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It's An Emergency!

2050 IS NOT SOON ENOUGH FOR A FIX

George Harvey

Shishmaref, Alaska, is falling into the sea. Photo: Alaska Department of Commerce, Community, and Economic Development.

Some among us could look at the fact that the United Kingdom adopted a law mandating that it be 100% carbon free by 2050 as good news (See CleanTechnica, http://bit.ly/CT-UK-net-zero-law). And CNN has told us New York City has set its climate goal, as well (http://bit.ly/CNN-NY-carbon-target). There was a time when I would have rejoiced. But that time has passed.

It is clear to me that net-zero carbon by 2050 is too little, too late. This is because, while we denied, dithered, or indulged in NIMBYism, things have changed. The evidence is mounting that climate change is now completely out of control, and we have to start actively removing carbon dioxide from our environment, as quickly as we can.

When I say things are out of control, I am not talking about a worst-case scenario. It is becoming increasingly clear that we have gone beyond what most people would consider a worst case. Trying for 100% carbon-free by 2050 is just so much hot air in a world warming much too fast.

This year's record-breaking heat wave in France was not just record-breaking. According to BBC News, it broke the previous record, set only a few years ago, by 3.25°F (http://bit.ly/BBC-Paris-heat). This not just breaking a record, it is smashing it utterly, making it irrelevant. This happened because the jet stream got stuck, pushing Saharan air into Europe, which has happened before and will happen again. The problem is that it is hotter than ever before, but we can bet it will almost certainly happen again, because what is normal is changing.

The record heat in Europe is happening at the same time that a long drought plaguing India has turned for the worse.

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Higher Prices for Beer with Climate Change

Beer. Iva Balk, Wikimedia Commons

Most beer is made from barley malt. Perhaps the greatest reason for this is that barley malt, which is dried sprouted barley grains, is particularly rich in amylase, an enzyme that can break down starch into the much smaller sugar molecules yeast use for food. Other grains and starch sources are not so able to do this, so many beers with wheat of rye in them contain large amounts of barley malt to provide extra amylase.

It happens that some of the people who really like beer are climate scientists, so it should not be surprising that a group of them modeled the availability and cost of crops as climate change worsens, as it certainly will. One such group of scientists includes researchers in the China, the U.K., and the U.S. They looked to find out how much barley could be grown in a warmer world, how much it would cost in a market with demand like that of today, and what the effect would be on the cost of beer. In the end, they gave their results in terms of a simple metric: What will the price of beer be, under various climate scenarios?

Barley was actually only one of the ingredients that they examined for their study. For example, they also modeled supplies and prices for hops, another important ingredient of beer. They also examined the potentials for agriculture in new places, such as Canada, where more barley could be grown, and the possibilities for current major pro-

Cont'd on p.21

BUSINESSES TO THRIVE IN A COMING ECONOMIC BOOM

George Harvey

ORPC, based in Portland, Maine, develops generating technology based on moving water. This RivGen power system now provides power to a village in Alaska. Photo from Ocean Renewable Power Company.

Here at Green Energy Times, we see an impressive amount of real news. It leads us inescapably to an understanding that is a little different from some things one hears today. We have come to a strong belief that, unless we go seriously astray, we could be heading into an economic boom that will be unlike anything ever seen before. And that is because climate change is almost without doubt the biggest business opportunity ever to face humanity.

There are fearmongers who go on endlessly about how bad things will be if we try to get all our energy from renewable resources. Groups paid for by fossil fuel interests talk about the trillions of dollars that will have to be spent on new infrastructure. They talk about lack of reliability and increased costs. We should remember, however, that there could be a causative relationship between who supports them and what they say.

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Green Energy Times would like to thank everyone who has submitted articles or helped in any way to make this all a reality. We want to also thank our advertisers & ask that you support them. Say that you saw them in *Green Energy Times*. Now let's all *G.E.T.* moving ahead towards a dean, renewable future – one where our children & grandchildren will be able to breathe & grow, live & love on this beautiful planet where we live.

Thank you for reading *G.E.T.* Please send your comments & suggestions to: info@greenenergytimes.org

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Upper Valley Electric Vehicle Expo: Sept. 14th

Electric Vehicles (EV) have been growing by leaps and bounds. There are now eighteen plug-in hybrid and eighteen all-electric models available at dealerships in Vermont, and twelve of the all-electric models have a range over 200 miles. Vermont EV registrations just topped 3000 vehicles and there are used EVs appearing for sale. Charging station locations have been steadily growing, and dealers are starting to stock and display electric cars.

Drivers can learn more about and test drive EVs at the fifth Upper Valley Electric Vehicle Expo on Saturday, September 14 from 11 a.m. to 3 p.m., at the Dothan Brook School on Route 5 in Hartford, VT. Numerous electric car, motorcycle and bike owners and dealers will be displaying their vehicles, answering your questions, and offering test rides for a first-hand experience. Starting at noon, there will be workshops by Dave Roberts from Drive Electric Vermont, Green Mountain Power and others on EV charging technology, costs, financing, policy and more. A selection of battery-driven lawn and garden tools will be on display, and several solar companies will be on hand to talk with you about using the sun to charge your EV.

EVs on display at the 2018 Upper Valley EV Expo for National Drive Electric Week. Image: Dave Roberts.

There are many reasons to change over to an electric vehicle. They are much cleaner than a gasoline-powered car and better for our health and the environment (assuming 'clean' sources of electricity, of course). They cost about half of what a gas car costs to fuel up and maintenance costs are a fraction too, because there are no oil changes, no exhaust systems, and brakes last longer from using the motor as a generator to recharge the battery while braking and stopping. They accelerate quickly for easy highway access. They are also quieter and ride very nicely with the weight of the batteries down low in the vehicle, adding stability during cornering and in bad weather.

There will be free refreshments contributed by Hanover Food Co-op, King Arthur Flour and others, including King Arthur Flour cookies baked on site in Solaflect's solar-powered oven.

This Expo is free and open to everyone. If you would like to attend, volunteer to help, or bring your EV to display, please go to our website and sign up. Everyone registering will be entered into a free raffle. Sponsor information and more details are on the website at www.uvevexpo.org.

The Upper Valley (UV) EV Expo is organized by several UV town energy committee members, with help from the UV Sierra Club and Vital Communities, as part of National Drive Electric Week, which is presented by Sierra Club, the Electric Automobile Association, and Plug in America.

Local sponsors who are helping to make this event possible include: Catamount Solar, Cyclewise, Green Mountain Power, Lyme Green Heat, Norwich Solar Technologies, Omer and Bob's, ReVision Energy, Solaflect Energy, Sun Catcher, SunCommon, and Team Nissan North. ♻

Upper Valley
ELECTRIC VEHICLE
EXPO
Sat 9.14.19 11-3pm Dothan Brook School UVEVexpo.org

Where: Dothan Brook School, Route 5, Hartford, VT
When: Saturday, Sept. 14th from 11am to 3pm
Rain or Shine!

What:
Test drives & rides with local electric vehicle dealers & owners
Electric car, bike and motorcycle owners & dealers will answer your questions
EV technology, options, charging & cost presentations
Solar opportunities including solar EV charging
FREE REFRESHMENTS!!!

Why Electric Vehicles:
Half the cost to fuel up as gas cars
Cheaper maintenance - no oil changes, no exhaust systems, and brakes last longer by using the motor to slow down
Quick acceleration and fun to drive
Cleaner, and better for our health and our environment

More info at **www.UVEVexpo.org**:
Sign up to attend, show your EV or volunteer. Registrants are entered into a free raffle. **This event is free and open to all!**

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MOVEMENT ON DECARBONIZATION

Serious Step Forward Thwarted in Oregon

J. D. Kaplan

"Send bachelors and come heavily armed," says one Oregon state senator to taunt his governor, Kate Brown. She literally sent the police over to nab him and the rest of the Senate Republicans hiding with him in Idaho. Gov. Brown wanted a vote on her climate bill, but their absence prevented the achievement of a quorum. No lawmaking can take place without it. Other threats of violence volleyed over this proposal and it folded at the end of June 2019.

It would have addressed, as best a government can, economic incentives that have led us into the climate-warming trend. A well-designed carbon market can rework those incentives in an economy, so that it releases much, much less heat and carbon, given a few decades and sane, amenable politicians.

If there is any good chance, we survive the heating of the Earth, detailed in this issue on page 27 of G.E.T. by Dr. Hansen's thorough contribution, it'll be from our slow rotation of the world's ship of industry and land use from dependency upon carbon emissions and toward a mostly decarbonized industrial world. We will produce some small fraction, yearly, of the CO_2 and other greenhouse gases (GHG) that humanity releases now, and probably scrub that remainder on the fly, in the intended, stable result.

Civilization can, in this way, be carbon-independent by design. If we make that transition in time, it will have been from commitment to major, thorough policy initiatives like the one narrowly avoided in Oregon this past month.

The Senate Republicans evidently thought it was a good idea to hide in Idaho. Photo: Sebastian Bergmann, Wikimedia Commons, CC-BY-SA 2.0 Generic.

Democrats in Oregon tried to pass a bill that would have added one to the number of U.S. states abiding a cap-and-trade system of account for carbon release across its whole economy. A carbon market of this kind allows a government to prod the economy to phase out continual release of CO_2 by anybody within its boundaries. Other gases can be targeted and, on a hundred-year time scale, eliminated as well; nothing need be made illegal or contraband to make it work. You'd still be able to fill a tank with available fuels and burn it, or make your own biofuels and burn them with impunity. It's a system of taxation and does not target any industry or business directly for punishment. When well-conceived and executed, in fact, no group should suffer inordinately—not even distance commuters.

This is decarbonization. It took some ambitious plans by the governor and her team to assemble; it is not clear to me why these plans shriveled up the Republican will to participate in legislative session, but this is the effect that it had. Oregon already has climate-concerned machinery in place and operating. In fact, the first American law to target carbon output was passed there in 1997.

To move toward a modern industrial world that is yet decoupled from carbon, many engineering options and a wide variety of policy tools will be tried. It is always sparked by one essential change on the playing field, though, one fundamental weight added into the political economy (http://bit.ly/Oregon-CAP). This is the introduction of a cost, a real monetary value necessary for exchanges we make with Mother Nature, as we do anything that releases carbon into the atmosphere, or ends up doing so. A value has to be attached to carbon in the unit of exchange, the local currency, so that our impact can be quantified. Carbon release is tied to just about everything we do to build the world we make for ourselves—modern, comfortable, and technocratic.

However, it doesn't *Cont'd on p.18*

VERMONT'S 2019 LEGISLATIVE UPDATE

Jessie Haas

The rap on the 2019 Vermont legislature is that they didn't get much done—notably, for climate activists, any kind of carbon pricing scheme – or the "Global Warming Solutions Act," which would require the state government to act on Vermont's climate pollution goals. So when I saw a photo of the Climate Caucus meeting post-session, I sent a message to my senator, Senate Majority Leader Becca Balint, to ask what they were all looking so proud of. She got back to me with a long list, which included additional funding for weatherization and electric vehicles, a high-profile bill to ban single-use plastic, and a bill that would allow schools to get more of their energy from solar power.

Above: The Climate Solutions Caucus; right: Youth Climate Presser. Images courtesy of VPIRG

A deeper dig, courtesy of VPIRG's Ben Edgerly Walsh, reveals that the weatherization and EV efforts fall well short of an emergency response. The one-time, approximately $4.5 million increase in weatherization funding for low- and moderate-income people will tighten up about 1400 homes. Sounds good, but according to an analysis by the Energy Action Network, Vermont needs to weatherize 90,000 homes by 2025 to hit the Paris Accord goals. In that context, 1400 looks like a pretty small bite. Most people don't know that our climate pollution (greenhouse gas emissions) is going up, but in reality it's up 16% from 1990 levels, based on the most recent data. That's a huge part of why we see legislative action as inadequate – we're not just not hitting our targets, we're going in the wrong direction.

Similarly, we need 90,000 new electric vehicles (Evs) to hit Paris Accord levels. This year the legislature provided incentives for approximately 440 EVs. At this pace we will fall miserably short. That's frustrating. The reality of the climate emergency ran head-on into political reality, and political reality won—though that's probably not how politicians see it. The legislature worked hard to get these changes through, while threading the needle to produce bills a Republican governor would sign.

To the governor's credit, he did sign them, as well as the bill restricting the outdoor use of neonicotinoid pesticides, which have been implicated in pollinator deaths. Hidden in the list is one truly big deal, S.30, a law that will phase out the use of hydrofluorocarbons (HFCs).

HFCs are used in refrigeration and air-conditioning. They came into use after the signing of the Montreal Protocol, as they do not destroy atmospheric ozone. However, they turned out to be a potent greenhouse gas. The Kigali Amendment, negotiated in 2016, would phase them out worldwide; however, the Trump Administration has not brought the amendment forward for ratification. States are taking up the cause, and Vermont now joins California, Washington, Maryland, Connecticut, and New York in the phase-out. Ultimately all 24 states in the U.S. Climate Alliance are expected to join this initiative.

The bill passed this year makes Vermont a small part in a pretty big deal. Project Drawdown identifies refrigerant management as the No.1-ranked global warming solution. It's not photogenic or cuddly, but it's powerful and fast, because HFCs are short-lived gases. Phasing them out globally can avoid an additional ¼ to ½ degree Celsius of global warming by 2100—in the context of an overall goal of holding warming below 1.5 to 2 degrees. This will happen at no extra cost to consumers, and should add $5 billion to U.S. exports, and create 150,000 new jobs nationwide according to the refrigeration industry, which supports it.

Refrigerant management is the unsexy solution, so it's no wonder it has gotten little attention. But the legislature and governor deserve our thanks for enacting this law, which is in line with the efforts of the Obama administration. As temperatures rise, cooling technology will proliferate, but as Project Drawdown notes, "The Kigali accord ensures a step change is coming…."

The plastics bill, described by National Geographic as the nation's "most comprehensive" also addresses the climate emergency. "If current trends continue," Edgerly Walsh said, "global plastic use could be the climate equivalent of over 600 coal plants in annual emissions by 2050," citing a recent study by the Center for International Environmental Law. Vermont, following the lead of its own towns (such as Brattleboro) is reducing that flow.

More is needed, much more, but much was accomplished as well, which doesn't always happen with divided government. Good on ya, folks. Keep at it!

Links available for this article at greenenergytimes.org.

Jessie Haas has written 40 books, mainly for children, and has lived in an off-grid cabin in Westminster West, VT since 1984, www.jessiehaas.com. ♻

Tracking Electric Car Sales

Drive Electric Vermont

David Roberts

With over forty electric car models available at dealers today, memories of the early days of modern plug-in electric vehicle (EV) sales are starting to fade. A recent visualization tweeted by Mase Goslin (see link below) presents national EV sales data for the United States in an animated chart showing total sales from December 2010 to May 2019. If you're reading *Green Energy Times* on paper, look for this article at greenenergytimes.net to get a direct link to the chart online.

https://cleantechnica.com/must-see

2012 Coda Electric

The visualization begins with the Tesla Roadster which already had 1,400 sales by December 2010 as well as the Chevrolet Volt, Ford Transit Connect, and Nissan LEAF models. By December 2011, two more models entered the market, the Fisker Karma and Mitsubishi i-MiEV. Another year went by, and we saw 2012 bring many more models including the Toyota Prius Plug-in, Tesla Model S, Ford C-Max Energi, Ford Focus Electric, Toyota RAV4 EV, Honda Fit EV, and the Coda EV. A batch of entrants in 2013 included the Ford Fusion Energi, Fiat 500e, Smart ED, Chevrolet Spark, Honda Accord PHEV, and Porsche Panamera S-E.

Some of these models were only available a short amount of time. Production of a new model is a tall order for any automaker but doing so from scratch as a new entrant to the market is an especially tough business to break into as both Fisker and Coda can attest. After brief appearances in the animation, they disappear because both went bankrupt by mid-2013 after selling less than a combined 2,000 vehicles nationwide.

In the sales visualization, time goes on and by the end of 2015, we see the Nissan LEAF and Chevrolet Volt occupying the top sales positions with about 90,000 vehicles each after five years of sales. More new models continue to enter the market after that, and we see the LEAF and Volt jockeying for the top position with the Model S in a distant third place, but beginning to steadily gain on the leaders. More vehicles come in and out of the lower slots as the animation continues, and then, starting in early 2018, we see the Tesla Model 3's meteoric rise to the top as the Model 3 hits about 188,000 sales by the end of May 2019. This well surpasses the runner-up Chevrolet Volt at 155,000. It is exciting to see the upstart Tesla making this much headway against more established automakers as they have struggled to develop and market EVs in ways that achieve higher sales. Chevrolet's end to production of the Volt in February of this year attests to this. Recently, many automakers have announced additional EV models due to arrive in the next few years, but it will likely be some time before any other automaker comes close to overtaking Tesla's Model 3 as the national sales leader.

The odds are good there is a new or used EV that could meet your needs the next time you're in the market for a vehicle. Find and compare EV options on the Drive Electric Vermont website: www.DriveElectricVT.com.

David Roberts is the Drive Electric Vermont coordinator. He has driven an all-electric car for the past six years and says if you must drive, drive electric. ♻

Tesla Model 3

Reducing Transportation Emissions

VT Legislator, Curt McCormack Sets Example

Deb Sachs

After a full day in Montpelier, including a special awards ceremony for K-12 schools, Representative Curt McCormack, Chair of the Vermont House Transportation Committee, glanced at his watch and smiled as we carpooled back to Burlington. While he had planned to ride the LINK Express as usual, he chose to carpool freeing up more time to squeeze in a bike ride and grab a bite to eat at the Burlington Discover Jazz Festival.

While Representative McCormack's normal mode of transportation, back and forth to Montpelier, is on the GMT LINK Express, he was happy to share a ride and catch up on project happenings on the way to his old north end Burlington home. Before accepting an invitation to any event, he makes sure he can make it via the LINK Express bus schedule.

Rep. McCormack doesn't own a car. Instead, he uses more efficient and less wasteful ways to travel including the local bus, Amtrak, ridesharing, biking and walking.

It was fitting for Rep. McCormack to recognize Vermont's top performing K-12 schools for their work to encourage schoolwide green travel choices. The annual Way to Go! School Challenge Awards Ceremony was on June 5th, the same day the Downtown Historic Preservation Program was celebrating its 20th year. It was a great day to meet at the Statehouse to experience and celebrate the many ways one can travel green and showcase the importance of investing in public transportation for more walkable downtowns and villages.

While congratulating the school award winners, he noted, "We grew up honoring Abraham Lincoln for walking a long distance to school. Today, his parents would be arrested. And the absurdity is, we invented this thing of parents driving kids to school. Twice a day traffic jams occur at most schools in America (and Vermont is no different). This is one more glaring example of what automobiles have become to us. Thank God for these kids!"

During his remarks to school award recipients, students and parent volunteers, Rep. McCormack emphasized that we need to make big changes to meet our energy and climate goals. Vermonters, not politicians, lead. "You are the ones to encourage us legislators to pass laws and to make investments in good public transit."

As a legislator 20 years ago, first representing Rutland and now Burlington, "I was one of 25 legislators who voted 'no' to increase the speed limit on highways from 55 mph to 65 mph." We need to return. "Going back to 55 mph would save many lives and a lot of fuel," noted Rep. McCormack.

During the legislative session, the House Transportation Committee reviews, among other things, where to spend the State's approximately $600M transportation budget. Rep. McCormack is an advocate of walking, biking and public transit. Be sure to let him know your concerns on how and where state funds might be leveraged to sustain and better integrate all modes of transportation.

Representative Curt McCormack, spreading a message, translated: "One Less Car" with partner, Lisa, riding tandem to lunch. Courtesy photos.

Pictured with Representative McCormack (rt) are the 2019 Way to Go! school winners, including Laura Asermily (yellow banana), Safe Routes Coordinator of Middlebury and recipient for Mary Hogan Elementary School, winner of the grand prize AllEarth PowerFlower. Photo: Cameron Savage.

Deb Sachs is CEO of EcoStrategies, LLC and Director of Net Zero Vermont, which specializes in sustainable development, transportation efficiency, renewable energy, and zero net energy solutions. She lives in Charlotte, VT. ♻

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**

SCS TRANSPORTATION - Services for Sullivan County.. 603-542-9609. **SCSHELPS.ORG**

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**

MID-STATE REGIONAL RIDE RESOURCE DIRECTORY - Services elknap-Merrimack Counties, excluding Hooksett and the towns of Deering, Hillsborough and Windsor of Hillsborough County. 603.225.3295 x1201. **midstatercc.org**

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/**

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 advantage 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, Poultney 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**

Vermont 2019 EV INCENTIVES Transportation Bill

Electric utilities and Drive Electric Vermont have offered EV incentives over the years, but so far, the State of Vermont has not advanced an EV incentive program. Legislators have debated the issue over the past several years, but nothing advanced until the recently finished session when Governor Phil Scott included an EV incentive proposal in his annual budget. Several legislative committees reviewed the proposal and made modifications, ultimately including language directing the Vermont Agency of Transportation (VTrans) to administer an incentive program in the 2019 transportation bill, also known as H529 (http://bit.ly/VT-H529.

Section 34 of this bill included at least $1.1 million in funding for electric car incentives on new purchases or leases. Eligibility will be limited to vehicles with base pricing of $40,000 or less and households with annual income below about $92,000 (officially 160% of the state median household income). Details on incentive amounts and means of delivery will be determined by VTrans in the coming months, as they hope to launch the availability of incentives in late 2019.

Also included in the transportation bill are requirements to support greater use of EVs in the State fleet and increasing the hybrids and EVs to at least 75% of new purchases and leases by July 2021. The work continues in 2019 with a $512,000 appropriation to support twelve all-electric vehicles at various locations around the state as well as the necessary charging stations. ♻

NH's (Mis)Use of Volkswagen Settlement Funds

Randy Bryan

The Volkswagen (VW) Settlement funds are the largest tranche of money available for electric and clean technology for New Hampshire in a long time. New Hampshire has lagged behind its surrounding states in electric vehicle (EV) sales and infrastructure deployment, and this money could allow us to close the gap.

Plugshare.com notes New Hampshire currently has three Tesla Supercharger locations: Hooksett, Seabrook, Lincoln. New Hampshire also has four Combo Charging System (CCS) and Chademo locations: Salem, Nashua mall, Nashua dealership, and Lancaster. With fast charge stations needed every sixty miles or so (like those in surrounding states), and wanted every 30 miles, there are big gaps in New Hampshire's coverage.

There are two funds available from the VW settlement, Appendix C and Appendix D. Appendix C money was given to VW's Electrify America to distribute to key metropolitan areas around the country for focused infrastructure (charging station) deployment. Boston was selected as one of those key areas. Hopefully, NH could receive some benefit from those funds as part of the greater Boston metro area. For instance, NH could receive funding for fast-charge stations in Seabrook (near I95), or along I93 and I89. Massachusetts (as a selected area) is well along in their deployment of these funds. No ready, practical plans are set for NH yet.

Appendix D (run by VW's Mitigation Trust) offers another pot of money. Most of this money is for newer, cleaner vehicles, some is for EV charging infrastructure. NH's VW Appendix D plan was approved in mid-October 2018. NH has ten years to spend this money. All expenditures must be acceptable to the Governor's Executive Council. NH's Office of Strategic Initiatives (OSI) is the lead agency appointed by the governor, assisted by the Department of Transportation (DOT), Department of Environmental Services (DES), and the Bureau of Economic Analysis (BEA).

Links to NH Mitigation Trust funding plans are http://bit.ly/NH-funding-1 and http://bit.ly/NH-funding-2.

