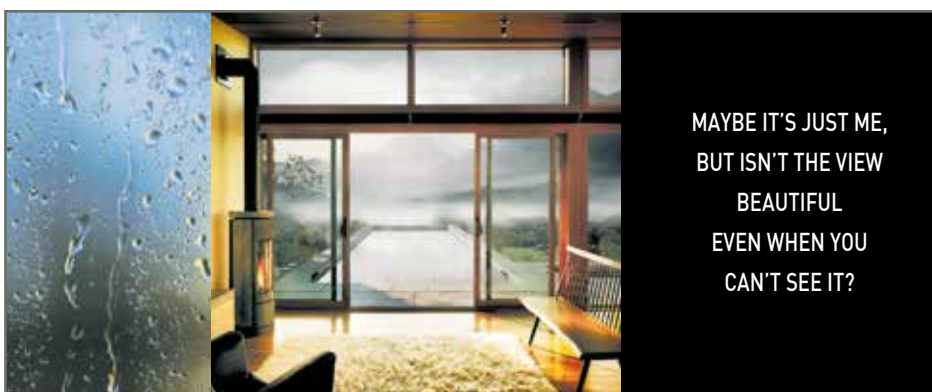
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Home of the Future Built in Woodstock, NY

By Marie Caruso



Woodstock, NY Passive House in the fall. Photo courtesy of Daniel Levy, Ph.D

which optimizes solar gain. PH building not only saves energy, it has the added benefits of being more durable and comfortable than conventional construction.

Most houses in the U.S. are built with wood, even those meeting PH standards, and chemical foam insulation products are popular. This one is built with autoclaved aerated concrete

(AAC) reinforced with steel rebar, insulated with mineral wool on the outside, and clad with fiber cement siding, which looks similar to wood. The exterior walls are 17 inches thick.

AAC is a lightweight pre-cast concrete product which is fire-, water-, pest-, and sound-resistant, and very strong and durable. It can be worked with typical carpentry tools and holds temperature extremely well. Developed in Sweden in 1923 and commonly used in many other countries, it is just starting to gain a foothold in the U.S.

According to Levy, there are now two homes built with AAC in the United States which are certified by the Passive House Institute US (phius.org), and four additional homes are underway in Staten Island, NY. The Woodstock house is the only one which doesn't use plastic foam insulation products. The AAC Passive Houses under construction on Staten Island are being built to replace buildings destroyed by Hurricane Sandy. These are being constructed with support from the New York State Energy Research and Development

Authority, to demonstrate the resilience of AAC to storms as well as energy efficiency.

Levy's Woodstock house sits on a concrete slab underlain with 10 inches of Foamglas insulation and a thick Stego vapor barrier. The ceiling is insulated with 24 inches of cellulose. The windows are tilt and turn, triple-glazed, imported from Europe.

The siting of the house and overhangs are designed to maximize sun exposure in the winter and minimize it in the summer. It is all electric, with a 7.56 kilowatt system of photovoltaic solar panels on a steel roof. It is on the electric grid, yet on an annual basis these panels should generate as much power as is needed for both this house and a studio apartment above the attached garage. The garage is wired for electric vehicle charging. There is no chimney, as there is no combustion whatsoever.

As the house is airtight, stale air is removed and fresh air provided through an energy recovery ventilation system. Heating and cooling are achieved with a ductless heat pump. The temperature remains even and comfortable in all seasons.

All the appliances meet Energy Star,

and lighting is entirely LED. The water heater and dryer operate with heat pumps, which draw heat from the surrounding air. Cooking is done by induction and baking by convection.

In addition to being certified by Passive House Institute US (PHIUS), the house meets the US Department of Energy Zero Energy Ready Home, NY State Energy Star, Indoor Air Plus, and Water Sense programs.

Levy is passionate about this method of construction and is planning smaller, more moderately priced homes built to the same Passive House, chemical-free standards as this one. If you'd like to learn more about the features of this house and his building techniques, you can reach Levy through his website: Greenspring-BuildingSystems.com.

A shorter version of this article was originally published in the summer 2016 issue of "Fresh Air," the newsletter of the Atlantic Chapter Mid-Hudson Group Sierra Club. Marie Caruso has been an active member of that group since 1979, having previously served as Group Chair, Executive Committee Member, and currently, as Volunteer Coordinator. As a leader in the fights to preserve Lake Minnewaska in the Shawangunk Mountains and Williams Lake in Rosendale, NY, she has written extensively about those issues.

A house recently built in Woodstock, NY, could be the vanguard of the future in zero-energy housing.

Daniel Levy, Ph.D., a former industrial education professor and certified Passive House consultant and builder, has constructed a two-story, 2350 square foot home, built with non-toxic materials while meeting the criteria for "Passive House." Passive House is generally considered the world's most stringent building and energy standard.

Passive House (PH) buildings, which are as likely to be commercial structures as homes, save eighty percent or more energy compared to structures built to current codes in the U.S. The name is a less than ideal translation from the German passivhaus, and is often confused with passive solar designs.

The principles of PH construction are superinsulation, thermal-bridge-free (no components that conduct significant heat through the building's thermal envelope), airtight to minimize energy loss through infiltration, high performance windows and doors, filtered fresh air with energy or heat recovery ventilation, and design

Climate Change 2017. What Must Be Done?

Cont'd from p.1

350 ppm by 2100, if we began reducing emissions in 2013 at the (optimistic) rate of 6% per year. One hundred GtC is almost as large as the net historical emissions from deforestation, so it is about as much as we could hope to extract via improved agricultural and forestry practices.

However, emissions did not begin to decline in 2013. Emission growth slowed down from about 3% per year in the preceding two decades to an average 0.6% per year in 2012-2015. Because of the time it takes to move politics and to change energy infrastructure, in our newest paper (now under review) we assume that global emissions will change little in the next four years.

If we further assume the same 6% per year emission reduction rate beginning in 2021 relative to

Ja2020, the extraction from the air required to get to 350 ppm by 2100 is approximately 150 GtC.

So, the bottom line is that the eight-year period (2013-2020) of continued high emissions changes the required CO2 extraction from 100 GtC to 150 GtC – another easy number to remember.

Is it possible to store 150 GtC in the biosphere and soil? Say, even if we make all plausible efforts to employ biochar where it has other benefits and apply rock



Dr. James Hansen is considered by many to be the father of climate change awareness. Photo: Flickr

dust in conjunction with reforestation and agricultural processes where it has other benefits? We will discuss that in a later message. Here I only want to note that the eight-year delay has made the task much more difficult, increasing the magnitude of carbon extraction from 100 GtC to 150 GtC.

Let me also comment on the realism or lack of realism of the

Cont'd on p.36



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WHY BUILD TO THE PASSIVE HOUSE STANDARD?

By Barbara and Gregory Whitchurch



Whitchurch Passive House cottage. Courtesy photo.

ing materials are easily available; and lending institutions are offering interest breaks for both new construction and renovations.

The main advantages:

PH saves energy, up to 90% of the energy demands of a conventional building.

The Residential Building Energy Code (RBES) is the baseline here in Vermont. Energy Star 3.0 from the Department of Energy is 30% more efficient than RBES; the Building America

code of Department of Energy is 45% more efficient than RBES.

The PH standard is 90% more efficient than RBES. These homes can reduce an annual \$3,000 energy bill (LP, oil, electric, wood) to about \$300! Since the entire home can run on electricity, a small solar array can offset one's total energy use.

PH is more healthful and more comfortable. Because a PH is super-insulated, meticulously sealed to prevent heat loss, and uses high-performance windows and doors, there is very little air leakage. Instead, air exchange is done mechanically

through a ventilation system, producing fresh air which is pollen- and dust-free, and controlling moisture, CO2 and VOCs (from cooking, painting, etc.). This freshness is noticeable when you enter a PH; the occupants often report decreased allergies, fewer colds, and better sleep. The temperature is also uniform from room to room -- no cold spots, drafts, or steamy upstairs bedrooms. (And no more ladybugs, earwigs, ants or mice.)

