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COURT RULES IN FAVOR OF YOUTH PLAINTIFFS

George Harvey

In 2015, a group of youthful plaintiffs aged eight to nineteen filed a lawsuit against the United States claiming that the federal government was “deliberately allow[ing] atmospheric CO2 concentrations to escalate to levels unprecedented in human history.” They further claimed that by doing this, the government was violating their rights to the life, liberty, and property they would have in the future.



Youth plaintiffs make history. Image from Robin Loznak, Our Childrens Trust.

On July 30, 2018, the Supreme Court ruled on applications from the Trump administration to stop or delay the case in various ways. Simply put, the Supreme Court of the United States ruled that the youths have a right to sue, and the case will go forward as scheduled.

Juliana v. United States is an extraordinary lawsuit with implications that may give it an important place in history. It goes beyond the question of whether the federal government and its agencies are doing damage exacerbating climate change. It takes the issue of challenging climate policy into the court and even creates questions about whether and when the courts can direct the government's policies. This is a real issue of the doctrine of separation of powers.

The plaintiffs have had a fair amount of help in this case. Earth Guardians, an environmental organization, and Dr. James Hansen, who brought the issue of climate change to the attention of many Americans, are giving their support. The legal fees are being paid by donors, or the work is being done pro bono. Support is coming from many quarters, and the issue is being brought to the attention of authorities in other countries.

The case went through a typical set of legal stages, slowly grinding its way through

Cont'd on p.32

Cover Crops Help Farmers Stand Up for Clean Water

Jessie Haas

This spring I watched a beautiful cover crop of winter rye grow in a field I often pass. Later, corn was seeded into the rye. For several weeks the crops grew together in two-toned harmony, the rye sheltering the young corn. Now, the rye is smothered in the dense corn planting, but it's done its job, adding nutrients and structure to the soil, and retaining moisture.

Cover crops are a powerful tool for that. They also have a major role to play in keeping sediment, nitrogen, and phosphorus out of waterways. According to Sustainable Agriculture Resource and Education, a division of USDA, cover crops can reduce sediment losses 31% to 100%. They also lead to a 48% reduction in nitrogen losses and between 15% and 92% of phosphorus losses. Remember, everything a farm field loses, a nearby water body 'gains', usually to its detriment.

For that reason, cover crops are mandated for annual crops near lakes and streams under Vermont's new Required Agricultural Practices. Given the many environmental benefits of cover cropping such as water protection, increased rainfall infiltration (6-fold in some systems), erosion prevention, drought mitigation, and carbon sequestration--environmentalists should be cheering, right?



Farm along the Connecticut River. Runoff from chemicals like Round-Up®, with known carcinogens, run off into the river wreaking havoc on the environment and are threats to human and wildlife health as well as to the health of our waterways. Image: Flickr.

Unfortunately, cover cropping as currently practiced in Vermont has led to a vast increase in the use of pesticides. It has become standard practice on large farms to knock down cover crops with glyphosate (Round Up) or other pesticides, including atrazine and 2,4-D, the active ingredient in Agent Orange. According to figures put together by Michael Colby of Regeneration Vermont from Vermont Agency of Agriculture reports, glyphosate use doubled between 2014 and 2016. 2,4-D applications increased from 418 pounds in 2014 to 5,361 pounds in 2016. (https://

soaring-pesticide-use).

There are other ways besides herbicides to knock down a cover crop, including mowing, disking, crimping with a heavy roller, grazing, or simply choosing plants that will be killed by hard frosts. These methods cost less and leave more crop residue on the surface. So why are many farmers wedded to chemicals?

For decades farmers have been educated to believe that getting bigger, moving cows indoors, using agricultural chemicals, computerizing, will finally be the key to making dairy

Cont'd on p.20

RISING SEAS: Florida is About to be Wiped Off the Map

Casey Coates Danson

Sea level rises are not some distant threat; for many Americans they are very real. In an extract from her chilling new book, Rising, Elizabeth Rush details how the U.S. coastline will be radically transformed in the coming years.

In 1890, just over six thousand people lived in the damp lowlands of south Florida. Since then, the wetlands that covered half the state have been largely drained, strip malls have replaced Seminole camps, and the population has increased a thousand-fold. Over roughly the same amount of time, the number of black college degree holders in



Many of our cities, such as Miami, are at the water's edge. Image: Wikimedia Commons.

the U.S. also increased a thousand-fold, as did the speed at which we fly, the combined carbon

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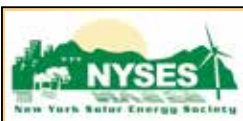
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Printing Valley News Lebanon, NH Using 100% Recycled News-print & Smudge-Free Environmentally Safe Inks*

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Thank you for reading G.E.T. Please send your comments & sug-gestions to: info@greenenergytimes.org

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As Vermont's Greenhouse Gas Emissions Continue to Rise, ACTION ON CLIMATE IS MORE IMPORTANT THAN EVER

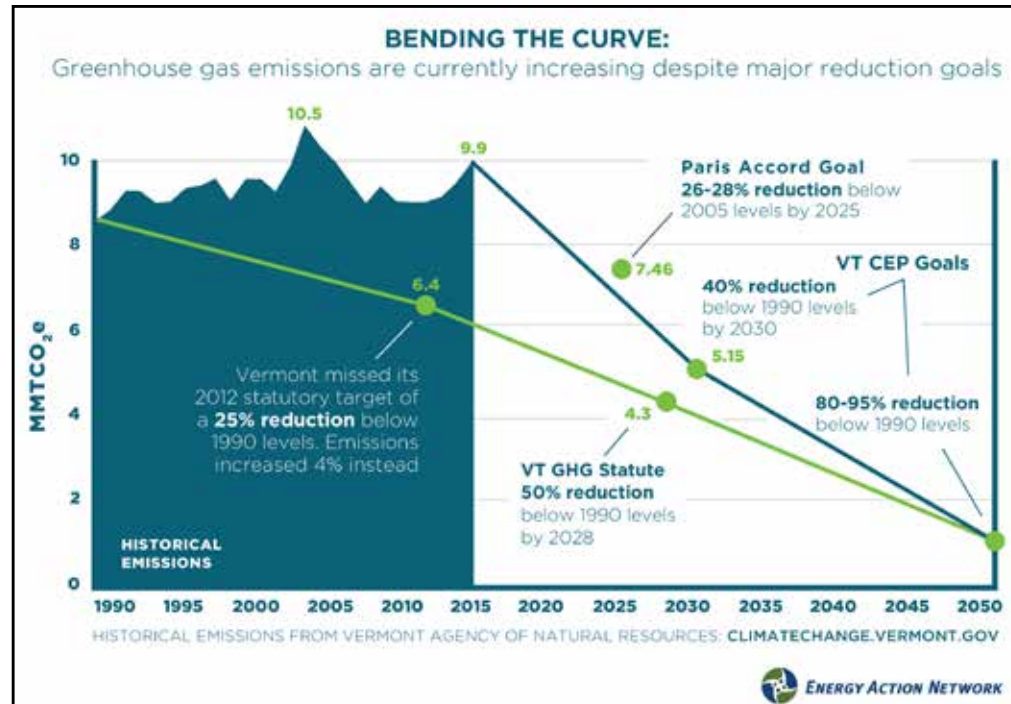
Ian Hitchcock

Things are heating up in Vermont and around the world. This summer, Burlington experienced both the three hottest consecutive days on record, as well as the warmest night ever recorded, with temperatures never dropping below 80 degrees.

While Vermont may be committed to addressing climate change on paper, at our current trajectory, we won't meet either our Comprehensive Energy Plan goal of 90% total renewable energy by 2050 or our state's statutory greenhouse gas (GHG) reduction targets. The recently released GHG emissions inventory by the Vermont Agency of Natural Resources shows that, despite these strong goals, our emissions have risen dramatically. Over the course of just two years, 2014 and 2015, Vermont's emissions rose 10%.

It is the exact opposite direction of where we need to go. It is not just an environmental issue, it is an economic one. Vermont imports all of the fossil fuels we rely on so heavily to heat our buildings and power our transportation network, which means strategies that keep more of those energy dollars in state can save Vermonters significantly. Thankfully, there are solutions we can embrace as individuals, as communities, and as a state.

We can take action as individuals to reduce our energy use, often in ways that end up saving us money and increasing our comfort in our own homes. One opportunity to take action is the upcoming Button Up Vermont campaign, aimed at elevating the money-saving, comfort-creating benefits of tightening up our homes and buildings. Ensuring that buildings are properly air sealed and weatherized can keep money from literally leaking out the door. Learn more about this effort, and



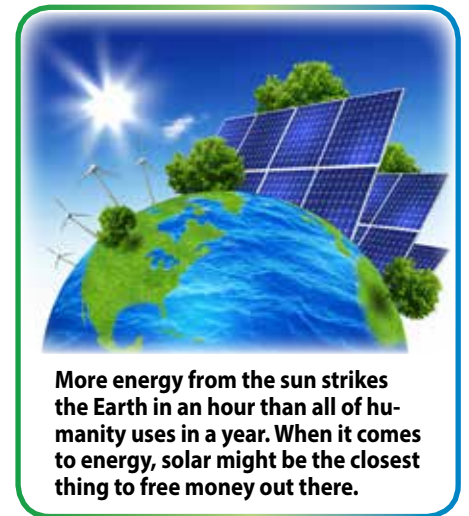
Vermont joined a politically bipartisan coalition of states committed to adhering to the Paris Accord goals of reducing greenhouse gas emissions (GHG) 26-28% by 2025. In addition, Vermont has its own statutory goal that aims for further reductions. Progress means bending the curve to reverse recent trends that show an increase in GHG emissions (MMTCO₂e - million metric tons of CO₂ equivalent).

how you and your community might participate, at www.ButtonUpVermont.org.

On the community level, Vermont is fortunate to be home to a network of over 100 town energy committees. These all-volunteer groups are helping to make their communities more energy-independent, affordable and livable. For the past year, I've had the privilege of helping to support these boots-on-the-ground groups as an AmeriCorps member serving with the Vermont Energy and Climate Action Network (VECAN). I have been inspired by the commitment of these local

leaders who are helping their municipalities retrofit municipal buildings, getting solar installed at schools, partnering with businesses on transportation solutions and more. Connecting with your town's energy committee, joining one or starting one yourself – with VECAN's help – can be another powerful way to advance much-needed solutions. For the full list of energy committees or info about how you can get involved, visit www.vecan.net.

Finally, supportive state policies and leadership are also essential. Ensure that you go to the polls this November



More energy from the sun strikes the Earth in an hour than all of humanity uses in a year. When it comes to energy, solar might be the closest thing to free money out there.

informed about where candidates stand on environmental, energy and climate priorities. Visit the nonpartisan Vermont-ConservationVoters.org and check out their legislative scorecard and candidate endorsements. You can also check out the recommendations laid forth by Governor Phil Scott's Vermont Climate Action Commission. The Commission recently released its report on strategies that the state should pursue to meet its greenhouse gas reduction goals. Check out the Commission's final report and share your thoughts on what needs to be done by submitting your comments on the report's conclusions by the end of September. Find all of the info by searching online for "Vermont Climate Action Commission."

Vermont has a job-creating, money-saving leadership role to play in tackling climate change. And there are solutions at every level – individual, community, and at the state – that can be advanced and, cumulatively, start to move our state in the right direction.

For help in starting an energy committee – or advancing energy projects and priorities in your town – contact the Vermont Energy and Climate Action Network – or reach out to Ian Hitchcock, an AmeriCorps Member serving with VECAN. Reach Ian by emailing ihitchcock@vnrc.org or calling 802-223-2328 ext. 118. ☕

AMERICA FALLING FAR BEHIND



Norway's Solar capacity is thriving: Image ifpnews.com

Our leaders like to talk about "American exceptionalism," but America is not so exceptional when it comes to renewable energy. In fact, we are falling far behind.

Countries all around the world are demonstrating that a transition away from fossil fuels is not only possible, but is a plausible, clean, and affordable path forward. Here's a quick look at what other countries around the developed world are achieving:

- In China, an entire province the size of Texas was powered on 100% renewable energy last year.
- New Zealand recently released a plan to transition to 100% renewable energy by 2035.
- Iceland is running on 100% renewable energy mostly through geothermal plants.

- Norway produces 98% of its power needs through renewable energy.
- Holland's entire train system now runs on wind power.

We can learn from these initiatives and join their commitment to reach 100% renewable energy.

See video at <http://bit.ly/Sanders-USA-renewables>.

Our leaders must have the courage to admit that if we can learn from the successful energy policies of other countries, we could become a world leader in clean, sustainable energy production.

Thanks for staying engaged,
– The Sanders Institute ☕



The world's largest floating solar farm is built in China on a lake that used to be a coal mine. Image: futurism.com.

FREE Tesla Powerwalls for 100 GMP Low-income Families with Health Problems

Green Mountain Power is offering Tesla Powerwall 2.0 batteries to 100 eligible customers, free of charge. A \$150,000 grant from the Vermont Low Income Trust for Electricity (VLITE) will pay for the cutting-edge technology and installation in the homes of low income customers with significant need for backup power reliability due to health and mobility issues. The VLITE grant will provide for 100 batteries and cover the cost, free, for customers in need.

Tesla Powerwall batteries provide backup power like a standard generator, but Powerwalls turn on seamlessly and are clean. They can be charged from power off the grid, or with a customer's own home solar array and offer eight to twelve hours of energy.

Those who are interested in the program should contact Kristin Kelly GMP's Director of Communications, at (802) 318-0872. ☕

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National Drive Electric Week 2018

and Proposed Federal Fuel Economy Roll-backs

David Roberts

Are you curious about electric cars? If so, visiting an electric car demonstration event is a great way to learn more about them. There is no better time to do this than National Drive Electric Week (NDEW). Last year there were 270 electric car events across the country during NDEW, with several in New England and New York State. This year NDEW runs from September 8-16th and, with around 300 events planned, the odds are good there is one not too far away from you.