Approximately $31M is available to NH from the Mitigation Trust; about 10-15% for administration and compliance responsibilities, leaving about $28M for acquisition projects; $15.M for newer, cleaner trucks, $4.6M for charge station infrastructure, $6.2M for public proposals. Also note, the Diesel Emissions Reduction Act (DERA) funding was recently increased in NH to help co-fund Mitigation Trust truck spending.

I talked to Tim White of NH DES who is the point man in DES for helping OSI analyze and recommend options for use of funds. White was most helpful and provided more information than I have room (or memory) to write. But, basically, the funds for Truck acquisition is on a fast track. Diesel and Alt-fuel RFPs are out and proposals are being submitted. About half of NH's $31M will be spent on newer diesel trucks ($15.5M). Some will go to propane and natural gas trucks. This RFP was first to go out, and the deadline for submission is the end of June. Eighteen projects by eight entities are being considered. But there is hope, OSI just announced an RFP for electric school buses, responses by July 26th! First funding is to be spent this year and in 2020.

The $4.6M infrastructure (charge stations) funds are on a much slower track. The Governor/OSI wants to be very careful on these funds, so is still studying how to spend the money. There are various NH organizations tasked with offering advice for infrastructure deployment: NH DES, Northeast Corridors transportation group (coordinating with surrounding states), the NH Senate SR 517 Commission, and a new study request to NH BEA/ Plug In America. All will likely recommend the same thing: spend first and most on fast charge infrastructure scattered around the state. Meanwhile, there are no RFPs open for submission, nor timeline yet for issuing RFPs, therefore, no actionable plans for infrastructure yet. Again, offering hope, NH's three top utilities just announced a plan to propose charge stations at up to twelve locations around NH. The link to SB 517 Commission is http://bit.ly/NH-SB-517.

In one recent national study (US PIRG, http://bit.ly/VW-PIRG-study), states were graded on how well the VW money is being used to leverage the state into Clean/Electric solutions. This study gave NH a 'D'. But the grade may not be entirely fair. The intent of VW Funds is to reduce

Cont'd on p.6

3rd Annual National Drive Electric Week Event
September 19, 2019 in Plymouth, NH

Curious about electric vehicle technology? Have an electric vehicle and want to show it off? Join NH Electric Co-op for their third annual National Drive Electric Week event on Thursday, September 19 at the Common Man Inn and Spa in Plymouth, NH.

We're looking for EV owners and enthusiasts to join us and help spread the word about the benefits of driving electric. We'll have auto dealerships there with EVs for test drives, charging station vendors, as well as many different EV models on display.

The event takes place 3pm-7pm. Refreshments and light snacks will also be provided.

NHEC's 2017 All-Electric Chevy Bolt.

Take charge of your future and come see how driving electric can benefit you! Find more information at https://driveelectricweek.org/EVevent2019. ♻

NH's VW Settlement *Cont'd from p.5*

NOX/SOX emissions. NH notes that new diesel trucks are cleaner than older diesels, and Natural Gas-Propane are cleaner still. However, EV technology is the best and most aggressive path.

The reason for a 'D' is quite clear. NH government was rather quick on spending the largest chunk of money for combustion vehicles, no electrics. A much slower path was chosen for electric charge stations, but at least the full 15% of Mitigation Trust funds are set aside for infrastructure. Our surrounding states are much farther along in their VW installation plans.

As author's opinion, this pattern is not new and speaks for itself. But, due to the just released e-bus RFP and utilities' charging proposal, I would boost NH's grade to C. Enjoy your summer! Ride in an EV.

Randy Bryan is one of the co-founders of Drive Electric NH. Bryan has been an advocate for electric cars for eight-plus years. His company, ConVerdant Vehicles, has converted vehicles to plug-in hybrids, including his own Prius in 2008, and developed and sold inverters that turn a Prius into an emergency generator. ♻

A User's Guide for e-Assist Bikes

David Cohen

Albert Einstein once commented, "I fear the day that technology will surpass human interaction." The bicycle, with its inherent human physical and sensory engagement, may have been what Einstein contemplated as a model solution to foil the technological takeover of our humanity.

From the early days of penny-farthings to the modern cargo bike, the bicycle has fundamentally been linked with human interaction. This holds true even as electric-bike technology is redefining the bike, and as the e-bike is bringing about a global transportation revolution.

Dave Cohen on his Yuba Mundo cargo bike allowing him to ride with a watermelon and other goods. Courtesy photo.

So, how does e-assist work? Any e-bike system includes some type of small motor that is activated on demand to assist a rider's pedaling action. The motor may be situated either on the front hub, rear hub or in the middle, also known as a mid-drive motor that runs the front chainwheel. You'll find endless opinions on which is best, but that really depends on what you will be doing with your bike.

The vast majority of e-bikes bought online or in stores feature either rear-hub or mid-drive motors because of the superior traction of rear-wheel drive. Mid-drive motors and their drive systems tend to be more efficient and produce more torque, because they can utilize the chain drive and rear gears. Rear-hub motors are less expensive and can be lighter. They also seem to get better and more efficient each year.

Other components of an e-bike system consist of a battery pack, a controller (the brains of the bike, so to say), and a control pad control or a throttle to adjust the level of assist. Some e-bikes include both a control pad and throttle. Most mid-quality e-bike systems feature a LCD display to indicate the level of assist power selected as well as a speedometer, odometer and a range of other information.

Owners of earlier generation e-bikes from just a few years back might be shocked at the technological strides made in a short period of time. Lightweight and reliable battery technology has certainly been a major advancement. However, with companies such as Bosch and Shimano entering the mid-drive assist scene, motor technology is keeping up. High quality e-bike motors now have cadence and torque sensors to help adjust the level of assistance based on how a rider is pedaling. Yes, there's a lot of technology here, but there's also an amazingly seamless and graceful feel.

Another major shift has been the dependability and effectiveness of conversion kits. A conversion kit can transform an existing bike into an e-bike and is oftentimes a cost-effective solution to purchasing an e-bike. Front-hub motor kits are generally easiest to install, but they lack traction in poor conditions. One of the most popular products currently is the Bafang mid-drive kit. It will fit virtually any bike, it's fairly simple to install and is easily programmed. Due to their outstanding torque, Bafang mid-drive kits are a particularly common solution for cargo bikes.

What might one expect to pay for an e-bike? That really depends on where you are looking and what you need. Purchasing a basic commuter style e-bike from a retail store, you might expect to start at around $1800. That will get you a rear hub motor model with fairly low-end but adequate components. Large companies like Raleigh and smaller ones like Surface 604 have offerings like this. You'll also find bikes online that start at $1600 on sites like RadPowerBikes.com, but when going lower than that, you really need to critique the quality of battery cells used and many other factors. Bikes with mid-drive motors tend to start at around $2400, but after that the sky's the limit. What is really cool is that many budget e-bikes are now sold complete with racks, fenders, puncture-resistant tires, bells and lighting systems that run through the main battery. You just get on it and ride.

Perhaps the biggest story is the evolution of the electric cargo bike. Companies such as Xtracycle, Yuba, Tern, Madsen, Larry vs Harry, Urban Arrow and Riese and Muller are producing

Cont'd on p.16

Incentivizing E-Bikes!

Vermont is one of the first states in the U.S. to offer rebate programs for e-bikes, e-cargo bikes and the installation of e-assist conversion kits. Due to a wise shift in the state's renewable energy policy, both Green Mountain Power and the Burlington Electric Department are offering $200 rebates for purchases at Vermont bike shops. The two utilities cover nearly 80% of Vermont's population! Vermont also has an e-bike low-interest loans program through the Vermont State Employees Credit Union.

Rebate, subsidies and tax breaks are essential to increase the adoption of e-bikes. Certainly, Europe, Britain and Scandinavia have led the way. For example, a program in Oslo, Norway provides $1200 towards buying an e-cargo bike. In London, England 20% of the purchase of an e-cargo bike is provided for businesses, and the French city of Angers recently unveiled a program to give 25% back on the purchase of an e-bike. Closer to home, the Canadian province of British Columbia just announced in July a car trade-in program that earns participants $850 towards an e-bike.

Most states in the U.S. offer rebates and subsidies for electric cars, but few are even proposing similar programs for e-bikes. The time is now to push for incentivizing e-bikes to promote a better quality of life, improved health and the benefits to the local environment. Most importantly, studies show that incentivizing e-bikes is a far more cost-effective and a radically stronger solution to climate change than promoting electric cars. ♻

Grid-Tied with Battery Storage

George Harvey

Twenty-nine panels sitting on the roof. Photos courtesy of David Abjornson.

New Hampshire resident, David Abjornson, has had a desire to reduce his carbon footprint for a long time. He did not want to jump into a big system, however, and wanted to start off with a smallish one, just so he could find out what he was getting into.

Three years ago, he was ready to make his first move. Having looked around at the renewable energy businesses operating in his area, he decided to hire Granite State Solar to build a small solar array on a west-facing part of his roof. He wanted solar panels that were the highest efficiency he could get, and he wanted the best warranty he could get, so he decided to go with SunPower Solar 327-watt panels with integrated 320-watt micro-inverters. Eight of these were installed giving him a grid-tied system of 2,560 watts.

Abjornson was impressed by the quality of Granite State Solar's work and the professionalism of its employees. He was also very pleased with the solar addition on his roof. In less than a year, he decided to go further.

The next step in his growing system was twenty-one more panels of the same model. This time, they would be installed facing south. He was so pleased with his experience with Granite State Solar, he again hired them to do the job. With twenty-nine solar panels in the system, it had grown to have 9,483 watts of capacity.

Abjornson learned a lot making these steps, and one thing especially stood out to him, something that is not obvious to many people. The fact that you have solar power does not mean you will automatically have electricity when the grid goes down. "If you have solar, you can't use it without battery backup if the power is out," he said.

Part of this is obvious. Solar panels do not produce much power when it is cloudy, and none at night. But even during a sunny day, the panels do not produce the type and amount of power most people want. The conversion of varying amounts of DC power to independently varying demands for AC power requires two things, a battery system and its support circuitry. Of course, Granite State Solar was able and willing to install the battery system.

Abjornson decided to get a Sonnen ECO-16 battery. This is an impressive system. It can produce 8,000 watts of power, which is probably more than most people would need. More to the point, it can produce 16 kilowatt-hours (kWh) of electricity. This is enough for a small family in a power outage to go for a full day or more, with moderate conservation. With strict conservation, the family could go much longer. Given the combination of 9,483 watts of solar power and 16 kWh of storage, Abjornson could, in theory, just keep going through almost any outage.

The way this works in practice is actually rather smart. The battery system has an internet connection and watches the weather to see what sort of conditions will come up. If it sees that bad weather is coming, it starts to prepare for an outage. When the electric grid stops producing power, the battery system does not come on immediately, but delays for about a minute. While this makes uninterruptible power supply for computers a good idea, it reduces safety concerns. The system similarly can know when the power is about to be restored.

Abjornson said, "It's fabulous. I did it to save the planet, a little bit at a time."

One might think that David Abjornson's story was over, because his dream goal had been met. Such, however is not the case. One minor detail had to be completed to get the appropriate attention, the addition of one thing – a Tesla. Yes, he got it. Yes, he loves it. And yes, Granite State Solar was able to install a home charger, so Abjornson's Tesla runs on solar power. ♻

Charging a Tesla from the sun at home.

Susan Ross's Story: Living Off the Grid

Susan Ross

In 2001, we built a home in New Hampshire where power was an afterthought. I didn't go into my lifestyle to live off-grid, but solar was the only option. A 48-volt system was installed with eight 120-watt modules, a Trace Inverter, eight Rolls batteries, and a Honda Generator.

I had faith and trust in the people who surrounded me. Little did I know for the next eighteen years I would live off a generator because the system couldn't power my home. Three charge controllers, two battery banks, two generators, one divorce and seven solar professionals later, I'm finally in good hands.

Dave Bonta, from Sundeaver, is a name I remembered from when we built, but I only met him in January 2019 when my charge controller quit. My batteries were old, and my Kohler generator decided not to start one cold morning. Dave was the only person to immediately help. He came to the rescue and brought his Kohler expert, Jeff.

I cried with relief the first time we spoke, and he probably didn't know what to think! By afternoon the Kohler was running and a new Outback charge controller was installed within days.

Life was good, or so I thought. Dave recommended a module upgrade, eight modules at 315 watts each. He was the only solar person to mention replacing modules. After their installation, life became great, because they were beautiful and blended into nature. I had power, so much power, for the first time. Within a day, Dave had to disconnect two modules so the Outback's cooling fan wouldn't run as much.

We had talked about me being the perfect candidate for a RELiON battery, so he visited Nancy Rae Mallery, publisher of G.E.T., to see her RELiON set-up that she had been encouraging him to look into. I could tell Dave was impressed and excited about the RELiON, so he ordered mine.

While waiting for the new battery, life couldn't get any worse, right? Wrong. Less than two weeks later, while waiting for the new battery, my battery meter started counting down on a full-sun Sunday morning, no less.

When Dave and Jeff arrived, I stress-cried again. This was my last straw, the point I never wanted to reach. I was done with this crazy lifestyle and needed significant change to stay. The six modules were too much for my existing system, so the batteries fried and the excess power went to the Outback which shutdown.

For the first time, my inverter wouldn't turn on, and everything was dark. For three days, I ran off the inverter's bypass switch for a direct feed to my generator while waiting for my RELiON battery.

The day the RELiON battery system was installed I was excited, and it's been amazing since! Average reading: 53.2 volts. Laundry, showers, filling a 70-gallon stock tank, night or day, the RELiON maintains 53 volts. It's crazy amazing. I'm in love with my new battery storage.

Dave said I would forget my generator, and I have almost. Life is changing dramatically with reliable, consistent, strong power – it's phenomenal.

I'm not one to push the energy envelope, I still use my icebox, but the possibilities are opening up, and it makes me smile. Every day I'm grateful for all Dave and Jeff have given me, the circle is complete eighteen years later, and life is just beginning with my beautiful modules and RELiON! ♻

Top: The Xantrex inverter and Outback charge controller. The settings were updated to work with the new lithium battery from RELiON. Bottom: The new RELiON LiFePO4 battery, installed by Dave Bonta.

The modules of the new array are larger, but slimmer than the previous one. Inset: Susan with her beautiful new modules. All photos courtesy of Susan Ross.

RENewed – Rethinking What it Means to be "Renewable"

David Blittersdorf

I have spent my life dedicated to renewable energy. Lately, I've been thinking a lot about what it really means to be "renewable."

Growing up in southern Vermont, I lived within hiking distance of the world's first utility-scale wind turbine at Grandpa's Knob. Inspired by Grandpa's Knob, I became fascinated with wind and solar energy at an early age. At 14, I built my first wind turbine to power a light in the small sugarhouse where my family boiled sap into maple syrup. As a student at the University of Vermont, I built yet another wind turbine. I've been in the renewable energy business ever since. For almost four decades my companies have proven themselves to be innovative leaders in the industry. We strive to enable everyone to engage in renewable energy generation at any scale.

David Blittersdorf and John Miller, AllEarth's Director of Engineering, display some of the RENewed inventory of pre-owned photovoltaic panels. Courtesy photo.

At my companies, we have started very important conversations about how we might make a more positive impact with our under-utilized renewable energy equipment. We don't think quality renewable energy equipment should sit in a warehouse — or worse, go to a landfill. We think there's a better way. Re-use. We want these resources in the hands of people who can put them to good use as soon as possible.

Every renewable energy company acquires assets that are useful at one time, but as the company evolves, they no longer serve a purpose. Over the last four decades, my companies have acquired a variety of wind and solar equipment that still has value but isn't getting used. Some of it was used for a time but is still in great shape, some of it didn't end up getting used for a project as it was originally planned. Other times, the site didn't work out, the developer fell through, or things didn't work out for permitting.

We noticed that there wasn't a good marketplace out there for this kind of used and pre-owned wind and solar equipment. So, we decided to do something about it. We started RENewed Wind and Solar (www.RENewedwindandsolar.com), an online portal for eco-conscious individuals interested in buying and selling underutilized renewable assets.

For the launch of RENewed, we selected assets from our inventory that perform well over time and have been well-cared-for, everything from recalibrated anemometers to pre-owned photovoltaic panels.

Data shows that solar panels will last for over 50 years, they just have slightly less output every year. It would be horrible for society to landfill them. They can be used over and over in new ways; it's a different way of looking at things. In 50 years, they may only put out 60% of the original power. But by re-deploying them into other applications, you can still use them.

The wind measurement systems we are selling have a proven record of success. They have previously been deployed and redeployed around the region to aid in the development of \new wind farms, including the 10MW Georgia Mountain Community Wind development we built here in Vermont.

We are coming to a time when there is a critical mass of used products available in the renewable's marketplace, so it is feasible for a company like ours to begin a venture like this. We will continue to obtain and distribute high quality renewable assets to increase the productive life. We live in a resource-limited world, so we hope to minimize the unnecessary manufacturing of items that are already in existence and, instead, create opportunities for productive re-use.

In the renewable energy business, we care deeply about reducing waste. We know quality renewable energy equipment shouldn't sit around gathering dust. Instead, these resources need to be out in the world helping to reduce carbon emissions and produce clean energy for our planet.

We hope you will join us in this effort. Please visit www.RENewedwindandsolar.com. We may have just the product that you've been looking for.

David Blittersdorf is an entrepreneur and engineer from Vermont with nearly four decades of experience as an innovative leader in the wind and solar energy industry. David founded NRG Systems in 1982 and AllEarth Renewables in 2004. AllEarth Renewables is dedicated to bringing clean, renewable energy to businesses, farms, municipalities and homeowners to help lessen our nation's dependence on fossil fuels and reduce greenhouse gas emissions. ♻

Energy Equity and Cooperative Solar in New Hampshire

Henry Herndon

New Hampshire is making strides in bringing equity to the energy transition. Thanks to forward- thinking legislation enacted in 2017, the New Hampshire Renewable Energy Fund supported the development of three low-income solar projects in 2018 and has awarded funding to support three more projects this year.

Left to right: Christa Shute, Vermont Law School (VLS) Energy Justice Fellow; David Riley, VLS Energy Clinician; Charlotte Cohn, VLS Energy Clinician.

Mascoma Meadows Cooperative Solar in Lebanon, NH is a 100kW system installed by ReVision Energy. All photos: Christa Shute.

But even with grant funding, it can be difficult to make these projects economically viable due to their complexity and high transaction costs. That's why pending legislation proposes to take further steps to advance energy equity via low-income solar.

Senate Bill 165, the Low-Income Community Solar Act, passed both the House and Senate, and Governor Sununu has stated he will sign the bill (http://bit.ly/NHG-CSA-news). If enacted into law, the legislation will provide a three cent per kilowatt-hour adder to solar projects providing power to communities where the majority of participants earn 300% of the federal poverty level or less. In other words, while a typical net-metering project might earn a rate of between $0.09/kWh and $0.12/kWh, under SB165, low-income solar projects could earn between $0. 12/kWh and $0.15/kWh.

Local tax policy is another issue that has the potential to spur or spurn low-income community solar. In the case of Gaslight Village, a low-income solar project awarded funding in Tilton this year, high property taxes may prevent the project from moving forward.

"Even with the grant funding, Gaslight Village project is not going to be able to move forward because at 43% of the low-income residents' net revenue, the local tax burden is too high," said Christa Shute of Vermont Law School's Energy Clinic. "Some New Hampshire municipalities provide different levels of tax exemption for solar projects or payment in lieu of tax (PILOT) agreements, but Tilton has chosen not to take these approaches to facilitate low-income solar." If the low-income adder under SB 165 goes into law, it may be sufficient to justify the Gaslight Village Project, even with the high property taxes.

Cities like Lebanon, home to the Mascoma Meadows low-income cooperative solar project, have enacted solar property tax exemptions. Having a statewide policy to not tax solar projects would level the playing field across the state.

The Mascoma Meadows project, developed by Vermont Law School's Energy Clinic in 2018, demonstrated a new "cooperative solar" model. Cooperative solar builds on the New Hampshire-pioneered movement of Resident-Owned Communities, or ROCs. ROCs are a legal innovation that allows families in a neighborhood (generally a mobile home park) to pool their resources and collectively purchase and own the land on which they reside. ROCs empower lower-income communities by freeing them from dependence on profiteering landlords. The cooperative solar model enables the community to either purchase the array outright or use impact investors to leverage federal tax credits and then purchase the solar array in year five.

"We feel the ownership option is a really important piece of energy equity and a just energy transition," said Shute. "It provides long-term sustainability and real, lasting benefits to these families."

There are other low-income solar models being worked on in New Hampshire that utilize the 15% set-aside in the Renewable Energy Fund for community projects with majority low-income participants. Other completed projects include Avery Hill Solar in Laconia, providing benefits to an affordable housing community administered by Lakes Region Community Developers; and Frosty Scoops Ice Cream in Plymouth, a project led by longtime NH renewable energy champions Sandra Jones and PAREI.

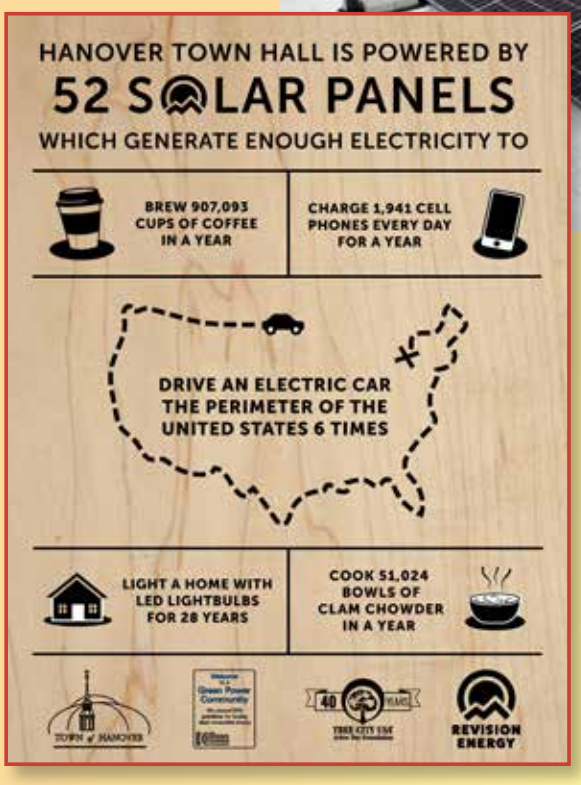
Henry Herndon is Director of Local Energy Solutions for Clean Energy NH. ♻

Hanover's Solar Growing Towards 100%

Hanover Municipal Building Solar Project, and Much, Much More

George Harvey

The citizens of Hanover, New Hampshire, voted in their town meeting of May 9, 2017 to join the "Ready for 100 Action" campaign, to make the town 100% renewably powered, including transportation, by 2050, and to get 100% of their electricity from renewable sources by 2030. It was the 29th municipality in the United States, and the first in New Hampshire, to commit to 100% renewable energy. Not only was the vote overwhelmingly in favor of the resolution, but Hanover was the first municipality in the country to pass such a resolution by popular vote.



Above: Solar array on the roof of Hanover's municipal building. Photo: ReVision Energy. Left: A few noteworthy illustrations of the value of solar power. Courtesy images.

The commitment marked the conclusion of a long effort by many people. But it also marked a starting point for new actions, and a lot has happened since it was made.

Most recently, a solar array was installed on Hanover's municipal building by ReVision Energy. ReVision had recently merged with Energy Emporium, of Enfield, New Hampshire, and this gave it a new office where local developments could be managed. The merger also meant that Kimberly Quirk, who had owned Energy Emporium and was familiar with the area, could provide her experience.

Quirk said that the system on the municipal building roof is up and running, adding, "Its 52 panels pretty much cover the roof. Their capacity is 16.5 kilowatts (kW)." The array's energy is being fed into the grid to help reduce the town's electricity bill.