PH is easier to maintain. Over the past few decades builders have moved from 2X4 to 2X10 construction. Now modern building science has moved on to super-insulated enclosures which find the "sweet


spot" where no furnace or boiler is needed. Highly efficient heat pumps heat and cool these buildings. All the money saved on equipment and repairs goes toward producing even more energy savings for the occupants.

Four years ago we set about building a PH attached to our own (<http://bit.ly/PH-Cottage>) "hippie home" -- as an alternative to assisted living for Greg's parents. Everyone involved in the project was new to PH, but even so, for about \$173/ft2 we created a basement and two stories of timber-framed, extremely comfortable, ADA-compliant living space. The air is fresh; an induction cooktop makes cooking safer and more efficient; the entire house runs on electricity produced by the solar array on our home.

Cont'd on p.29



Habitat PH under construction. Page 29: Habitat PH in E. Montpelier, VT. Courtesy images: Chris Miksic



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Cont'd from p.28

Triple-pane Intus windows contribute to the coziness and quiet. In pursuit of our proof-of-concept demonstration, we also placed relative humidity, moisture and temperature sensors throughout the walls and roof; engineers, architects and builders are watching these readings as they demonstrate the superior safety and resiliency of this building.

Central VT Habitat for Humanity Chapter (<http://bit.ly/VT-HfH>) is finishing a PH in East Montpelier for a young couple and their young daughter. Its cathedral-ceilinged living room opens between huge windows to a protected deck. Window awnings allow winter solar gain while shielding the summer sun for cooling. Although small of footprint, the layout exudes spaciousness and openness. Continuously filtered, fresh air is provided by heat pump

ventilator. A small 7kW PV array will offset the energy needs of the family.

It's certainly not unusual to run across builders and remodelers who are still living in the last century. A lot of them will say things like, "A house has got to breathe!" -- an excuse for sloppily allowing air leaks, the number one cause of lost heat, drafts and high heating bills. Or, "All that extra insulation will never pay off!" -- an excuse for not keeping up with the evolving science of high-performance building. Widely available energy modeling software, such as the PH Planning Package (PHPP) and WUFI Passive, now exposes these excuses for what they are. A PH is not only the house of the future -- it's the house of the present.

More information: www.PHAUSVT.org.



Renderings by Tolya Stonorov, of Stonorov Workshop



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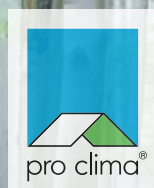
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Myths and Magic Surrounding The 'PRE-FAB' Boom

By John Connell



A pre-fab home under construction as a boom-truck lowers a section into position. Courtesy photos.

Though currently the darling of residential design and construction media, "prefab" is much more than a passing fashion. Much more likely to pass is the notion that prefab necessarily implies cheap construction of an inefficient building that will not last.

Prefab is here to stay. Doubt it? Just consider today's door or window products. Not so long ago these items were hand-built on site. And similar transformations have taken place with kitchen cabinets, fireplaces, flooring, tile, shower bases, stairs (circular and conventional), roof hatches, chimneys...these site fabricated building parts are now mostly made in factories. Today we even have custom pre-cast foundations delivered to the site (Superior Wall Inc.).

That said, it is important to understand that factory delivery of prefabricated components and structures is constantly evolving and not all prefab products are equal. While few measure up to all the media hype, most have many significant advantages. A key, as with many things, is knowing what to look for and where to find them.

COST SAVINGS

Undoubtedly there are savings to be had in building prefabrication, as distinct from "stick-built" construction done on the building site. Manufacturers' deeper buying power allows them to source materials at Home Depot prices or lower. How much of those savings are passed along to the customer depends on the manufacturer, the project and, to an extent, on the customer's knowledge of the factory delivery process.

Additional labor savings are found in the reliable work schedule of a factory. Building indoors means no 'down' days due to weather. Additionally, some factories even use round-the-clock shifts.

Waste is much lower in a factory – typically 5% compared to 15% or higher on a traditional construction site.

Finally, there are significant savings that accrue from knowing the exact date of delivery. This means the builder can have all supporting trades lined up for efficient completion of the project. Again, these savings are dependent on finding trades that are experienced with factory delivery. The builder needs to clearly choreograph the supporting trades and request a price reduction for the reduced time and scope.

SCHEDULE ADVANTAGES

Incredibly, a typical three-bedroom house spends only a few weeks on the assembly line. But to really optimize that efficiency all the design decisions must be clearly made in advance. Architects and professional designers are worth their fee in this context but most manufactures are also practiced at collecting the design decisions needed to insure smooth fabrication on the assembly line.

A common prefab axiom holds that anything that can be accomplished on an assembly line should be done in the factory. This is only true up to a point. There are some finishes that can be efficiently installed in the factory only to be damaged by the site workmen connecting the mechanicals and closing up the "marriage" walls on site. It is possible to have too much done in the factory. Deciding how much to have prefabricated requires a knowledge of the factory as well as your supporting site trades.

Generally, prefab delivery is a sterling example of the builders' motto: "prior plan-

ning prevents poor performance." When all design decisions are addressed and understood before the project hits the assembly line, the final product will arrive at the site on schedule – usually to the day and the hour! Now that's magic.

QUALITY

Most factories produce wall and floor assemblies superior to those built on site. Using dry materials, the latest fasteners, jigs and CNC (Computer Numerical Control) cutters – these building parts are square, straight and solid. But that's just the beginning. Because modular units are considered a "product" and sold across state lines, they must be rigorously inspected before being allowed out of the factory. Law requires that designs of components and assemblies pass third-party engineering review to assure compliance with all codes, including structure, electrical, plumbing, energy, ADA (Americans with Disabilities Act) standards, fire and safety.

Increasingly, we find factories specializing in high-performance "energy prefabs." These houses are extremely tight and well-built. The first house in Vermont to receive the LEED residential rating was a prefabricated home.

While prefabricated delivery is still evolving, we are lucky to be in a time when these products have never been better. Builders and homeowners still need to be selective about who they work with, just like picking a general contractor or any other trade. But if you know who and what to ask, this is a building approach at the height of its game. In the last few years, I have used this approach to build energy-efficient homes, architect-designed residences, simple camps and multi-unit mixed-use residential homes. While I still use conventional stick-built methods when necessary, I always start with prefab.

John Connell teaches prefab design and construction at the Yestermorrow Design/Build School in Warren, VT. You can reach him at 2morrow Studio at 802.496.5546 or 508.477.5400. More at: prefab2morrow.com.



Top: The first LEED home in Vermont; center: a Connecticut cottage; bottom: a Vermont modern pre-fab home.

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NET-ZERO MONTPELIER 2030 DESIGN COMPETITION

And the Winner of the \$10k Prize is 'Team Bridges'!

Net Zero Vermont Inc. announced the winning design team for the Montpelier 2030 Design Competition \$10K prize is "Team Bridges," a collaboration of 12 professionals from 10 companies and organizations. The announcement was made at a Statehouse news conference by Net Zero Vermont Co-CEOs Deb Sachs and Dan Jones.



Dan Jones (left) and Deb Sachs present Team Bridges with a \$10k check as the winners of the Net-Zero MP 2030 competition. Courtesy images.

with nearly seven hundred ballots and extended comments submitted. The \$10,000 winner's prize in the Sustainable Montpelier 2030 Design Competition is sponsored by NetZero Vermont with seed funding from five sponsors: AllEarth Renewables, Ben & Jerry's, Vermont Creamery, National

Life Group, and VSECU.