NDEW events usually include opportunities to speak with local electric car owners about their experience, including what it's like to drive one in northeast winter conditions, maintenance issues, where and how to charge and more. Many car dealers also attend these events and offer test drives of electric cars, so you can try one for yourself away from the pressure of a showroom. Electric bicycles are also commonly available for rides. If you haven't been on one they are a blast!

Trying out an electric car and possibly driving one yourself is especially important these days. On August 2, 2018, the Trump administration announced a proposed roll-back in vehicle fuel economy standards. The existing standards require vehicle efficiency of about 37 miles per gallon in real-world driving by 2025, but with the roll-back, new vehicles would only need to average about 30 miles per gallon in real-world driving from 2020 over the next six years.

The federal roll-back also proposes to prohibit the State of California's ability to develop more stringent emission control measures, such as the zero emission vehicle (ZEV) program. The ZEV program requires

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2017 Drive Electric Week event in White River Junction, Vermont. Courtesy Drive Electric VT.

automakers to sell increasing numbers of electric cars over the next ten years. Nine other states have joined California's lead on the ZEV program, (see sidebar on p.7) and it continues to be a critical factor in getting more electric cars on the road at prices consumers can afford. Without the ZEV program, we will likely have fewer electrified models available at local auto dealers, even as many other countries ramp up their clean transportation requirements on automakers.

Many elected officials are actively opposing this proposed change to vehicle efficiency and emission regulations. Massachusetts Attorney General Healey is leading a coalition with 19 other states and the District of Columbia which announced they intend to sue the federal government to prevent the proposed roll-back, which would:

Increase the country's oil consumption by 5 to 12 million gallons per day in 2025;

Result in 16 to 37 million metric tons more carbon pollution in 2025; and,

Cost Americans roughly \$193 billion to \$236 billion more at the pump through 2035.

It is too early to know how the proposed shifts in federal policy will impact electric car availability in the northeast, but checking out a NDEW event and committing to make your next car electric will send a

Drive Electric
 Vermont

Cont'd on p.7

National Drive Electric Week Sept. 8-16, 2018.

Find an event near
 you at driveelectric-week.org



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The \$5,000 rebate is taken off the Manufacturer's Suggested Retail Price (MSRP) and comes on top of a \$1,000 rebate from NHEC, plus a \$7,500 federal tax credit. Add up the incentives and you can be driving the world's best-selling electric vehicle for as low as \$16,490! Visit www.nhec.com/drive-electric.


Eversource customers are offered the same rebate through September 30th. For more information about the Nissan LEAF and the offer for Eversource customers, and to download the flyer to take to a local Nissan dealership, visit the

electric vehicle section of Eversource.com. A recent Eversource electric bill is also necessary to participate in this exclusive promotion.

Join NHEC on September 13h for Drive EV Event

Are you considering going electric? Come talk to owners who have successfully done so. Join us on September 13, 2018 at the Common Man Inn & Spa (3-7 p.m.) in Plymouth to celebrate National Drive Electric Week. We'll have free test drives, raffle prizes and other goodies.

Are you an EV owner? Bring your ride to display! The first 25 EV owners who register to bring their cars will receive a \$25 Common Man gift certificate.

For more information or to register your EV for display, please visit <http://bit.ly/register-EV>. 






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NATIONAL DRIVE ELECTRIC WEEK IN NH

Randy Bryan, Drive Electric NH

Get ready! On Saturday, September 8th, the Sierra Club of NH will host the eighth annual National Drive Electric Week (NDEW) event, along with the Granite State Clean Cities Coalition, New Hampshire Automobile Dealers Association, and Drive Electric NH. The event will be at Capitol Plaza on Main Street in downtown Concord from 8:30 AM until 1 PM.

Since 2011, the event has gotten bigger and better, hosting a variety of electric cars and technology gathered together on the sidewalk in front of the State House, adjacent to the Concord Farmers Market. Dealerships will display their latest electric vehicles, and electric vehicle owners will be there to share their experiences as well. It's a terrific opportunity to learn about electric cars, bikes, motorcycles, and trucks, as well as vehicle charging systems, in a fun and informational setting. You might even get to drive one!

Also, Drive Electric NH is helping to coordinate six or seven other NDEW events around the state, up from four events last year!

Check out DriveElectricNH.org and DriveElectricWeek.org websites to keep up-to-date on events, dates, times, and locations. This is your opportunity to go to an NDEW event near you, ask questions, kick the tires, and go for a drive in an electric car. We think you'll like the ride!

In other news, NH has continued to progress on the electric-vehicles front. Governor Sununu has elected to allocate the full 15% of the Volkswagen Settlement Appendix D funds to charging infrastructure deployments. The Office of Strategic Initiatives is the lead




Hilltop Chevrolet's Chevy Volt in front of the Concord, NH State House during Drive Electric Week in September 2017. Photo courtesy Catherine Corkery, NH Sierra Club.

organization overseeing this project, with full cooperation from various state and non-government organizations.

The NH Senate is convening a commission to make recommendations regarding the use of the Volkswagen funds and regarding the development of electric transportation options. Again, various critical stakeholders are involved in this commission, including Drive Electric NH.

Drive Electric NH has also helped several organizations stage five

other EV events around NH this summer. This brings the total number of 2018 events organizing in NH to 12-13, so far, versus four last year. The number of interested and cooperating groups continues to expand. We invite all who are interested to host their own event to contact us for ideas, assistance and outreach. We also invite all owners of EVs and related technologies to contact us to display at our events.

Randy Bryan is one of the co-founders of Drive Electric NH. Randy 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. 

New Hampshire National Drive Electric Week Events

Date	Time	City	Location
Sat. 9/8	8:30 am-1 pm	Concord	Capital Plaza, Downtown
Sun. 9/9	12-4 pm	Portsmouth	City Hall, lower park lot
Sun. 9/9	12-4 pm	New London	New London Historical Society
Thurs. 9/13	3-7 pm	Plymouth	Common Man Inn
Sat. 9/15	12-4 pm	Keene	Keene Ice
Sat. 9/16	1-3pm	Exeter	City Hall park lot and bandstand

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SMART COMMUTING IN NH & VT

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

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

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

In New Hampshire you’ll find a similar site at “NH Rideshare” where you can find car-pools, 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 elknep-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 advance card. (800) 872-7245 amtrak.com

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

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

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

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

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

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

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

MARBLE VALLEY REGIONAL TRANSIT - For Rutland, Killington, rural Manchester, 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

CHARGING YOUR EV FROM HOME

Greg Whitchurch

The reviews, the government agency reports, and the science are in: electric cars are faster, more powerful, quieter, more comfortable, cleaner, less polluting, safer to ride in (<http://bit.do/ev-safety>) and cheaper than Internal Combustion Engine (ICE) cars. So why do people still avoid buying a new or used electric vehicle (EV)? When asked, most say they worry about the range of a full charge and about the availability of charging. To address these two concerns, let me share our family's experiences, because they might be typical experiences of most EV owners.

In 2015, my wife, Barbara, and I decided to go greener, so we bought a 2008 Prius (for more than three times what I usually pay for a car, \$6600!); we loved both the car and the feeling of being more responsible. Going beyond that, in 2016 we bought a 2015 Nissan LEAF (\$12,000 OMG!) Now, the LEAF is just about the shortest-range, low-budget EV around, but what a difference over our ICE cars! Power to spare, much better traction and balance in snow and mud, no appreciable maintenance costs or schedules. (With four cameras for surrounding views of parking lines, curbs, cars, and pedestrians; bluetooth voice-activated phone calling; maps and directions to shopping, eating, touring, charging spots; super-quick DC charging; Bose® sound; LED headlights; etc. , it was more features than we'd select for a new car, but nice to have anyway.)

Just as predicted, we worried ourselves to distraction regarding the range issue. But those feelings have slowly evaporated (without any unfortunate instances) and now it's “no worries” for us. We discovered that being able to just plug in when we got home meant we were always ready to go by the next morning -- no more looking at gas station price signs or hanging around gas pumps in the weather while filling up.

For the first year and a half we used a regular 120VAC 15A outlet in our garage almost exclusively to charge our car; we used public charging perhaps three times. In the past year, we've started using the public chargers (sometimes free!) around central and northern Vermont. The ChargePoint app shows us chargers everywhere and which ones near us are available, and we've gotten very comfortable using those, but still we seldom charge away from home.

The pre-2018 LEAFs have unusually small batteries, allowing a range of perhaps 75 miles in the dead of winter, maybe 95 or so in the summer. (Just like ICE cars, your mileage may vary. EVs don't suffer as much as ICEs from jack-rabbit starts, but the high-speed stuff costs extra energy, whether gas or electric.) However, again, plugging in when parked at home is the exchange for trips to the gas station. One can certainly always plug in while at home to avoid keeping track of the “tank. ”

In the extremely rare case where we run our relatively small LEAF battery down past the second voice warning and then further down to the level where flashing

warnings appear, we plug into our wall socket by 6:00pm and are fully charged again before noon the next day. (Wish I'd had that much warning on my ICE cars over the year, but those are stories for another time.) The second voice warning offers to find the nearest available charger, map it out on the dashboard display, and then

guide us there by voice, but we've never done that.

Not that we keep it fully charged, though. Fifty percent charge is more than we use most days of driving, which requires eight or nine hours of charging. So, unless we're planning to

use it all, we keep the battery at about 60% to 80%, and plug it in when we need to. The Prius is our “second car” now, and we didn't use it at all from the first week in May until the last day of July.

Other people and I have seen people plug their trickle chargers into an outdoor socket or extension cord at their offices, the Red Cross, universities, friends' or relatives' homes, at a park 'n ride lot pick up 10 to 80 miles, depending on time, of “free” fuel while the car sits parked.

So, if you buy an EV, don't feel panicked by a perceived need to install a Level 2 charger in your garage or to be able to find them sprinkled all over the landscape like gas station/markets are nowadays. As demonstrated by even Tesla owners (who have much larger batteries), you can get by for as long as you wish with just the trickle charger that comes with your car and any nearby 15 amp, 120 volt AC socket. On the internet, there are lots of intermediate, cheap solutions for speeding up your charging times, if you wish. But take some tips from these guys: <http://bit.do/110evcharging>, <http://bit.do/110evcharging2> and <http://bit.do/110evcharging3>.

Warning: Beware of internet information. I had a hard time finding folks with actual wall socket charging experience. But I found LOTS of threads where folks say “seems like...of course. . . I think you'll find . . . it only makes sense to. . . probably...it's not possible...” If you're not careful, you'll discover that the Earth couldn't possibly be round; no one ever landed on the moon; climate change is a conspiracy to garner more funding for research; and Santa doesn't (or does) exist.

Greg and Barb (his wife) Whitchurch are owners of a Nissan LEAF, a Prius and a net-zero passive house with solar PV and hot water in Middlesex, Vermont. ♻



Remi relaxes in her mobile dog house, an all-electric Nissan LEAF. Credit: Greg Whitchurch.

AUTONOMOUS CARS VS. MASS TRANSIT, WHO WILL WIN?

Randy Bryan, Drive Electric NH

I have been thinking about this question for some time now. Like a picture puzzle, lots of little pieces (facts and opinions on autonomous vehicles), but I had no sense of the image. That changed last night, in my sleep, when I usually do my best thinking, as the image started to reveal itself. I hope my conclusions aren't old hat to the reader, as they seem quite new to me.

Guiding my thoughts was an inextricable grounding in what I would want to do. There are lots of aspects to this issue: autonomous cars, autonomous buses, trains, city use, suburban use, rural use, and, oh yeah, human nature. Let's go through some questions.

Some pundits have said that autonomous vehicles will take over all driving (no steering wheel). As autonomous vehicles prove safer, insurance for vehicles with steering wheels may eventually go much higher than for those without. And who wants to drive in traffic jams and city streets? On the other hand, who doesn't want to drive on a mountain road on a clear day or take the family on vacation in your own car? My conclusion is most driving will go automated, especially the closer to cities.

Freight transport is another area ripe for automated driving. Trucks can "platoon" (bunch up to decrease wind resistance and fuel use) with the lead truck making the route decisions. If a truck farther back in the chain wants to leave, it will slide out to an empty space and the platoon will re-join. Lower fuel cost, no driver, same start and destinations. This is a no-brainer. Most long route trucking will go automated.



Autonomous Waymo Chrysler Pacifica Hybrid minivan undergoing testing in Los Altos, California. Image: Wikimedia Commons, Author Dllu

Some pundits have said autonomous cars will kill taxis and local bus transit. I believe this will be mostly true for local travel. The prospect of having my car drive me to any destination is enticing (I can read, watch and text to my heart's content). Shared autonomous driving (Uber-like service) offers even lower cost options; individual pickup and drop-off is a winning combination. Those who can't drive will be newly empowered. The hold ups will be timeliness of pickups, cleanliness of the cars, and whether you pay not to share the ride with others and their destinations. Expensive taxis and fixed local bus routes will suffer.

Some pundits have said autonomous

cars will kill bus and train transit. Yesterday, I would have agreed. But, according to my revelation last night, this is not so assured. Yes, people will prefer their own car on any roads available up to some painful congestion point (learned from many years traveling on Long Island). That pain point will be easier to tolerate when we don't drive and can entertain ourselves. The real constraint here is destination parking (availability and cost). Why take your automated car if the destination's parking is problematic and expensive? This is where cities can control their own destiny. Constrained parking means more people will favor mass or shared transit where no

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parking is required. But, for mass transit to succeed, travelers will want convenient local travel at their destination. Fortunately, automated Uber-like shared transport (serial or parallel sharing) means affordable individualized transport will be available in most urban and suburban destinations. So, a city no longer needs a comprehensive bus system like greater New York or London for commuters to feel free to leave their car behind.