She also told me that ReVision Energy has other developments in line for Hanover. I was a bit surprised at how many there are. Right now, ReVision is installing a 70-kW array on the roof of the building at the water reclamation facility. ReVision is also developing a plan for the town for a 700-kW ground-mounted solar system at the Water Department on Grasse Road. Electricity from that system will be used to supply energy for the municipality. These are just the projects ReVision has in the works now.

Sustainable Hanover is working with four installers to start up Solarize Hanover 2, which will install solar systems on rooftops or property of residents at reduced cost. They include ReVision Energy; Solaflect, of Norwich, VT; Catamount Solar, of Randolf, VT; and Norwich Solar Technologies, which is based in White River Junction. Solarize Hanover 2 follows on the heels of a successful predecessor, with similar features.

Another project that Hanover is now looking into is a large solar array for a community solar system. This is in the early stages, and there is no real indication yet of where the array would be, exactly what size it would have, or who would develop it.

The purpose of a community solar system, called a solar garden in some parts of the country, is to provide solar power for homes that do not have a place on site to put a set of photovoltaic panels. Many such households would be in apartments. Also, there are homes with no open areas that are free of shade from mountains, trees, or other buildings.

Solarize Hanover 2 banner is proudly displayed on Main Street.

Julia Griffin, Hanover's town manager, told me that it is looking further afield to find other sources of energy. For example, the town is examining the idea of buying electricity from the Vineyard Wind, an offshore wind farm in waters off of Martha's Vineyard, Massachusetts. Apparently, Vineyard Wind will offer a power purchase agreement for electricity at 6.7 cents per kilowatt-hour, a price that is low for New England.

Griffin told me, "The town of Hanover is designated a Green Power Community, which means that it exceeds EPA guidelines for buying renewable energy. It has also for forty years been designated Tree City USA by the Arbor Day Foundation." Clearly, the commitment to the environment among the people of Hanover has been maintained for a long time.

Perhaps that long effort is the secret of why the people of Hanover voted to commit to 100% renewable energy so overwhelmingly. It is because of the ongoing efforts of a large number of people. Both Griffin and Quirk mentioned the efforts of the Sustainable Hanover Committee, which is part of the municipal government. They also mentioned individuals who had contributed to the effort along the way, people Griffin calls "tireless volunteers and darned smart climate-change worriers." Among them are Yolanda Baumgartner, Marjorie Rogalski, and Judi Colla.

It is clear that these efforts go well beyond the town limits of Hanover. Griffin has traveled through other parts of this country, encouraging towns and cities to take up their own plans and projects.

Quirk commented on this, "Hanover has really raised the bar for education on where we should be and what we need to do." ♻

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.

- Residential Renewable Energy Tax Credit: http://bit.ly/energy-gov-R-E-tax-credit
- Electric Vehicles - Tax credit for qualified plug-in electric drive vehicles including passenger vehicles and light trucks. For vehicles acquired after December 31, 2009, the credit starts at $2,500 and goes up to $7,500 based on the battery specs.

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, 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.

Advanced Wood Heating Advanced wood pellet heating systems -- $6,000 per pellet boiler/furnace (in partnership with Efficiency Vermont). Details at www.rerc-vt.org or call (877) 888-7372.

- Retails sales of "Advanced Wood Boilers" are exempt from Vermont's 6% sales tax. http://tax.vt.gov/exemptions,,
- **Details at https://fpr.vermont.gov/ woodenergy/rebates**
- **Windham County**
- For residential low- and moderate-income residents there is a pellet stove program. Contact the Windham and Windsor Housing Trust for more information: Tara Brown at 802-246-2119
- For wood heating (pellet or chip boilers/ furnaces) in municipal buildings, schools, and non-profits contact the Windham Regional Commission: Marion Major at 802-257-4547 ext. 109 or windhamregional.org/energy/wwh

In Rutland County (and towns in neighboring counties that boarder Rutland Co.) contact Melanie Paskevich mpaskevich@nwwvt.org at NeighborWorks of Western Vermont, (802) 797-8610.

Pellet Sap Evaporators:

Incentives are available for new, high-efficiency wood pellet- or chip-fired evaporators utilized as primary evaporators completely replacing oil or cord wood-fired units. $200/sq-ft of evaporator pan. Info at RERC-vt.org

Other Utilities Heating Offers

- Members of Washington Electric Co-op (WEC) can get a $1,000 rebate on approved pellet boilers/furnaces. This can be added to the CEDF and EVT incentives for a total of $7,000. Call WEC for details: 802-223-5245.
- Members of the Vermont Electric Co-op can get a $150 credit on the purchase of an approved pellet stove: www.vec/energy-programs.

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

All incentives subject to availability, limits, and may change at any time. For complete details, and participating retailers/ contractors, call 888-921-5990 or visit efficiencyvermont.com/rebates.

Lighting

- Special pricing on select ENERGY STAR® LEDs at Vermont retailers.
- LEDs for indoor growing: $100 back for qualifying fixtures

Weatherization

- Comprehensive air sealing and insulation projects - up to $2,000 back with an Efficiency Excellence Network contractor
- Air sealing and insulating your attic and/or basement with a contractor of your choice: up to $500

Appliances (must be ENERGY STAR)

- Dehumidifiers $25 - $40 rebate
- Clothes Dryers - $200-$400 rebates

Heating/Cooling/Water Heating

- Central wood pellet boilers and furnaces: $6,000 rebate (in partnership with CEDF)
- Heat Pumps:
- -Air-to-Water System: $1,000/ton rebate
- -Centrally-Ducted System: $800/ton rebate
- -Ductless Heating & Cooling System: $400-$500 discount at participating distributors
- Heat pump water heaters: discounts up to $600 at participating distributors
- Window air conditioners: $200 for select ENERGY STAR Emerging Technology models
- Smart thermostats: up to $100 back for select ENERGY STAR models.

Wood Stove Change-Out

CEDF Change-Out

(customer must have an existing/installed non-EPA certified stove to change-out):

- Pellet stoves: $1,000 incentive
- Cord wood stoves: $800 incentive
- A $100 incentive is also available to replace the catalyst in an existing EPA-certified woodstove.

Efficiency VT offers a $650 rebate for a new pellet or cord wood stove w/o the need to do a change-out. If the customer does have a EPA certified stove S/he wants to get rid of they can get another $100 for that. *Cannot be combined with above offer.*

Residential New Construction

- Enroll to receive a home energy rating, expert technical assistance, and incentives – Efficiency Vermont Certified™ projects receive up to $3,000 cash back
- Washington Electric Coop and Vermont Gas Systems customers may also receive additional incentives

Commercial and Institutional

- Buildings over 5000 square feet can get a rebate of $1.25/sf up to $50,000 from Efficiency Vermont, plus an additional $3000 from the CEDF.

Other Opportunities To Save

- Advanced Power Strips – special pricing starting at $6.95
- Pool Pumps – up to $500 back on select ENERGY STAR models
- Heat Saver Loan – low-interest loans of up to $35,000 for home weatherization and heating improvements

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Public Utilities Commission

NH PUC: Get up-to-date information at http://bit.ly/puc-nh-RE-rebates

Commercial Solar Rebate Program

Incentives are limited to 25% of the total project cost or $50,000 if less than the AC incentive payment otherwise calculated, whichever is less. The Program is available to non-residential structures with a commercial electric meter located in New Hampshire. Incentive levels for PV systems are as follows:

- $0.40/watt (lower of AC and DC) for new solar electric facilities (Step 1 application received on or after March 19, 2018); and
- Expansions to existing solar systems are not eligible.
- Incentive levels for solar thermal systems are as follows:
- $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;
- Expansions to existing solar systems not eligible.

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

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/Wind Rebate Program

-Effective January 2, 2018, this program offers rebates to qualifying NH residents who install photovoltaic (PV) or wind turbine electrical generation systems. Rebate levels are $.20 per watt of panel rated power up to $1,000, or 30% of the total facility cost, whichever is less. *Check for updates at http://bit.ly/NHResidentalRebate*

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

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 https://www.nh.gov/osi/energy for more information.

NH Electric Cooperative Incentives for Electric Vehicles and Electric Car Charging Stations

- NHEC offers a $1,000 incentive on a Battery Electric Vehicles (BEV), $600 on a Plug-In Hybrid Electric Vehicles (PHEV), and $300 on Electric Motorcycles.

NHEC offers incentives for Level 2 Electric Vehicle Charging Stations.

- For Commercial and Municipal Members – Incentives are up to $2,500 per charging

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.

unit. A maximum of two charging units may be installed

• For Residential Members – Incentives are up to $300 per charging unit. By participating in the residential program, you'll be able to charge the EV during off-peak hours at a rate that is lower than the basic residential rate.

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/HPWES for more information and an online Home Heating Index calculator

NH ENERGY STAR Homes

• Incentives for new homes which meet ENERGY STAR guidelines. Incentives include

• HERS rating fees paid by the utility, rebates for ENERGY STAR lighting, appliances –up to $4,000 based on the HERS score.

• Visit www.NHSaves.com/newhome for more details.

NHSaves Residential ENERGY STAR ® certified Products Program

• Mail-in/online rebates are available toward the purchase of the following ENERGY STAR® certified products: Clothes Washers, Clothes Dryers, Room Air Conditioners, Room Air Purifiers, Refrigerators, Dehumidifiers, and Pool Pumps. For current rebate information and forms go to www.NHSaves.com/appliances.

• Refrigerator/freezer recycling is available – unit must be in working condition (10 – 30 cubic feet in size), program includes free pickup and $30 rebate. For program requirements and scheduling information go to www.NHSaves.com/recycle.

• Instant rebates available on certain ENERGY STAR® certified LED light bulbs purchased through participating NH retailers, and instant or mail-in rebates available on ENERGY STAR® certified light fixtures (varies by retailer, see store associate or rebate form for details). Infor: NHSaves.com/lighting.

• Rebates are available to residential electric customers of the four NHSaves utilities.

NHSAVES Online Store

• Our extensive online store offers discounted pricing for residential electric customers of the four NHSaves utilities on a large variety of LED light bulbs and fixtures, as well as offering additional products to make your home more efficient, such as lighting controls, advanced power strips, thermostats, water saving devices, and various weatherization products. Orders and product fulfillment are handled by our vendor, EFI.

• Visit www.NHSaves.com/lighting-catalog.

• **Plymouth Area Renewable Energy Initiative (PAREI):** plymouthenergy.org

• **NH Solar Shares:** nhsolarshares.org

• **NHSaves:** nhsaves.com

Energy Star® Residential Heating, Cooling, & Water Heating Equipment Rebate

• Rebates of up to $500/ton on Air Source and Geothermal Heat Pumps. Rebates of $500 - $750 on Heat Pump Water Heaters. Rebates of $100 on WiFi Thermostats

• Program details and application at www.NHSaves.com/heating cooling

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/SHW_Manual.pdf

• Visit http://www.masscec.com/shw

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-yr term.

Energy Efficiency

• After 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 for: 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-program.. Please call 866-527-7283 to schedule a free home energy assessment.

Mass. 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 partnership program between 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 expands 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 http://www.masssolarloan.com/.

• Renewable Thermal Infrastructure Grant Program: https://www.mass.gov/funding

DEPT OF ENERGY RESOURCES

• 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 SMART INCENTIVE

Currently SMART incentives are only available for PV systems sized under 25kW. All Eversource West and Most of National Grid Blocks are full for 25kW and larger. There will be a 400MW review process this spring and summer. Details at http://masmartsolar.com and https://www. mass.gov/solar-massachusetts-renewabletarget-smart.

MA STATE INCENTIVE

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

• Incentive updates for air-sourced heat pumps: https://www.masscec.com/air-source-heat-pumps

• Wood stove Change-out program: https://www.masscec.com/commonwealth-wood-stove-change-out

Heating Programs

• The Commonwealth Woodstove Change-Out program, a partnership between MassCEC, the Massachusetts Department of Environmental Protection and the Department of Energy Resources, offers rebates to assist Massachusetts residents in replacing non-EPA-certified wood stoves with cleaner, more efficient EPA-certified wood or pellet stoves.

• Woodstove Program Info: http://bit.ly/mass-cec-woodstoves

• Heat Loan info: http://bit.ly/mass-save-heat-loan

• Insulation Incentives: http://bit.ly/mass-saves-home-insulation

Electric Vehicles

• After January 1, the maximum rebate for EVs in Massachusetts will be reduced to $1,500 and only fully battery electric or hydrogen fuel cell cars will be eligible. Hybrids will not be given rebates. In addition, the sticker price of the car must be under $50,000 to qualify for the program. Visit: https://mor-ev.org/

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NYSERDA

Welcome to the 2017 New York solar incentive and rebate information: 169 programs and incentives at: http://dsireusa.org (enter your zipcode) Programs and Services from NYSERDA: For the latest NYSERDA solar, ground source and air source heat pumps, EV residential and commercial incentives and more visit: nyserda.ny.gov/All-Programs.

EV Incentive from National Grid

National Grid, in partnership with BMW, is bringing eligible customers an incentive on a BMW i3 or BMW i3s EV. Form is at https://www.NG-BMWi3.

• Energy Rebates: https://NG-energy-rebates

National Grid: Heat Pumps

Total incentive amount not to exceed $1,100 for ASHP or $1,500 for GSHP (installations per project). Installation of the high efficiency measures must be completed between 4/1/2018-12/31/2018. *Mini-split heat pump units that only provide cooling are not eligible: http://bit.ly/Heat-pumps.

Home Energy Waste

Getting a home energy assessment can help you take control of your energy costs, 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: http://bit.ly/ny-nrg-waste.

RENEWABLE ENERGY/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.

The Megawatt (MW) Block Dashboard provides real time infor on the status of block and current incentive levels by sector and region. Block status is updated as applications are submitted, so check for current status. http://bit.ly/MW-block

Residential and Small Business

• http://bit.ly/ny-sun-Solar-Res-sm-bus

Commercial and Industrial

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

Commercial Energy Storage

NYSERDA is providing $350/kWh of energy storage capacity in addition to the current NY-Sun solar incentive. https://on.ny.gov/2FvS6L1

Community Solar

• http://bit.ly/NY-sun-Community

Commercial/Industrial PV Installer

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

Residential/Small Commercial Solar PV Installer

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

Financing Options

• http://bit.ly/NY-Sun-Financing

Clean Power Estimator

• http://bit.ly/NYSUN-power-estim

Geothermal

• rebate of $1500 per ton of installed capacity for residential/small-scale systems, $1,200 per ton for commercial/large-scale systems up to $5000

Electric car

• buyers in New York State can now get a rebate of up to $2,000 on qualifying EV models from participating dealers. See https://on.ny.gov/2Rd14zL

• Charge Ready NY: $4,000/installed Level 2 electric vehicle (EV) charging stations for public, workplace, and multi-unit dwelling stations. http://bit.ly/ChargeReadyNY.

Utility sponsored incentives & tips: http://bit.ly/utility_sponsored_incentives

Clean Energy on Farms

• $19 Million Available to Accelerate the Use of Clean Energy Technologies On Farms. Learn more at: http://bit.ly/NYSERDA-Farm-Clean-Energy.

National Grid

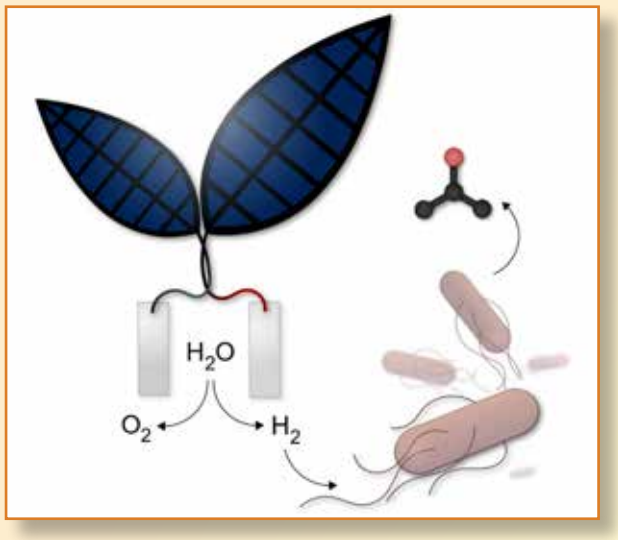
• National Grid savings for customers, http://bit.ly/Thanks-For-Saving-Energy

• *For more utility rebates google the utility name and search for rebates.*

UP-TO-DATE INCENTIVE INFO CAN BE FOUND AT: WWW.DSIREUSA.ORG

The "Bionic Leaf" Could Help the Planet

EarthTalk® From the Editors of E - The Environmental Magazine



The bionic leaf is a system for converting solar energy into liquid fuel developed by the labs of Daniel Nocera and Pamela Silver at Harvard. Credit: Jessica Polka, CreativeCommons.

Brainchild of Harvard biochemist Daniel Nocera, the "bionic leaf" is a small man-made solar collector that takes sunlight and water and turns it into any of a variety of usable fuels or fertilizers. Nocera's first iteration, the so-called "artificial leaf," was developed in 2011 at the Massachusetts Institute of Technology (MIT) and could split water into oxygen and hydrogen when exposed to sunlight in a process similar to (and inspired by) Mother Nature's photosynthesis.

Nocera soon thereafter moved his lab to Harvard and teamed up with Pamela Silver there to create the "bionic" version which takes the concept further. There they fed the resulting hydrogen to an on-board catalyst, resulting in the generation of immediately useable downstream liquid "fuels" such as fertilizer for farms, isobutanol to run generators and engines, and PHB, a precursor for bio-plastic.

The team's first version of the "bionic" leaf was about as efficient as natural photosynthesis, that is about one percent of the solar energy flowing in came out as biomass dense enough to use as fuel. But their most recent version ups the ante considerably, clocking in at ten times more efficient than Mother Nature's fastest growing plants.

"If you think about it, photosynthesis is amazing," Nocera tells the Harvard Gazette. "It takes sunlight, water and air—and then look at a tree. That's exactly what we did, but we do it significantly better, because we turn all that energy into a fuel."

When mass-produced, these tiny solar "carbon-negative" fuel factories could be inexpensive enough for everyday people to use to power their vehicles and run their lights and appliances. Farmers with a small on-site array of bionic leaves could create enough fertilizer for their own needs instead of buying container-loads of synthetic fertilizer produced at sprawling CO2-spewing factories and shipped for thousands of miles.

The widespread application of bionic leaves could be especially advantageous in developing countries (and remote areas in general) where access to conventional fuels and fertilizers is limited and expensive, or non-existent. Nocera hopes his work can bring the poor of the world their "first 100 watts" of energy through one form or another of the technologies he is developing. A Harvard-funded pilot program putting bionic leaves to use in India is just getting off the ground, and Nocera hopes to expand globally within the near future.

The vision is for retiring every fossil fuel out there and replacing them with solar fuels from your own "bionic" garden. Imagine a world with no more utility bills or lining up at the gas pump? "You can use just sunlight, air and water," concludes Nocera, "and you can do it in your backyard."

Contacts: Nocera Lab, nocera.harvard.edu; Silver Lab, silver.med.harvard.edu; Harvard Gazette, news.harvard.edu/gazette.

EarthTalk® is produced by Roddy Scheer and Doug Moss, visit www.earthtalk.org or question@earthtalk.org. ♻

Costa Rica: Carbon Neutrality

Costa Rica recently announced that it will be 100% carbon-neutral and 100% free of single-use plastics by 2021. The country has been 99% free of fossil fuels for electricity since 2015. It has also taxed fossil fuels for transportation, with the income going into forest protection. The result is that the forests now cover twice the area than they did thirty years ago, providing for carbon capture to offset use of fuels. ♻

A User's Guide for e-Bikes

Cont'd from p.7

e-cargo bikes that can replace a car or van, many with modular options for families to transport the kids as well as for commercial applications for businesses. Almost all now incorporate built-in mid-drive technology for its superior torque capability. In the U.S., businesses like UPS are experimenting with e-cargo bikes for deliveries, and there's even a new documentary called Motherload, exploring the e-cargo bike mobility revolution for moms and dads. Additionally, in Europe and in Britain, there are substantial government subsidies, rebates and grant programs to help replace vans and trucks with e-cargo bikes.

The number of mid-quality to really good e-bikes and e-cargo bikes on the market is certainly astounding, but it is important to point out the presence of plenty of subpar to dreadful e-bikes and conversion kits sold online or at stores like Walmart. Counterfeit battery cells, poor e-assist systems and bikes that weren't designed as e-bikes are all out there for the taking! For a great source of information on what to consider and what to avoid, check out ElectricBikeReview.com.

The emergence of the e-bike demonstrates how technology can evolve while maintaining our core capacities to interact with the world. Combining human energy with the supplementary electric power not only positions the e-bike as the ultimate hybrid vehicle, but it also opens the door for bike transportation to be far more inclusive for seniors, families and many others and not just something for the young and fit.

As bike mobility is now regarded as an indicator species for the health of any community, the rise of the electric bike likely would have received a nod of appreciation from Albert Einstein.

Dave Cohen is an integrative psychotherapist in Brattleboro. He is the founder of VBike (vbikesolutions.org), dedicated to promoting new bike design and technologies in Vermont. ♻

German Storage Solutions

The states in the north of Germany produce excess renewable electricity. They export much of what they do not need, but they have been hampered by a lack of transmission lines going to areas in the country's south.

Energy storage offers opportunities to reduce transmission demands, and new technologies are being examined. Grid power can be used to make hydrogen, which can then be used to generate electricity in times of high demand or to heat buildings. This technology is sufficiently developed that the states have agreed not to hold off on developing renewable power sources because of lack of transmission infrastructure. Instead, they will develop ways to use otherwise unwanted power, including for production of hydrogen for fuel. The hydrogen can also be used to produce other chemicals, such as other fuels or ammonia. ♻

Raising the Bar for Geo-Thermal

How to Get Ultra-High Efficiency

Matt Desmarais and Jeff Harrison

Housing Vermont, a nonprofit development company, wanted to create fifty-five new, permanently affordable rental-housing units. To keep their costs permanently low, they worked with Blake Group to design and build a next-generation geothermal heating and cooling system for their construction project in Brattleboro Vermont. The primary energy-related goal of the project was to reduce the building consumption of propane and electricity to a point where usage per apartment was low enough that future hikes in energy prices would not have a significant impact on unit rental fees. Secondarily, for global sustainability, a low CO2 footprint was desired.

Above: Red Clover Commons in Brattleboro, VT. Courtesy photo. Rt: The water room with the Thermal Care near frictionless compressor on the left and Grundfos Magna3 ECM pumps visible on the right. Image: Blake Group.

Over the past eight years, The Blake Group has been refining the design of what it takes to make a geothermal system operate with higher performance while also reducing installation costs, resulting in a number of outstanding projects. The Brattleboro project uses one seventy-ton, ultra-high efficiency magnetic bearing chiller providing both the heating hot water and cooling chilled water. The geothermal energy source or sink consists of twenty-four advanced geo-exchange closed loop bore holes, each 500 feet deep.

For ultra-high efficiency, geothermal systems, the Blake Group has developed a new set of design paradigms to produce some outstanding results. For the Brattleboro project the results are in: the system has performed with a seasonally varied coefficient of performance (COP) that fluctuates between 6.8 and 13, roughly two to four times better than the average residential geothermal installation.

While the Brattleboro apartment building has been measured to be an outstanding performer, there is also still room for improvement that may be obtained in more complete version of the Blake Group's design. What is the secret to ultra-high efficiency? It's not one big secret, but a lot of small points that add up to big savings. The keys are:

1. A near frictionless magnetic bearing "Thermal Care" chiller is used in place of a traditional scroll compressors, which operates at an average COP of about 7.2. This type of compressor uses about 50% less energy than scroll compressors, though are only practical for commercial, industrial or multi-family HVAC loads.