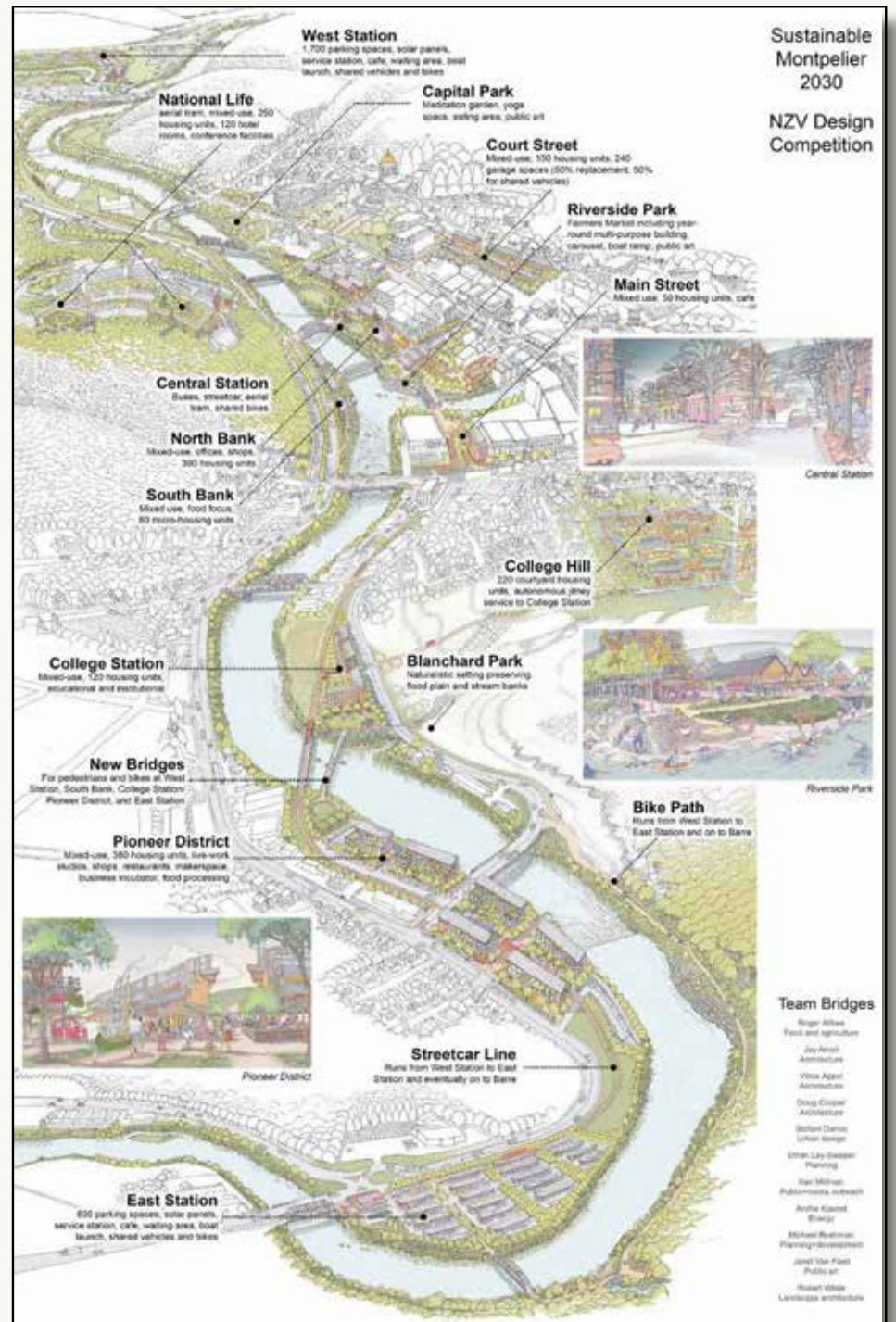
The details about the competition process, the winning design materials and video of the team presentation are available at <http://bit.ly/nz-design>.

Team Bridges is a purposeful blend of twelve professionals from ten companies and organizations. Learn more about them at: <http://bit.ly/about-Team>.

"While this competition started last summer, the whole initiative really began two years ago when the Montpelier Energy Advisory Committee helped guide the City Council to declare that our nation's smallest capital city would become net-zero in its use of carbon fuels by 2030. While this was a wonderfully ambitious goal, we, as a city, had no idea how to accomplish that. To create a net-zero future, we needed to re-imagine our city in a way to overcome the challenges. In July, we launched the Sustainable Montpelier 2030 Design Competition inviting designers and architects to help imagine a desirable future. This is the result of that effort," noted Dan Jones, a co-Executive Director and Project Manager of Sustainable Montpelier 2030.

For more information about Net-Zero Vermont and to view the design team entries, visit www.netzerovt.org.

Green Energy Times has followed the progress since inception. These articles can be seen at <http://bit.ly/GET4-2014> (Issue #25) and <http://bit.ly/GET4-2015> (Issue #31).



Detail of Team Bridges winning competition design for downtown Montpelier

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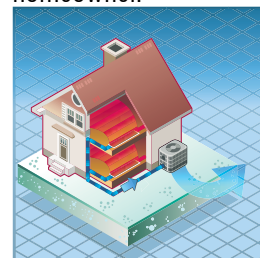
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Eco-Conscious Ways to Heat Your Home This Winter

By Lauren Pezzullo

With our planet's temperature hitting record-breaking highs each year, there's no question that global warming is alive and kicking. And we know that designing our homes to be environmentally responsible is a way to combat these effects. Maybe you have even made a pact to go net-zero in home energy use someday, or rely solely on wind power at some point in the future. But with a skeptic of climate change as our country's leader, we can't afford to put off these well-meaning goals any longer. It is now more critical to adopt alternative methods of energy consumption than ever before.

As we head into the cold winter, we're faced with some of the heaviest months of fossil fuel usage—when we all turn to our fuel-guzzling furnaces to keep warm. But there are plenty of eco-friendly alternative methods that will keep you just as cozy. Here are some ways to reduce your carbon footprint for a greener winter season before you can even say "climate crusader."



RADIANT HEATING

Although our current construction is different, the concept of radiant flooring—heating objects rather than air—is the same as what the ancient Romans used for the hypocausts that warmed their hot baths and marble floors. And it makes sense. Since heat rises, this method of underfloor warmth distributes the heat more efficiently. Plus, it eliminates the wasteful energy leaks rampant in traditional hot-

water heat distribution or warm-air ducted systems.

Among the three types of radiant floor heat, hydronic—which channels the warmth via hot water through underfloor tubing—is the most environmentally responsible, since it regulates temperature so well and can be used in conjunction with solar for on or off-grid homes. Best of all, it can be covered by just about any flooring material you'd like. Say hello to 20 to 30% more heat gain and goodbye to frigid bathroom tile on your feet!

GEOTHERMAL HEATING

What could be more eco-conscious than a method of heating whose name literally means "heat from the earth"? Enter geothermal heating, which draws from the constant temperature of the earth's crust. Heat is transported from underground pipes—known as the ground loop—to a heat pump, which then circulates through your home as warm air. Geothermal heating systems don't rely on fossil fuels—they have even been used to help recycle wastewater! In fact, according to the EPA, they're among the most environmentally friendly and energy efficient heating systems around.

SOLAR HEATING

The sun warms our seas and atmosphere, so why not our homes, too? Even on cloudy days, you can harness the power of this abundant, sustainable energy for heating your home in a variety of ways. First, there's a solar air heater, which works like a greenhouse—heat from the sun is trapped in a collector and then distributed as warmth through an air hose—or through hot water tubing in a hydronic collector—into your home. Another option is a photovoltaic system—roof-mounted solar pan-

els that convert sunlight into electricity. And while this requires a considerable upfront investment, there are plenty of available governmental incentives and tax credits to make the cost more affordable. The best part is that once your panels are paid for, you're looking at a lifetime of clean, renewable energy—for free!

PELLET STOVE

Hailed by the Department of Energy as the "cleanest solid fuel, residential heating appliance," these stove types run on compact pellets made from organic recycled waste like sawdust, corn or nutshells, or wood shavings that would have otherwise ended up in a landfill. The compression regulates their moisture content for more efficient combustion, so they burn cleaner and more efficiently than a traditional fireplace, producing less smoke creosote and other air pollution.