Will buses or trains win out for mass transit? Buses of all sizes will certainly lower their operating cost when they go electric (much lower fuel and maintenance costs) and driver costs are eliminated. Smaller bus sizes will gain the most. But, as the roads fill up, buses will slow down too, unless high-occupancy vehicle (HOV) lanes are available. This is again where city planners can affect their own city's destiny. HOV lanes versus rail tracks? I am not an expert on this. There are strong advocates on both sides. For me, it is sufficient to know that mass transit can be favored (constrained parking) and available (ongoing investment) as needs and solutions change. City planners have the tools to shape their world.

Randy Bryan is one of the co-founders of Drive Electric NH. Randy 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. ☼

Nat'l Drive Electric Week 2018
Cont'd from p.4

ZEV PROGRAM Zero Emission Vehicle States

- California
- Connecticut
- Maine
- Maryland
- Massachusetts
- New Jersey
- New York
- Oregon
- Rhode Island
- Vermont

positive message to automakers who may be re-evaluating their electric car plans. If you don't make it to a NDEW event, you can always visit a local dealership or keep an eye out for other events in your area to experience one for yourself.

You can learn more about Drive Electric Week events near you at <http://DriveElectricWeek.org>.

David Roberts is the Drive Electric Vermont coordinator. He has driven an all-electric Nissan LEAF for the past five years and says, "If you have to drive, drive electric." <http://www.driveelectricvt.com> ☼

Pickups Gearing Up for Huge Fuel Economy Improvements

Eric Junga



Automakers are rolling out an impressive suite of fuel-saving technologies just as the U.S. Department of Transportation (DOT) and U.S. Environmental Protection Agency (EPA) seek to roll back vehicle efficiency and emissions standards. Many of these technologies will be applied to full-size pickups, the perennial poster child for going easy on domestic manufacturers when it comes to setting future fuel economy (CAFE) and greenhouse gas emission (GHG) standards. Let's take a look at how the Detroit Three's pickups might fare in relation to the standards already on the books, starting with an unexpected rising star.

RAM's big fuel economy play

RAM's parent company, Fiat Chrysler Automobiles N.V. (FCA), is a persistent fuel economy laggard. According to DOT fuel economy projections, FCA's model year 2018 overall average fuel economy is projected to fall short of its standard by a full 3.4 miles per gallon (MPG). But by

embracing cutting-edge technologies, the automaker's RAM pickup line looks poised to become an efficiency trailblazer.

RAM is the first domestic automaker to offer a 48-volt mild hybrid system, making it a standard feature on the entry-level V6 engine and an option on its V8. Mild hybrids use a relatively small battery and belt-driven motor-generator, making the system simpler and cheaper than a traditional hybrid. Mild hybrids boost fuel economy (more than two MPG on the V8) while providing additional torque, a characteristic most pickup buyers are bound to appreciate. Because mild hybrids avoid the cost and complexity of a traditional hybrid, these systems could become standard equipment in many more vehicles down the road. The 2019 RAM includes other notable technology such as active aerodynamics that further improve fuel economy. Aerodynamics alone will contribute to a fuel economy improvement of one MPG.

Learn more at: <http://bit.ly/ACEEE-Hybrid-Pickups>, where links are available.

Eric Junga is Senior Research Analyst, Industry and Transportation, for ACEEE (The American Council for an Energy-Efficient Economy). ACEEE acts as a catalyst to advance energy efficiency policies, programs, technologies, investments, and behaviors. For information about ACEEE and its programs, publications, and conferences, visit aceee.org. ☼



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Saffron and Solar Farms

A WIN-WIN FOR THE ENVIRONMENT AND AGRICULTURE

Margaret Skinner



Raised beds established at the Peck Electric Solar Farm in New Haven, VT to test the potential of growing saffron in front, beneath or behind the solar arrays. Corms will be planted in the beds in September, and the saffron will be harvested in October. Photo: A. Ghalehgalabbbehani.

Above: Crocus flower; red threads are the stigmas, which when dried become saffron, worth \$20 per gram. The yellow stamens and purple petals are used for dye and other purposes. Photo: I.T. Jansen-Lonnquist

The University of Vermont researchers who demonstrated that saffron could be profitably grown in Vermont have teamed up with Peck Solar to investigate the potential of growing saffron within one of their solar fields in New Haven, VT. At a retail price of \$5,000 per pound, saffron is the world's most expensive spice, and the U.S. imports 46 tons annually. The UVM researchers, Margaret Skinner, Bruce L. Parker and Arash Ghalehgalabbbehani have been conducting research on saffron for the past four years and found that it can be grown in the field, despite Vermont's cold winter temperatures. To help keep their farms financially viable, farmers have been building ground-mounted solar arrays on portions of their land instead of selling to real estate developers. This has led to vocal opposition from some groups. Their concern is that farmers will take advantage of the lower-risk, higher reward opportunities of energy generation, and discontinue farming, which can be high risk as weather conditions become more extreme and unpredictable.

Over 24 million acres of agricultural land have been lost to development since 1982. A 4.3% drop in the number of farms in the U.S. was observed from 2007 to 2012, and this decline is continuing. Saffron production could reverse that trend.

Peck Solar, a South Burlington, VT based company, has been a family-owned electrical contractor for over 45 years. In 2008, they entered the solar power arena and have worked on both commercial and residential projects. To date they have installed over 120 megawatts of solar power generation capacity in Vermont, which contributes significantly towards meeting Vermont's goal for 90% of the state's energy needs to be met with renewable energy resources by 2050. Peck Solar has been working with farmers around Vermont to help them capitalize on the value of their land through construction of solar arrays. Steve Yates, Peck Solar's Project Director, hopes that growing high value crops like saffron within the solar fields will help keep agricultural land in the hands of farmers and allow them to create revenue by growing crops while generating clean energy. This is the first year of a 2-year project, and the cooperators are hoping for a fruitful harvest this October, with even more in future years.

More information on UVM's saffron research is at <https://www.uvm.edu/~saffron/> or contact Margaret Skinner, Tel: 802-656-5440 email: miskinner@uvm.edu.

Green Energy Times will follow the progress of this project in our mid-October edition, as the first harvest hopefully proves to be successful. Stay tuned! ☀

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Geothermal Moves Forward in New York State

George Harvey

One of the spectacular successes of clean energy is that it is proving to be both least expensive and most comfortable. This is happening with increasing frequency across a number of technologies. One place where it is true is with heating and cooling.

We have known for some time that the lowest monthly bills for heating and cooling have come from geothermal systems. And in a well-insulated home, geothermal systems provide a good level of comfort.

The problem for most people has been that they were expensive to install. Geothermal systems typically extract heat from the Earth and pump it into a home. Most underground heat exchangers have been costly, as they usually require drilling wells or digging up large areas of lawns for a heating loop. A heat exchanger can be put into water, if there is a large enough pond or river, but such is not usually the case.

Recently, companies

and organizations have been setting up programs that make geothermal systems affordable. Their success is so great that the question is rapidly changing from whether homeowners can afford geothermal heat and cooling to whether they can afford not to invest in geothermal.

One of these organizations is GroundUp: Geothermal Alliance of Western New York. GroundUp was formed with the hope of bringing geothermal heating and cooling to every possible home in Western

New York. It has a new option that allows homeowners to switch to geothermal with no down payment and a regular charge of \$128 per month, in addition to the cost of electricity required to run it. Many well-insulated homes of less than 4,000 square feet can be converted under the program.

GroundUp says that owners of homes heated with oil or propane can save as much as 80% on heating bills by installing geothermal



systems. While that is worth considering, another thing that anyone heating with oil or propane should think about is that their heating systems will need to be replaced at some point, and the investment needed for that might pay the bill to keep a geothermal system running for years.

According to GroundUp, the New York State Energy Research and Development Authority has up to \$15 million available through June 2019 for the installation of ground source heat pump systems for residences, businesses and institutions. GroundUp is just one program that takes advantage of this.

The GroundUp web site is www.groundupgeo.org.

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SOLAR 'ON GOLDEN POND'

SOLAR ENERGY HELPS SLA PROVIDE MORE CONSERVATION ON SQUAM LAKE



The solar presentation at Squam Lake Association, NH on July 26, 2018 where the proposed solar for SLA was presented. Photos: Squam Lakes Association.

The Squam Lakes Association (SLA) in Holderness, NH will be covering most of the south-facing roof of their headquarters building with a 33kW solar PV system. The solar energy produced on site will provide 100% of the annual electricity used in the offices, workshop, gift shop and meeting rooms.

"We have been looking at doing this for a long time and have been inspired by the Lakes Region Conservation Trust's project," said EB James, Executive Director at SLA, "and we are thrilled that we can now expand our conservation footprint by generating our own clean electricity. We really want to model using clean energy as essential to the continued health of Squam Lake, its watershed, and our environment. Solar energy is free to collect, abundant and is the cleanest and most deployable source of energy available today."

The beauty of the orientation and location of the SLA headquarters is that

the south-facing roof faces Route 3 and, therefore, has high-visibility allowing SLA to show all passers-by that this is a solar-powered campus. "While the solar modules will still be visible, the black modules will be aesthetically pleasing as they will be installed on SLA's new black metal roof," says Brett Durham, SLA Director of Operations.

Ted Vansant of New England Commercial Solar Services (NECSS) and Sandra Jones of the Plymouth Area Renewable Energy Initiative (PAREI), both Holderness residents, have combined their solar expertise to help the SLA find grant and state solar rebate funding, design the system to meet the needs of SLA and procure the equipment and install the system.

"Our mission here at PAREI is to help our community reduce energy use and

produce renewable energy one building at a time," said Sandra Jones, PAREI director and co-founder. "Assisting SLA with powering their buildings with solar energy helps both of our organizations fulfill our missions. We really hope SLA and PAREI's members will come out and support this project."

"We are thankful to the New Hampshire Charitable Foundation for providing us with a challenge grant for the solar installation," says Pam Smith, SLA Director of Development,

"and we look forward to working with our supporters and the community to meet the fundraising match."



NECSS is a New Hampshire company providing low-cost solar construction and financing services to commercial, municipal, non-profit and educational clients throughout New England. Ted believes that every solar panel that is installed helps address climate



Photo: Peter Wiggin, courtesy of Squam Lakes Association.

NH SOLAR SHARES RECEIVES GRANT REVISION ENERGY WILL BUILD THE INAUGURAL PV ARRAY



The artistic rendering of the NH Solar Shares solar picnic area includes the future Frosty Scoops seasonal ice cream stand that is currently in the planning process.

NH Solar Shares just announced that the NH Public Utilities Commission selected their proposal to fund - in part - the installation of a 28.8kW solar PV system to be located adjacent to the Frosty Scoops Ice Cream Stand in Plymouth on spaced donated by the Common Man Family of Restaurants. On Wednesday, June 20th, the NH Executive Council voted unanimously to support NH Solar Share's project in Plymouth. The grant award to NH Solar Shares will be in the amount of \$86,721 and funded with monies from NH's Renewable Energy Fund.

"This is a huge boost to our fundraising

effort," said Sandra Jones, Manager of NH Solar Shares and Director of the Plymouth Area Renewable Energy Initiative. "We will break ground in September and complete this - our inaugural Solar Shares' project by the end of October, 2018."

NH Solar Shares has contracted with Revision Energy of Brentwood, NH to install and maintain the solar equipment. "Revision is excited to be working with Sandra with NH Solar Shares and the New Hampshire Electric Cooperative on New Hampshire's first solar project to directly benefit our low income neighbors. We

see this as a great start to a trend we hope will continue throughout the state to make more clean, renewable energy accessible to everyone," said Craig Cadieux, Employee-Owner, ReVision Energy Solar Designer.

The solar energy produced will provide 10 income eligible households in NH Electric Cooperative service territory with a monthly solar share credit on their bill. These shareholders will be in the program for two years with the added goal of becoming an energy champion - one how is willing to learn and share information about solar energy, energy conservation and how clean energy helps our environment. Shareholder

Cont'd on p.35



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Simpliphi Lithium Batteries in Our Region

Many thanks
to our
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John Hassell

Simpliphi lithium ferrous phosphate (LFP) batteries are making their way into residential and small business renewable energy applications in the North Country. Let's take a look at a few residential systems in our area.



Fabrizio's home at Windy Ridge Orchards near North Haverhill, New Hampshire.

Many people are familiar with the Windy Ridge Orchard outside North Haverhill, NH. Great café, pick-your-own everything, craft store and lots of apples. The owner of the café, Sheila Fabrizio, has her home on the grounds of the orchard and uses solar power, with Simpliphi batteries for energy storage.

The entire house is supported by a six-panel solar array and one Simpliphi 24V lithium ferrous phosphate (LFP) battery.

The system has been in operation for about two years and fulfills all of the power needs for the house. A small 6kW Generac generator is also in the system, should it be needed due to long periods of inclement weather.

the Simpliphi batteries. Dartmouth College has a large tract of land near the town of Errol, NH, referred to as Wentworth Location. A new facility was constructed to allow students and faculty to conduct instruction and research. It consists of a large town hall



building and a smaller building that provides storage and houses the power room and the incinerating toilet, called the Destroylet, by the students. The power system uses a six-panel solar array, an inverter and two Simpliphi 24V batteries. The system is designed to use DC lighting, ceiling fans and refrigerator; the inverter is used only when AC power is needed. The site has an Internet connection. The power system is set up for on-line access



Susie Batchelder's home near Groveton, New Hampshire.