2. Low temperature heating water. Low temperature terminal heating devices were sized to use 95°F to 105°F hot water, and provides a significant portion, perhaps 20% of the energy savings.

3. Grundfos Magna3 ECM pumps move water through the facility with lower watts / GPM than the more commonly used variable speed drives with AC motors. Just this change in pump type saves about 8% of the annual KWh consumed by the pumps.

4. Energy recycling using waste heat from cooling, for heating. When the building requires BTUs for heat, it's high efficiency chiller first uses the building chilled water air conditioning loop as an energy source, then blends in warmer geothermal source loop water into the air conditioning loop to prevent it from getting too cold. This method of operation generally occurs all the time the outside air temperature is either above 40^{0}F outside or below 74^{0}F, a very significant number of operating hours. The system recycles these BTUs, using the chilled water to cool down apartments which are south facing, while pumping those same BTUs to apartments that are calling for heat.

5. Pipes are sized to reduce the required pump horse power, just one pipe size larger than more traditional rules of thumb make a significant reduction in annual killowatt hours (KWH).

6. Thanks to the increased heat transfer of advanced borehole heat-exchanger piping, "Versaprofiles: GeoperformX", material in the ground, the closed loop boreholes do not operate below 48^{0}F, well above freezing, so losses normally associated with the use of propylene glycol are eliminated.

7. While not used in Brattleboro, a small portion of the building energy collected as low temperature thermal solar heat (55^{0}F) can also significantly reduce the annual KWH used by a geo-exchange system.

The Brattleboro project is one of several ultra-high efficiency geothermal projects that have been driven by the Blake Group. Want to see first-hand how Blake's expertise can work for your commercial building? On July 30th, Blake invites you to tour their certified Net-Zero Building in East Windsor, Connecticut. Please RSVP in advance.

Looking for geothermal for your commercial, industrial or multi-family building? Blake does informational presentations around the Northeast on "Near Net-Zero HVAC by Design" and "The Myths and Science of Geo-Exchange" which shares the industry's best practices on geothermal design.

For more information or to RSVP to see Blake's net-zero headquarters, contact Matt Desmarais at matthew.desmarais@blakeequip.com. .

Matt Desmarais is an industrial sales engineer with Blake Group. Jeff Harrison is a Professional Engineer for Blake Group who specializes in geothermal design. ♻

Bank of the Commons:

Ecological Sustainability as the New Gold For Ecological Transformation

Roy Morrison

The challenge in building an ecological civilization from industrial business and pillage-as-usual is not technical or legal, but financial. To save ourselves from ecological catastrophe, our economic and financial system must value and embrace sustainability and devalue pollution, depletion and ecological damage.

Ecological sustainability must be monetized as the new gold, and store of value and capital to help finance the trillions of dollars of productive investment necessary for ecological transformation and the support of social and ecological justice. Oil, coal, natural gas must become stranded assets, written down and left in the ground and awarded a new non-pollution credit to be monetized by future renewable investment. A trillion dollars of stranded fossil fuel assets can become a trillion of dollars of investment in wind and solar hardware installations.

A new Bank of the Commons will support and invest in sustainability to provide broad and enduring ecological and social benefits to be monetized as capital by the Bank of the Commons.

The monetized value of sustainability becomes a capital asset for the Bank of the Commons and used both to invest in further ecological improvement and as social property distributed annually to all as social dividend for sustainable conduct.

The Challenge at Hand

How to move quickly from 'green' plans and pledges to sustainable reality?

How do we build an economy where economic growth means ecological improvement, not ecological degradation, where the price system sends clear signals for sustainability, where sustainable goods and services become cheaper, gain market share, and increase profits? How do we assure that an ecological price system is complemented and supported by intrinsic social rewards for the general pursuit of sustainability expressed through the strengthening of freedom and community, protection of the commons, and by social and ecological justice?

Bank of the Commons

The Bank of the Commons will both invest in ecological sustainability and monetize sustainable ecological value through pollution reduction and the growth of ecosystem services credited to all members of the community.

The benefits of replacing coal, oil, and natural gas must also be monetized and broadly shared by valuing the reduction of pollution, depletion, and ecological damage, and by the new ecosystem services provided by the regeneration of the ecosphere and the real natural capital accounts of living wealth.

Bank of the Commons investments will result in a dual multiplier effect upon the economy. First, by the shared benefits from economic growth, and second, by booking and distributing value of real wealth resulting from the collective social effort and success in reducing pollution, restoring habitat, and advancing social and ecological justice.

These benefits of the ecological turn are part of sustainable community wealth and shared by all. At the same time, the balance sheets of polluting, depleting, ecologically destructive entities are charged and debited for such self-destructive conduct where the polluter, not the community, is directly charged.

For example, borrow $10 million from the Bank of the Commons to build a wind farm producing 12 million kilowatt hours of energy a year to be sold in an ecological market for $3 million dollars a year. At the same time, the value of the carbon dioxide saved and pollution reduced, and ecosystem services restored are monetized on the balance sheet of the Bank of the Commons at a calculated $4 million a year to be both distributed as a citizen's dividend and reinvested in further sustainable efforts by the Bank of the Commons.

Similar to a regulatory asset like Renewable Energy Credits (RECs), that is created by solar and wind electricity, the pollution reduction and ecosystems services created by sustainable investment is added to the books of the Bank of the Commons. It is booked as ecological capital on the right side of the balance sheet and as a valuable cash asset on the left side of the balance sheet. Ecological accountants can handle the combination of reinvestment and citizen distribution much as in done by the Alaska Permanent fund with oil revenues and is used to create investment income and a citizen's annual distribution.

In 2017, around 5.14 billion metric tons of carbon dioxide were produced by U.S. energy consumption alone (34.8 billion metric tons globally). If the value of an avoided metric ton of carbon dioxide is booked at $100 a ton, the balance sheet capitalization of the Bank of the Commons would increase by $100 million dollars per million metric tons of carbon displaced, for a potential total value for a renewable energy future of $514 billion dollars.[1] Globally this amounts to Green capitalization of $3.48 trillion dollars. This is a recurring credit.

Environmental sustainability, not gold, should be the universally recognized store of real value, the manifestation in financial terms of economic growth as ecological improvement.

1 https/www.statistica.com/sta Energy and Environmental Services. U.S. carbon dioxide emissions 1975-2017.

Roy Morrison builds solar farms. His next book forthcoming is Ecological Economic Growth. ♻

DECARBONIZATION

Cont'd from p.3

have to pull these goals apart nor should it pull our standards of living down. It is important that our politicians understand the situation facing them, though, in the political landscape, whatever your perspective on the advance of decarbonization policies. They are appearing all over the world, implementing strategies, policies, taxes, incentives, funds, education and all manner of support for changes of substance toward this goal. The appearance of these initiatives, these motivated policies might be called 'political climate,' as opposed to the political weather, per se, which can appear rather senseless, to say the least.

They have varying timelines and a wide range of goals—it isn't all CO2, for example, even among GHG-focused programs. But the economic machinery working toward carbon reductions in the atmosphere has been in bloom, of late, despite the political will to turn one's back to it.

I would like to point G.E.T. readers to some useful pages in watching this phenomenon which may help to decloak the economic instruments that appear within decarbonization activity. The World Bank's carbon pricing dashboard link is https://cpd.worldbank.org.

Additional links:

1. The US EPA page explaining how things are calculated in carbon trading https://www.epa.gov/ghe-calc

2. Literature to help governments understand decarbonization and do it well https://www.carbonpricingleadership.org/

3. Oregonian climate work is explained here, with pages and reports: [https://occri.net]

4. An ambitions list from the governor: https://www.oregon.gov/kate-brown-climate/list

J. D. Kaplan is a certified remote pilot and a former member of the I.T. crowd. He is a reader in the areas of bioelectromagnetics and cryptocurrency. For G.E.T. readers, Mr. Kaplan intends to profile "natural climate solutions," those dependent upon forestry and land use. He lives and works at or above sea level near Boston. ♻

2019 VERMONT CLEAN ENERGY REPORT IDENTIFIES A MATURING CLEAN ENERGY CLUSTER

The Vermont Public Service Department (PSD) is pleased to announce the release of the 2019 Vermont Clean Energy Industry Report, the sixth annual effort in the state to describe the status and characteristics of Vermont's clean energy industry.

Commenting on the report Commissioner June Tierney said, "With the highest clean energy employment per capita in the nation (5.7%), the Clean Energy Industry is a significant contributor to the Vermont economy."

The PSD's Clean Energy Development Fund (CEDF) commissioned BW Research Partnership, Inc. to conduct the study of Vermont's clean energy cluster and issue the report. The full report can be found on the PSD's web site at http://bit.ly/GET-CEDF-report or downloaded directly at http://bit.ly/GET-CEDF-direct.

Commissioner Tierney also said, "The clean energy sector of Vermont's economy continues to mature and provide good jobs and expanding markets for Vermonters. Growing the clean energy economy will serve us well by improving the lives of Vermonters and helping Vermont meet its goal of obtaining 90 percent of our energy from renewable sources by 2050."

Important findings of the report include:

- Vermont continues to be the national leader in per-capita clean energy jobs.
- With a total employment of almost 18,900 workers, the clean energy sector is a significant part of the Vermont economy, representing about 6% of all workers.
- Over 14,500 Vermont clean energy workers now have full-time jobs in the sector, up from just over 12,000 in 2017.
- There is a lack of new talent that created difficulty for clean energy employers and is likely constraining growth of the sector.
- The total number of clean energy establishments grew by nearly 2% to 3,678.
- Vermont clean energy employers are very optimistic for 2019, expecting to add about 1,000 jobs, a growth rate of 5%. ♻

Heat pump pool heater

ECONOMIC BOOM *Cont'd from p.1*

Who would have thought airlines would represent a renewable power investment opportunity? Harbour Air, in Vancouver, is converting all 41 of its seaplanes to electric power. Photo: BriYYZ, CC-BY-SA 2.0 generic, Wikimedia Commons.

One really important issue is that dealing with climate change means employing millions of people at thousands of businesses for dozens of years. As part of his presidential campaign, Washington's Governor, Jay Inslee, called for spending $9 trillion of investment creating eight million jobs, according to the Huffington Post (http://bit.ly/Insleeplan).

One important aspect of renewable energy is that prices will almost certainly decline. Solar and wind power are already at parity with the least expensive fossil fuels in most of the United States (http://bit.ly/Lazard-LCOE-12). Wright's Law of economics suggests that they will only continue to decline. (Please see an article at CleanTechnica, which I wrote, for more, http://bit.ly/CT-prices-dropping.)

All this means that spending money on renewables will save us money, especially because many fuel-burning power plants are old and need to be replaced anyway, making further investment in them unnecessary.

Battery prices have dropped to the point that utilities are already using them instead of the more expensive natural gas peaking plants. An article at CleanTechnica says the firm 8minutenergy is actually building a 520-megawatt-hour (MWh) battery in Nevada, which it claims will deliver power at $35/MWh (http://bit.ly/CT-8minute-battery). This is less than a quarter of the $152/MWh to $206/MWh energy from the natural gas burning peaking plants costs, according to Lazard's Levelized Cost of Energy Analysis, Version 12.0 (http://bit.ly/Lazard-LCOE-12). Furthermore, the quality of the electric supply from batteries is significantly greater than that from fossil fuels and nuclear power, because batteries can respond to changes in demand instantly, and fossil fuel technologies cannot. Since batteries compete with peaking plants, it seems a lot of them will be built, and this means there is investment opportunity.

There are other benefits to this possible economic dynamo. Renewable investments mean our energy will be increasingly secure. This is partly because transmission lines are the most vulnerable parts of the grid and most renewable power sources will be closer to the customers. In some cases, they are at customer sites in microgrids which can continue to operate when grid power is down but often provide really inexpensive electricity when the grid is working, as an article at Climate Central explained (http://bit.ly/CC-microgrids).

Coal plants have been closing, and now natural gas plants are beginning to do so, because they cannot compete with renewables. An example, discussed in an article at CleanTechnica, is a natural gas plant in California, which GE is closing with a loss of two-thirds of a $1 billion investment (http://bit.ly/GE-plant-closing). But GE's loss represents another investment opportunity which is why the company is now focusing on renewable energy.

Transportation is an important issue for renewable resources. Technology is improving rapidly, and costs are going down. Sales of EVs are mounting worldwide, according to GreenTech Media (http://bit.ly/GTM-EV-sales). At the same time, despite this growth, the overall car market is down, because gas mobile sales are off sharply.

Home heating costs are declining rapidly. Behind this is a surge in sales for both heat pumps and efficiency. Read just about any issue of Green Energy Times for examples of this and other advances in renewable energy.

There are possible blocks to development, but they are almost entirely political and not based on economics in any way (apart from fears of stranded assets from those who still push fossil fuels and pay for political campaigns). We might examine a series of examples for this.

The electric bus (ebus) industry is expected to grow to $85 billion per year by the end of 2023, according to an article in MarketWatch (http://bit.ly/MW-ebus). Nearly all of this business activity is in Asia, with most of it in China. The U.S. position in the ebus market is so small that the article barely mentions it, as the country is held back from a lucrative market by lack of interest. Since the payback time for the extra costs of an ebus is so favorable, this will change in the U.S.

Most photovoltaic (PV) cells and panels are made in China. The U.S. produces very few. To protect the jobs of workers in two plants, both owned by foreign companies, we entered into a trade war. The result is that Americans pay more for PVs, and China has lots to ship to other countries. And China finances at least some installations by using potential military sites as collateral.

Neodymium, which is used for magnets in wind turbines, is mostly mined in China. We have mines, but ship the ore to China to be processed. Now that trade could be held hostage by the Chinese in a trade war, giving a big advantage to Chinese wind turbine makers, according to a Reuters article (http://bit.ly/US-dependence-on-China).

While we are being held back by oligarchs in Washington D.C., we can understand that the situation will not last forever. Whether it is because of investment potential or because the damage of climate change becomes too much to bear, we will respond. We hope it will happen within the next year or two. But we can be assured that when that time comes, investors who act on the facts, instead of "fake news," will have a lot to invest in. And at that point, America will have a real opportunity to be great again. ♻

"The shale gas revolution has frankly been an unmitigated disaster."

- Steve Schlotterbeck

Injection well head. Joshua Doubek. CC-BY-3.0, Wikimedia Commons.

An article at OilPrice.com (http://bit.ly/OP-fracking-quote) quoted Steve Schlotterbeck, former chief executive of EQT, a shale gas giant, saying at a petrochemicals conference in Pittsburgh, "The shale gas revolution has frankly been an unmitigated disaster for any buy-and-hold investor in the shale gas industry with very few limited exceptions. … Nearly every American has benefited from shale gas, with one big exception, the shale gas investors." ♻

The Plastics Problem – Are solutions in sight?

George Harvey

Vermont Public Radio (VPR) recently ran two stories that both speak to the same problem but from very different points of view. They point to both a problem and a solution.

The first one I will examine here, though it was the second to broadcast, is "Plastic Has A Big Carbon Footprint – But That Isn't the Whole Story" (http://bit.ly/VPR_plastics). In this story, National Public Radio reporter, Christopher Joyce, described the carbon footprint of plastics and compared them with the alternatives.

Founders Eben Bayer and Gavin McIntyre. Photos courtesy of Ecovative Design.

Many of us are familiar with the problems plastics are causing in our environment. Bits of plastic are caught in the ocean where they stay for years, gradually gathering in gyres. These were covered in the article "Garbage Patches in our Oceans," in the August 2015 edition of Green Energy Times (http://bit.ly/GET-ocean-garbage-patches). The VPR story, however, went into aspects of the problem we did not cover in that story.

Plastics nearly all come from oil and gas. Extraction, transportation, refining, production, processing, and more transportation all contribute to the climate effects from plastics. In the VPR broadcast, Carroll Muffett, head of the Center for International Environmental Law, said emissions from aspects of manufacture, use, and disposal of plastics is expected to be about 56 billion tons between now and 2050, fifty times the current emissions of all U.S. coal-burning power plants.

The problem with this is partly that replacing the plastic with such things as paper will only make things worse because of the emissions and losses associated with those replacement materials. They use forest products and are associated with their own emissions from transportation, manufacture, and disposal. For example, a plastic bag weighs much more than a plastic bag, so it requires much more energy to transport.

The broadcast on carbon emissions associated with plastic does not sound particularly hopeful, but it should be taken with an understanding of the possibilities for new replacements. The other VPR broadcast I mentioned went into this. That program was "Molding Mycelium – The Roots of Mushrooms – To Tackle Plastic Pollution" (http://bit.ly/VPR-mycelium). It includes an interview with Eben Bayer, founder and CEO of Ecovative Design (ED), a company that is doing extensive research on mushrooms and the products that can be made from them.

Bayer is a mechanical engineer by training, and the problems he has been working on relate mostly to such things as packaging, insulation, and padding. They range far wider than those, however, and include artificial leather and a vegan meat substitute.

Bayer started his business with the understanding that plastics are dangerous and that their use has serious consequences. He saw that he could develop materials that could replace them with little or no negative environmental effect.

The foam plastics used to protect products in shipping provide a good example of what ED's products can do. Just as polystyrene foam can be made in a mold to form protective padding for specific products, such as televisions, for example, ED could grow materials with similar structural benefits in similarly shaped molds. The mushroom-based padding on the television is so like what might be cast from styrene that many people would not immediately see the difference.

That difference, however, is profound. Where styrene may take centuries to break down in a landfill, or, worse yet, wind up in a gyre in the middle of the ocean, the product from ED can be added to the compost and can break down in a few short weeks.

Readers of *Green Energy Times* who have sharp eyes and good memories might remember that ED was mentioned in our June 2018 article, "A Real Home-Grown, High-Performance Door" (http://bit.ly/GET-Home-Grown-Door). That article was about Gryphon Doors, which were made with insulation by ED's mycelium.

And in fact, *G.E.T.* has covered other products that were compostable plastics or replacements for plastics as well. One of these, which appeared in the August,2015 issue was "Good Plastics? Really?" (http://bit.ly/GET-good-plastics).

The message here is simple. Plastics present enormous problems, but solutions do exist. ♻

Compostable molded packaging, grown from the mycellium, has no negative environmental effects.

A Clear-Eyed Look at Glass Recycling

What really happens to that bottle, anyway?

Michele Morris

Glass has long been a darling of folks who think of themselves as champions of "green" values like waste and toxics reduction (or elimination!), sustainable energy use, and all-around miniaturization of our planetary footprint. But when it comes to single-use packaging like wine bottles and peanut butter jars, glass isn't all it's cracked up to be.

Don't get us wrong—we love our Mason jars and growlers. We use them over and over for much more than zucchini pickles or burp-inducing beverages. Reuse rocks! But what happens when that same container is used just once, then recycled? Let's take a look at glass recycling in Vermont.

STEP 1. Your "blue-bin" recyclables go to a drop-off center or transfer station. From there, they probably go to one of Vermont's two materials recovery facilities – commonly called MRFs (rhymes with smurfs). Chittenden Solid Waste District's (CSWD) MRF in Williston receives blue-bin recyclables from the northern half of Vermont.

STEP 2. At the MRF, glass bottles and jars are smashed at the beginning of the sorting process by spinning metal discs. These discs are spaced two inches apart. Anything smaller than two inches—corks, loose bottle caps, pill bottles, etc.--drops through these spaces and ends up as trash mixed with the glass.

The broken glass travels past vacuums, magnets, and a whole series of complex machines that shake, rattle, and roll that whole messy mix. The goal is to separate glass from all that trash.

This cleaned-up glass goes through a special smasher that breaks the shards down to tiny, sand-like particles known as processed glass aggregate (PGA).

STEP 3. CSWD pays about $5.00 per ton to send the PGA to a quarry in Colchester, VT, where it's blended with quarry stone and sold for use as a subbase in local construction projects.

People who've been on our fabulous MRF tour since are always surprised to learn that the 6,500 tons of glass bottles and jars put in your blue bins do not become new bottles and jars. This is true all over the Northeast (and in most other parts of the United States).

Recycled glass can be used to make new glass containers only if the colors are separated and the glass is free from any non-glass contamination. There are clean-up facilities that wash and sort glass by color, but the closest one to the northeast is in Canada. The financial and environmental costs of hauling such heavy material long distances are significant.

Bottles delivered to a redemption center or reverse vending machine for the nickel refund go through an entirely different system that doesn't include a MRF. These bottles have a slightly better chance of becoming new bottles, but they travel many, many miles to do so. Transporting heavy glass wastes energy, creates emissions and impacts roads.

Recycled glass bottles and jars crushed and sifted into processed glass aggregate. Photo: Josh Tyler/CSWD.

The bottom line is that no matter which system you use to recycle your glass bottles and jars, they are unlikely to end up as new glass containers.

CSWD has invested more than a million dollars in equipment devoted to ensuring that our community's glass bottles and jars stay close to home and out of the landfill. All signs are pointing to more and better options in the future—we'll be sure to share them as they come online.

In the meantime, we urge everyone to follow those three R's:

Reduce packaging (and costs) by buying in bulk and portioning at home;

Reuse containers. Replace single-use containers with durables like water bottles, coffee mugs, and shopping bags. You can even bring a glass or plastic storage container to the meat and seafood counter;

Recycle what's left--the right way. Not sure? Visit www.cswd.net for tips and answers!

Michele Morris is the Director of Outreach and Communications for the Chittenden Solid Waste District. CSWD's mission is to reduce and manage the solid waste generated within Chittenden County in an environmentally sound, efficient, effective and economical manner. Our vision: Products are designed to be reused or recycled and our community fully participates in minimizing disposal and maximizing reuse and recycling. ♻

Recycling Textiles: Why and How

Abby Overton

Image: Flickr.com

In the U.S., we generated 16 million tons of textile waste in 2015, up 69% from 2000. Once in landfills, natural fibers can take hundreds of years to decompose. They can release methane and CO_2 gas into the atmosphere. Synthetic textiles like polyester are designed not to decompose. In the landfill, they can release toxic substances into groundwater and surrounding soil.1 Right now, 84% of U.S. textiles go to landfills -- we can do better! Let's work on collecting, recovering, and reusing our textiles.

Sort old clothing, curtains, table linens, bed linens, and other fabric items into three piles: great condition, good condition and poor condition. Great condition looks new, has retained its shape perfectly, and bears no signs of wear and tear. Good condition may be a little bit faded or worn but still in wearable/useable condition with no stains or holes. Poor condition is stained, threadbare or has holes.2

Household linens that are in great or good condition can be given away or donated. Habitat for Humanity ReStores takes donations of end bolts and samples. Scraps from furniture you have re-upholstered and samples from an interior designer can become craft projects at schools, or go to theater programs -- they are always looking for interesting fabrics for costumes and sets! Quilts for Kids, with chapters around the country, provides quilts and wheelchair bags to children in hospital.

Great-condition clothing is excellent for swaps or consignment stores. To host a clothing swap, invite a handful of friends who wear approximately the same size to bring their closet surplus, and exchange clothes among you. Alternately, bring your items to a consignment store in your area. They'll sell them for you and give you a portion of the proceeds.

Good-condition clothing and linens can also be donated to a thrift store like Goodwill, a PTA Thrift Shop, or the Salvation Army. There, the items are sorted, priced and placed on the sales floor for secondhand shoppers to find. Thrift stores often use the proceeds from the sale of these items to support charity and school initiatives.

You really shouldn't donate your poor-condition clothing or household linens to a thrift store. If you're getting rid of it because of its condition, you can bet no one else will want to use it, either.

Use poor-condition household linens as stuffing for pillows or as rags -- just rip them up and use them for all your cleaning needs, saving money on paper wipes sold in plastic cylinders. If you use non-toxic cleaners and your rags are all-natural fiber, you can throw them in your compost bin once you have used them all you can. Also, your local animal shelter will probably take any kind of scraps to use as animal bedding.