FIREPLACE INSERT

Ah, the crackle of a roaring fire. Nothing gives a room more of a cozy, inviting ambience like a traditional fireplace. Unfortunately, most traditional wood-burning fireplaces aren't exactly efficient. For all the heat they radiate, they lose even more, pulling in 300 cubic feet of warm air per minute out of the room, where it escapes through your chimney. But they're the heart of the home during the winter—so rather than giving yours up, simply make it more efficient. Fireplace inserts fit inside of your existing metal or masonry fireplace to create an effective seal, which prevents or reduces significantly the loss of heat, for greater

Cont'd on p.33



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ECO-HEAT *Cont'd from p.32*



heating efficiency and less air pollution. And make sure your wood is sustainably sourced by using waste wood, or supporting companies whose firewood bears the FSC certified logo—this indicates that it was harvested from responsibly managed forests.

PASSIVE DESIGN

The easiest ways to go green with your heating is to work with what you already have. Passive design is a heating technique that involves no dangerous emissions or mechanical interference. You can increase your heat gain by caulking and weather stripping draft-prone areas, such as doorways and windows, and by adding effective insulation—wool, cork, cotton, and recycled plastic are all green alternatives.

Even small changes like adjusting the thermostat or using heavy rugs and thermal curtains will work too, if it means that you're reducing your reliance on fossil fuels. Because when it comes to our environment's future, every bit counts.

Lauren Pezzullo is a writer, editor, and musicophile who's passionate about vegetarianism and sustainable eating. As an editor for Modernize, she writes about energy-efficient living in the home. She's currently writing her debut novel.

NORTHEAST BIOMASS HEATING CONFERENCE AND EXPO

Many challenges face the biomass thermal energy industry today, including warm winters and an uncertain legislative future. From April 25-27, 2017, the ninth annual Northeast Biomass Heating Conference & Expo (NEBHX) in Burlington, VT, will confront these issues head-on, with conference tracks on policy, technical and project development, and business development.

NEBHX will draw hundreds of visitors from across North America to attend what has become the can't-miss biomass thermal energy conference in the United States. What started out as "Heating the Northeast with Renewable Biomass" in 2009 has now grown into NEBHX, with over 1,500 attendees and 400 businesses, agencies, and organizations represented since that year.

This year's NEBHX is a chance for industry insiders and newcomers alike to learn more about modern wood heat and related biomass thermal energy applications. NEBHX 2017 is geared to engineers, architects, specifiers, project managers, policy influencers, and industry experts, with topics that include:

- Perspectives on Thermal Storage
 - Air Quality and Emissions
 - Boiler Plant Metrics
 - Tools and Perspectives on Feasibility Studies
 - Forest Management, Certification, and the Biomass Thermal Energy Industry
- In addition, a pre-conference Biomass101 workshop will be offered free of charge to those new to the biomass heating industry.

This will be followed by a free "sneak peek" of the expo hall, where you can apply your new understanding of modern wood heating options.

Other pre-conference opportunities include:

- An all-day biomass boiler bus tour to view a variety of biomass heating systems in action.
- "Piping and Controls for Retrofitting Pellet Boilers to Existing Heating Systems." This in-depth technical course presented by hydronics expert John Siegenthaler of Appropriate Designs is geared to engineers, architects, system designers, and installers. Continuing education credits for maintaining professional certifications will be available.
- "How to Win the Job, Without Leaving your Profit on the Table." New this year, this sales and marketing workshop presented by Mike Gorman of Techknowledge Systems will help business owners and project managers learn effective strategies for growth. Continuing education credits are available in some states.

During the conference, consumers and the public will be able to view state-of-the-art technology in modern wood heating units on the expo floor free of charge. Manufacturers will have time to network with potential customers and introduce them to new ways to heat their homes, businesses, and schools.

Individual registrants, exhibitors, co-hosts, and sponsors are encouraged to take part in this year's NEBHX.

For more information, be sure to visit <http://nebiomassheat.com/>.

Big News for NYS Geothermal Heating

On February 7, 2017, New York Governor Andrew Cuomo announced a proposal to provide incentives for geothermal heat pumps. This is a \$15 million program, with the maximum incentive to be a \$6000 rebate. This news just came out as Green Energy Times was preparing to go to press. More will be coming in our next issue. Meanwhile you can learn more at <http://bit.ly/NYSERDA-policy-framework>.

2017 NY-GEO Conference

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New York needs to cut all greenhouse gas emissions to meet its reduction targets. Attendees at the third annual NY-GEO 2017 Conference can

learn how geothermal heating and cooling can help meet that need.

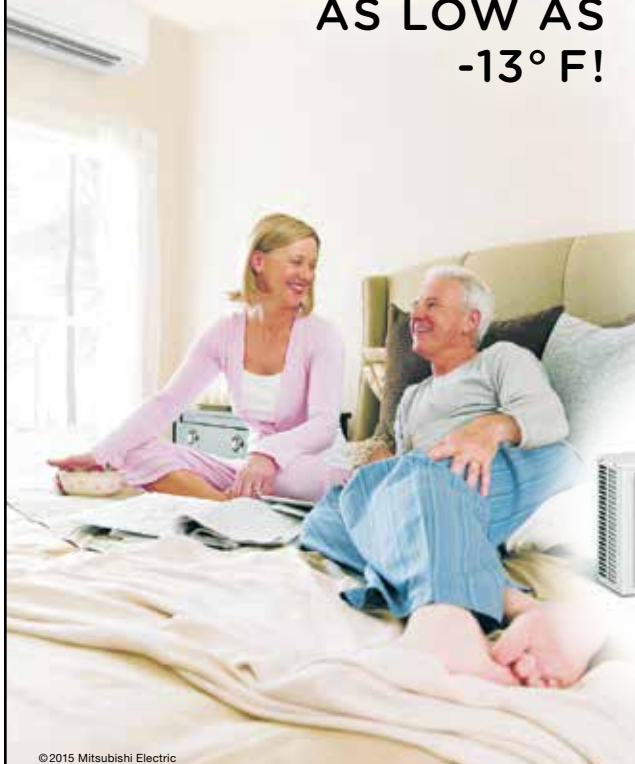
The conference will be held at the Wolf Road Radisson in Albany, NY on April 19 -20. The Conference features two main workshop tracks on the latest technology and policy advances:

- Sustainability track, for engineers, architects, consultants, and policy-makers is eligible for credits.
- Best Practices track provides information for installation contractors, drillers, building owners, and managers.

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RESOURCES

350-Vermont: General group that coordinates a variety of statewide actions.
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American Council for an Energy-Efficient Economy: Consumer guide to home energy savings - aceee.org/consumer

American Solar Energy Society (ASES): www.ases.org

Backwoods Solar: Specialty: solar, off-grid - www.backwoodssolar.com

Buildings Energy Data Book: buildingsdatabook.eren.doe.gov

Carbon Tax: carbontax.org

Clean Power Estimator: www.consumerenergycenter.org/renewables/estimator

Consumer Guide to Home Energy Savings, Heating, Appliances, Refrigerator Guide, Building Envelope, Driving: <http://aceee.org/consumer>

Dept. Public Svc. (CEDF): publicservice.VT.gov/energy/ee_cleanenergyfund.html

Dsireusa.com: www.dsireusa.com Renewables & Efficiency. Find state, local, utility, & federal incentives for renewable energy & energy efficiency.

Efficiency VT: This is a must-go-to site for immeasurable amounts of info. www.efficiencyVT.com

Energy Efficiency & R/E Clearinghouse (EREC): eetd.lbl.gov/newsletter/CBS_NL/nl6/Sources.html

Energy Efficiency & Renewable Energy Clearinghouse (EREC): eetd.lbl.gov

Energy Guide: Unbiased advice about today's energy choices. Find ways to save, lower your bills & help the earth's environment - www.energyguide.com

Energy Star Federal Tax Credits: www.energystar.gov/tax_credits.