On the road between Lancaster and Groveton, NH, you'll see Perras Ace Hardware. The owner, Susie Batchelder, lives north of Groveton and uses solar power for her house, supported by ten, Simpliphi 48V batteries. The original lead-acid battery bank consisted of twelve four-volt batteries connected in series to achieve 48V. The new battery array supplies the same usable capacity but in a much smaller and cleaner package.

The original flooded lead-acid batteries consumed considerable floor space and required an exhaust fan for odors and hydrogen gas. The new Simpliphi battery array is much smaller, lighter and odorless. No ventilation is needed. The system has been working for about ten years, but only the last year with

should it be needed. Another solar powered system was converted from flooded lead-acid batteries to Simpliphi. The original battery bank consisted of 16, Trojan T105 batteries, which have a rated capacity of 900 ampere-hours (450 usable Ampere-hours,



Dartmouth College Wentworth, NH location.

at 50% discharge). The battery bank was replaced by three Simpliphi 24V batteries. The usable capacity of the Simpliphi battery is about 400 ampere-hours (at 90% discharge). The system has been in operation for about two years.

Simpliphi batteries were chosen for all of these applications due to their superior performance, when evaluated against other technologies. Looking at the comparison chart, the lithium advantage is apparent.

The Simpliphi lithium ferrous phosphate (LFP) battery gives the user and installer advantages over some battery chemistries. The name "Simpliphi" is not just a brand name, it represents a philosophy: Using the Simpliphi battery makes the system simpler to install and maintain.

Residential renewable energy systems are usually based on 12-volt, 24-volt or 48-volt battery assemblies. Simpliphi batteries are supplied in a 12, 24 or 48-volt package. One Simpliphi battery supplies the full system voltage. There is no need to buy 2, 4, 6 or 12-volt batteries and connect them in series to get the required system voltage.

With Simpliphi, if you need to add capacity to your battery system, you simply add another battery (or batteries). Each battery provides the full system voltage. All batteries are connected in parallel.

Each battery has its own, internal battery management system (BMS), which manages charge and discharge. Each battery has its own 80-amp circuit breaker; yes, you can actually turn each battery on and off. The batteries do not need ventilation, produce no odors or gases and can be installed in any position. For more information go to: www.simpliphipower.com

John Hassell is the owner and president of Be Green Solar, LLC in Benton, NH. He is a retired engineer who became a bit bored in retirement and started Be Green Solar. In



Parameter	Simpliphi LFP	Lead-Acid L16
System Voltage	24	24
Required Capacity	200 AH	200 AH
Rated Capacity	132 AH	420 AH
Usable Capacity	118 AH (90%)	210 AH (50%)
Battery Voltage	24	6
No. Batteries Required	2	4
Total Usable Capacity	236 (90%)	210 (50%)
Life (Cycles)	10,000	3,000
Absorb Time Required	0 Hours	1-3 Hours



This solar-powered system for another home in Massachusetts was converted from the Trojan T-105 flooded lead-acid batteries to Simpliphi Lithium batteries. Note the smaller area needed to house them.

addition to providing renewable energy systems to users in NH, MA, VT, NY, ME and PQ, he works with NGOs, principally in Haiti, to provide electrical power to remote villages and medical clinics. He can be reached at john.solarguy@gmail.com or by phone at 603.787.2317.



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THE UK'S CARBON EMISSIONS HAVE DROPPED TO 19TH CENTURY LEVELS

George Harvey

Fossil fuels started to take on a special significance in the United Kingdom as far back as the Late Middle Ages, when the newly introduced invention of the chimney made it possible to heat individual rooms in the homes of wealthy families. Before that, the hearth was often in the middle of a big room with a hole in the roof to let the smoke out. After that time, whole forests were cut down to burn in the newly-invented fireplaces, until wood shortages forced most people to switch to the more expensive coal.

Coal became increasingly important. In time, coal powered the steam engines of the industrial revolution, and they propelled the ships that maintained British commercial and military might. The engines also supplied power to the mills, factories, and, eventually, electric generators.

In time, oil began to take coal's place as an economic force. It powered small vehicles, and it began to displace coal for rail transportation, but coal continued to be very important for quite a while.

During nearly all this time, pollution was recognized as a serious problem. The earliest date we know of when pollution controls were attempted was when King Edward I banned use of a type of low-grade coal because of its smoke. That was in 1272, but the prob-



Jack-up crane ship and wind turbine in the North Sea. Wikimedia Commons.

lem of smoke grew worse.

The Great Smog of 1952 killed about 4,000 people in the London area in a few days and contributed to about 8,000 other deaths. Clearly, the U.K. had reasons to deal with pollution before climate change was widely understood.

Coal use peaked in the U.K. in 1956, when 221 million tons (Mt) were burned. It has been in overall decline since that time. The decline has been steep since 2012, when 64 Mt were burned, and it was down to 15 Mt in 2017. Now what little coal is used is devoted almost exclusively to generating electricity, and the last coal plant is scheduled to close by 2025.

The decline of the U.K. coal industry was reflected by a decline in carbon emissions. To a large degree, however, coal has been replaced by oil and natural gas, so emission reductions have been slower than the decline in the use of coal. But that may be changing.

There have been very important changes

in power generation over the last several years, which have put downward pressure on the use of all fossil fuels. The growth of offshore wind farms has been spectacular in the North Sea. While this is especially true for Scotland, there have been significant installations off the coasts of England. There have been installations in the Irish Sea, as well.

The effect of the increase of wind power and the decrease in the use of coal has been a large decrease in emissions. The amount of carbon dioxide released into the atmosphere in the U.K. has declined to the point that it is about what it was in 1890. In that year, Queen Victoria was

the monarch, Nellie Bly made her epic trip around the world in 72 days, and Wyoming became the 44th state, setting a new standard as the first state to allow women to vote.

The drop in U.K. emissions has been inspiring, but it has not been without its problems. The English government has been very much against onshore wind power. Perplexingly, it has done this while it has pushed fracking, even in some very beautiful areas of the country.

Another problem has been that the U.K. has adopted biomass plants to replace coal plants. Half of the largest coal-burning plant in the country has been converted to burn wood, and to keep it running, forests are being clear-cut in the U.S. state of Georgia.

The English attitude has been somewhat offset by that of the Scottish government, which has been working on energy independence based entirely on renewable energy. Scotland set a goal several years ago of getting 100% of its electric power from renewable sources, primarily wind power, by 2020. The result is that Scotland increasingly exports electricity to England.

The carbon emissions that remain for the U.K. to deal with are significant. Electricity still is being generated from gas. Gas and oil are both used for transportation and heat. But the path forward appears to be toward lower emissions yet. ♻️

MASSACHUSETTS' ENERGY STORAGE PROGRAM Wins Clean Energy States Alliance State Leadership Award

Green Energy Times Staff

Every other year, the Clean Energy State Alliance (CESA) gives out six State Leadership in Clean Energy (SLICE) awards. CESA is a nonprofit coalition of public agencies working to promote clean technology, and the SLICE awards highlight model programs and projects that accelerate clean energy technologies and strengthen clean energy markets.

The SLICE awards are given to programs of state and municipal governments. The entries are submitted by CESA member organizations across the country. They are judged based on public benefits and results, cost effectiveness, leadership, innovation, and replicability.

One of the six 2018 SLICE awards was given to the Advancing Common-

wealth Energy Storage (ACES) Program in Massachusetts. CESA honored the Commonwealth for "demonstrating effective energy storage use cases and business models, the ACES program will have impacts far beyond Massachusetts." The ACES program was funded by the Department of Energy Resources through alternative compliance payments and is administered by the Massachusetts Clean Energy Center. It has provided \$20 million in grants to 26 projects to develop an energy storage market in the commonwealth. It has also drawn \$32 million in matching funds.

Energy storage is seen as beneficial to almost the whole economy, with special effects in the communities where the infrastructure is installed. The ACES awards were given for projects that were not only innovative but applicable through a wide

range of geographic areas.

Massachusetts Governor Charlie Baker spoke about the SLICE award that had been given for the ACES Program. After making note of the history of innovation and leadership in the commonwealth, he said, "Through the strategic development of ways to modernize the electric grid, Massachusetts will continue to pursue a diverse energy portfolio that will reduce costs for ratepayers and help create a clean and resilient energy future."

House Minority Leader Bradley H. Jones, Jr. (R-North Reading) said, "Under the Baker-Polito Administration, Massachusetts has positioned itself as a national leader in the development of clean and renewable energy sources. The SLICE award is a recognition of this administration's ongoing efforts to expand the state's energy storage capacity so ratepayers can have access to more reliable and affordable energy options." ♻️



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Artist: Christine Pellerin

Past and Future of Ductless Heat Pumps

Looking Back Four Years, and Now in 2018, the Record Speaks for Itself

By Mike Hamlin

In 2014, I wrote a couple articles regarding ductless heat pumps for Green Energy Times. I was recently pleasantly surprised to learn of and get to read responses from over the years from as far away as the mid-west and even from New Zealand. In the latter case, that person based an investment decision in solar photovoltaic from the article and has never regretted it. That particular article focused on the benefits of the new generation ductless heat pumps and how they could triple the benefits of photovoltaic solar panels when coupled and used as the primary source of heating and cooling in energy efficient homes. The benefits were demonstrated with an elaborate math display using then heat pump performance factors, kW to btu conversions, annual solar photovoltaic outputs, heat loss/gain reports and current energy costs. It was based on Mitsubishi heat pump performance factors, only because it was and still is the brand we've represented for many years. Personally, I've studied and recorded years of heating and cooling performance data and savings on my own system as well as others in order that I could provide meaningful presentations for both NH Electric Co-op and EverSource Power Workshops in addition to speaking at energy fairs for the towns of Meredith and Wolfeboro, NH.

Ten years ago, we installed our first and, at the time, the newest model Mitsubishi Super-hyper H2i unit. Having been in this industry 50 years now, I knew this had a great future ahead of it, but I grossly under-estimated how great it would be. You see, I had experienced the disastrous heat pump fad of the 70s and 80s, and it left me traumatized and very skeptical of heat pumps for the next 25 years. During those years geothermal has come, and sort of gone. We haven't even had a request for one in more than two years, and we've designed and installed hundreds prior. However, last

year we reached over 1,000 Mitsubishi installations. I am getting three to five requests a day for Mitsubishi, have sold and overseen the installation of many, many systems without ever leaving the office. Our Mitsubishi sales are primarily all based on referrals, and I am so thankful I no longer need to explain 'who is Mitsubishi?' What is a heat pump? How does it work? How much can it save? If you're a consumer and thinking about buying, I wouldn't hesitate a moment to invest in these marvelous machines. Super Inverter heat pumps are here to stay for a long, long time. They will save you money and are very affordable even before rebates. They are relatively simple, very, very reliable and need only cleaned filters to be happy. Please know that many leading brands are all good heat pumps. Choosing a trustworthy and experienced installer you feel comfortable with is essential. Most distributors can tell you who they are.

I would like to conclude by sharing with you a well-known TV show host, personality, actor, singer, writer and theatre performer and last but not least, another wonderfully satisfied Mitsubishi owner.

Introducing Mr. John Davidson. Here in his own words, is his experience;

Dear Folks,

I hope I can adequately express my enthusiasm for our new installation of Mitsubishi Hyper Heat H2i Heat Pumps!! Please understand that I am sincere, because you might not believe me when you see how much we are raving about our new AC.

You see, ours is an older converted farm house that we thought

could never be comfortable in the New Hampshire summer months. We had accepted that when we bought it, because we love the house so much. But now we are over the moon. The surprise: the under sold benefits are amazing. The representative's presentation was casual, no hard sell, no over-hype, just honestly wanting to meet our needs. Well you hit it out of the park.

We never expected 1. The sound level to be less than whisper quiet. We just can't hear it; 2. The air temperature to be so constantly comfortable; 3. The low humidity that improves the comfort of the whole house, even rooms where there is no unit.

Bottom line, with just these 4 units (we chose the floor models which totally blend in to our classic wood paneling) our 4000 sq. ft. home has been changed forever.

- John and Rhonda Davidson



The Davidsons are very happy with their Mitsubishi Hyper Heat H2i Heat Pumps installations. The heat pump can be seen in the backdrop while John plays croquet. The Davidsons chose the floor model, seen in the back right corner of their piano room. Image: WMUR NH Chronicle.



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To see a video of the house and the Davidsons' move to New Hampshire, see WMUR's NH Chronicle July 23, 2018.

Mike Hamlin is an expert in the area of "state of the art" heat pump design and application in New Hampshire's Lakes Region. He has more than 50 years working in various capacities for a leading world HVAC Manufacturer, Leading HVAC Distributors, Consulting and as an HVAC equipment and system design specialist for a leading local HVAC contractor: mrhamlin1951@icloud.com. ☕

Tesla Batteries and Solar Arrays Save Money for Homeowners

George Harvey

Green Mountain Power (GMP), which provides electric utility services for roughly three-quarters of the people of Vermont, has reported significant savings from the growth of net-metered solar power and installations of Tesla Powerwall batteries, which it subsidized. In fact, during a heat-wave in August it saved \$600,000 because of the combination net-metered solar photovoltaic (PV) systems and batteries.

For many people, this did not come as a surprise. GMP has been a pioneer among utilities for the use of both technologies. Over the years, it has developed a thorough understanding of the values of both the sun and storage, so it is not surprising that they should pay off.

GMP introduced net-metering in Vermont as a way to save money for all customers. Counterintuitively, even though GMP paid more for net-metered electricity than it charged retail customers, net-metering saved money for everyone. There are a number of factors behind this, but one easily understood key is a simple matter of supply and demand.