For worn-out clothing, some companies like Patagonia accept their own items back for recycling. Fashion retailers like H&M and American Eagle Outfitters offer in-store clothing recycling bins to collect textiles and accessories of any brand, so recycling your clothing can be as easy as a trip to the mall!

Finally, there may be textile recyclers in your area that will take textile waste. Find a drop-off spot near you using a handy recycling locator like the ones at RecycleNation.com and Earth911.com. None of it needs to go to the landfill!

One of the best ways to protect the planet from textile waste is to buy durable goods. Purchase items you know will last! Another great way is to shop second hand. Don't just donate to a thrift store or sell at a consignment shop -- buy furnishings and clothing there, too! You'll be reducing energy, water, and chemical use, and you'll enjoy your purchases that much more, knowing you are doing good for the earth.

For more information and to find home furnishings made by companies who work to protect the earth, please visit the Sustainable Furnishings Council (SFC) at https://sustainablefurnishings.org/. The Sustainable Furnishings Council provides comprehensive information on environmental, safety, and health issues in the home furnishings industry. The SFC champions initiatives that improve products and processes.

1 *thebalancesmb.com*
2 *Earth911.com*

Abby Overton is the Communications Manager for Sustainable Furnishings Council. She is grateful to be part of the team and, in her small way, contributing to the greening-up of the furnishings industry. She is excited to help educate consumers about their eco-friendly options. ♻

Image:wafflegroup.com

OOho Pods Reduce Plastic Bottle Usage

EarthTalk® From the Editors of E-The Environmental Magazine

A London-based start-up wants to replace plastic water and soda bottles with these edible (and biodegradable) "Ooho" pods made from seaweed. Credit: Skipping Rocks Lab.

As more people become aware of the extent of plastic waste clogging up our environment, cutting back on plastic use is fast becoming a key environmental priority around the world. According to a 2017 study by researchers from the University of Georgia, UC Santa Barbara and Sea Education Association, humans have produced 8.3 billion metric tons of plastic since mass production started in the 1950s. While we've recycled about nine percent of all that plastic and incinerated another 12 percent, as much as 75 percent has been discarded into landfills or, even worse, set adrift into the environment. If we don't slow down our current run rate of producing new ("virgin") plastic, we can expect to add another four billion metric tons of it to our global environment by 2050.

With no cheap and scalable way to collect and get rid of all this plastic, the best we can hope for is to not make the problem worse. Luckily sustainable alternatives to plastic are coming on strong. PLA (polylactic acid) plastic, which is derived from plants and functions like conventional plastic, is promising but needs to scale up to become economically viable as it requires dedicated recycling/processing systems

Cont'd on p.39

Higher Beer Prices

Cont'd from p.1

ducers to face declines due to warmer, drier, or more extreme weather.

The scientists published their conclusions, "Decreases in global beer supply due to extreme drought and heat," in the journal Nature Plants (http://bit.ly/nature-beer) last October. At that time, its conclusions were described in most media as showing that beer prices could double because of climate change. What they actually said was that beer prices were projected to go up by 193%, in a mid-range scenario for climate change. Unfortunately, nearly all of the media misunderstood this and reported it as doubling the price. An increase of 193% brings the price to 293%, or nearly triple what it currently is.

Also, unfortunately for beer drinkers, that mid-range scenario is getting to look increasingly unlikely, as the most likely scenario of climate change is getting worse, due to our political inaction. The website IFLScience has an article that illustrates this whose title speaks for itself, "Permafrost in Canada is Thawing 70 Years Earlier Than Expected" (http://bit.ly/fast-thaw). So perhaps we should act as though the scenario for the end of the 21st century were only a decade away.

Other news would reinforce that idea. Th article at IFLScience appeared only days after news came at CNN's web site that two billion tons of Greenland's ice had melted in a single day (http://bit.ly/melting-greenland). Things are changing far faster than anyone anticipated, and it is not good.

The Nature Plants article provided a number of scenarios, and the one widely reported was just a mid-range example. The worst case it described (though not the worst that could conceivably happen) had the price of beer in some places increasing by 338%, with Ireland as the example. To be absolutely clear, that means an increase to 438% of what it currently costs. So, if a six-pack of a beer costs $9 now, in this scenario, it would go to nearly $40.

While these are just the results of scientific modeling, they are being taken quite seriously by people in the brewing business. An article at supplychaindive.com describes the work Molson Coors is doing to perform risk management (http://bit.ly/molson-risk-management). It says that over the past decade, Molson Coors has put over $20 million into assuring that they have barley in the future. To do that, it is working with growers to ensure that things do not go completely out of hand. It has set up a web portal to manage data.

The potential for the price of beer to get outrageous, however, is not the really bad news. Barley is just one food resource. Its supply problems speak to an overall need to address problems of climate change for agriculture, regardless of the crop. Barley is sensitive to temperature and availability of water but so is just about everything else farmers grow. Barley will be grown in areas that had not previously been warm enough for it, but overall, production would probably decline markedly. Sadly, the same is true for peas, carrots, poultry, and more.

We have seen prices spike for foods in the past. In 1974, the price of sugar suddenly jumped about ten-fold. The same year, an onion shortage made them disappear altogether from many supermarkets. And about the same time, our country ran out of grapes and raisins. Many people do not remember those shortages. They went away quickly, and now they seem somehow unreal.

Malted barley. ArnOlson, Wikimedia Commons

The shortages we see for the future have a different sort of reality. As they come, which it seems they certainly will, the price increases will not be spikes that go away quickly, as those of the past did. They will be of very long duration, possibly decades.

The conclusion for this should not be as scary as it might sound, provided people prepare for the changes. The advice we can give is for all people to grow as much of their own food as possible. For those who do not have land for a garden, we suggest using community gardens, where they exist, and advocating for them where they do not. And learn how to save your seeds. ♻

How to Determine if a Heat Pump is Right for You

Matt Sargent and Bruce Landry

The first step in determining if a heat pump is appropriate should be to have an energy audit completed by a certified home performance contractor. The audit will determine costs and savings for recommended efficiency upgrades. Typically upgrading air tightness and insulation will not only improve comfort and provide energy savings but will allow your heat pump to work much more effectively. In Vermont, contact Efficiency Vermont to find a certified contractor in your area.

Once you've completed this important step there are a few things to consider prior to selecting a heat pump for your home. What type of fuel do you currently heat with? Oil, electricity, and propane are considered expensive heat, so installing a heat pump to offset these fuel sources is typically a cost-effective upgrade. Natural gas, pellets and cord wood are inexpensive fuels and switching from these fuels to a heat pump may not lower your heating costs.

It may take more than one heat pump to effectively heat your home or business. Check to ensure your electric service (line to your home) has enough electric capacity to run one or more heat pumps. Upgrading the electrical panel can add expense to the installation.

Ductless mini-split heat pumps are basically a "point-source" heating system, meaning they have no distribution system such as ducts or baseboard heat. The best way to take advantage of point-source heating is with an open floor plan. Homes that are divided into smaller rooms may have difficulty maintaining appropriate temperatures throughout the home.

Once you have decided that a heat pump makes sense for you, the design work begins. For best results contact a heat pump contractor in Efficiency Vermont's Efficiency Excellence Network (EEN). EEN contractors work closely with Efficiency Vermont and have the training and technical ability to ensure your heat pump installation is a success. You can find an EEN heat pump contractor in your area by contacting Efficiency Vermont.

Proper sizing and selecting the right heat pump are critical to the success of an installation. Getting the sizing right is done by performing a heat loss calculation. This is typically done by the contractor or HVAC distributor using energy-modeling software. It's important to get this step right; if inaccurate assumptions are entered into the energy model software, then the recommended output will be inaccurate.

Outside view of a mini-split heat pump system. Image: Wikipedia.org.

An example is a project with Central Vermont Habitat for Humanity. This project was enrolled in Efficiency Vermont's Residential New Construction Program, and their energy consultant created a preliminary energy model from the plans showing a design heat loss of less than 10,000 Btu per hour. For this small, super-efficient home, I felt a single zone heat pump rated at 12,000 Btu per hour might be appropriate; however, sizing and selecting the proper heat pump is ultimately the responsibility of the heating contractor.

When the heating system was put out to bid, Contractor No. 1 came back with a unit rated at 24kBtu per hour. Contractor No. 2 came back with a 42kBtu unit. I believe they both relied on the same HVAC distributor to do their heat load calculation. Keep in mind this is a new high-performance house with no back-up boiler for those cold snaps, and the heating contractor would be responsible if the heating system proves to be inadequate to maintain comfort. Even so, this type of over-sizing can reduce a heat pump's ability to modulate or turn down to a lower output, which is very important for maintaining efficiency when less heat is required.

For new construction, the Vermont Energy Code, RBES 2015, states that maximum oversizing of a heat pump is 115% of ACCA manual S heating and cooling equipment sizing guide.

Efficiency Vermont has recently learned that in some cases, multi-zone systems are not performing at their expected efficiencies. Multi-zone heat pumps tend to be less efficient than single-zone heat pumps for several reasons and oversizing can exacerbate this performance discrepancy. Installers sometimes make the mistake of selecting a heat pump based on number of zones they want to serve rather than the output capacity of the heat pump.

To run efficiently, modern heat pumps modulate their output to match the heating or cooling load in the building. If they are not able to turn

Cont'd on p.36

Naturally Cool with Natural Cooling

George Harvey

QuietCool® whole-house system. Photos courtesy of Jeff Kapsalis.

I would think that just about everyone has had the experience of lying in bed, tossing, being unable to sleep because it is too hot. Air conditioning (AC) can help, but it uses a lot of energy. If you live in an off-grid house, it might not even be an option.

In the old days, the fix was to sleep on a screened-in porch to take advantage of the cool night air. Today, for those who do not have screened-in sleeping porches, the usual alternative is to toss, turn, and wish you could sleep outdoors in a hammock without being attacked by mosquitoes.

Fortunately, there is another solution to such problems.

Jeff Kapsalis is a contractor in Shelburne, Vermont. He founded and ran his company, All Aspects Tile and Carpentry, for over a decade, when, about seven years ago, he came across a new whole-house fan from a company called QuietCool® (QC). With a specialty working in kitchens and bathrooms, he understood the need for ventilation, and the things that are needed for efficient operation. A lot of the technology on the market was old to him, but in this equipment, he saw something he liked. He started with an installation in his own house.

The area around Burlington is cool at night, but a well-insulated house, which can be wonderful at retaining heat for those long winter nights, has a secret problem for the summer. It retains heat in those summer nights wonderfully well also. In a heatwave, it takes a good house a day or two to heat up much, because the insulation keeps the heat out. But the temperature inside goes up each day, and the heat that does come in is retained to start the next day off warmer. Add to that the fact that normal household activity warms a house, and without AC, it can be uncomfortable at night.

Whole house vent systems had been around for fifty years, blowing household air outside, which meant cool, outside air was drawn in any open window. The idea behind such a system was to draw in outside air to cool houses at night, then close all the windows to keep the cool air inside during the day. It worked well in an insulated house, and it used less energy than AC, but the user had to be willing to put up with its cranky habits. The fans were noisy. Like AC units, they had to be removed for cold months and installed in the spring. They had to be tended to regularly.

The QC system provided whole-house cooling by sucking the hot air out of the house's living spaces and into the attic, from which it went out through the attic vents. Fortunately, most houses have attics with sufficiently large vents, which means they are candidates for installation.

The system draws air through a ceiling vent, and from there it goes into a round duct that is wide, flexible, and insulated. This leads to the fan, which is suspended from a rafter. Since the fan is suspended on straps that dampen sound, it is nearly inaudible in most of the house, and typically not noticeably audible from nearby. Its action replaces the attic's hot air with cooler air from the house.

The ceiling vent can be covered in the fall with an insulated panel specially made for the purpose. So, the fan does not have to be removed, and the work involved in keeping the system is much reduced almost to nothing. It is far less than the work of installing and removing AC units, certainly.

One of the great things about this system is the small amount of energy it uses. Small units can draw as little as 65 watts. Large ones draw much more, but the largest can provide for a 3,500 square foot house on about a tenth of the energy that AC uses.

Kapsalis liked the QC system so much that he became a dealer. You can find his cooling business, *Naturally Cool Vermont*, at naturallycoolvt.com. ♻

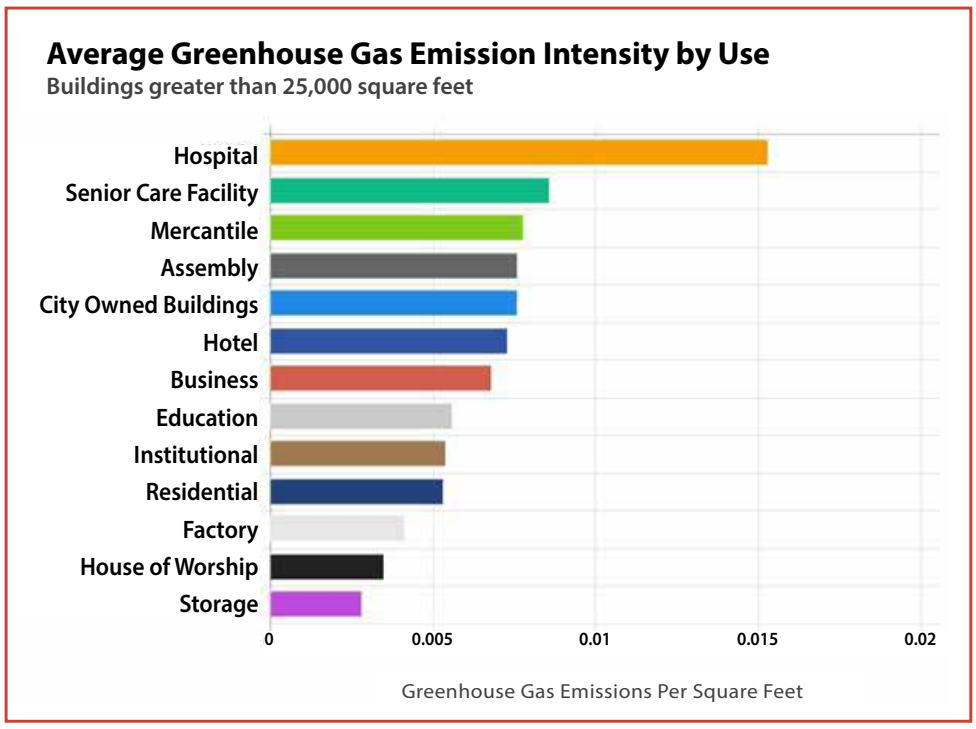
The attic assembly of the Naturally Cool *system.*

NYC's Climate Mobilization Act
What Does It Mean for Building Owners?

Marc Zuluaga

In April of this year, Introduction 1253-2018 was approved by the New York City Council along with several other major pieces of legislation as part of a Climate Mobilization Act. While it will take some time to more precisely gauge the Climate Mobilization Act's impact across the industry, the Urban Green Council described it as "arguably the most disruptive in our lifetime of the NYC real estate industry."

Previous building energy legislation in NYC has focused primarily on providing the market with access to information in the form of benchmarking and audits. In response to increasing demands for more urgent climate action, this new local law will require energy performance levels – and significant retrofits in some cases – in most existing buildings over 25,000 square feet between now and 2030 and deeper reductions beyond 2030.

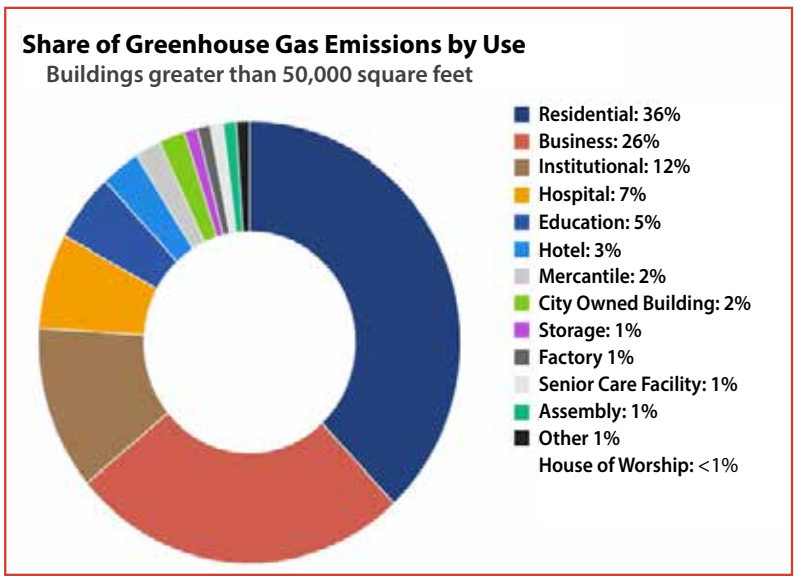


Graphs: New York City Council https://council.nyc.gov/data/green

HOW IT WILL WORK

The law establishes targets for carbon-emissions intensity per square foot for buildings based on occupancy class. For instance, multifamily buildings, office buildings, schools, and storage facilities will have different intensity targets. Mixed-use buildings will have their targets set based on a weighted average of their different spaces. Across all segments, these targets will get reduced over time. Building on the type of data submitted as part of annual benchmarking, all tenant and owner energy used at a particular building will be converted to carbon intensity per square foot.

Starting in 2024, buildings will be fined on an annual basis for carbon footprint that exceeds their targets. Based on their performance today, approximately 20% of buildings exceed the 2024 – 2029 targets while approximately 75% of buildings exceed the 2030 – 2034 targets (https://council.nyc.gov/press/2019/04/18/1730/). As an alternative to this performance-based framework, rent-regulated multifamily buildings with at least one rent-stabilized apartment will be required to implement a prescriptive list of upgrades by 2024. These upgrades include indoor temperature sensors providing feedback to boilers and apartment thermostatic controls.



WHAT IT WILL MEAN TO THE MARKET

The lowest carbon intensity buildings today will not be at risk of fines, while higher carbon intensity buildings today will have to reduce their carbon footprint through deep-energy retrofits by 2030 to avoid fines of $268 per ton of carbon emissions in excess of the building's limit. With a carbon-based metric, fuel sources matter in addition to energy intensity. For instance, #2 oil results in approximately 40% more carbon emissions than gas per British thermal unit (BTU). To meet the 2030 target, older steam-heated multifamily buildings will have to implement a number of upgrades, while in office buildings, tenant electricity loads that dominate carbon footprint will need to be addressed systematically over time.

Additionally, the legislation allows for reported greenhouse gas (GHG) emissions to be reduced each year through the purchase of clean electricity or GHG offsets. Although the basic carbon reporting metric is relatively simple, evaluation of credits in the form of purchased carbon-free electricity or greenhouse gas offsets will require thoughtful analysis in order to identify the most cost-effective pathway for any building to comply. The law will require an advisory group to make recommendations regarding a carbon trading approach that could allow the market to more optimally allocate resources across buildings.

BOTTOM LINE

The lack of support or, in some cases, legislative rollbacks, from the current administration has galvanized U.S. cities and communities to take action locally. Major cities like New York, Washington DC, Chicago and others are taking different approaches in hopes of achieving similar results: triaging and reducing GHG output from the highest emitters and setting net-zero goals for new construction.

While particular strategies may vary based on building systems and ownership structure, smarter buildings that align carbon-reduction strategies to most positively impact asset value and tenant experience are a good place to start. Visit www.smartbuildings.nyc for further resources and information that focus on whole-building solutions to reduce carbon emissions.

Marc Zuluaga is the CEO of Steven Winter Associates. ♻

AEROBARRIER
Case Study No.1

Nate Gusakov

In our last article we introduced AeroBarrier. Here's a quick refresher:

In essence, the system involves blower door pressurization of the house (to +100 pascals), a series of tripods with spray nozzles on them and the introduction of a fine mist of specialized acrylic caulk. From there, much like a balloon with pin holes in it, the pressure drives the sealant to all the small cracks in the building and seals them up. During installation, we monitor the air leakage on our computer and watch the needle drop as the various holes and cracks throughout the house fill with sealant. When we reach our leakage target, we turn off the machine, clear the air with a few fans and open windows and clean up. In most situations, we can take a house from around 7 ACH50 down to below one in under two hours of spraying. The space can be worked in again within about thirty minutes, and once cured, the sealant is a non-toxic, low-VOC substance that is GreenGuard Gold certified for use in schools and hospitals.

In this issue, we present a case study from a recent install in Lake Placid, NY:

We got a call from homeowners in a pickle. During their construction of a kit-built log home (total volume ~44,000 cubic feet), New York adopted a residential building code that requires a blower door test showing air leakage of <3 ACH50 in order to receive a Certificate of Occupancy (C.O.). They needed to be able to move in early this summer, but after their best efforts at caulking likely leak points, the house tested at 5.3 ACH50 (3900 CFM), so it was a no-go on the C.O.

Appliances and fixtures were installed and all finishes were complete except for floors, which had not yet been laid. The owner was quite concerned about the possibility of residue from AeroBarrier on finishes and fixtures, and so we first discussed all possible methods of manually air-sealing. Two features in particular made this a steep challenge: the walls are full round logs with inconsistent gasketing between them, and the ceiling is tongue and groove pine with no air barrier applied above it. These two conditions implied thousands of small air leaks that would have required many days' worth of labor to seal up with color-matching caulking, and even then, there would be no guarantee that the house would reach 3 ACH50.

By using AeroBarrier: 1. We could guarantee the owner that the house would be tight enough to pass code. 2. Because the sealant is essentially self-directed, we could be confident that only the leakage pathways would be sealed, and time and material wouldn't be wasted sealing up areas that weren't going to leak in the first place. 3. The owner would be able to confirm scheduling right away with the flooring contractor, and therefore keep everything on track.

Once we received approval to go ahead with AeroBarrier, the house was prepared for the installation: fixtures were bagged or covered, appliances were wrapped, counters and railings were covered with drop cloths. Because AeroBarrier installation goes faster when outside relative humidity goes down, we waited until the following day to let weather conditions dry out. A quick install would help reduce the potential for residue on finished surfaces. The following day we successfully sealed the house from 5.3 to 2.7 ACH50 (1792 CFM) in well under two hours. The owner was amazed at the cleanliness of the finished surfaces after fixture and counter protection was removed. There was virtually zero cleanup. We packed up and headed out, and the project moved forward with a major code obstacle out of the way.

Nate Gusakov is the lead installer for Zone 6 Energy and is based in New Haven, Vermont.

Zone 6 Energy offers expert air-leakage consulting, AeroBarrier installation, and BPI-certified blower door testing throughout New England and upstate NY. ♻

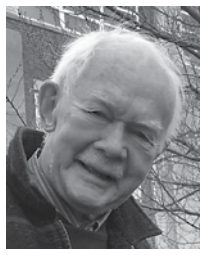
Exterior of the log home. Note the keyed profile milled into the tops and bottoms of the logs. With inconsistent gasketing, this was a serious potential leakage pathway.

A gable dormer after the installation. AeroBarrier sealant can be seen as thin white lines along bottom of rafters.

Lake Placid Cabin: all is set up for AeroBarrier install. Photos courtesy of Nate Gusakov.