Federal Energy Regulatory Commission (FERC): www.ferc.gov

Federal Energy Regulatory Commission(FERC): www.ferc.gov

Find Solar: www.findsolar.com

Fossil Fuel Freedom: Group working to make Vermont's energy plan 100% free of fossil fuels:
To join this group go to: groups.google.com/group/fossil-fuel-freedom

Greywater Info: www.oasisdesign.net/greywater

Home Energy Saver: Interactive site to help you identify & calculate energy savings opportunities in your home. A lot of great information! - hes.lbl.gov

Home Power Magazine: www.homepower.com

IREC/ Interstate Renewable Energy Council: RE educational info. www.irecusa.org

NABCEP/ North American Board of Certified Energy Practitioners: This organization that tests & certifies PV system installers. Individuals are Certified, companies are not. www.nabcep.org

NESEA/ Northeast Sustainable Energy Assoc.: www.nesea.org

National Association of Energy Service Co. (NAESCO): www.naesco.org

National Renewable Energy Laboratory (NREL): www.nrel.gov

National Solar Institute: www.nationalsolarinstitute.com

NeighborWorks® Alliance of Vermont: Low-cost energy loans - www.vthomeownership.org

New Hampshire Sustainable Energy Assoc. NHSEA Focused on N.E. US, for consumers & industry- RE & clean building info, events. www.nhsea.org

New York Solar Energy Industries Association/NYSEIA www.nyseia.org

NFRC independent rating & labeling system for the windows, doors, skylights www.nfrc.org/

NH Office of Energy and Planning: www.nh.gov/oep/programs/energy/RenewableEnergyIncentives.htm

Renewable Energy World: www.renewableenergyworld.com

Renewable Energy Vermont: www.revermont.org

SEIA/ Solar Energy Industries Association: The SEIA Tax Manual to answer your solar related tax questions. www.seia.org

SmartPower: www.smartpower.org

Solar Components: www.solar-components.com

Solar Living Source Book: realgoods.com/solar-living-sourcebook

Solar Power Rocks: Impressive data and info ,including per state. www.solarpowerrocks.com/

Solar Store of Greenfield, MA Stock & install a wide variety of solar & environmentally friendly technologies. SolarStoreofGreenfield.com

Tax Incentives Assistance Project (TIAP): www.energytaxincentives.org

The Energy Grid: www.pvwatts.org

The Office of Energy Efficiency & Renewable Energy (EERE): develops & deploys efficient & clean energy technologies that meet our nation's energy needs - www.eere.energy.gov

Track the Stimulus Money: www.recovery.gov/Pages/home.aspx

Vermont Energy and Climate Action Network (VECAN): works to start and support town energy committees as a powerful, people-powered response to realizing a clean energy future. www.vecan.net.

Vermont Tar Sands Action: Group working to stop the XL Pipeline and any other developments stemming from the Alberta Tar Sands. To join this group go to: groups.google.com/group/vt-tar-sands-action

VPIRG: understand the clean energy resources available to VT - www.vpirg.org/cleanenergyguide

VT Energy Investment Corporation (VEIC): nonprofit organization that issues home energy ratings for new & existing homes. 800-639-6069 - www.veic.org

Weatherization, Energy Star & Refrigerator Guide: www.waptac.org

www.susdesign.com Online info for solar benefit with house design: overhangs, sun angle & path...

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Teen girls see big drop in chemical exposure with switch in cosmetics

By Sarah Yang | Berkeley News



The shampoos, lotions and other personal care products you use can affect the amount of endocrine-disrupting chemicals in one's body, a new study shows. (iStockphoto)

A new study led by researchers at UC Berkeley and Clinica de Salud del Valle de Salinas demonstrates how even a short break from certain kinds of makeup, shampoos and lotions can lead to a significant drop in levels of hormone-disrupting chemicals in the body.

The shampoos, lotions and other personal care products you use can affect the amount of endocrine-disrupting chemicals in one's body, a new study showed. (iStockphoto)

The results, published today in the journal *Environmental Health Perspectives*, came from a study of 100 Latina teenagers participating in the Health and Environmental Research on Makeup of Salinas Adolescents (HERMOSA) study.

HERMOSA is a community-university collaboration among UC Berkeley, Clinica de Salud del Valle de Salinas, and a team of youth researchers from the CHAMACOS Youth Council, a project to involve young people in public health and the environment.

Researchers provided teen study participants with personal care products labeled free of chemicals such as phthalates, parabens, triclosan and oxybenzone. Such chemicals are widely used in personal care products, including cosmetics, fragrance, hair products, soaps and sunscreens, and have been shown in animal studies to interfere with the body's endocrine system.

"Because women are the primary consumers of many personal care products, they may be disproportionately exposed to these chemicals," said study lead author Kim Harley, associate director of the UC Berkeley Center for Environmental Research and Children's Health. "Teen girls may be at particular risk since it's a time of rapid reproductive development, and research has suggested that they use more personal care products per day than the average adult woman."

Analysis of urine samples before and after a three-day trial in which the participants used the lower- chemical products found significant drops in levels of these chemicals in the body. Metabolites of diethyl phthalate, commonly used in fragrances, decreased 27 percent by the end of the trial period. Methyl and propyl parabens, used as preservatives in cosmetics, dropped 44 and 45 percent respectively. Both triclosan, found in antibacterial soaps and some brands of

toothpaste, and benzophenone-3 (BP-3), found in some sunscreens under the name oxybenzone, fell 36 percent.

Surprisingly, there was a small increase in concentrations in two less common parabens. Those levels were small and could have been caused by accidental contamination or a substitution not listed on the labels, the study authors said.

Kimberly Parra, study co-director, said it was important to involve local youth in the design and implementation of the study.

"The results of the study are particularly interesting on a scientific level, but the fact that high school students led the study set a new path to engaging youth to learn about science and how it can be used to improve the health of their communities," she said. "After learning of the results, the youth took it upon themselves to educate friends and community members, and presented their cause to legislatures in Sacramento."

The CHAMACOS Youth Council included 12 local high school students who helped design and carry out the study. One teen researcher, Salinas native and study co-author Maritza Cárdenas, is now a UC Berkeley undergraduate majoring in molecular and cell biology.

"One of the goals of our study was to create awareness among the participants of the chemicals found in everyday products, to help make people more conscious about what they're using," said Cárdenas. "Seeing the drop in chemical levels after just three days shows that simple actions can be taken, such as choosing products with fewer chemicals, and make a difference."

The researchers noted that cosmetics and personal care products are not well-regulated in this country, and that getting data about health effects from exposure, particularly long-term ones, is difficult. But they say there is growing evidence linking endocrine-disrupting chemicals to neurobehavioral problems, obesity and cancer cell growth.

"We know enough to be concerned about teen girls' exposure to these chemicals. Sometimes it's worth taking a precautionary approach, especially if there are easy changes people can make in the products they buy," said Harley.

Cárdenas said the research findings have already influenced the products she buys for herself.



Ingredient of the Month

By Larry Plesent

ORGANIC DEODORANTS GO MAINSTREAM!

I am not claiming that Cameron Diaz is singlehandedly responsible for the explosion of interest in organic deodorants. But the superstar's announcement that she "has not used antiperspirants in 20 years...they are bad for you..." has sparked the interest from fans and others who have always suspected all was not well in underarm protection land. And she is not alone. Julia Roberts, Joan Rivers, Bradley Cooper and Mathew McConoughey have all come out saying that they avoid conventional underarm protection products.

Responding to this need are a slew of new additions to a marketplace traditionally dominated by only a handful of iconic brands.

EO and Weleda make two of my favorite alternative underarm sprays. Both are very natural, but EO features certified organic ingredients which is why they get my vote for first place in that category. Humans are all very different, and this type of natural underarm spray does not always work for everyone. My wife loves the sprays and never seems to smell stinky. But many active people do much better using organic push-up deodorants; which is why we chose to manufacture solid underarm products at Vermont Soap in Middlebury.

Vermont Soap makes an excellent range of push-up type products that are very effective. Sage Lime is quite nice, but I prefer Spicewoods Extra Strength for that longer lasting protection. Other good

companies to check out include Organic 101, Truly Organic and Naturalnews.com. All of these companies make the grade for using 100% organic ingredients and for their effectiveness. Remember, organic means audited and found to be natural from farm to bottle. In today's globalized market, it is nice to have a product you can actually trust as actually being nontoxic and natural. If you are especially aroma-challenged, try using Vermont Soap's Blue Bar to wash with before using your deodorant. Its double strength tea tree and peppermint blend really seems to help in that department.