As a regulated utility, GMP is required to supply power to many customers at a fixed retail price, regardless of when they buy it. But GMP buys power at the going rate, which is high during peak demand times and can sell at figures much above the fixed

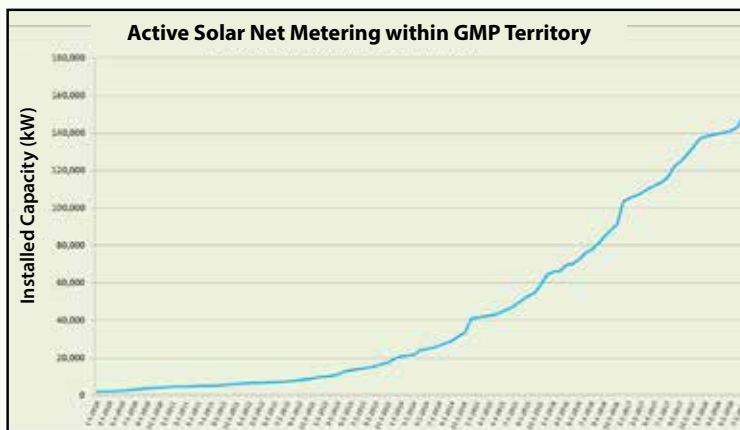
retail price. Solar PVs produce power when the sun shines, and since most people are active during those times, demand for electricity is often high at just the time the PVs are making electricity. As a result, net-metered electricity, which is at

above-retail price, can replace peak-demand electricity, which has even higher prices.

The one problem with this is that the sun sets a couple of hours before demand drops. That makes electric-power storage important.

GMP has consistently looked to the most advanced technologies to improve service and reduce costs. When Elon Musk announced the Tesla Powerwall battery, he mentioned that one electric utility had already expressed interest. That utility was GMP.

Last year, GMP announced that it would provide Tesla batteries at reduced prices to its customers in Vermont. Normally, the battery cost over \$5,000, and the installation might



cost another \$1,500. GMP would provide batteries to the first 2,000 customers who signed up at the amazingly low price of \$1,500, or it would lease the battery for a no-money-down price of \$15 per month on a ten-year lease. The one noteworthy catch was that GMP would have to be able to draw power from the battery when it needed to do so. And, that power was to be replaced at no cost to the customer.

It is important to understand batteries and transmission costs. The charge GMP pays for transmission is calculated based on the heaviest load of the year. The transmission costs are spread across the customers as a part of

their bills. The lower the heaviest load of the year is the less everyone pays for electricity, all the time.

The 2000 Tesla batteries that GMP installed at customer homes have a combined capacity of 27 megawatts. This is an important resource during hours of peak demand. It reduces both the amount GMP pays for power and the transmission costs. The net-metered solar installations have the same effect, though at slightly different times of day.

People who have net-metered solar systems are paid for the electricity they put onto the power grid. People who have batteries that are available to the utility to draw from get security from power outages at a low cost. But the benefits these people get in GMP territory reduce the costs for all GMP customers.

In August, GMP announced that they had seen a rapid rise of solar energy capacity in Vermont from less than 10,000 kilowatts (kW) installed in 2010 to more than 150,000 kW installed through July 2018, enough to power about 30,000 homes. The amount of growth in 2018 has far exceeded expectations for solar development. The numbers reflect active net-metering projects in GMP territory and represent about 65% of all the solar development in GMP's coverage area. ☕

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 and forestry products and agricultural waste materials
- Create jobs and enhance economic development in rural America
- For more information go to www.rurdev.usda.gov/BCP_Biorefinery

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- 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 – \$3000 per boiler/furnace. Pellet boilers/furnaces as a \$6,000 rebate, paid for by the CEDF and EVT. Details at <https://www.encyvermont.com/rebates-wood>.
- Starting July 1st retails sales of “Advanced Wood Boilers” are exempt from Vermont’s 6% sales tax. <http://tax.vt.gov/exemptions>,
- **Details at www.RERC-vt.org or call (877)888-7372**

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/www

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

VT TAX CREDITS

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

Tier III programs

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

EFFICIENCY VERMONT

Lighting (must be ENERGY STAR®)

- Special pricing on LEDs at Vermont retailers for as low as \$.95.

Home Efficiency Improvements

- Improvements: air sealing, insulation and heating system upgrades - up to \$2,500 in incentives by using a participating* contractor

Appliances (must be ENERGY STAR)

- Dehumidifiers \$25 - \$40 mail-in rebate
- Clothes Washers - \$40 - \$75 rebate
- Refrigerators - \$40 - \$75 rebate
- Clothes Dryers - \$50 to \$400 rebate

Heating/Cooling

Efficiency VT (EVT) has a new custom incentive for commercial/institutional

installations of pellet heating systems. Contact EVT for details: (888) 921-5990.

- EVT also has a flat-rate incentive of \$3,000 for pellet boilers. This can be combined with CEDF’s \$3,000 incentive for a total of \$6,000.

For residents of Windham and Rutland counties there are specific pellet stove programs designed for low to moderate income residents to change-out old cord wood stoves for new pellet stoves or to install pellet stoves even if they don’t have an old wood stove.

- In Windham County contact the Windham and Windsor Housing Trust: Tara Brown at 802-246-2119 or go to their web page: www.w-wht.org/rehab-loan-program.
- In Rutland County (and towns in neighboring counties that boarder Rutland Co.) contact Melanie Paskevich mpaskevich@nwwwvt.org at NeighborWorks of Western Vermont, (802) 797-8610).
- 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.

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

Other Opportunities To Save

- Advanced Power Strips – special pricing starting at \$6.95*
 - Pool Pumps – up to \$600 rebate on select ENERGY STAR models
 - Commercial Refrigeration Evaporator Fan Motors - \$60-\$100 each w/ point of purchase discount
 - Heat Saver Loan – low-interest loans of up to \$35,000 for home weatherization and heating improvements
 - For commercial refrigeration, lighting, or HVAC rebates, apply online for a 20% bonus at rebates.encyvermont.com
- 1. *all rebates/incentives subject to availability, limits and may change – for complete incentives and requirements, and for participating retailers/contractors, visit encyvermont.com or call 888-921-5990*

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

– waitlist; closed to new applicants

This Program has been modified by Commission Order to consolidate the two eligible project categories:

Category 1 was previously for solar electric and thermal systems rated less than or equal to 100 kW (AC) or thermal equivalent and Category 2 was previously for solar electric systems greater than 100 kW (AC) but less than or equal to 500 kW (AC). 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:

- \$.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:

- \$.12/rated or modeled kBtu/year for new solar thermal facilities fifteen collectors in size or fewer;
- \$.07/rated or modeled kBtu/year for new solar thermal facilities greater than fifteen collectors in size; and
- Expansions to existing solar systems are not eligible.

Contact [CISolarRebate@puc.nh.gov](mailto: 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 and Wind Rebate Program

- Waitlist only until funding available; no new applications being added to waitlist Check for updates at <http://bit.ly/NHResidentialRebate>

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

- waitlist and closed to new applicants.
- 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

- waitlist and closed to new applicants.
- 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 up to \$2,500
- For Residential Members up to \$300 using Time-of-Use (Off Peak) rates
- Pre-approval is required.
- Visit: <https://www.nhec.com/>

NH Home Performance with ENERGY STAR

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

- Visit www.NHSaves.com/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). For more information please visit www.NHSaves.com/lighting.

- Rebates are available only to residential electric customers of the four NHSaves utilities.s

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.

PAREI

- To explore the possibility of a solar installation. Plymouth Area Renewable Energy Initiative. www.plymouthenergy.org
- www.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 - \$600 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/get-clean-energy/residential/commonwealth-solar-hot-water/SHW_Program_Manual_Small_Scale.pdf
- Visit <http://www.masscec.com/programs/commonwealth-solar-hot-water>

MassSave Heat Loan SHW

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

Energy Efficiency

- After conducting a free residential Energy Audit, residential customers are eligible for up to \$25,000, commercial loan up to \$100k at 0% interest heat loan with terms up to 7 years to cover the following energy efficiency improvements: atticwall-base-ment insulation, high efficiency heating systems, high efficiency domestic hot water systems, solar hot water systems, 7-day digital programmable thermostats, Energy Star replacement windows
- Available only to utility customers of W. Mass Electric, National Grid, Berkshire Gas, Nstar, Unitil and Cape Light Compact
- Visit www.masssave.com/residential/heating-and-cooling/offers/heat-loan-program Please call 866-527-7283 to schedule a free home energy assessment.

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 program, a partnership between the Massachusetts Department of Energy Resources (DOER) and MassCEC, will work with local banks and credit unions to provide financing to homeowners interested in solar electricity. DOER's program works with banks and credit unions to expand borrowing options through lower interest rate loans and encourage loans for homeowners with lower income or lower credit scores.

- Since 2008, the solar electric industry in Massachusetts has grown into a robust economic sector with over 1,400 businesses and 12,000 workers, with enough solar electricity installed in the Commonwealth

to power more than 100,000 homes.

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

DEPT OF ENERGY RESOURCES

- The Massachusetts DOER is in the process of designing a new solar incentive program. The latest information can be found at <http://bit.ly/SMART-Solar-Incentives-Program>.

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

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

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

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

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

MA SREC II Policy

Massachusetts' Solar Renewable Energy Credits Program, SREC II prioritizes sites, by using an SREC factor based on the type of installation.

- The credits provided for energy produced by a system are calculated by multiplying the factor times a full credit value.

- Full credit is given for residential, parking canopy, emergency power, or community-based systems, or any other system of less than 25 kW.

- Larger systems get a factor of 0.9, if they are building-mounted or at least 67% of the power produced is used at the site. If a larger system meets neither of these criteria, but is built on a landfill or brown-field site, or if it is less than 650 kW, then it gets a factor of 0.8. Systems that qualify for none of the foregoing get a factor of 0.7.

- Expect changes in spring 2018.

- http://bit.ly/Mass_SREC_II.

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

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

- MOR-EV provides rebates of up to \$2,500 for the purchase or lease of zero-emission and plug-in hybrid light-duty vehicles. 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 NYSEDA: <https://www.nyseda.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>

Home Energy Waste

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

Visit: <http://bit.ly/ny-nrg-waste>.

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NY-SUN

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

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

The Megawatt (MW) Block Dashboard

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

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

Residential and Small Business

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

Commercial and Industrial

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

Community Solar

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

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

Clean Power Estimator

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

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://www.nyseda.ny.gov/All-Programs/Programs/Drive-Clean-Rebate/How-it-Works>.

Utility sponsored incentives & tips:

http://bit.ly/utility-sponsored_incentives

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

LEVI'S - BLUE JEANS FOR THE BLUE PLANET

Jessie Haas

Levi's is cutting carbon emissions, with a goal of using 100% renewable energy in its own facilities by 2025. They plan to cut emissions in those facilities by 90%, compared to 2016 figures, and to cut emissions in their supply chain by 40%.

Though a smaller percentage, the supply chain improvements could have the biggest impact. Levi's-owned facilities comprise only 1% of the company's carbon footprint. Sewing accounts for 9%, growing cotton 10%, making fabric 31%.

Levi's believes their goal is achievable. In a pilot project with the Partnership for Cleaner Textiles, Levi's worked with five Asian plants in 2016. Focusing on "low-hanging fruit," the plants reduced emissions by an average of 20%, and collectively saved \$1.1 million.

Farmers are not included in the supply chain program, but Levi's is working with the Better Cotton Initiative, which helps farmers use less chemical fertilizer and switch to methods like cover cropping. Cotton is a notoriously heavy feeder. It depleted the soils of the south and led to the westward expansion in the 19th century. Better cotton is a win for the planet.

The consumer is also part of the equation. Actions taken by consumers comprise one third of Levi's total carbon footprint. The company now prints on clothing labels, "wash less, wash cold, line dry, donate when no longer needed." Additionally, tailors in retail stores offer repairs, to make garments last longer.

That faded look that contributes to Levi's chic? It was once supplied by work, wear, and dirt. Of late, textile workers used toxic chemicals to fade the jeans. The process took many hours and resulted in toxic dyes and chemicals flushed into the waterways. New laser technology allows Levi's to design 'wear patterns' and essentially shave them off the outer surface of the fabric. The new process takes 90 seconds, allowing manufacturers to practice just-in-time delivery, and avoid producing styles that do not prove popu-



Image:Wikimedia.org

lar. These practices have recently become widespread in the denim industry, with the processes being made available in an open source library.

All this means a pair of jeans you can wear with a clear conscience, especially if you do your part. Wear them for a week or so before washing. You don't have to wait until they're dirty enough to stand up on their own but go for some owner-customized,

do-it-yourself wear patterns. Wash them cold, dry them on a clothes line, and get back to Levi's roots, and your own.

The Levi's story is part of something much larger. Four hundred forty-eight global corporations are working with the Science Based Targets Initiative (SBTI), a nonprofit-led project helping companies comply with the Paris Climate Accord. Among the corporations that have signed on are many familiar names: Anthem, Ben and Jerry's, Colgate Palmolive, Honda, IKEA, McDonald's, Pfizer, Philip Morris, Stanley Black and Decker, Target, Toyota, Unilever, Walmart, and Xerox. (Visit SBTI's website for a complete list, with many corporations' targets listed in detail.) These are corporations with global reach, and they are now working on a global initiative to reduce their carbon footprints. It's safe to say that not every company on the list is currently seen as a climate hero, but each has publicly demonstrated a commitment to change.

The list deserves to be better known; along with washing our jeans less frequently, we could vote with our dollars to support SBTI companies. The list should also grow. Take a look at the list. Who's not on there that should be? Petition drive, anyone?