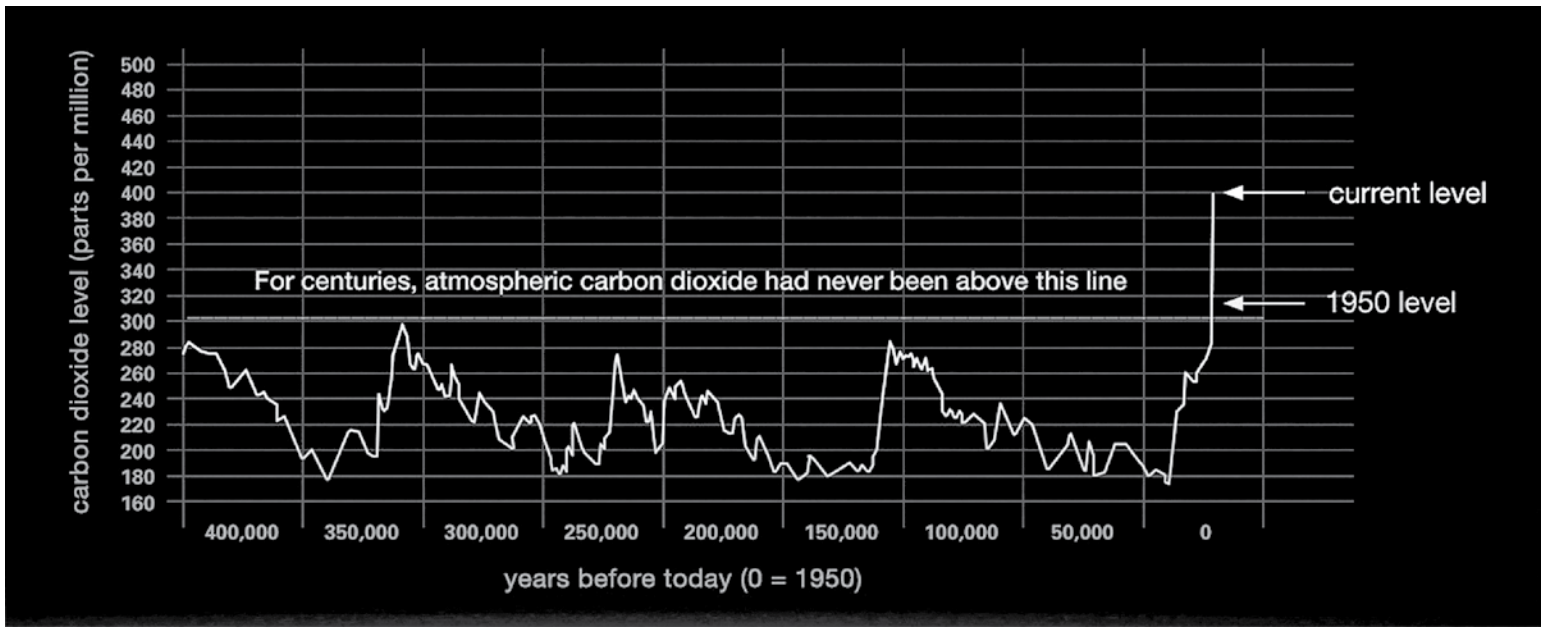
IT NO LONGER EXISTS

John Bos



We don't like change, even though change is inevitable. Sometimes it takes a 2 X 4 up alongside the head to get our attention. And then we "see" that some change in our lives could have been avoided if only we had paid attention.

Driving back home in the early '60s from our family vacation in Montauk at the tip of Long Island, our vacation high gave way to consternation as the traffic increased and the pall of pollution over the Manhattan skyline became ever more visible.



Change. The Montauk we once knew no longer exists. Money found its way to Montauk. As the Montauk real estate heated up so did the temperature of the Atlantic Ocean. The (before Trump) EPA reports that sea surface temperatures have been consistently higher during the past three decades than at any other time since reliable observations began in 1880. The more southern regions of New England began crossing a temperature threshold in which the water is no longer hospitable to lobsters, causing them to migrate north to Maine and far beyond. The remaining lobsters are incurring a higher incidence of shell disease because of increased ocean temperatures.

There is a direct relationship between our steadily degrading environment and the ever-growing quest for profit at any cost.

Fear, abject fear, may be the only thing that gets our attention, that brings us to our senses about global warming. It will be only then that we will have to face up to the reality that it is already too late for our grandchildren's children. Whatever actions we still may be able to take as we approach the end of this century might prolong the time that is coming when Darwin's survival of the fittest will be humankind's all-consuming challenge. The "fittest" will not include the poorest.

"Nearly everything we understand about global warming," Nathaniel Rich wrote in his major article "Losing Earth: The Decade We Almost Stopped Climate Change" in the New York Times last August, "was understood in 1979." 1979 – that's four decades ago.

The Rich article is a must read if you truly want to learn about the discovery and comprehension of the impacts of global warming on humankind and about those who understood and raised the alarm and those who understood but didn't want us to know.

As comprehensive as Rich's work is, Naomi Klein disagrees with the central premise of Rich's piece: that the end of the 1980s presented conditions that "could not have been more favorable" for bold climate action. "On the contrary," she writes in The Intercept, "one could scarcely imagine a more inopportune moment in human evolution for our species to come face to face with the hard truth that the conveniences of modern consumer capitalism were steadily eroding the habitability of the planet."

When Klein delved into this same climate change history some years ago in her important book "This Changes Everything: Capitalism vs. the Climate," she concluded as Rich does, "that the key juncture when world momentum was building toward a tough, science-based global agreement was 1988. That was when James Hansen, then director of NASA's Goddard Institute for Space Studies, testified before Congress that he had '99 percent confidence' in "a real warming trend' linked to human activity."

In her book Klein exposes the myths that are clouding the climate debate. Americans were told the market will save us, when in fact the addiction to profit and growth was digging us in deeper every day. Americans were told it's impossible to get off fossil fuels when in fact we knew exactly how to do it: it just requires breaking every rule in the "free-market" playbook: reining in corporate power, rebuilding local economies, and reclaiming our democracies.

The long-time greenhouse gas impact predictions by the Intergovernmental Panel on Climate Change (consisting of scientists the world over) are no longer predictions; they are reality. The planet is now responding to the way we humans have lived on Earth by "talking back" with floods and mud slides, fires, hurricanes and tornados, earthquakes, rising oceans and melting polar caps. The denial of climate change is either an ignorant or deliberate "belief," not a fact.

Klein writes that "we aren't losing earth – but the earth is getting so hot so fast that it is on a trajectory to lose a great many of us." That said, she is more optimistic than I am. Klein sees the fact that countries with a "strong democratic socialist tradition" – like Denmark, Sweden and Uruguay – "have some of the most visionary environmental policies in the world. From this we can conclude," she says, "that socialism isn't necessarily ecological, but that a new form of democratic eco-socialism…appears to be humanity's best shot at collective survival."

This brings Klein to note the growing movement of political candidates who are advocating a democratic eco-socialist vision and rejecting the neoliberal centrism of the mainstream of the Democratic Party, "with its tepid 'market-based solutions' to the ecological crisis, as well as to Donald Trump's all-out war on nature."

The wondrous world we once knew no longer exists. Humankind's (mostly MANkind's) dominion over Earth is over. The planet will survive but millions of tomorrow's children will not. Are you paying attention?

John Bos lives in Shelburne Falls, MA and writes frequently about climate change and climate change denial in the Greenfield Recorder and Shelburne Falls Independent. He invites comments and dialogue at john01370@gmail.com. ♻

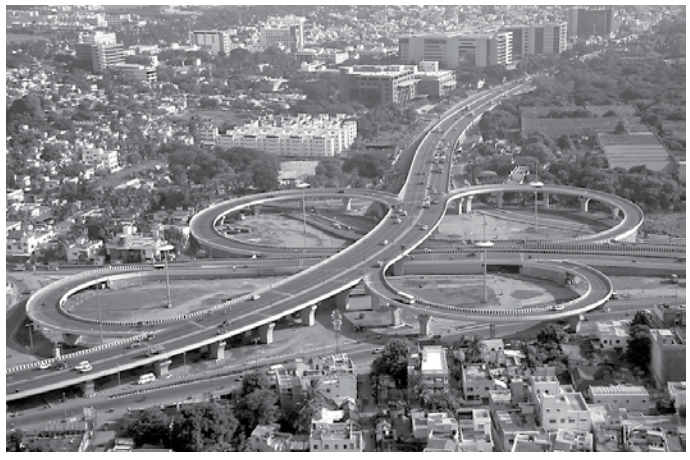
IT'S AN EMERGENCY! *Cont'd from p.1*

According to CNN, the city of Chennai is out of water, because the monsoon, which brings rain every year, failed (http://bit.ly/CNN-Chennai-drought). The reservoirs are bone-dry, so there is no tap water. Chennai has four and a half million people, and all of them have to get their water from tank trucks that bring it into the city. People stand in line for hours to get a pot filled. That drought is now threatening to cut off water altogether for over 100 million people, with hundreds of millions more somewhat less vulnerable.

The list of problems of similar magnitude goes on and on. And while it is nothing new to have problems, the severity and frequency of problems that we are now seeing are new. And all people, everywhere, are vulnerable. And I am sorry to sound discouraging, but that includes here. If we are not having bad weather, it is because we are lucky, and luck will not hold out forever.

I have long told people that the only thing absolutely predictable about weather is that it will be weird. No more. Now I have to add that one other thing is predictable: It is getting more extreme.

In the past, there was the Year Without a Summer, 1816, in which New England farmers lost even their hay crops because every month had killing frosts. There was Northeast Blizzard of 1888, and the heat wave that came to the Northeast only six years later. There was even the medieval "Little Ice Age." But all these events have one thing in common: they were caused by natural events. Nearly all scientists agree that what we have now is at least partly caused by us.



Chennai, a modern city with 4.5 million people, is entirely out of water. Photo: Pratik Gupte, CC-BY-SA 1.0, Wikimedia Commons.

Weather is weather. Climate is a pattern of weather, a very different thing. When the overall pattern gets warmer, that does not mean that there are not still cold days. And in fact, because the weather is getting more severe with climate change, we could even set an occasional cold weather record. But overall, the temperatures are rising.

The reason I say 100% by 2050 is too little too late, is that climate change appears to be happening far faster than it was foreseen in even the worst-case scenarios. According to an article at CNN, satellite data shows that ocean water temperatures off northern Alaska are 10°F above normal (http://bit.ly/CNN-warm-Alaska-seas). We are talking about ocean water here, something that stays around for a while, not some breeze blown in from the south for a few days. And Greenland has lost as much as two billion tons of ice per day, melting into the ocean. Earlier this spring, temperatures in parts of Greenland were 40°F above normal. These things are part of an overall pattern called climate change.

One really discouraging thing is that the permafrost is melting, as Al Gore warned us it might, releasing methane into the atmosphere. This is a tipping point, after which recovery of our climate becomes far more difficult. At the time Al Gore warned us, we might have hoped to avoid that. We cannot hope to avoid it now.

The permafrost is not just melting, it is melting at a rate that seems to be beyond what just about anyone envisioned. Scientists have said we are at a point they did not expect to see for another 70 years. We might say that in this respect, 2050 is much too late,

Cont'd on p.27

Rebellion to Save the Earth

Dr. Alan K. Betts

This has been a winter of extremes across the planet. Saturated soils from late snowmelt and heavy spring rains have delayed planting crops here in the northeast. For Vermont, this was the fourth wettest April on record and we have had another seven to eight inches of rain in May. While it was exceptionally cold in the northern US in February, temperatures set new records in Europe. In England temperatures peaked at 70 degrees in February, and fires started on the moorlands. At the same time, visionaries in England were planning the first rebellion to save the Earth: The Extinction Rebellion. This is fitting because the industrial revolution powered by fossil fuels took off in Britain in the late 1700s with the development of efficient steam engines.

No-one anticipated then that as the burning of fossil fuels accelerated, and increasing greenhouse gases trapped more heat in the oceans, climate change would also accelerate. This April and May, the Arctic ice shrank to a new minimum, and the mid-latitudes are frequently seeing nearly stationary global weather patterns that are increasing climate extremes. Unfortunately, poorer tropical countries are seeing far worse. In southeast Africa, where tropical cyclones used to be very rare, two powerful storms developed over the warmer ocean and hit Mozambique. First came cyclone Idai in March with massive flooding which left about 1000 dead. Then Kenneth, an even stronger category 4 storm struck in April with five feet of rain in less than a week. Try to imagine the flooding and destruction in a poor nation.

Image: garryrogers.com

In early May, a new UN report on Biodiversity and Ecosystem Services reported that soon a million species will go extinct from loss of habitat and climate change. Nature is in an unprecedented global decline and species extinction rates are accelerating. The report chair, Sir Robert Watson, comments "The health of ecosystems on which we and all other species depend is deteriorating more rapidly than ever. We are eroding the very foundations of our economies, livelihoods, food security, health and quality of life worldwide. We need transformative change."

It is the rich nations that are responsible for the tragedy that is devastating the Earth and the future of humanity. For 27 years, we have not kept the promises we made in 1992 to stop dangerous climate change, and now we are deep into a climate emergency. But rather than acknowledge this and act, we listen to the soothing propaganda from the fossil fuel industry and their many affiliates that say: "Buy bigger cars and trucks and buy more consumer stuff. Use your freedom to exploit the Earth: the future is not our responsibility."

So, it was heartening to see that this new global group, the Extinction Rebellion, has grasped that the destruction of the Earth is now a civil rights issue, which can only be checked by civil disobedience. This rebellion to save the Earth is not to defend individual rights, but to defend the rights of our children and the rights of life on Earth that faces extinction. They will not accept that while our corporations have the 'right' to exploit the Earth, so far the Earth has been given no rights.

This group is trying to force the rich countries responsible for destroying the planet to take action on the global climate and ecological emergency. They shut down London for 3 days, April 15-17, with a huge street party, until they were successful in getting their first demand: that the British and Scottish governments tell the truth and declare a 'climate emergency.' The second demand is that government must act now to halt biodiversity loss and reduce greenhouse gas emissions to net zero by 2025. This is very demanding goal requiring tight coordination across all levels of government and industry. The third demand by this non-political group is that the government must create and be led by the decisions of a Citizens' Assembly on climate and ecological justice. You can read their honest commentary on the challenges ahead on their web-site: rebellion.earth.

In contrast, the collapse of ethical standards and honesty in Washington, and the attacks on climate science mean we cannot expect leadership here. So, follow and support these global movements to hold governments accountable. Recognize we have no right to sacrifice our children and much of life on Earth. Take a deep breath, keep talking to your neighbors and politicians, and accelerate the transition to an energy efficient renewable future.

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

<< **IT'S AN EMERGENCY!** *Cont'd from p.26*

because we are already 39 years past that, at 2089.

Another really bad thing is that the oceans appear not to be taking up CO_2 the way they did in the past, according to an article in Science Times (http://bit.ly/oceans-and-co2). This means that more of our emissions are staying in the atmosphere, making things worse faster.

We have clearly passed tipping points. I can only admit that denial and NIMBY-ism have won the first rounds. And the result of this is that large numbers of people will suffer. They may include hundreds of millions in India and hundreds of millions more in Africa and Asia. They may even include hundreds of millions in Europe.

Will this hit us in the Northeast? Yes. We are in a part of the world that is blessed with moderate weather, but it will not last forever. Our luck will run out as well. And it looks increasingly like it is not just our grandchildren and children who will suffer, but we ourselves. And what we have might be worse than Hurricane Sandy or an ice storm. Severe heat, like that in Europe, hurricanes, tornados, and even ice storms and blizzards can be made worse by global warming. They can, and quite probably will, fall upon us.

There was a time, not long ago, when I told people that we will get through climate change, because we have to and we have all the technology we need to stop it. Today, I can only say that we will, because we have to. I am not sure that we have the technology to stop it anymore, because we have already waited too long. We have to stop waiting. ♻

SAVING EARTH

James Hansen

I must finish Sophie's Planet this year, so I am writing few communications. However, I make the draft of Chapters 31-34 available here [at http://bit.ly/Sophies-Planet-31-34], because my perspective of and conclusion about events in the 1980s differs from that of Nathaniel Rich in *Losing Earth*. I kept careful notes during that era and subsequent years, so I am confident that what I write is accurate, but I would welcome corrections.

Earth was not "lost" in the 1980s. Earth is not lost today, but time for action is short.

Climate concerns in the late 1980s led quickly to the 1992 Framework Convention: all nations agreed to limit greenhouse gases to avoid 'dangerous anthropogenic interference' with climate. The problem was that neither the 1997 Kyoto Protocol nor the 2015 Paris Agreement directly addressed global energy policies. For the sake of young people, we must understand that failure and take appropriate actions.

It is wonderful that more people are waking up to the fact that we have a climate emergency. The emergency was clear more than a decade ago when it was realized that the long-term safe level of atmospheric CO2 was less than 350 ppm[1]. Already, we were well into the dangerous zone.

Good policy-making requires an understanding of the time scales of change. The public tends to focus on extreme weather and climate events, because of their great practical importance. However, the 'existential threat' of climate change derives from long-term underlying climate change that affects sea level and the habitability of parts of the world, as well as the magnitude of extreme events.

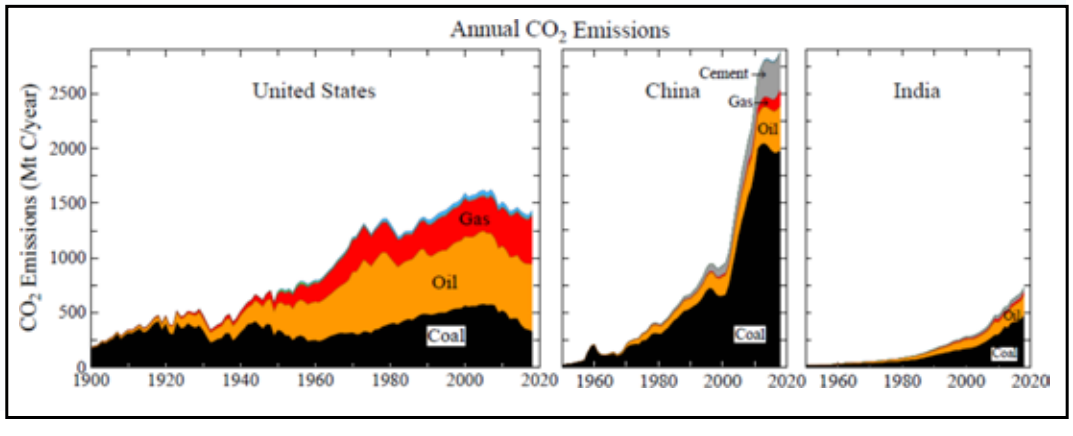
In Sophie's Planet I argue that the climate system's inertia, i.e., its slow response to human-made changes of atmospheric composition, provides us the possibility to avert the existential threat of climate change. But to achieve that end, we need to understand not only the climate system, but the time scales for change of the energy and political systems.

Why do I include political systems? My training in physics is relevant to climate and energy systems, but politics? I have witnessed a lot, and I took careful notes. The period includes the Clinton and Obama Administrations, which supposedly tried to address climate change. We need to understand the mistakes.

Political polarization makes solution of the climate problem more difficult. I doubt that political extremes represent most people. I make a case in Sophie's Planet for a third party in the United States aimed at making America America again. American leadership is needed to address climate change.

It will be a lot of work. Polarization did not come about instantly, and it cannot be fixed quickly. Groundwork includes changing to a ranked voting system, so third party candidates are never 'spoilers.' That requires changing some state Constitutions. The party should decide whether/when it is ready to field a presidential candidate. A third party with even a few representatives in Congress can begin to have a big impact. Initially, it may be only a force for changing the major parties, but that is a lot.

(To read the rest of this article, visit http://bit.ly/GET-Saving-Earth.) ♻



Wentworth Community Housing:

A Look at The Upper Valley's New Solar-Powered, Super-Insulated Apartments

Extraordinarily affordable and energy-efficient multi-unit building to open in White River Junction this summer

This article is part of a G.E.T. series on net-zero housing in the Northeast. Check out the next issue of G.E.T for the next installment.

Chris Gillespie

Wentworth Community Housing will be getting most of its energy from the sun, thanks to a 70 kW-DC PV array installed by Norwich Solar Technologies. Efficiencies are seen thoughout the building and interior. Courtesy photos.

Wentworth Community Housing, a collaboration of co-developers Twin Pines Housing and Housing Vermont, is slated to open this July on Sykes Mountain Avenue in White River Junction, VT, likely to the delight of many of the area's major employers.

Development and Construction

"We were hearing from employers that the high cost of housing was making it difficult to attract employees to the Upper Valley," said Twin Pines Housing Executive Director Andrew Winter, citing the area's historically low unemployment and vacancy rates as the main reasons for the Upper Valley's high cost of housing—and the resulting thirst for affordable alternatives.

Wentworth Community Housing has thirty units, twenty-one of which will be restricted at or below 60% of Windsor County's area median income. The remaining nine units will be made available to households earning between 80% and 120% of the area median income. These higher income units were made possible by workforce housing funding through Vermont's 2017 Housing for All Revenue Bond. Winter notes that these nine units, although more expensive than the others in the building, are still below the area's market rate.

All of Wentworth Community Housing's one- and two-bedroom apartments have amenities sure to appeal to any future tenants, including new kitchen appliances and an underground garage for parking. Heat, hot water, electricity and waste removal are included in rent. Gossens Bachman of Montpelier served as the building's architect while ReArch Company, Inc. of South Burlington handled construction.

According to Winter, the views from the building also aren't half bad, as the property is pushed back into the slope of a hill that overlooks Lily Pond in one direction and the hills of Lebanon, New Hampshire in another. Said Winter, "It feels like you are in a tree house, particularly in the upper floors of the building."

SOLAR ENERGY

Wentworth Community Housing will be getting most of its energy from the sun, thanks to a 70 kW-DC photovoltaic array designed and installed by Norwich Solar Technologies. Expected to go live this summer and be active by the time the first tenants move in, the array will supply tenants' typical electrical demand as well as power the building's HVAC system, which includes an energy recovery ventilation (ERV) system that will use heat from exhausted air to heat incoming air.

According to Norwich Solar Technologies, the solar array will produce 80,500 kWh of energy a year, which will offset the annual carbon emissions of twelve passenger vehicles or seven average homes.

NEXT GENERATION ENERGY EFFICIENCY

Twin Pines took great strides to perfect Wentworth Community Housing's building envelope as well, installing triple-glazed windows and using R32 and R49 insulation for the walls and roof, respectively. Winter says that Twin Pines has been very pleased with the building's blower door test scores.

In addition to these measures, Wentworth Community Housing will also be one of the first properties to have all of its major systems' operations monitored by Housing Vermont's Parsons Platform. According to Winter, the Parsons Platform, will allow Twin Pines to remotely monitor the efficiency of "everything from the solar array, to the hot water heater, to the HVAC and ERV" in order to benchmark performance and identify and diagnose potential issues early on.

"The hope is that, by building more energy efficient buildings and buildings that use solar for heating and cooling needs, we are able to avoid the fluctuating costs of fuel that typically go along with code-compliant buildings," said Winter. "We work really hard to minimize annual rent increases."

THE BENEFITS OF SUSTAINABLE HOUSING

Utilizing solar energy and curtailing the building's reliance on fossil fuels is a major win-win for Twin Pines, since they are able to significantly reduce the building's carbon footprint (the solar array is expected to offset nearly 1,700 metric tons of carbon emissions over the next three decades) while simultaneously stabilizing rent for the tenants. This, says Winter, is a great relief for the Twin Pines team, who are always looking for innovative ways to avoid passing expenses onto tenants.

"We at Twin Pines believe that it is essential for developers of affordable housing to focus on the long-term sustainability of their housing," said Winter. "Energy-efficient buildings yield benefits for their developers and their tenants."

For more information about Wentworth Community Housing and to apply for an apartment, visit https://www.tphtrust.org/portfolio-item/wentworth-community-housing/

Chris Gillespie is a contributing writer for Green Energy Times based in Brooklyn, NY. He can be reached at chris@greenenergytimes.org. ♻

Do-It-Yourself Energy Upgrades

David Keefe

#1 in our new DIY Series, kindly brought to you through Efficiency Vermont

Vermonters are a handy bunch. Many of us build, repair, or renovate things on our own. If you are considering an energy-efficiency upgrade, you might be thinking about doing it yourself. This article is the first in a series about how to improve your home's efficiency with your own hands. We'll start with some general considerations here and follow with future articles on doors, windows, basements and attics.