'No-no' ingredients in conventional underarm products include triclosan (now banned in Europe) and propylene glycol

(used in typical anti-freeze) which can cause rashes in sensitive individuals. Why risk this? For a few dollars more you can be using a nontoxic and effective product that is safe for sensitive skin.

Switching to organic deodorants is easy (just do it) but here is a tip. When using organic deodorants for the first time, some people sweat more than usual for the first few days. I have no idea why but certain essential oils

can trigger this temporary unintended consequence. You can either bear through it or switch scents until you find the one that works best for your metabolism.

This is The Soapman wishing you and yours an aroma-rific winter!



Image from depositphotos.com.

"Personally, since the study, I've tried to use more organic products," she said. "It's hard, especially as a college student who doesn't have a lot of money. You tend to just get what's on sale. But I've decided to splurge more on products with fewer chemicals because of the effect in the future. And if you can't make the best choice when you're buying because of

cost, you can at least try to limit the use of the products you do buy."

The California Breast Cancer Research Program of the University of California helped support this research. Chemical analyses were performed through Bio-monitoring California, a California Department of Public Health program that tracks levels of chemicals in California residents.



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Elmore Roots' Permaculture Know-How UNDERSTORIES

by David Fried



What if you could grow nine types of fruits and nuts in the space that you would need to turn around with your arms outstretched? If you have one spot in your yard where you can do this and it gets at least one half to three quarters of a day of sunlight, you will be amazed at what you can harvest. Let me tell you how.

All plants that make fruit and nuts need sunlight. If you can arrange them so the tallest ones are to the north and the shortest ones are to the south, you get a

great vertical wall of sunlight penetrating to the leaves of each of your plants and trees. The leaves are like little efficient solar collectors, so they maximize the sun's energy that they get and turn it into fruits and nuts.

Let's start with the shortest choices for trees or bushes. The American Lowbush Cranberry, Swedish Lingonberry and Lowbush Blueberry can all share the mulch layer and only rise up about six to eight inches from the earth. Set them one to two

feet apart and they will fill in the spaces under the shrub layer above them – different varieties for pollination – about four feet apart. (Remember to plant the taller plants to the north so that their understories all get some light from the south).

Above the blueberries, but to the north, you can plant hazelberts and elderberries, two of each, about five feet apart. They will hover above the blueberries but not shade them out, because they are planted

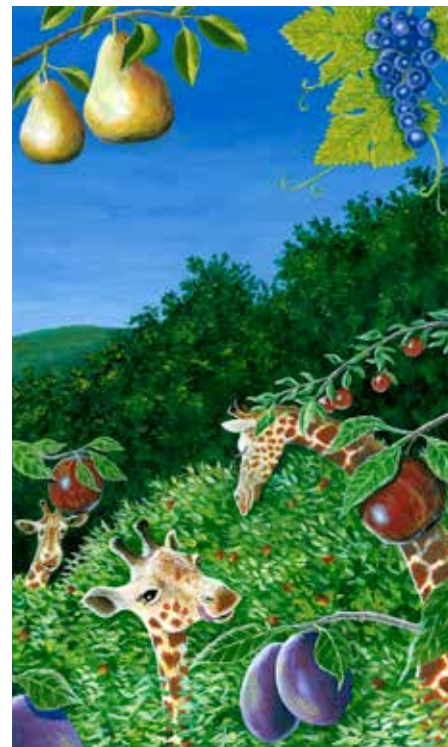
to the north. They also do not mind a bit of shade from the trees that you will plant above them.

Now plant an apple tree. The local pollinators will find another wild apple or flowering crab to pollinate your apple tree. Or, plant two different cultivars of pear trees. Be sure to plant either of these trees to the north of the hazelberts and elderberries. Space these trees about eight feet apart.

That could be the top of your canopy of fruit and nuts, or you can take a few steps to the north and plant a Korean Nut Pine. It is slow growing but over time will grow into a great specimen, visited by birds and squirrels. This tree will also produce your own pine nuts one day, here in the northeast.

Growing tips: keep the ground mulched with bark mulch or grass clippings and add compost each spring.

Before long you will have a fruit and nut grove in a small area. As you sit on a bench nearby, all the songbirds will sing



Paintings by Vermont artist Gabriel Tempesta

Climate Change 2017. What Must Be Done.

Cont'd from p.27



Louisiana flood of 2016. USDA photo.jpg

6% per year rate of reduction for CO2 emissions. Some people say that is implausible, and then, out of the other side of their mouths, they say that we need a plan to reduce emissions by 80% by 2050. I have got news for them. An 80% reduction by 2050 implies approximately a 5% per year reduction, for the common assumption of exponential reduction, i.e., the percent applies to the fossil fuel emissions still remaining, a reasonable assumption, because you take the low-hanging fruit first.

An alternative scheme to get 80% reduction would be linear reduction of emissions, so 80/30, i.e. approximately 2.7%/year, if reductions start in 2020. In this linear case, the percent reduction is relative to 2020 emissions, not relative to the prior year's emissions. The truth may be between these (exponential and linear) cases. There is some truth to the low-hanging fruit concept and the fact that some emissions may be recalcitrant, which favors the exponential approximation. However, if a carbon fee rises gradu-

ally over time, the linear case might be a better approximation.

The important point is that the reduction rate to achieve 80% reduction by 2050 is conceivable. However, it will not happen unless the world comes to its senses in the next few years and agrees that it is necessary to have an across-the-board (oil, gas, coal) rising carbon fee collected at domestic mines and ports of entry, thus making the price of fossil fuels more honest by including their costs to society. This would make economies more efficient and spur economic growth.²

Jim Hansen is the Director of the Climate Science, Awareness and Solutions Program at the Columbia University Earth Institute.

¹ 1 GtC = 1 gigaton carbon = 1 billion tons carbon = 1015 grams carbon = 1 petagram C = 1 PgC; so a GtC is exactly the same as a PgC. Much of the community seems to be switching to PgC, but here I still use GtC. Also note that we give the mass of carbon, not the mass of CO2, because the atomic mass of C = 12 and O = 16, the CO2 mass exceeds C mass by a factor 44/12 (~3.67). Fossil fuel emissions today are ~10 GtC, easy to remember.

² It takes two to dance. I have always said that it requires an agreement between either U.S. + China, Europe + U.S. or Europe + China to be made near-global via border duties on products from non-participating countries and rebates to manufacturers for products shipped to non-participating countries. I had thought that either pair involving Europe was unlikely, because, as the Science Adviser to the European Commissioner said, pointing to a building of EU bureaucrats, "you need to persuade them." However, recently there are some murmurs in the EU about the carbon fee concept, albeit not yet by the major parties, so, given other political developments, maybe it is possible for Europe to play a leading role, despite its current struggles.

their thanks to you, the squirrels and butterflies will visit you more often and the now rich soil life will twist and turn in their rich and fluffy earth world. You are now the creator and director of this simple but intertwined new creation called "understories." The trees and shrubs will now do the work while you enjoy the view and the harvests.

David Fried is the propagator, grower and writer at Elmore Roots Nursery in Elmore, VT.

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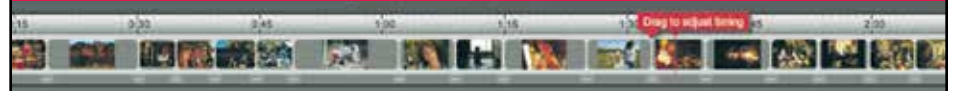
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Winter in the Permaculture Home Kitchen

By Kay Aihla McGrenaghan Cafasso



Elderberry syrup made with honey and dried elderberries.

Permaculture design and gardening continues all year, even when the growing season is at rest. It is essential to continually ask: How we can we be more efficient with our time and energy, live with greater health consciousness, meanwhile working with our locally available resources.

Looking ahead towards the 2017 gardens, it is helpful to consider during mid- winter:

- What foods do we wish we had grown more of?