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. Links available with the posting of this article on the GET website. ♻️

IT'S WORTH THE RIDE TO THE WAYSIDE — CELEBRATING 100 YEARS WITH ANNIVERSARY ALE, YANKEE COOKING, AND ICE CREAM

A commemorative book by Brian and Karen Zecchinelli, Southwestern Publishing Group, Inc., 64 pages, \$14.95

Book Review by N.R. Mallory

Green Energy Times (G.E.T.) first learned of the Wayside Restaurant when I received a call from the owners, Brian and Karen Zecchinelli, requesting copies of G.E.T. for their customers, and that they only wanted publications that matched their support of green and eco-conscious beliefs.

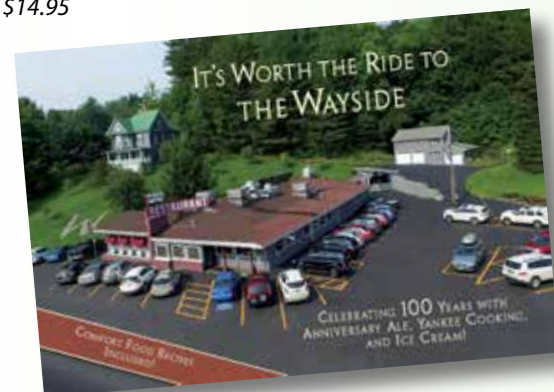
This request shortly led to a story in the December 15, 2011 edition of G.E.T. called *Wayside Restaurant Earns Vermont Green Restaurant Designation*. In part it said:

"The Wayside Restaurant has been renovating and upgrading its operation for the past 10 years, to become compliant with the high standards required to become a Green Restaurant. This year, they reaped their rewards by being awarded a designation that only five restaurants in the state have received. Karen and Brian Zecchinelli, proprietors of the well-known Wayside Restaurant in Berlin are proud of this designation and have plans to do more. (Stay tuned)." Read the full story at (<http://www.GET-wayside-green-restaurant>).

The plans to do more were answered when we again heard from Brian and learned that they would be adding solar to help reduce the high costs for their high level of hot water consumption. The system was installed on the roof of the restaurant.

From waste reduction, to composting, water and energy conservation and an environmental action plan to further reduce the environmental impact of its business, the restaurant is not only green but is now one of the country's longest operating restaurants. The iconic Wayside Restaurant on the Montpelier-Berlin line in Vermont officially turned one hundred in July, making it one of a very small handful of century-old eateries in Vermont.

Even if the Wayside isn't in your immediate area, you might want to make the trip to help them celebrate this historic year. As the title of their commemorative book states, *It's Worth the Ride to the Wayside*.



They are toasting this milestone event all year long with champagne, local ale produced by Long Trail Brewing Company, and Vermont spirits. Every one of their top shelf liquors, except for scotch, is now distilled in Vermont!

For those that want to try some of the Wayside's Yankee cooking at home, they have produced a 64-page history book titled, *It's Worth the Ride to the Wayside—Celebrating 100 Years with Anniversary Ale, Yankee Cooking, and Ice Cream*, complete with 18 comfort food recipes. It has been noted that a few of the recipes are so rich that they should file a tax return! "Sure you can always substitute 2% milk for the heavy cream, but why?" says owner Brian Zecchinelli.

In conjunction with Vermont's legalization of "recreational" marijuana use, the Wayside sold "pot brownies" on Sunday, Monday and Tuesday nights during July! In reality, their popular chocolate brownies were simply baked in pots and garnished with a Vermont flag, classic counter humor from an old-fashioned restaurant, that's worth the ride to check out!

The book is an easy, fun read. The Wayside is iconic in the region. The book reflects on why they have survived for 100 years and are still going strong. Happy Anniversary, to all the great folks who make *It Worth the Ride to the Wayside*.

For more information, visit WaysideRestaurant.com. ♻️

Businesses "Incentivize" Employees Towards Sustainability

Roddy Scheer and Doug Moss (EarthTalk®)

Many companies "talk the talk" when it comes to going green and do the minimum possible so as not to look bad (e.g. install recycling bins), but fewer "walk the talk" by actively investing in sustainability initiatives, let alone empower staffers to take action on behalf of the planet. But as employees start to demand more of their employers, some companies have begun to "leverage" corporate resources to help their people cut carbon footprints, both at home and at work, in various ways.

To wit, WeWork, a startup that runs some 200 "co-working" shared workspace facilities around the world with 200,000 customers, announced recently that it would no longer allow any of its 6,000 employees to be reimbursed for meat meals (red meat, poultry and pork) on their expense reports—and will no longer serve any meat at company events. "As a company, WeWork can save an estimated



At WeWork's co-working office facilities, you will find foosball and pool tables, but you won't find any red meat, pork or poultry as the company tries to reduce its environmental impact. Credit: Yusuke Kawasaki, FlickrCC.

16.7 billion gallons of water, 445.1 million pounds of CO2 emissions and over 15 million animals by 2023 by eliminating meat at our events," says WeWork co-founder Miguel McKelvey.

Another way companies can cut their employees' collective carbon footprint is

by encouraging them to live close enough to work so they can walk or bike. Facebook compensates employees who buy or rent a home within 10 miles of its Menlo Park, California campus up to \$15,000 to discourage long fossil-fuel-spewing commutes. Energy bar manufacturer Clif Bar offers employees \$500 toward the purchase of a "commuter bike" as an eco-friendly alternative to driving to work. Baltimore's Live Near Your Work program matches employer grants to help employees purchase homes close enough to their jobs so they can walk or bike to work. And Make Collective, an advertising agency in Christchurch, New Zealand, recently started paying its employees who use their bikes to commute a \$5/day bonus. And for the workers who keep up the bicycle commuting for more than six months, the benefit doubles to \$10 per day, paid out at the end of the year as a bonus.

Helping employees go green on the home front is *Cont'd on p.34*

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GOING SOLAR FOR VERMONT SOAPWORKS MADE TOTAL \$ENSE

Larry Plesent

Most everybody wants to be green; even if we are not always sure what it will mean.

With U.S. commercial operations using nearly 40% of domestic electrical consumption, controlling business overhead with onsite energy production is financially a win-win for many businesses as well as for the planet. Those solar panels on the roof or site are a billboard announcing to the world that a company understands the importance of economic and ecological sustainability. If it is a small or retail business, consider that a portion of your customers will love you all the more because you care! In the daily business battle for hearts and minds, it is always better to be perceived as the good guy who is in it for the long haul rather than the pirate ripping out short term gains and damning the consequences.

All well and good. But how do the solar numbers work out in the real world?

Cash flow is the blood and air of the body of the company. Constrict it too much and the whole thing begins to wilt. (Pardon the analogy, it IS gardening season). Loosen cash flow up, and the company flourishes.

Current Vermont rules encourage roof-mounted systems, a response to the proliferation of large ground-mount systems as are prominently visible from our scenic highways. We also had to agree to use at least 50% of what we produce in the building that hosts the installation;



Vermont Soapwork's new 150kW solar array on the roof of their Middlebury, VT factory. Image: VT Drone.

not an issue in our case.

There are many different financing schemes available to "go solar." The simplest way is buy into an existing or proposed system. By buying or leasing panels (a percentage of output) on a large commercial installation, a company can garner a 10% to 20% savings on their electric bills. This scheme works very well with hydropower or wind, too.

Putting up your own panels can save you even more over 20 to 25 years. Plus, and this is a big plus; if you have a permit in hand in 2018, you can save 30% of the total cost of the system through a federal tax rebate.

Eighteen months ago, Vermont Soapworks set out to solarize its 30,000 s.f. roof in an effort to mitigate its somewhat daunting electrical bills. It started by obtaining three bids for a flat roof mounted 150kW system. This is the size that the Public Service Board rules encourage. Our roof is large enough to install 225kW of solar panels.

However, doing so lowers the price the utility will credit us for the energy we produce, otherwise called the "Vermont solar adder." Bizarre but true. I still don't understand the reasoning behind this limitation, but there it is.

The first bid came in at \$550,000. This seemed high, and it was. Questioning the economics of the investment at that price we continued the process. The next bid came in at \$275,000. This seemed crazy low. Further investigation showed us why. This company wanted to use inverters that had a likely eight

year useful life at the amperage we would generate, rather than 25 years or more from a better quality bank of inverters. (Inverters turn DC solar panel power into more useful AC power). The panels were super cheap and we are pretty sure that they were returns from a massive recall of potentially defective panels.

The middle bid came in at \$475,000. Better, but not what we had hoped for. By negotiating down the maintenance contract we settled on a figure closer to \$425,000. These are the contractors that got our business. We got a quality system installed by quality people that should outlast the 25-year stated life of the unit. Shout out to Suncommon for their help and patience and professional staff!

Key Bank offered us 100% financing on the system. Basically, they get the first ten years of power the system produces. After that we own it and whatever power it makes for the next 15 years. After that,

we expect another 5-10 years of lower production numbers as the panels and inverters age and become less efficient.

Since we own the panels, we get the tax incentives. The 30% federal tax incentive is worth \$127,000. Plus, we take the interest and depreciation schedule. Adding it all up we are looking at \$1M in income on a roughly \$500,000 investment (with estimated interest charges) over 20 years. That's an estimated \$25,000 in yearly income and tax savings over 20 years for a no money-down investment. Not too shabby!

Every deal is a little different and incentives and Public Service Board guidelines can change year to year. But if you are a business looking to go solar, get going now or lose the 30% tax credit which is to be phased out at year's end.

This is the Soapman reminding you that your next bar of organic Vermont Soap might be made with solar power. Thanks for reading.

To learn more, contact Vermont Soapworks at vermontsoap.com or call them at (802) 388-4302.

Larry Plesent is a writer, philosopher and soap maker living and working in the Green Mountains of Vermont. Learn more at www.vermontsoap.com. ☺

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FIDELITY INVESTMENTS MAKES HISTORY

with New Sustainable-Minded Investment Offering, and on Track to Bring Solar Farm to New Hampshire Campus

Chris Gillespie

Fidelity Investments is investing in renewable energy in the Granite State and beyond.



The planning board of the town of Merrimack, New Hampshire voted on June 19, 2018 to grant conditional final approval to Fidelity Investments, one of the largest employers in the state, to build a 12-acre solar field at their 554-acre Merrimack campus.

According to plans on file at Merrimack Town Hall, Devonshire Energy LLC, a wholly-owned subsidiary of Fidelity, initially proposed the construction of the solar array field. In the application, Devonshire Energy suggested building the solar farm using roughly 346 ground-mounted solar array racks containing 8,640 360-watt modules. Similarly, Devonshire also suggested building an overhead 34.5kV line with utility poles to connect the solar-generated electricity with the existing electrical grid.

If the solar farm is completed to

match this scope, it will provide 12% of the power supply at Fidelity's facility at 2 Contra Way.

Having been approved by the planning board, Devonshire's proposition now requires an alteration of terrain permit from the state Department of Environmental Services. Since there is an existing wetland and vernal pool in the middle of the proposed construction site, Devonshire must propose, and receive approval for, a storm water management plan.

Although a 12-acre solar farm is a big deal, it is only a small component of the sustainability-related news coming from Fidelity in recent weeks.

In a press release from June 26, 2018, Fidelity announced that it expanded its suite of sustainability-focused index funds with a new fixed income offering: the Fidelity Sustainability Bond Index Fund. The Fidelity Sustainability Bond Index Fund, in conjunction with the Fidelity U.S. Sustainability Index Fund (FENSX) and Fidelity International Sustainability Index Fund (FNIYX), makes Fidelity the first and only investment firm to offer environmental, social and governance (ESG) index mutual funds in every major asset class.

The new sustainability bond index fund is available directly to individual investors, as well as through third-party financial advisors and workplace retirement plans.

"We know from speaking with clients, advisors and employers that interest in ESG investing continues to grow," said Colby Penzone, senior vice president for Fidelity's Investment Product Group. "With our latest ESG index fund offerings, which now span the major asset classes, we're providing more opportunities for investors to advance specific causes and align their personal principles with their investment objectives."

The market for ESG investment opportunities, such as the Fidelity Sustainability Bond Index Fund, is expected to continue to grow in the near future, as 86% of millennials are interested in sustainable investing, and 90% are interested in pursuing sustainable investments as an option in their 401k plans, according to an August 2017 report from Morgan Stanley.

In the same year that Fidelity launched FENSX and FNIYX, Fidelity also became a signatory of the United Nations-supported Principles for Responsible Investment, which is a voluntary set of rules that encourages investors to use responsible investment practices to enhance returns and better manage risks all while working towards the long-term betterment of the environment and society.

By taking small and large-scale steps, Fidelity Investments reinforces and exemplifies the fact that, in order for societal

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progress to be made in moving away from fossil fuels, we must take action on the big, international level, as well as in our own backyards.

Chris Gillespie is a contributing writer for Green Energy Times. He can be reached at chris@greenenergytimes.org. ☺

VERMONT NEEDS A CLEAN WATER COMMITMENT

Mark Curran

Vermont faces numerous environmental challenges, but there are two that need our immediate attention. Greenhouse emissions and resulting climate changes are things all Vermont businesses need to address. Unfortunately, Vermont cannot go it alone, and it requires an international effort to slow global warming.

Clean water should be our next priority. With the help of our New York, New Hampshire and Canadian neighbors, we can make near-term improvements to Lake Champlain and the Connecticut River. Our numerous interior lakes are our sole responsibility to keep in pristine condition.

Many people think of Vermont as synonymous with a healthy environment, and that image is important to our tourist industry and the many products we ship out of state. Lake Champlain contributes \$300 million annually in tourism dollars to the Vermont economy and river-related tourism, such as the popular activities along the Connecticut River which generate an additional \$109 million in economic activity.



Lake Champlain hosts blue-green-algae blooms that close beaches every summer. Image:www.vermontbiz.com

Unhealthy water is a real threat to the Vermont economy and our way of life. Each time a beach closes in the summer due to blue-green algae, our state gambles away our reputation as a beautiful place to visit, recreate, and do business. More important, no Vermonter should

ever need to question the water they use for drinking, bathing or recreation.