Over the last 35 years, I've crawled through hundreds of attics, installed a bunch of insulation, and sealed up a lot of air leaks. Here are some things I've learned.

Vermiculite insulation may contain asbestos and should not be disturbed. Photo by David Keefe.

Most people are not sure which things to do to make their home efficient. You won't save money by doing things yourself if you do ineffective things, so it helps to have a qualified energy-efficiency professional evaluate your home and help you develop a game plan.

An energy audit by a home performance contractor is a good way to start. The auditor can identify opportunities for improvement that you might not think of and can help work out an overall strategy that works for you and your home. He or she will conduct important safety checks to make sure there are no existing problems like moisture or carbon monoxide that should be addressed. If you are going to fix some things yourself, you can ask the auditor about the correct materials or methods for those items.

There are hazards you might encounter. There might be vermiculite insulation in your home. This loose granular metallic-looking material may contain asbestos and should not be disturbed. You might also find asbestos-containing materials on old ductwork or heating pipes. There may be knob-and-tube wiring or other electrical issues. If you live in an old house, you shouldn't disturb the paint without following lead-safe practices. (Paint produced prior to 1978 in the U.S. may contain lead.)

There is a state-wide residential energy code in Vermont, and it applies to existing homes. You should be aware of this when doing your own work, and you should verify that any contractors you hire are following those rules. You can get more information about the code at: https://publicservice.vermont.gov/energy_efficiency/rbes.

Air sealing might well provide your best bang for the buck. By "air sealing" we don't primarily mean weather stripping windows and doors (although that can certainly be part of it). We mostly mean finding rough holes – often not visible from the living space – and plugging them up. Much of the most important air sealing happens in basements and attics and focuses on places where framing comes together or where pipes, wires or other mechanical systems go through holes.

If you have a wet basement, you should start there. As we tighten up our homes, moisture problems in the basement become bigger issues. Anything you can do to dry out your basement is worth considering, whether it's gutters, drainage, ground cover or sump pump. A dry basement is important for the performance, durability and healthfulness of your home.

Strange as it seems, maybe the best DIY approach involves a contractor. Energy upgrades often involve moving stuff out of the way. In your attic or basement or both, there may well be personal items, often unused for years or decades, that need to be moved or removed. This is a perfect time to do that rather than pay a contractor to do it. It saves you money and you end up with a less cluttered space. There may also be air sealing or carpentry details you can do, and a contractor can provide advice on how to do it properly.

Doing it yourself can save you money, but it makes sense to do your homework first, so your efforts get the maximum benefit. You can find more information at https://www.efficiencyvermont.com/tips-tools

In the next article, we'll talk about doors.

David Keefe is a fifth-generation Vermonter who has worked for over 35 years as a contractor, consultant and teacher to improve the performance of existing homes. ♻

LEED Performance Buildings in the Northeast:

ENVIRONMENTAL BENEFITS INCLUDE COMPOSTING TOILETS

Composting takes place in all soils that support plant and animal life. As waste breaks down in the composter a less chemically complex, more chemically stable substance rich in organic matter and very similar to soil is produced. Human waste consisting mostly of water is reduced by over 90%. By-products of the composting process are water vapor and CO2, and are released harmlessly into the atmosphere through the ventilation system. Below are some Leadership in Energy and Environmental Design (LEED) case studies from *Clivus New England*.

VISITOR CENTERS: MASSACHUSETTS AUDUBON SOCIETY, Wellfleet, MA

• 10,000+ sq. ft. nature center serves 70,000 visitors annually • Nepon foam-flush toilets on Clivus composters and greywater filtering SAS • Systems eliminate septic tank • Greywater recycled to planter beds (reduced sized SAS) • Flower garden adds attractive and educational element • Eliminated sewage altogether. • USGBC LEED Platinum Award.

AUDUBON CENTERS: NH AUDUBON AT SILK FARM, CONCORD, NH

• 12,119 sq. ft. nature center • 96 seat auditorium • Nepon three-oz. foam-flush and waterless toilets • Clivus composters • Greywater recycled to planter beds • Building expansion possible without septic system expansion • USGBC LEED Gold Award.

FEDERAL BUILDINGS

US FORESTRY SERVICE WHITE MTN. COMPLEX, CAMPTON, NH

• 23,400 sq. ft. headquarters. • Offices for 100 employees. • Visitor and Discovery Center. • Nepon three-oz. foam-flush toilets.• Clivus composters. • Greywater filtering system. • Indoor greywater planter beds. • USGBC LEED Award pending.

UNIVERSITY LEARNING CENTERS

UNIVERSITY OF VERMONT, UNIVERSITY HEIGHTS COMPLEX

• "Green" learning and residential center. • Classrooms, lounge, mailroom, faculty offices. • Nepon three-oz. foam-flush toilets. • Clivus composters. • Reduced water usage. • Provides first hand education in conservation • USGBC LEED Gold Award.

PRESERVATION SOCIETIES:

SOCIETY FOR THE PROTECTION OF NH FORESTS, CONCORD, NH

• 11,400 sq. ft. green addition
• 408 sq. ft. conference room
• 23 private offices
• Discharge greywater only
• Indoor atrium treats greywater and improves indoor air quality
• Protect sensitive area adjacent to Merrimack River
• Nepon three-oz. foam-flush toilets
• Clivus composters
• USGBC LEED Gold Award.

EDUCATIONAL FACILITIES: VERMONT LAW SCHOOL, South Royalton, VT

• 23,500+ sq. ft. classroom building.
• Nepon foam-flush and waterless toilets.
• Clivus composters.
• ACT 250-compliant.
• USGBC LEED Silver Award.

Energy Audits for the Homeowner

Home Energy Series #1 of 6

Michael Canavan

In today's home environment, greater consideration is given to the energy usage of residential buildings - from multi-unit buildings to tiny houses. The adoption of higher performance energy codes is helping to improve energy usage in the new homes that are being built today. But what about your not-so-new house? How can you improve your energy usage with the older home you have?

The naked eye cannot detect heat loss in a home (top), but with an infrared camera, we can see where the hot and cold spots are in the house on a warm day. The lighter areas show the hotter spots as in the attic and held in the basement concrete. Great way to see where the heat is escaping in the winter. Photos courtesy of Michael Canavan.

We will discuss two levels of energy usage inspections and reports in this article series. Let's start with a Home Energy Report. Elements of the report are property information, the building design, appliances and equipment, and optional observations.

For the property information section, the address and year the building was constructed, the number of residents and age grouping, and local energy type used and its costs are all basic required information.

The building design sections of an inspection look at the building's site orientation, height above ground, foundation type, and attic absorbency and type. Then the inspector goes for the details: insulation type and level, airtightness of the building, and window or glass opening area. This section gives the inspector the basic information on how the house is performing with the as-built conditions that exist.

Next, the inspector looks at the big energy users in the building: mechanical systems including the water heater and equipment for heating and cooling along with any connected thermostats; systems for distributing energy such as hot water piping, ductwork, and wiring; and appliances such as refrigerators, washers, dryers, and the overall lighting system with respect to the number of bulbs and the types of each one. Together, all of these indicate how much energy is being used and point to ways of saving energy.

Finally, the inspector is looking to fill in the optional information which includes items like common air leakage points, any moisture issues, green building features in the building and on the site. This section helps assess where the building is below standard and the components that are energy savers.

The information is entered into a computer program developed by the US EPA to produce a report. The report will determine the home's carbon footprint, energy cost based on usage. It will evaluate the various systems equipment for age and efficiency. Then a list of upgrades for saving energy is presented as recommendations with the greatest payback listed highest, which helps the homeowner get the most return on their money earlier. The recommendations are usually within two groupings: the first is for upgrades for the building and the second is planning for the equipment and normally replaced items such as roof and water heater.

The second type of energy inspection goes much deeper into the workings of the home. The inspector will use additional equipment to understand the hidden deficiencies in the building. Heating and cooling energy in a building always wants to find equilibrium (hot goes to cool) which is thermal movement and high pressure fills in low pressure which is air movement. By using a blower door testing fan and an infrared camera (IR) more air leakage can be uncovered and be readily diagnosed.

The blower door test is a fan calibrated to move air out of the building at a target rate of 50 air changes per hour (ACH) as the minimum standard goal. When the home is depressurized to this rate the inspector can now go through the house and look for unwanted air leaking using a smoke pen and taking IR photos of suspect areas, gaps around attic insulation, window door openings, pipes, electrical outlets and so forth. This information is put in a much more detailed report that describes where leakage issues are uncovered, and recommended corrections for them, in addition to the basic equipment findings discussed earlier.

You, the homeowner, can begin to become more energy informed and educated by using the results of these reports to reduce your energy footprint and become a more efficient user of energy.

Michael Canavan is the owner of Eagle Home Inspection Solutions of Norwich Vermont. Learn more at EagleHomeInspectionSolutions.com or (802) 526-2642. ♻

Revamped HHI Tool: First Step to a More Energy-Efficient Home

With an eye on making life easier and homes more energy efficient, NHSaves has unveiled a revamped online tool that calculates fuel usage and qualifies residential customers for rebates and incentives through the Audits and Weatherization program.

The improved home heating index tool (HHI), which launched on the NHSaves' website on June 1, is the first step toward qualifying for a home audit. Using the online tool, customers simply plug in their fuel usage over one year, the square footage of their home, their provider and their zip code. The tool then provides customers with a heating index of their home's energy usage.

The Audits and Weatherization program is offered by Eversource, Liberty Utilities, New Hampshire Electric Co-Op and Unitil. For customers enrolled into the weatherization program, rebates and incentives are available up to $4,000 on overall improvement costs.

The new tool represents a significant upgrade for customers, who previously had to print out an application and mail it in, along with copies of their fuel-use records, to learn if they qualified for the program. Now, once qualified, they can file the application electronically.

"My gut feeling is that it turned people away," says Frank Melanson, Supervisor, Energy Efficiency at Eversource. "Now, things are much smoother."

The HHI tool and weatherization program is a part of The Home Performance with Energy Star program, a comprehensive, whole house approach to improving energy efficiency and comfort at home that can save customers on energy costs. The program was recently honored by the American Council for an Energy-Efficient Economy (ACEEE) with the Exemplary Program Award as one of the leading energy-efficiency programs in the United States.

"The home heating tool brings people into our retrofit weatherization program, which improves the efficiency of the home by tightening it up, adding insulation and making it more comfortable," says Matt Minghella, Residential Program Manager at Liberty Utilities.

NHSaves provides utility partner customers with technical assistance that allows them to more accurately project long-term savings with energy efficient projects. Contractors are also provided training that helps them identify energy-efficient opportunities and the best energy improvement measures that can be taken. Finally, the utility partner guides vendors and contractors through the design process with the goal of qualifying for the highest possible savings and rebates.

Natural gas customers of Liberty Utilities and Unitil who do not qualify for the program can still reap benefits through a "visual audit," as long as they are capable of upgrading at least one home heating zone to a WiFi thermostat. This abridged audit also determines the home's energy efficiency, and in some cases, can even lead to a homeowner ultimately qualifying for the weatherization program. Regardless, contractors will still install LED light bulbs and pipe insulation, as well as check on the effectiveness of top-level insulation.

Customers enrolled in the weatherization program are provided with a list of recommended qualified contractors who will conduct a comprehensive home energy audit. The audit, a $450 value, is only $100 to customers in the program. For customers who move forward with any suggested recommendations detailed in the proposal, the $100 will be rolled into the cost of the project after all rebates are applied.

The auditor will conduct diagnostic tests throughout the entire home in search of ways to improve energy efficiency and earn rebates and incentives. From the attic to the basement, to the windows, doors, duct work, appliances, lighting, water, heating and cooling systems, the house will be analyzed for opportunities for improvement. In the end, customers can save up to 30 percent on their energy bills.

"Customers who go through this program will see immediate benefits through their utility bills, and through the fact that their house will be more comfortable and quieter, because it's better insulated," says Ben Stephenson, Program Coordinator, Customer Energy Solutions for Unitil.

Customers looking to see if they qualify should visit https://nhsaves.com/programs/energy-audits-weatherization/. ♻

Many thanks to our sponsor:

NHsaves
Your Source for Energy Efficiency

Many Benefits: Invest in Low-income Solar

Solar energy has chronically had trouble getting access to the investment side of low-income housing development. The concept of tax credit finance for low income housing is that low income folks need housing, spend money on rent, benefit the community when they have stable housing, but struggle to make long term investments individually and on their own.

The low-income housing community essentially aggregates the economic power of lots of low-income people and puts it to best use making long term investments in excellent quality housing. More commonly, energy efficiency goals were achieved through investments in better-than-lowest-common-denominator systems and features (heating, cooling, insulation, appliances, etc.). As solar applications earn their place in that mix, they help maximize the benefits of the wise long-term leveraged investments made by our sophisticated housing developers to keep housing costs both low and predictable for the low-income tenants who need it most.

Brendan Malley from Norwich Solar Technologies put it this way. "In our self-interest, this is a market that can scale. Low-income housing is constantly under development, and solar can become one of the elements that is included as a matter of course."

Making solar and building efficiency affordable to everyone includes every income level. To move to a fossil-fuel free future, we need to clearly address this issue and continue to make energy-efficient housing available to all. Many recent housing development projects in G.E.T's region are examples of how this can be achieved for low- and moderate-income residents.

To learn more, go to norwichsolar.com or call the folks at Norwich Solar Technologies at 802.359.7405. ♻

Making Climate Change Understandable

Roger Lohr

How does a writer convey the seriousness of climate change without gloom and doom? A presentation regarding communicating changing climate by New York Times climate writer, Kendra Pierre-Louis, was conducted at Dartmouth College to discuss how she tries to resonate with readers about climate change without bumming them out.


Kendra Pierre-Louis

The challenge is to encourage the readership to be concerned and to act. According to information cited by Pierre-Louis, there is a spectrum of perspectives on climate change readers: 21% are alarmed; 30% are concerned; 21% are cautious; 12% are doubtful; 9% are dismissive and 7% are disengaged on the subject. She stated that more than 50% of the population in every state in the U.S. believes that climate change is a problem.

Pierre-Louis stated that her goal is to spur accurate understanding and correct the misperceptions about climate change. She does this by correlating information to daily life and interrogating policies.

She has produced stories about thinner sea ice, rising sea levels, disappearing ice in the Arctic, and that Antarctic is melting three times faster than a decade ago. Pierre-Louis felt that scientific data is often presented in a misleading way. Take cold temperatures during the winter amidst the trend of global warming for instance. People who were born after 1976 have never had a year that the average temperatures have been below the average annual temperatures. There may be a very cold day, week, or month, but the longer-term trend is warmer temperatures based on actual facts of temperatures over time.

Another misperception is that climate change causes wildfires, droughts, floods, hurricanes, etc. In reality, climate change creates conditions that make these things more likely, and this is very different from causing wildfires and so on.

Pierre-Louis, who has been at the Climate Desk at the Times since 2017 and previously wrote environmental science stories for Popular Science, suggests that writers find a hook to exemplify the science and try to connect with people. For example, she's written about the impact of warming seen by Winter Olympic athletes like gold medal cross country skier Jessie Diggins. Kendra incorporates humor into her science information when possible, and she is honest when she is uncertain about the story facts.

Belief in Climate Change

A study by the Yale Program on Climate Change Communication and the George Mason University Center for Climate Change Communication, that drew on information from surveys taken across the political spectrum between November 2013 and December 2018, showed:

- 73% think climate change is happening - up 11% since 2013.
- 62% think it is human caused – up 15%.
- 57% think most scientists agree it is happening – up 15%.
- 72% think climate change is important to them personally – up 17%.
- 69% are worried about climate change – up 16%.
- 65% think it will harm Americans – up 12%.
- 49% think it will harm them personally – up 11%.
- 46% think we have already experience climate change effects – up 11%.

A Stanford University study found that Republicans underestimate the actual number of other Republicans that believe in climate change (57% of Republicans believe it). Majorities in both parties agree that the world is experiencing global warming and call on government action to address it, but they may disagree on the cause. There is some evidence that due to climate change messaging which appeals to values or religious authorities, there may be increased belief in climate change by more conservatives.

Perhaps there is hope that there will be bipartisan support to address climate change in the near future.

Roger Lohr of Lebanon, NH owns and edits XCSkiResorts.com. He has published articles and promotional topics on snow sports, sustainability, and trails in regional and national media. He is also the Recreational Editor for Green Energy Times. ♻

Weeds, Invasive Species, and Climate Change

George Harvey

In mid-May, amid the bustle of getting *Green Energy Times* ready to go to press, I noticed a post at BBC Future, "How Weeds Help Fight Climate Change" (http://bit.ly/BBC-nat-seq). It is a fascinating article that introduced me to natural sequence farming (NSF), something I had known nothing about.


Weeping willow, a thirsty tree, is considered a weed in Australia, where water is scarce. But it is useful there for erosion control and helps the land retain water. Photo: Antilived, Wikimedia Commons.

Those who are somewhat familiar with permaculture might see NSF as a type of that. I think it actually is quite different, because permaculture seeks a permanent environmental solution, while NSF seeks to reclaim land by taking it through a sequence of events, changing it in ways that emulate natural sequences.

NSF restores areas of distressed fertility. Plants are grown that can rebuild the soil and retain it, so it will not wash away. Often this means starting up forests in high areas. Downslope land is rebuilt in much the same way, using species that can grow on the land as it is. Marsh and wetlands are intentionally developed with the help of leaky weirs, which allow water to pass down the streams, but at reduced speed. As NSF slows the flow of water, more of it gets into the water table and there is less erosion.

Experiments with NSF started over forty years ago with Peter Andrews, an Australian farmer (www.peterandrewsoam.com). To deal with repeated droughts, he tried techniques he developed. Unfortunately, his neighbors got upset. He slowed the water in creeks, which they thought would leave them with less. And he encouraged weeds to grow, including thirsty stands of willow, which his neighbors thought was just wasting precious water without any benefit.

Peter Andrews' story is a saga, with a number of ups and downs. Ultimately, many farmers of New South Wales, including all of his adjoining neighbors, were converted to NSF. Despite the fact that it was developed in the middle of land hit by one of the worst droughts in history, the farms that used the system have remained continually productive. Their sheep and cattle had plenty to eat and drink, while those of farmers not using NSF died of thirst and starvation. And so, the system is spreading to other parts of Australia.

In the course of this story, I was struck by the fact that Andrews stressed the importance of weeds. This was not just the native sort that farmers did not want, such as willows. It even included invasive species. The reason is that when the soil is degraded, the plants we might want to grow there often will not survive. We need to get roots into the ground to build the soil back up (which has a side benefit of drawing carbon dioxide out of the atmosphere). If non-weed plants will not reestablish the soil, weeds have to do it.

Andrews points out that weeds do not take over permanently. They will only remain until they are crowded out by other plants. A field that has been cultivated until it is no longer fertile, for example, could go over to dandelions, knotweed, brambles, and who-know-what else. When trees start to grow, those weeds will disappear. And all the while the soil is built up, restoring it to be whatever it will be, whether that means a meadow, an orchard, or a wildlife sanctuary. Andrews also stressed biodiversity, which is important for a healthy environment.

The form of the land may be changed, as well, to slow the progress of water. Even slopes are encouraged to have "steps." The steps, areas of nearly level land on a slope, slow the progress of water down, reducing erosion, and retaining water.

Though I did not see references to it in Andrews' videos or material written about him, it has become clear to me that we really need to revisit the question of how we see weeds, alien species, and invasive species. To be brief, a weed is a plant that is where we do not want it. An alien is a plant from some other place. And an invasive species is an alien that spreads as a nuisance.

A weed might be a sugar maple seedling that comes up in the tomato bed. Alien species include peach trees, and if a volunteer peach happens to be too close to the foundation of a house, it is also a weed. (Yes, with climate change we have volunteer peaches in Vermont.) Lamb's quarter and tilapia are invasive in some parts of the world. So are garlic mustard, kudzu, and Japanese knotweed, and though each can be a nuisance, each also has possible benefits.

In a time of climate change, we may have to change our views about what we encourage or discourage to grow. If we get to the point that the only way to rebuild the soil is to allow weeds to grow, then they are no longer weeds. ♻

Elmore Roots' Permaculture Know-How

Flower Power

David Fried

We used to have buses painted with flowers and shoes, backpacks, shirts, record albums. Donovan had an album called "A gift from a flower to a garden." Even when we were young we knew there was something innocent and hopeful about flowers.

Now as a grower of fruits and nuts, I am surrounded by flowers in trees and bushes and in fields. The buartnut flowers (a cross between a heartnut and a butternut) are draped today across mock orange bushes under them. They look like little grapes in a bunch and have a purple hue.

When you look inside the blossom of the females, you can see a baby round green fruit forming. Photo: N.R. Mallery

Kiwi blossoms are different on the male and the female (you need both to get fruit). When you look inside the blossom of the females, you can see a baby round green fruit forming. The male does not have this.

Most fruit trees need two different cultivars to cross pollinate so we get fruit. That is of course why you plant two pear trees -they are called "pairs" for a reason. Sour cherries and peaches are self-fruitful. This means they do not require pollen from another tree in order to make fruit.

Everyone loves lilacs. Did you know their flowers are edible? I saw them used in cake frosting and they were good!

Siberian pea shrubs have yellow blossoms that taste like garden peas. Black locust tree flowers are among the seven wonders of the world. Especially if you like the smell of grape soda. I walk out to our locust grove and pop the blossoms in my mouth like fragrant popcorn.

Plants just sit there, so they need pollinators to move from tree to tree. We can help them by planting flowering, fruiting trees.

When mowing I leave stretches and patches of blue flowers and yellow flowers and pink flowers, because I like the way they look. They also are a refuge for pollinator insects.

These are not just honeybees of course. There are a lot of sweet pollinators flying around who are connecting the dots from blossom to blossom, tree to tree, so the fruit can be born.

Yesterday I saw a spider with a white dot on its back that looked so much like one of the blossoms in the tree. I am sure it has done so well because it fits in and unsuspecting others are not concerned about its presence. There is a lot of life in a blossoming tree.

All of us who were there in the flower power days of the 60s and early 70s remember the feeling in the air. We could make the world better. With love, with peace, with flowers. We saw that things could be improved. We would not be satisfied with same old same old. And our green planet depended on us.

Many of us plant gardens and fruit groves. Some of us write for or publish alternative magazines. Most of us work to be kind to our parents, our children, our

Painting by Gabriel Tempesta

neighbors, and the checkout person at the store. One of my great teachers, Shlomo Carlebach, said,"Who is our neighbor? The one who we are standing next to right now!"

When we were flashing peace signs to each other and wearing flower power sweatshirts, we had a taste of how the world could be better. Let's keep that vision alive and set a good example in the world with actions that keep plants and pollinators thriving. A consciousness for doing good in the world is growing and pretty soon we will see the flowering plants flashing their peace signs to us.

Seen on a tea bag tag recently, "The earth laughs in flowers." Ralph Waldo Emerson and E.E. Cummings were reminding us to lighten up a bit and see the blue and yellow flowers along our paths today..

David Fried owns Elmore Roots Fruit Tree and Berry Nursery in Elmore, Vermont. ♻

Ingredient of the Month

"... even the dark side of green is better than no green at all."

The Dark Side of Green

Larry Plesent

Worried about your health? The health of your pets, children and the planet? In the end, it's the con in convenience that screws everything up. Forget about diabetes, obesity, and immune-system breakdowns. How about just getting outside for some fresh air, sunshine and exercise?