- Is there enough dried tea or garlic stored for our family? What medicines can we grow at home, infusing our care into our own backyard 'farmacy'?
- Would a root cellar be feasible as a new structure or can we insulate an area in the cellar?
- What fresh greens can we grow on our windowsill or counter top?
- Where is the best location for a cold frame to access fresh, cold hardy greens in the snow?
- What foods shall we grow for fermentation in our garden?
- Do we need to plant more native pollinator habitat or more at risk plants?
- Are we doing our part to sequester carbon in our home landscape?

The answers to these questions will influence our design for next year. We are looking at the successes and failures of the previous season, considering the whole system of time management, volume and quality of our harvest, resource and nutrient cycling, placement of elements for the most efficient relative location, etc. Of course, we are also looking at areas that we have not yet considered as potential for food production until now, and surveying soil, light, slope, access, and water conditions. Now is the perfect time to dream up our 'arden', a yard turned into a garden! We want to spring right in with spring weather, so meeting with permaculture designers for an onsite consultation, perusing seed catalogs with friends, or attending a permaculture training course yourself are great ways to start while the land is covered in snow.

Permaculture design also applies to the layout of space and place in our home. While we may be missing the activities of the growing season, we can set up these areas during winter:

- Dry herbs in a shaded and well ventilated area; dry fruits with a dehydrator; set up fermentation crocks to make sauerkraut, beet kraut, kimchi, or brew healthy drinks like beet kvas, etc.;
 - Start a worm bin for vermi-compost in or near the kitchen (don't worry, it won't smell bad as long as you balance the moisture level correctly, and the worms won't climb out since they prefer darkness under the soil);
 - Set up buckets of sand in a cold room or cellar and store root crops (once harvested from the field they can be placed carefully in damp sand, don't allow any vegetable to touch a neighboring vegetable, nor the wall of the bucket, to prevent them from rotting). If space allows, set up a larger root cellar, or join a local winter CSA;
 - Sprout seeds and beans for fresh nutrition grown locally at home;
 - Save money by making your own elderberry syrup and fire cider to keep your immune system strong.
- A good permaculture design integrates your lifestyle with the

specific site conditions, so during winter it is important to note how rewards of the growing season are felt in the kitchen and in our bodies. A good permaculture design also opens up many possible healthy adjustments to our lifestyle that stem from our own abundant landscape. When making decisions about how to facilitate a landscape, there is a kind of magic we can strike. This magic happens when we balance the two influences of site possibilities and our lifestyle, since they continually and reciprocally inform one another.

Kay Aihla McGrenaghan Cafasso is the Director of Sowing Solutions, a permaculture design and educational center based in Western Massachusetts. Learn more at www.PermacultureSeries.org and www.SowingSolutions.org.



Winter growing ideas - sauerkraut and sprouts. Courtesy photos: Kay Aihla McGrenaghan Cafasso

INDOOR SALAD GARDENING

How to grow nutrient dense soil sprouted greens in less than 10 days

By Peter Burke.

196 pages. Chelsea Green Publishing. © 2015, \$29.95

Book review by N.R. Mallery

Part of sustainability is taking responsibility and being accountable for our needs. While Green Energy Times focuses much attention on renewable energy, building efficiency, and energy efficiency, another very important part of sustainable living is being responsible in our choices about the food that we eat. This is important for on-going health and well-being, both for ourselves, and for the planet.

How do you do this if you live in an apartment? What if it is winter and money is tight? How about a case where you are off-grid where grow lights are not an option due to their heavy energy load? Readers of Indoor Salad Gardening may find answers to these

questions are easier than expected. It is a low-tech approach that can result in an abundant harvest all year round, even without grow lights, even in the dead of winter, with 14 inches of snow on the ground.

Indoor Salad Gardening is for everyone. It starts a new gardener off with things nearly anyone can do year-round indoors,

such as growing fresh lettuce and salad ingredients. This is followed by growing vegetables to cook and sprout gardening. The book is for the advanced gardener, as well, with explorations of such subjects as tips and recipes for growing mediums and how to compost the roots of plants that were harvested to produce new soil.

Author Peter Burke has had years of experience growing fresh salad greens throughout the entire year, including the winter months. He has done this with no lights, no pumps, and no greenhouse, in little more than a cupboard and a windowsill. He has shared his methods in this marvelous book. It gives great directions, amply supported with photographs, to bring farming know-how inside.

There are a number of advantages to growing vegetables in the home. They are far more nutritious than produce that has been trucked from across the country or flown in from overseas. They are fresher and taste better. They can be organically grown at



A farm on a window sill. Photos: Chelsea Green Publishing.

very low cost. They are much better for the planet, because vegetables, even if organically grown, are usually grown and transported using fossil fuels.

Among the things I like about this book are the small investments required to get going, the approach to recycling and reusing containers and planters, the attention to organic growing, the small space requirements, and nearly no ongoing cost. A tiny bit of planning makes it possible to have one harvest come right after another, through the year.

There is a section of frequently asked questions and trouble shooting. The methods used, however, are simple enough that many people will have little need to consult them.

I recommend this book highly for everyone. The benefits of absolutely fresh, high quality, organic vegetables are well known. The amount of time, space, and money invested in having them are not obstacles. Not only does Peter Burke put great food within reach of just about everyone, he makes it an easy and enjoyable way to get great nutrition.

I am certain about this one. I highly recommend the book. I look forward to starting an indoor salad garden of my own.

N.R. Mallery is the publisher of Green Energy Times and an avid gardener.



LIBERATING SCIENCE

Cont'd from p.1

quickly found that they could be used to show that climate change was well under way, simply by comparing them with the 1990 maps. The White House ordered the USDA to withdraw the 2005 maps and replace them with the old ones.

This cover-up did not work, however. The National Arbor Day Foundation (NADF) was one of several organizations that quickly produced accurate maps to replace the ones used by the government to cover up data. Now, the NADF issues up-to-date maps more regularly than the USDA did. (<http://bit.ly/arbor-day-zone-changes>)

The people, organizations, and states of this country can take on the job of keeping science alive in a day when "alternate truths" are issued from the central government. Even the hard jobs of organizing satellites to do research and getting detailed information to those who need it are within our grasp.

If the amateurs running the show in Washington insist on ignoring the facts, offering alternatives to truth, and silencing scientists, then they will not last long. Reality has a habit of being very present in the real world, and it is not dependent on the wishes of those who find it disagreeable. Reality cannot be trumped.

As more and more businesses and increasing numbers of people see that climate change is causing scores of billions of dollars in damages each year, the political influence of climate-change denial will fall on fewer and fewer attentive ears. Our job is to limit the damage until that time. It is coming very, very soon.

LEARNING TO LIVE Without Plastic

by Anne Brice, Berkeley News | Jan. 9, 2017.



Professor Minoo Moallem challenged her students to avoid using plastic for 24 hours in her class "Objects and Commodities." (UC Berkeley photo by Anne Brice)

Tiffany Ma could not brush her teeth. She could not pour her cereal. Or even check her email. Well, she could. But she promised she would not.

She was taking a UC Berkeley course called "Objects and Commodities," and she and her classmates were embarking on a lofty challenge: Don't use anything made of plastic for 24 hours. So far, so good.

Then she popped in her contacts. That's when she realized how hard avoiding plastic was going to be. She braced herself for a long day.

"Plastic is so integral in our daily lives," said Ma, a fourth-year student in molecular and cell biology. "We really take it for granted."

Throughout the day, Ma tried her best to avoid plastic. She used her refillable water bottle, passed up her morning to-go cup of coffee and wrote with pencils instead of pens. But there were some things she could not avoid. She needed her phone to communicate and her laptop for research. And she needed her makeup that day — it had been a stressful week and her skin was not at its clearest.

Minoo Moallem, a professor of gender and women's studies who teaches the class, says that while she knew finding alternatives to plastic would be incredibly difficult, if not impossible, the exercise raised awareness of how reliant we are on plastic.

"Plastic is so much a part of who we are," she says. "Students came to realize that they can make tiny changes to damage the environment less. When our relationship with plastic changes, then our relationship with the environment will change."