The Federal government has appropriated \$8.4 million for the Lake Champlain Basin Program, which is a helpful start. And this year, the Vermont Legislature passed a bill redirecting funds from un-

claimed bottle deposits away from beverage companies and into the state's Clean Water Fund. These are both important steps forward and should be celebrated.

Elected officials will return to Montpelier next January with a looming deadline to determine how to continue financing projects that clean up our lakes and rivers – and stop pollution before it gets there. This is a debate that has occurred before, and the Legislature and Governor Scott have numerous studies, including a recent one by State Treasurer Beth Pearce, that detail the pros and cons of the options on the table.

This is not a debate about how much we can afford. It's a debate over how much we value Vermont's way of life and green economy. We should insist that everyone – politicians, municipalities, industries and agriculture leaders make the commitment that our lakes, rivers and streams are something we can all enjoy and be proud of.

Mark Curran is the co-founder of Black River Produce in Springfield, VT and a member of the Board of Directors at Vermont Businesses for Social Responsibility. ♻️

Cover Crops Help Clean Water

Cont'd from p.1

profitable. They have made substantial investments in systems to do just that. Meanwhile, milk prices have tanked, and many more farms have gone out of business. The farmers who remain have found ways to make the current methods work for them, though maybe just marginally. There is little appetite for taking a risk, and a widespread perception that farmers are bearing a disproportionate share of the clean water burden—especially as new water treatment permits are allowed that would actually increase the amount of phosphorus municipalities discharge into Lake Champlain.

States serious about cleaning up waterways can't afford to simply switch from one pollutant type, nutrients, to another, pesticides. They also can't afford to lose their farmers. To meet clean water goals and keep our remaining farms profitable, Vermont needs to help farmers transition to cleaner cover cropping. One option might be to tax pesticides with all income from the tax going to support individual farmers

with transition needs. Education of the public and farmers, and adding grass-fed product lines to major brands, could also help. The state could also simply add language minimizing herbicides to its RAPS (Required Agricultural Practices) but, ideally, change should happen in a way that gets buy-in from farmers.

Make no mistake, though. This is a tough nut to crack at the legislative level. It will probably take farmer-to-farmer leadership and word of mouth to create a clean cover crops movement. Let's take a stand to help assure clean water where we live, work and play.

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.

Links are available with the posting of this article on the Green Energy Times website. ♻️



Top: Farmer spreading pesticides on cover crops. Image: Flickr.
Below: Farmer spreading pesticides on a field. Wikimedia Commons

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MICROPLASTICS ARE IN OUR FISH

George Harvey

We have seen a number of articles about microplastics, or microbeads, in *Green Energy Times* before. Two examples are Larry Plesent's article, "Microbeads are in the News!" which appeared in December 15, 2015 (bit.ly/GET-microbeads), and "Garbage Patches in our Oceans," which appeared in August 15, 2015. (bit.ly/GET-ocean-trash)

Recently, a reader brought more information to our attention. It is specific to microplastics pollution in Lake Champlain, and it may help readers can get a better understanding of the problem.

Microbeads, or microplastics, are plastic particles five millimeters or less in size. The smallest of these particles are too small to see easily. They are so small and light that Brownian motion, the physical phenomenon that accounts for muddy water staying muddy over time, prevents many of them from settling out of the water. That means that they will not go away until they degrade.

Many species of small animals identify microplastics as food. The result is that many of the tiniest animals will get full of them, become unable to digest food, and starve. Those that do not starve are eaten by larger animals in the food chain, so microplastics accumulate in larger species, until the largest fish, such as salmon, can have a fair amount of them in their bodies.

A study conducted by students at the State University of New York at Plattsburgh last year looked at the presence of microbeads in at least fourteen species of fish, along with a number of

BAIT FISH



invertebrate species and at three species of waterfowl. Samples were treated chemically and put through sieves to find the amount of plastic in the flesh of the animals. The only species of those they examined that were found to be free of microplastics were terrestrial isopods, such as woodlice. A poster showing the results of their work is at bit.ly/microplastics-poster.

The microplastics bioaccumulate, so larger carnivorous and omnivorous animals are likely to have greater amounts of them than smaller ones. This is true of many of the lake fish people eat. It is also true of waterfowl. And since waterfowl and other animals leave excreta on land, the pollution of plastics is building there, as well.

We may think of plastics as inert, and they nearly are in some ways. The microplastics represent a serious problem of contamination, however, because they absorb a number of kinds of pollutants, which they can give up to any animal, including human beings, who ingest them.

As they accumulate in your body, so do the poisons they hold.

Microplastics come from many different sources. Toothpaste is one example that is well known. It is used in toothpaste as a mild abrasive. They are found in cosmetics also. But they are created as larger

pieces of plastic break down with exposure to nature, so major sources include clothing and rope. And since we create and distribute millions of tons of them each year, they have become a nuisance.

Clearly, plastics can have serious problems for just about anything that is alive. There have been proposals that ocean gyres full of them could be cleaned up, if we dedicated hundreds of ships to the work. But that will not help with microplastics, which are difficult to remove from the environment and are found almost everywhere. It appears that one important way to deal with microplastics is to eliminate use of non-biodegradable plastics as much as possible. ♻️



Microplastic on a finger: www.theepochtimes.com

House Approves Welch Amendment to Increase Funding for Lake Champlain Water Quality



The U.S. House of Representatives approved VT Representative Peter Welch's bipartisan amendment to increase funding for the Lake Champlain Basin Program from \$4.4 million to 8.4 million. The program supports water quality improvements around the lake and the surrounding watershed. "Lake Champlain is the environmental crown jewel of our region," Welch explained. "It is central to our cultural heritage and natural history, and an invaluable recreational and economic resource. It is essential that this great lake be protected and preserved for generations to come."

Read more at <https://8.4-mil-L-Champlain>.



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Dry Wood Chip Boiler Heats 104-Unit Housing Complex

Jim Van Valkenburgh

Applegate Apartments in Bennington, Vermont is among the largest affordable housing developments in the state. Heat and hot water have always been provided in each unit as part of the rent, which is a nice benefit for tenants. But in recent years, annual fuel costs had risen to over \$175,000 per year. Housing Vermont, Shires Housing and Applegate Housing Inc. put their heads together to make Applegate more sustainable, financially and environmentally.

In 2017, the 104 units at Applegate Apartments got new windows, insulation, roofing, siding and a new central biomass-fired district heating system which together reduced the 19-year-old complex's annual heating costs by over 50%.

Newly buried insulated pipes carrying biomass-heated hot water now run throughout the complex, connecting all 23 buildings to a new central boiler house. This change eliminated 23 separate oil boilers which were burning over 50,000 gallons of oil each year for heat and hot water.

Eric Schmitt of Housing Vermont described the project. "Comparing the new system's first year energy costs to the previous two years (2013-2015), when the complex had 23 individual oil boilers, the complex saw energy costs drop from an average of \$169,000 to a first-year cost for dry wood chip fuel and propane of \$49,668. This incredible reduction can be attributed to a combination of the fuel switch to dry wood chips and the many energy saving upgrades that were made to every building in the complex."

Froling Energy installed the new Viess-



The new 1.84 million BTU/hr Viessmann Vitoflex 300-RF biomass boiler. Courtesy photos: Froling Energy.

mann Vitoflex 300-RF dry wood chip boiler and storage silo that is at the center of the new system. Froling also supplies the 25% moisture content screened wood chips into the silo with their blower truck which pushes the chips into the 25-foot-tall silo through a five-inch diameter pipe. Their dry chips and the blower truck delivery method are innovations that greatly reduced the typical initial cost of a wood chip boiler system. With semi-dry wood chips, the Viessmann boiler meets all Vermont emissions requirements without expensive scrubbers or ESPs (electrostatic precipitators). Future maintenance costs will also be less than they paid for maintaining the many old oil boilers each year.

Schmitt went on to tell about "value engineering" that helped to contain costs of the biomass boiler system. "Using our energy

modeling software and working with Froling Energy, we right sized the biomass boiler from the original design at 3.2 million BTU/hour peak output (MMBTU) to 1.8 million BTU/hour. This one change saved \$200,000 in construction costs. This was a very safe change because our modeling showed that even when outdoor temperatures were at -10°F, the downsized system was still only running at 75% of maximum capacity." A new propane boiler was also installed for back-up and to cover peak load situations.

Housing Vermont continues to keep track of the new boiler system's performance at Applegate. Schmitt commented, "Our software gives us real time insight into the current operation of the new system with data about the operation and output of the biomass boiler and details like whether the propane back-up boiler is running when the biomass should be. So far, we confirm that all boilers have been running effectively."

The Applegate Energy Rehab project has been a big win for everyone involved: Shires Housing who manages the property, Naylor & Breen Construction the project general contractor, Goldstone Architecture, WV Engi-

neering, Froling Energy and others. Funding for the project came from a variety of sources including Housing Vermont, Efficiency Vermont, the Vermont Clean Energy Development Fund, Vermont Housing and Conservation Board, HUD and the Vermont Community Development Program.

Froling Energy, based in Peterborough, New Hampshire, specializes in installation of commercial biomass boiler systems in New England. Its recently completed projects include wood chip boiler systems installed at the Merrimack County Jail complex in Boscawen, NH, at Whelen Engineering's manufacturing campus in Charlestown, NH and at Plymouth (NH) Regional High School.

Jim Van Valkenburgh is VP Sales & Marketing for Froling Energy. He can be reached at 603-924-1001

x2. For more information on Froling Energy go to www.FrolingEnergy.com.

The 42-ton dry wood chip silo at Applegate Housing.



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National Bioenergy Day

Green Energy Times Staff

The Sixth Annual Bioenergy Day is on October 24, 2018. It is a day for the industry to let everyone know what bioenergy is all about.

Bioenergy is not just logs and wood chips. The industry includes processing and using waste products from industries relating to forest products, including paper and woodworking waste. But it also includes processing all sorts of organic products from agriculture, food waste, and municipal waste. Also, bioenergy does not necessarily imply direct combustion of products.

Wood pellets and chips can be burned directly for electricity or heat. They can also be used in a gasification process, in which they give off gas that can be run into a gas turbine. The gasification process can be very clean, with almost no particulate emissions. It can also be extremely efficient. GE subsidiary, Jenbacher, claims that for cogeneration, its engines can be about 90% efficient, and they can use gas from a gasification process for fuel.

Another process that delivers bioenergy is anaerobic digestion (AD). It processes by-products that would otherwise require treatment, such as food waste, manure, or sewage. Old-fashioned ways of dealing with these materials were expensive and environmentally problematical. Using AD renders them into energy and compost, turning a problem potentially into a profitable process.

Organic waste materials can also be used to make liquid fuels, and these can be substitutes for petroleum fuels.

Clearly, there are a lot of bioenergy technologies, and many of them have the potential to become much more important.

Most of us know bioenergy for its use at home and in buildings of all sorts. Anyone with a wood stove is using a bioenergy for heat.

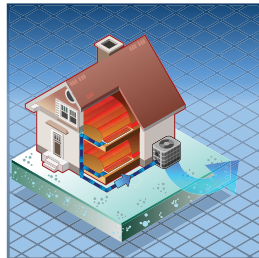
On Bioenergy Day, there will be events all over the country. Readers can look

them up online at www.bioenergyday.com. The participants who are putting on events for the day can be found in the "2018 Participants" link at the top of the web page. Many events are not yet posted, so we suggest looking after mid-September. We do notice that Froling Energy of Peterborough, New Hampshire, is listed as a participant. ♻️

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What Kind of America Do We Want?

Dr. Alan K. Betts



As I write in late July, wildfires are burning across the Eurasian Arctic as temperatures soar. These climate extremes remind us every month of the

urgency of the global renewable energy transition. Unfortunately, the global rise of nationalism is undermining the need to work together to solve these planetary-scale environmental issues.

Protection of the environment was once a national interest, one of the responsibilities of government to take care of the public interest and welfare. For decades, both of the major political parties in the U.S. supported this policy. This was the bargain with capitalist America that left our corporations free to focus on maximizing profit and productivity; while the government took responsibility for the broader long-term interests of society and local and global environmental issues. Now we have moved into a new political era, where this pact has disintegrated, and business and far-right wing groups have combined in an effort to dismantle this essential protective role of government.

For the business world, this is at least comprehensible, because only benefit corporations are committed to making a positive impact on society, their workers, the community and the environment in addition to making a profit. But the other strand, the rise to power of an American version of fascism is new. But it is one we must face, because so much that we treasure both in America and on Earth is at

stake.

Fortunately, this new American fascism is not well-disciplined like earlier versions in Europe in the last century. Unfortunately, its financial resources are large, because it has the backing of many corporations lured by reduced corporate taxes and reduced government regulation. If the gullible electorate can be bought this November, American democracy is in peril. I should say in disclosure that I was a child born into the wreckage of south-eastern England in September 1945, so I have a bleak perspective on fascism.

The president, who yearns to be an absolute ruler, has aligned his interests with the so-called "alt-right," a diverse collection of neo-fascists and white supremacists, along with the evangelical fundamentalists, who believe we should return to a white America with theirs the state religion. Our democracy is threatened because the Republican Party in Congress has abandoned most of its values and principles; and allied itself with this new American fascism that strongly supports the president. Lies, scapegoats and brutality are everywhere.

The Environmental Protection Agency, signed into law by Republican President



Arctic tundra burning. Image: Western Arctic National Parklands.

Nixon in 1970, is also threatened. Its recent corrupt administrator may have been fired, but the mission of the EPA is shifting from protecting human health and the environment to protecting polluting industries. We are undermining the protections of the Clean Air and Clean Water Acts to marginally increase corporate profits. The Republican Party is content with this rejection of its long-held commitments, provided it gets in return re-election payments from these businesses. Access by government scientists to the press has been curtailed to hide the dangers ahead from this policy shift.