We often joke about the dark side of green. If you are heating your home entirely with local firewood instead of heating oil, here is a good portion of what you might need (picture) to get through a northern winter. By the time you cut down the sick and damaged trees (greatly enhancing the health and future health of your woodlot), de-limb and cut into rounds, split, move to the woodshed, stack and bring inside to burn, you will have touched each piece at least six times.

Are you heating your home entirely with local firewood? Cordwood Image: Flickr

At 4,000 pounds a cord (a basic firewood measure), multiplied by eight cords for the year, that is 32,000 pounds. Now move that weight six times. In the end you will have handled nearly 200,000 pounds of wood! How much easier is it to turn a thermostat and pay the delivery truck? That's the hidden con in the convenience.

Doing your own firewood keeps one physically strong and mentally awake. You live a longer, healthier life, often with far less doctoring required. You spend time outdoors getting sunlight in your eyeballs and fresh air into your lungs. Plus, there is that gentle satisfaction that repetitive physical work brings to those who learn to appreciate it. No gym membership required. The world is your exercise room.

You are also using a local renewable resource, improving the forest if done correctly and saving the oil for more important things like making the plastic in battery casings.

We live off-grid on solar power and wet cell batteries. I tell guests, "We are running on batteries, like a submarine!" We use cheap golf cart batteries which require water to be added every season. So, you might say that our house runs on water, but that is kind of stretching it. When you make your own power, you are an active member of the process, monitoring and adjusting the system and turning off lights as you move from one area of the house to another. You think about amperage use of devices and charge times for hand-held battery-powered tools. Not a lifestyle for sleepy-minded people who just want to drink cold beer and watch TV, although you can do both of those things successfully on solar power.

But yes, electricity is cheap and currently abundant. So why bother?

We bother because we care about the future of people and our relationship to our little planet. We bother because we want to be more a part of the solution than a larger part of the problem. We bother because outliers and pioneers are often decades ahead of modern culture memes. We bother because we can and we will.

And so can you.

One way to be part of the solution and get on board with the Vermont Soap program is to systematically replace yucky stuff with yummy stuff one product and one body at a time. We see "green" as a process, and the result of the process is an increasing focus on sustainability over extractive technologies. "Green" is what and who we are, and what our society will look like in fifty years if it is to exist at all.

We do it because even the dark side of green is better than no green at all.

This is the Soapman encouraging you to make small relentless changes to business-as-usual and to make the greenest and most healthful choices available in everything that you do.

Larry Plesent is a writer, philosopher and founder of the Vermont Soap Company; dedicated to replacing yucky stuff with yummy stuff for all the girls and boys who care. Thanks for reading. Learn more at www.vermontsoap.com and www.reactivebody.org. ♻

GARDENING WITH BIOCHAR

by Jeff Cox

Storey Publishing, LLC, January 2018, 128 pages, $12.76

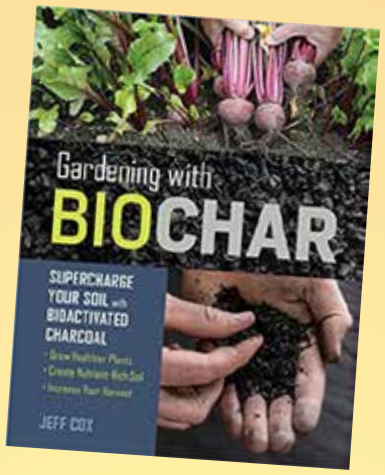
Book Review by Jessie Haas

Can your garden, brush pile, and wood stove save the planet? Yes, according to Jeff Cox, in his new book, Gardening with Biochar. Cox, a contributing editor at Horticulture, brings his scientific chops to this short book. Four chapters cover the history and science, how to make biochar, how to inoculate it, and how to use it in your garden.

Why would you want to?

Biochar can boost garden productivity, improve tilth, and buffer the effects of heavy metals. But the big reason to use it is that it sequesters carbon. "Scientists estimate that if we could increase the amount of carbon stored in the world's soils by just four parts per thousand each year, we could sequester 100 percent of the carbon we currently add to the atmosphere annually," Cox says.

Biochar is a charcoal, roasted (not burned) at 660°F. It can be made of any organic material, but woody plants are ideal. Plants spend their lifetimes drawing in and storing carbon. Much of that carbon is released when the plant dies. But converting it to biochar and incorporating it into soil retains most of the carbon, for centuries.



Biochar was invented by early peoples in the Amazon Basin. The soil there rapidly hardens after trees are cut, becoming incapable of supporting crops. But 2500 years ago, indigenous people discovered that incorporating biochar and organic material made the soil extremely fertile. Over a region as large as France, they established dense populations and large cities, on soils that are still fertile today.

Cox covers this history, and the science of biochar, in the first forty pages of his book. Then he tells us how to make it, covering feedstock (including the pH impact of different kinds of wood). He recommends accumulating and drying woody debris in the spring and summer, chipping it and storing in loosely covered barrels. Come fall, you can make a burn pit (the most productive method), a TLUD (Top-Lit-Up-Draft gasifier), which is the cleanest method, or save your feedstock until winter, when you can roast it in a sealed metal container such as an ammo can in your woodstove, while simultaneously heating your house. For each method, Cox provides clear instructions and photos. He also gives guidance on buying biochar at the garden center.

Once you have your biochar, you need to innoculate it. It naturally repels water, and when powdered can easily blow away. But mixing a minimal amount of water, along with compost, manure, 'worm juice' or even flour, like making a sourdough starter, gives microorganisms a chance to colonize the many nooks and crannies. Without this step, biochar will lie inert in the soil for a season or two and may even retard crop growth initially.

Once your char is innoculated, it's time to add it to the garden. Cox lays out a couple of methods, but this is a less-detailed section of the book—because really, it's pretty simple to use biochar once you've prepared it right.

"Every bit of biochar makes a difference," Cox says. "The more biochar makers we have on this planet, the more we can reduce the effects of global warming. Each year, terrestrial plants absorb 60.6 billion tons of carbon during photosynthesis. About the same amount cycles back into the atmosphere through plant respiration and decomposition." But about 10% of that carbon is defined as waste; straw and cornstalks, wood trimmings, branches, leaves, and brush. If all of that six billion tons were made into biochar, that would offset most of the carbon dioxide humans release every year. That's more than you can do in your garden, but every little bit really does help.

Links:

1. https://www.storey.com/books/gardening-with-biochar/

2. https://newenglandbiochar.com/

3. http://www.css.cornell.edu/terra-preta.html

Jessie Haas has written 40 books, mainly for children, and has lived in an off-grid cabin in Westminster West, VT since 1984, www.jessiehaas.com. ♻

Natural Protection Against Biting Bugs

George Harvey

In May, we saw an article from the Sierra Club, "5 DEET-Free Ways to Protect Yourself From Bugs" (http://bit.ly/DEET-free). While that was good, we decided it might be worthwhile to look into the matter further.

DEET is a chemical that was developed about seventy years ago by the U. S. Army. It is not an insecticide, but it interferes with the sense of smell some insects use to find their prey. Mosquitoes, for example, can smell carbon dioxide and lactic acid, and they follow these scents upwind to potential victims. DEET, which is said to be our most important mosquito repellent, interferes with their ability to smell, and so a person wearing it does not attract so many of them.

Lavender. Photo by Ken Irwin, Wikimedia Commons, CC-BY-SA 2.5 Generic.

Like many chemicals, there is some controversy with DEET. Our government says it is safe for nearly everyone, with some cautions about using it on small children. Some countries have banned it as an irritant. Of course, there are people who claim it is worse than that, but the science to support the claim is not widely accepted. This leaves some people wondering what to use.

The Sierra Club article examined five products that could discourage bugs from biting. When we looked into the matter, we found others suggested several more. Some of these are of particular interest, because they are natural, of little or no known toxicity, and unlikely to persist in the environment. The repellent ingredients we found include the following: oil of lemon eucalyptus, neem tree oil, catnip oil, grapefruit seed extract, citronella, tea tree oil, geraniol, soybean oil, thyme oil, cinnamon oil, lavender.

Information can be found at numerous web sites about these ingredients. Some of them describe how to prepare do-it-yourself insect repellents, for example "10 Natural Ingredients That Repel Mosquitos" at healthline.com (http://bit.ly/DIY-repellents). Some natural repellents are considered to be as effective as DEET.

A number of the ingredients listed above are in two sets of products highly recommended by our editor, Nancy Rae Mallery. One product line appeared in a product review, "Dealing with Summer's Not-so-welcome Bugs," in the June 2014 issue of Green Energy Times (http://bit.ly/VS-insect-repellents). That review covered three related Vermont Soap products, citronella camp and garden lotion, citronella camping spray, and camp and garden soap. Mallery says she still buys the spray "by the gallon," and she clearly intends this to be taken as literally true.

Another brand Mallery praises highly is Natrapel®, a product line of Tender Corporation, whose main office is in Littleton, New Hampshire. Though it is a very different product from what Vermont Soap produces, she says that Natrapel® picaridin is very effective for avoiding being bitten by ticks. She has stories about being with other people who return home covered with ticks when she finds none during careful searches on herself, a fact she attributes to her use of Natrapel®.

It is important to buy local products awhen possible, so an added attraction of both Vermont Soap and Tender Corporation products is that they are local in the G.E.T. distribution area. Many of our readers are familiar with Vermont Soap because of Larry Plesent's "Ingredient of the Month" series. Tender Corporation has some very interesting products and policies, so we may look deeper into it in the future. ♻

RESOURCES

350-Vermont: General group that coordinates a variety of statewide actions.
To join this group go to: **http://350vermont.org**
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
CO2.Earth: See emissions harms, scientific advice, and pathways to follow. www.co2.earth
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
New York Solar Energy Society (NYSES): www. nyses.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 Jobs: Listed by city, state, and district, **SolarStates.org**
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…

Heat Pump for You *Cont'd from p. 22*

down low enough to match the load, they simply turn off. When a heat pump cycles on and off rather than turning down to a low speed it is called short cycling, which can cause higher-than-expected energy use. You will feel comfortable, so you will think everything is working until you get your next electric bill. In some cases, this short cycling can get expensive.

Design options include floor mounted heads, wall mounted heads, ceiling heads, and compact ducted heads. Each has its own function that should be considered in the design layout.

Compact ducted mini splits are available and can be ducted to nearby rooms. They are not quite as efficient as single heads but can be a better option than multi-heads. Single zone, cold climate heat pumps are most efficient option.

The recommendation is to use one or more single zone heat pumps that are more energy efficient. Never size more than 115% of the heat design load requirements or select an oversized heat pump based on the number of zones required in a home. Oversizing can and often will cause more problems than under-sizing.

The best place to get the right answers is with an EEN contractor or by calling Efficiency Vermont at 888-921-5990, www.efficiencyvermont.com.

Another resource is the Northeast Energy Efficiency Partnership, NEEP guide to sizing and selecting heat pumps https://neep.org/sites/default/files/Sizing%20%26%20Selecting%20ASHPs%20In%20Cold% 20Climates.pdf

Bruce E. Landry is an EEN Energy Consultant. His focus is to remove fossil fuels from our homes and businesses. He also consults with Habitat for Humanity, helping them build their homes to Low Energy Use, High Performance Standards.

Matt Sargent is a Senior Energy Consultant at Efficiency Vermont where he works with builders and architects to help them design and construct energy-efficient buildings. He is passionate about helping Vermont achieve its goal of 100% net-zero new construction by 2030. ♻

GUIDE TO ADVERTISERS

Composting Toilets Evolve

The Relationship Between Water Conservation and Watershed Health

Ben Goldberg

A previous G.E.T. article, published in issue 9, Aug. 15, 2011*, described portable composting privies as a greener option to porta-potties. Since that time, there have been a number of inquiries about how the privy functions, questions about urine diversion in general and the present state of composting toilets. This article is a response to those questions and also offers an update on some of the newer versions of composting toilets, and some rationale for the technology.

The original portable porta-potty image from GET, *Aug. 15, 2011. All images courtesy of Ben Goldberg.*

There is a variety of new composting toilets emerging for use as a result of consumer and ecological demands. The most recent innovation is urine diversion. To say it is recent or an innovation is slightly inaccurate, since that's the practice of most of us mammals. But to adapt innovative toilet technology to that principle is becoming a trend. In fact, one of the global trend-setters, The Rich Earth Institute, is located right here in Vermont. Rich Earth has been developing protocols and equipment for collection, stabilization, and reuse of diverted urine as a locally sourced fertilizer since 2011 and is helping to establish forward-thinking design and permitting policy for the next generation of bathroom users. Rich Earth is influencing the way we will be going to the loo in the future to reflect a water-conscious global population, and the need to conserve a dwindling global supply of phosphorus.

Keeping the nutrients in pee out of the waste stream, where they then become unchecked pollutants, also conserves the potable water that would otherwise flush them away. Nutrients escaping from septic systems and waste treatment facilities in the Long Island Sound watershed, for example, with communities along the Connecticut River having a few of the larger ones, are identified as a major contributor to the Long Island Sound oxygen-deprived dead zone.

To collect pee for reuse requires some user participation. In Brattleboro, VT, DIY contributors voluntarily fill handy containers which they transport to a local Rich Earth collection depot and vie for the largest amount contributed at the annual "Piss-Off" contest and celebration. Local contributors are the major source of supply for Rich Earth's research and stabilized fertilizer. Rich Earth also collects pee at festivals and events in their Pee-Only porta-potties and four-place stand-up stations.

Above: On site at the Garlic and Arts Festival, Orange, Massachusetts; left is a Full Circle Throne.

One can also find manufactured toilets designed specifically for urine diversion. The seat – or as I enjoy calling it, the user interface - is divided into two sections. The front portion is a human-anatomy-friendly funnel that connects to a collection vessel below via dedicated tubing. The, um, rear end is a larger hole that can either incorporate a chute as a pathway for the solids to enter a composting toilet by gravity, or a flushing bowl that connects to septic or sewer. Isolating the liquid for reuse accomplishes a number of goals, all of equal value. Roughly eighty percent of the nutrients that would otherwise become environmental contaminants, are captured, and become easily accessible for reuse. They remain uncontaminated by fecal pathogens. You save large volumes

Cont'd on p.38

Composting Toilets Evolve

Cont'd from p.37

of potable flush water, thus reducing the burden on your septic system, ground water, or local sewage treatment plant, all while contributing to overall ecosystem health. Reusing the nutrients as locally sourced fertilizer contributes to local food security and reduces dependence on fossil fuels used to manufacture and transport commercially made products from agri-giant corporations.

Vermont is also home to one of the newest composting toilet products on the market. Full Circle Composting Toilets from Putney, diverts urine for reuse, and collects solids for composting in interchangeable storage bins down cellar, below the finely crafted wooden throne outfitted with a Separett seat.

Combining urine diversion technologies with existing non-UD composting toilet systems allows for composting the solids and capturing the liquids for reuse. For example, a Separett or Full Circle commode with a Phoenix Composting toilet provides a very functional hybrid system.

Other products that are emerging onto the scene that use diversion design on location are the composting privies made in Sunderland, Mass by the Privy Counsellors. Made to order, they offer an aesthetically pleasing ecological alternative to the porta-potty, the structures are built to last using artisan-quality crafting - aka Perma-Potty. They can be trailered to a temporary or more permanent site and provide an alternative to sites with no basement or crawl space. They are currently in use in area community gardens, farm schools, farmer's markets, and other outdoor public and private gathering places, and homesteads. They are consistent with the ecological agricultural theme of many of their sites.

The privies use a Separett diverting seat and modified carboy urinals for liquids, and a batch collection bin for solids. Each batch gets transferred when full to a long-term vented sequestering bin for the duration of the composting process. When the sequestering bin fills, it is capped off and inoculated with composting organisms to facilitate the process. Another bin is started while the original one composts. A pail full of mature compost or healthy topsoil are good choices for starter organisms. Because the salty and acidic urine has been separated, composting worms can also be added to the sequestering bins to help facilitate the composting process. Urine can also be composted in dedicated sequestering bins as a treatment method if the high-nitrogen urine is mixed with carbon rich bedding such as pine shavings or crushed leaves in the appropriate proportions, and starter organisms are added.

The most recent ADA-compliant privy at a future farm school in eastern Massachusetts.

The notion of composting toilets and now, urine diversion, is a stretch for some. For the many others with whom I've spoken about ecological sanitation and who do not already have buy-in, it instantly makes obvious sense. More and more people are becoming aware of the relationship between water conservation and watershed health, and the personal choices we make about how we manage our poo and pee. In the same way we are taking a good hard look at our food, transportation, consumer, and energy choices, we are being called upon to take the same look at our bathroom habits.

Ben Goldberg has been working with worm composting and composting toilets for over 30 years, because he recognizes the importance of healthy soil and clean water. He lives and works in the Pioneer Valley of western Massachusetts, in the Connecticut River Watershed.and starter organisms are added.

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Ben Goldberg has been working with worm composting and composting toilets for over 30 years, because he recognizes the importance of healthy soil and clean water. He lives and works in the Pioneer Valley of western Massachusetts, in the Connecticut River Watershed. ♻

PFASs Are Forever

And so are a whole bunch of other things we would be better off without.

George Harvey

Many people are familiar with a story about Julius Caesar's last breath. The story is that there are twenty-five sextillion molecules in the Julius Caesar's breath, in which he famously said "Et tu, Brute!" And this number is so great, compared to the number of breaths it would take to fill the atmosphere, that one or more of those molecules will probably be in any given breath you take.

Of course, most things do not last forever. Carbon dioxide is captured by plants to make things like cellulose to grow. The carbon is sequestered in the roots of plants, and when the plant dies, it decays into other compounds. Some of it is transformed to elemental carbon, and when we burn coal, we are using carbon trapped in this way long ago.

PFAS have been found in house dust. Photo: A Ocram. Wikimedia Commons. CC-BY-SA 1.0

Most organic compounds decay over time, but some substances cannot be broken down over any practically useful period. If we make these, the amounts in existence will only increase. If we release them into the environment, they will only accumulate. If they are toxic, they can only make life increasingly difficult with passing time.

This is true even if the amount emitted at any time is very small. So, if there is a toxic substance on a fabric, normal wear of that fabric will get tiny amounts of it into the air, water, and soil. If there are a lot of pieces of the fabric in use, each will contribute to the accumulated amount.

PFAS are such substances. They have a number of uses, ranging from manufacture of other chemicals to textiles and floor wax. But every product that has them is a constant source of emissions. Each article with them emits its own "Et tu, Brute," breath every moment it is used, putting out molecules that get into each of us.

The result is that nearly a third of Americans already drink water with PFAS in it. Very possibly, all of us in this country have them in our bodies. They are "forever molecules" that don't go away.

The problem is not just that PFAS are toxic. It is that as long as we use them, the toxic accumulation will increase, making the toxicity worse. Acting to stop using them will be necessary. It is just a matter of how long we wait, and how much damage is done, before we act.

The Sierra Club recently sent out an appeal to all of us to get in touch with those who represent us in Congress, letting them know we want them to act on PFAS. You can see this short appeal, and add your name to a petition, by visiting http://bit.ly/say-no-to-PFAS.

We might add, however, that the issue goes far beyond PFAS. We at Green Energy Times believe that substances that "are forever" should not be used without passing significant review examining what their long-term effects might be. ♻

Natural Skin Care Alternative
Catskills Comfrey

N.R. Mallery, publisher of G.E.T.

Comfrey has long been used in poultices to relieve inflammation. And now, Catskills Comfrey is using its natural properties in salves.

Catskills Comfrey's plants are all grown organically on a small farm in Delaware County, New York. They are never treated with herbicides, pesticides, or other things you would not want on your skin. Each plant is just fertilized with a shovelful of aged horse manure, with harvests two to three times each year. Within 48 hours of harvest, the comfrey is dried, crushed, and stored in airtight containers to preserve freshness and maintain high-strength potency.

Nearly everything in Catskills Comfrey products is grown organically, right on the premises. In addition to about 350 comfrey plants, the farm grows Calendula and arnica for its signature blends. It also grows its own hemp for CBD (cannabidiol).

Owner Seth Hersh told me about CBD, "I visited many retail stores last year and received numerous comments from folks I knew and trusted, and who were experiencing positive response to CBD. Most were using drops at the time. So, I decided to step in and now produce a comfrey plus arnica plus CBD version."

One customer recently reported that Catskills Comfrey blended with CBD was helpful with his problems associated with Parkinsons, reducing his level of pain from an eight down to a three or four. Hersh's own experience was that it helped a disorder called "trigger finger." Stiffness, muscle pain, and sore joints all seemed to benefit.

"There is no reliable cure for arthritis, Trigger Finger, or muscle or joint pain, so a topical 'clean and green' palliative option can be a blessing in many situations that would, otherwise, be rather discomforting," Hersh said. And comfrey-based ointments can be effective without all the side effects one might have from prescription medicines.

Catskills Comfrey makes four versions of their ointment: The Original formula; one with arnica and calendula; one with chili pepper; and the CBD formula. I decided to try all of these myself and found varying results on my own areas of inflammation. For the most part, one of the four ointments always worked to some degree.

For instance, when I put the chili pepper salve on my swollen knees, I was delighted with relief that actually lasted for a couple of days. I want to warn the reader, however, that this is seriously hot stuff, as I found when I accidentally got a tiny bit on my lips. I give it a thumbs up for pain and inflammation, but not for lips and tongue.

Interestingly, aside from salves, Hersh uses comfrey as a fertilizer regime. It makes a great addition to the compost pile and is extremely high in the nutrients for plants. Catskills Comfrey uses excess comfrey production to make a tea that is fed to the CBD-dominant hemp plants. Since they grow near each other and is readily available, Hersh comments on this fertilization method, "How's that for a carbon-zero foot print?"

Each of these 100% formulas has a place for relieving suffering. I especially love the chili pepper ointment. I recommend it to readers, as I have mentioned it to two physicians already. I plan to share some with my own daughter-in-law, who is a dermatologist!

The Catskills Comfrey website is catskillscomfrey.com. ♻

OOho Pods *Cont'd from p. 21*

to truly "close its loop." Likewise, paper or cardboard cartons could be a viable alternative to plastic food and drink storage containers if they are produced at great enough scale to justify dedicated facilities to process them for recycling, given that they are also infused with non-recyclable layers for strength and to prevent seepage.

PLA and cardboard are just the beginning of what is possible. Food producers and chemists are experimenting with making containers out of biodegradable plant products like corn starch, cassava and even algae. And just this spring, tens of thousands of runners participating in the London Marathon were given water out of edible pods made from seaweed and plant extracts instead of plastic bottles. Skipping Rocks Lab, the London-based startup behind the newfangled containers, reports that they're not only cheaper to produce than plastic but are also biodegradable, breaking down completely within a month, while not imparting any flavor or taste to the water or whatever else is inside.

While there's something to be said for technology, an older school "alternative" to plastic is all-natural plant material. American supermarkets could learn a lot from some Southeast Asian grocers, for instance, that wrap up produce for sale in biodegradable banana leaves instead of plastic bags. These all-natural wrappers can be thrown into the compost pile or yard waste bin and become rich soil without ever having to be processed using fossil-fuel based energy (as traditional recyclables usually do).

You can do your part by telling your friends, neighbors, store managers, policymakers, elected officials and anyone else within hearing distance that you and millions of others like you don't want any more single use plastics in your town, county, state or country. And if you haven't already done so, get yourself a reusable water bottle and reusable shopping bag(s) so you can start being part of the day-to-day solution.

Contacts: "Production, use, and fate of all plastics ever made," http://bit.ly/plastics-fate; Sea Education Association, www.sea.edu; Skipping Rocks Lab, www.skippingrockslab.com.

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