Moallem isn't the only professor on campus integrating concepts of sustainability into her courses. More than a dozen professors across a range of departments, from architecture to African American studies to nuclear engineering, are working to incorporate content related to carbon neutrality, climate change and sustainability into their undergraduate course material.

It's all part of UC's Carbon Neutrality Initiative. Announced in 2013 by President Janet Napolitano, the initiative commits UC's 10 campuses to become carbon-neutral by 2025. That means reducing emissions from its buildings and vehicle fleet by about 80%, or 115,000 metric tons.

Spearheading the Berkeley campus's push for carbon neutrality is



Jacobs Hall on Berkeley's campus has platinum certification from the U.S. Green Building Council's LEED program. (Photo by Ryan Jang)



Undergraduate Tiffany Ma tried her best to avoid using plastic for 24 hours, but quickly realized it was going to be harder than she thought. (UC Berkeley photo by Anne Brice)

the Cal Climate Action Partnership, part of the Office of Sustainability and Energy, made up of a coalition of students, faculty and staff. The group has led hundreds of projects on energy efficiency, transportation, waste, water and travel, all working to lighten the campus's carbon footprint.

By encouraging faculty to incorporate sustainability content into their curriculum, the campus hopes to inspire students to apply these concepts in their fields of study. Moallem says that while sustainability might not seem to relate to gender and women's studies, it's actually quite relevant.

"Older generations had sustainable ways of living," she says. "Many of them were developed by women. They were experts in recycling, reusing, preserving, maintaining. But that is now lost. It's a wealth of knowl-

edge that we don't have access to anymore."

Part of the reason it's been lost, she says, is that we, as a society, don't regard what was traditionally considered "women's work" — everything from childcare to nutrition to identity and memory — as significant and meaningful.

"That kind of knowledge isn't considered a form of knowledge," she says. "I think we need to do tons of research and bring back this kind of forgotten knowledge into people's everyday lives."

Learn more about Berkeley's sustainability initiatives at the Office of Sustainability and Energy's website.

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Source: <http://bit.ly/no-plastic>.



Moallem says older generations of women were experts in recycling, reusing and preserving — knowledge she says we need to bring back into our everyday lives. (Photo by DurhamDundee via Flickr)

Global Warming Hiatus

Cont'd from p.23

Correcting other biases in ship records

In the same publication last year, NOAA scientists also accounted for changing shipping routes and measurement techniques. Their correction — giving greater weight to buoy measurements than to ship measurements in warming calculations — is also valid, Hausfather said, and a good way to correct for this second bias, short of throwing out the ship data altogether and relying only on buoys.

Berkeley's analysis of ocean buoy (green) and satellite data (orange) and NOAA's 2015 adjustment (red) are compared to the Hadley data (purple), which have not been adjusted to account for some sources of cold bias. The Hadley data still underestimate sea surface temperature changes. (Zeke Hausfather graphic)

Another repository of ocean temperature data, the Hadley Climatic Research Unit in the United Kingdom, corrected their data for the switch from ships to buoys, but not for this second factor, which means that the Hadley data produce a slightly lower rate of warming than do the NOAA data or the new UC Berkeley study.

"In the last seven years or so, you have buoys warming faster than ships are, independently of the ship offset, which produces a significant cool bias in the Hadley record," Hausfather said. The new study, he said, argues that the Hadley center should introduce another correction to its data.

"People don't get much credit for doing studies that replicate or independently validate other people's work. But, particularly when things become so political, we feel it is really important to show that, if you look at all these other records, it seems these researchers did a good job with their corrections," Hausfather said.

Co-author Mark Richardson of NASA's Jet Propulsion Laboratory and the California Institute of Technology in Pasadena added, "Satellites and automated floats are completely independent witnesses of recent ocean warming, and their testimony matches the NOAA results. It looks like the NOAA researchers were right all along."

Other co-authors of the paper are David C. Clarke, an independent researcher from Montreal, Canada, Peter Jacobs of George Mason University in Fairfax, Virginia, and Robert Rohde of Berkeley Earth. The research was funded by Berkeley Earth.

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WOODSTOCK ARENA SOLAR

Cont'd from p.12

dramatically with each subsequent tier of work.

The chart below shows how annual energy costs will be reduced by the four-tier plan.

How does the Board's four-tiered plan look in terms of dollars saved through energy cost reductions? Here's the breakdown:

- **TIER 1:** Refrigeration plant overhaul: savings of \$20,000
- **TIER 2:** HVAC Upgrade: savings of \$20,000
- **TIER 3:** Solar farm: savings of \$50,000
- **TIER 4:** Complete system integration: savings of \$50,000
- **TOTAL SAVINGS:** \$140,000

This project will be expensive — a sizeable \$1.4 million dollars. The fundraising

began earlier this year, even before the project was publicly launched, and the arena has already raised about one-third of their \$1.4 million.

Across the country, rinks large and small are always looking for innovative ways to save energy -- and therefore money and carbon. The National Hockey League's Greener Rinks initiative is sharing best practices with the small community rinks. Here are some examples:

At the University of Colorado, excess heat from the skating rink's refrigeration system is used to heat the water in the swimming pool.

Paul Moore, the chairman of the Board of Governors for Falmouth Youth Hockey in Massachusetts and the coach of the Falmouth High School hockey team, has reduced his community's facility's electric bill by installing 4,400 solar panels on the roof and in a nearby parking lot that produces just short of one megawatt of electricity, enough for about 164 homes. The

Falmouth Arena was featured on the cover of the Dec. 15, 2016 issue of Green Energy Times, and we believe that it is actually the first net-zero skating rink in the U.S. <http://bit.ly/GET-12-16>.

And then, there's Canada.

Blogger Colleen O'Shea, a self-identified "hockey mom," who has written in the online journal "Re-surfacing" (12/22/16) about the Woodstock Arena's plans to net-zero

their facility, has also written an interesting piece about the town of Kapuskasing, Ontario, where the town council has decided to go "almost off the grid" with its recreation center. She writes, "Going off the grid is an idea that municipalities and arena owners sometimes dream about...but not many have the courage to take that big step forward. Not so with the Town of Kapuskasing. This northern Canadian lumber town decided to take their 40-year-old recreation center nearly off the grid in an effort to reduce its yearly energy spending. By installing modern equipment and creating electricity by using cheap natural gas, their savings would cover the financing costs of the project, with a 25-year savings estimate of \$4.775 million."

The Kapuskasing Regional Conference Complex (a.k.a. the "Sports Palace") is a true community complex with a kitchen, meeting rooms and a stage, as well as a twin pad for skating and five curling sheets. One of the twin pads is used for off-ice activities from May to August; the other is used year-round. In 2017, the Town will be adding an indoor swimming pool to the complex. The proposed new energy system was budgeted at \$2 million.

In the fall of 2015, when the Kapuskasing town council approved the overhaul, the annual energy costs for "Sports Palace" was \$260K. The projected energy usage after the installation would see that number halved—down to \$130K. It would give the facility a new, energy-efficient mechanical/electrical/controls system, including superior ice-making equipment for harder, better quality ice; replacing the existing ammonia plant with a system using bio-degradable, food-grade glycol; and monitoring software and automatic controls to simplify maintaining the ice.

So, although the Woodstock Arena is not the only facility to explore innovative methods of energy conservation and financial solvency, it is certainly at the head of its class. Mayhew hopes that the



Union Arena Community Center, Woodstock, VT. Courtesy photo.

net zero goal can be reached in about two years, and that it will be an example for other rinks.

It is an excellent example indeed.

The Woodstock Union Arena is located at 80 Amsden Way, Woodstock, VT (802) 457-2500. Learn more at unionarena.org.

Barbara Whitchurch is a Board Member of Vermont Passive House, a non-profit dedicated to educating the public about the concept of Passive House and promoting the Passive House Standard among architects, builders and state government (phausvt.org). She is the co-owner of a certified passive house in Middlesex, Vermont. She is a freelance editor, writer and jewelry artisan, and the pet parent of the world's greatest Great Pyrenees, Bailey.



The Falmouth, MA ice arena has 3,300 solar panels on its roof. Courtesy photo.

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