Long-term issues like climate change and the need to shift to renewable energy are being buried in today's EPA. The Earth may have almost infinite resources that we


depend on; but since it has no money, it can be ignored, even though the downstream costs for life on Earth have become too vast to contemplate.

But the day of reckoning will come. Our national debt and our future debt to the planet are unpayable. Internally the president is attempting to discredit the federal government, and bully the free press in his quest for power. Externally, he has oscillated between bullying the rest of the world, and cozying up to dictators. All this has led to the collapse of U.S.

authority in the world.

None of this can be papered over by more transparent lies. Sadly, it is hard to confront corruption in our government. It is hard to deal with the conflict between the mythology of our great democracy, with government by the people and for the people; and the callous whims of a president who thinks the U.S. Constitution and the rule of law are dispensable.

But confront we must. The clock is ticking. Our communities and businesses should get together this summer, and ask what kind of America we want.

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

Second Deadliest Birthrate in India Affects All of Humanity

Frosty Wooldridge

India expects its population to jump from 1.252 billion to 1.55 billion within 33 years. It adds 16 million, net gain, annually. Their human misery index explodes off the charts.

In 1960, India reached 500,000,000 people. Today, driven by religions that prohibit birth control, India suffers every kind of social and environmental consequence known to humanity with its 1.252 billion people. Even more catastrophic, it adds 16 million more people, net gain, annually.

India's major river, the Ganges, which I once rafted, flows into the ocean with the most polluted, toxic and contaminated waters known to humankind. It features trillions of gallons of untreated sewage, industrial waste, hundreds of chemicals and millions of pieces of plastic that flow into the ocean 24/7. That watery, chemical-ized conveyor belt creates a 20,000 square mile dead zone at the mouth of the river. Once it hits the Indian Ocean, those contaminated waters spread all over the planet – poisoning marine life, avian life, reefs, the ocean floor and all that causes deadly acidification throughout the planet.

Of note, the U.S.A., China and India dump the most plastics into the world's oceans. Latest estimates show 5.25 trillion pieces of plastic float on and flow under the surface around the world killing millions of marine creatures annually. As per investigations by marine biologist, Julia Whitty, published in OnEarth magazine, 46,000 pieces of plastic trash float on every square mile of Earth's oceans. We've known this for 20 years, but there is no action to stop it by creating incentive-driven deposit-return laws inter-



Sustainability issues exist among the filth in the Ganges River in India. Image: Wikispaces.com.

nationally.

Within India, hundreds of millions of people lack a toilet. Therefore, they defecate and urinate on the land daily. In fact, the Indian Express said, "Best experts tell us that 60.4% of Indians lack a toilet." The stench in the cities, the filth in the streets and the total contamination of soils and rivers by that many people injecting their waste upon the lands and waters 24/7 cannot be comprehended.

Thus, every day of the year, 1,000 Indian children under the age of 12 die of dysentery, diarrhea, other waterborne diseases, and from drinking contaminated water

(Source: www.populationmedia.org).

Yet, as India's population accelerates by 16 million net gain annually, they grow so fast, they cannot solve any of their problems. Disease and squalor top the "human misery index" beyond the concepts of the American people.

You can only imagine that India cannot support jobs, classrooms and housing for that many people added annually. Yet, there is not one word about population stabilization from India's leaders. At one point, Indira Gandhi attempted to bring birth control to India when I visited in 1984, but she failed because of religious-cultural norms that

overpowered reasoned thinking.

If you look at the beauty of the Taj Mahal, one of the most famous landmarks of India, a short trip to the river next to it shows millions of pieces of plastic clogging its waters. And, the water features endless chemical poisons leaving it unfit for human or animal use.

In the cities, air pollution poisons the lungs of everyone breathing that toxic air 24/7. You see everyone tapping into electrical wires illegally; trash and stench everywhere; the traffic is a free-for-all that confounds and confuses the Western mind; and The National Nutritional Monitoring Bureau estimates that only 15% of Indians receive adequate nourishment daily.

As can be imagined, because of adding that 16 million more people annually, India's wilderness suffers encroachment via roads, housing, mining, lumbering and other development. Animal extinction rates soar. The Bengal tiger and the snow leopard will not survive in the wild within several decades. Elephants face an uncertain future. Birds of all kinds face extinction from loss of habitat. Fish and plants vanish.

With all the realities facing the people of India, no one raises a finger to address their population predicament. Even in the face of so much human misery, their leaders live in "cognitive dissonance" also known as "intellectual denial of reality."

Please realize that this country's dilemma is the tip of the iceberg. At any time, we may witness horrific outbreaks of cholera and other diseases that will kill millions in Asia.

Cont'd on p.25

RIISING SEAS: "FLORIDA IS ABOUT TO BE WIPED OFF THE MAP"

Cont'd from p.1

emissions of the Middle East, and the entire population of Thailand.

About 60 of the region's more than six million residents have gathered in the Cox Science Building at the University of Miami on a sunny Saturday morning in 2016 to hear Harold Wanless, or Hal, chair of the geology department, speak about

sea level rise. "Only 7% of the heat being trapped by greenhouse gases is stored in the atmosphere," Hal begins. "Do you know where the other 93% lives?"

A teenager, wrists lined in aquamarine beaded bracelets, rubs sleep from her eyes. She returns her head to its resting position in her palm. The man seated behind me roots around in his briefcase for a breakfast bar. No one raises a hand.

"In the ocean," Hal continues. "That heat is expanding the ocean, which is contributing to sea level rise, and it is also, more importantly, creating the setting for something we really don't want to have happen: rapid melt of ice."

A woman wearing a sequined teal top opens her Five Star notebook and starts writing things down. The guy behind her shovels spoonfuls of passionfruit-flavored Chobani yogurt into his mouth. Hal's three sons are perched in the next row back. One has a ponytail, one is in a suit, and the third crosses and uncrosses his gray street sneakers. The one with the ponytail brought a water bottle; the other two sip Starbucks. And behind the rows and rows of sparsely occupied seats, at the very back of the amphitheater, an older woman with a gold brocade bear on her top paces back and forth.

A real estate developer interrupts Hal to ask, "Is someone recording this?"

"Yes," the cameraman coughs. "Besides," Hal adds, "I say the same damn thing at least five times a week." Hal, who is in his early seventies and has been studying sea level rise for over 40 years, pulls at his Burt Reynolds moustache, readjusts his taupe corduroy suit, and continues. On the screen above his head clips from a documentary on climate change show glacial tongues of ice the size of Manhattan tumbling into the sea. "The big story in Greenland and Antarctica is that the



'Take the six million people who live in south Florida today and divide them into two groups, those who live less than six and a half feet above the current high tide line, and everybody else.' Photo: Milkweed Editions.

warming ocean is working its way in, deep under the ice sheets, causing the ice to collapse faster than anyone predicted, which in turn will cause sea levels to rise faster than anyone predicted."

Dig into geologic history and you discover this: when sea levels have risen in the past, they have usually not done so gradually, but rather in rapid surges.

According to Marco Rubio, the junior senator from Florida, rising sea levels are uncertain, their connection to human activity tenuous. And yet the Intergovernmental Panel on Climate Change expects roughly two feet of rise by century's end. The United Nations predicts three feet. And the National Oceanic and Atmospheric Administration estimates an upper limit of six and a half feet.

Take the 6 million people who live in south Florida today and divide them into two groups, those who live less than six and a half feet above the current high tide line, and everybody else. The numbers slice nearly evenly. Heads or tails, call it in the air. If you live here, all you can do is hope that when you put down roots your choice was somehow prophetic.

But Hal says it doesn't matter whether you live six feet above sea level or sixty-five, because he, like James Hansen, believes that all of these predictions are, to put it mildly, very, very low. "The rate of sea level rise is currently doubling every seven years, and if it were to continue in this manner, Ponzi scheme style, we would have 205 feet of sea level rise by 2095," he said. "And while I don't think we are going to get that much water by the end of the century, I do think we have to take seriously the possibility that we could have something like 15 feet by then."

It's a little after nine o'clock. Hal's sons stop sipping their lattes and the oceano-

graphic scientist behind me puts down his handful of M&M's. If Hal Wanless is right, every single object I have seen over the past 72 hours – the periodic table of elements hanging above his left shoulder, the buffet currently loaded with refreshments, the smoothie stand at my seaside hotel, the beach umbrellas and oxygen bars, the Johnny Rockets and seashell shop, the lecture hall with its hundreds of mostly empty teal swivel chairs – will all be underwater in the not-so-distant future.

One of the few stories I remember from the Bible vividly depicts the natural and social world in crisis. It is the apocalyptic narrative par excellence, Noah's flood. When I look it up again, however, I am surprised to find that it does not start with a rainstorm or an ark, but earlier, with unprecedented population growth and God's scorn. It begins, "When human beings began to increase in number on the earth." I read this line and think about the 6,000 inhabitants of south Florida turning into 6 million in 120 short years. "The Lord saw how great the wickedness of the human race had become." I think about the exponential increase in M&M's, Chobani yogurt cups and grande lattes consumed over that same span of time. The dizzying supply chains, cheap labor and indestructible plastic. "So God said to Noah, 'I am going to put an end to all people, for the earth is filled with violence because of them.'" And then the rain began.

I do not believe in a vengeful God, if God exists at all, so I do not think of the flood as punishment for human sin. What interests me most is what happens to the story when I remove it from its religious framework. Noah's flood is one of the most fully developed accounts of environmental change in ancient history. It tries to make sense of a cataclysmic earthbound event that happened long ago, before written language, before the domestication of horses, before the first Egyptian mummies and the rise of civilization in Crete. An event for which the teller clearly held humans responsible.

Dig into geologic history and you discover this: when sea levels have risen in the past, they have usually not done so gradually, but rather in rapid surges, jumping as much as 50 feet over a short three centuries. Scientists call these events "meltwater pulses," because the near-biblical rise in the height of the ocean is directly correlated to the melting of ice and the process of deglaciation, the very events featured in the documentary footage Hal has got running on a screen above his head.

He shows us a clip of the largest glacial calving event ever recorded. It starts with a chunk of ice the size of Miami's tallest building tumbling, head over tail, off the

tip of the Greenland Ice Sheet. Then the Southeast Financial Center goes, displaying its cool blue underbelly. It is a coltish thing, smooth and oddly muscular. The ground between the two turns to arctic ice dust and the ocean roils up. Next, chunks of ice the size of the Marquis Residences crash away; then the Wells Fargo Center falls, and with it goes 900 Biscayne Bay. Suddenly everything between the Brickell neighborhood and Park West is gone.

The clip begins again, and I watch in awe as a section of the Jakobshavn Glacier half the size of all Miami falls into the sea.

"Greenland is currently calving chunks of ice so massive they produce earthquakes up to six and seven on the Richter scale," Hal says as the city of ice breaks apart. "There was not much noticeable ice melt before the nineties. But now it accelerates every year, exceeding all predictions. It will likely cause a pulse of meltwater into the oceans."

In medicine, a pulse is something regular, a predictable throb of blood through veins, produced by a beating heart. It is so reliable, so steady, so definite that lack of a pulse is sometimes considered synonymous with death. A healthy adult will have a resting heart rate of 60 to 100 beats per minute, every day, until they don't. But a meltwater pulse is the opposite. It is an anomaly. The exception to the 15,000-year rule.

From 1900 to 2000, the glacier on the screen retreated inward eight miles. From 2001 to 2010 it pulled back nine more; over a single decade the Jakobshavn glacier lost more ice than it had during the previous century. And then there is this film clip, recorded over 70 minutes, in which the glacier retreats a full mile across a calving face three miles wide. "This is why I believe we are witnessing the beginning of the largest meltwater pulse in modern human history," Hal says.

As the ice sheets above Hal's head fall away and the snacks on the buffet disappear, topography is transformed from a backwater physical science into the single most important factor determining the longevity of the Sunshine State. The man seated next to me leans over. "If what he says is even half true," he whispers, "Florida is about to be wiped off the map."

Reprinted from *Global Possibilities*: <http://bit.ly/GET-rising-seas>

Casey Coates Danson is the founder of *Global Possibilities*. She received her BFA in Environmental Design from Parsons School of Design, graduating with honors during the Carter years when solar tax incentives were first in place and architectural design emphasis was on sustainability. She is a published writer in her fields of interest. ♻️

<< Cont'd from p.24



The Ganges flows into the Indian ocean with the most polluted, toxic and contaminated waters known to humankind. Image: Wikimedia

By 2050, 33 years from now, India expects to out-populate China with 1.55 billion people. As it stands, they lack the 'arable land' to grow enough food. They clearly lack clean water as they dry up their ground water supplies.

When India starts facing hunger crises via lack of arable land, lack of rainfall, and growing 'catastrophic climate destabilization' with its 1.252 billion people—we're all in

trouble.

No amount of immigration solves anything for Indians. No amount of international aid will help them. Why? The answer is it's because they keep growing human numbers beyond any solutions.

If you're in your 30s or 40s, you and your children will see this international debacle on a stage unseen in human history. That's why America, Australia, Europe and Canada must create an international discussion on human population stabilization before Mother Nature does it for us, rather brutally and without mercy.

Eleanor Roosevelt said it 50 years ago, "We must prevent human tragedy rather than run around trying to save ourselves after an event has already occurred. Unfortunately, history clearly shows that we

arrive at catastrophe by failing to meet the situation, by failing to act when we should have acted. The opportunity passes us by and the next disaster is always more difficult and compounded than the last one."

Frosty Wooldridge lives in Golden, CO. He speaks at colleges, civic clubs, high schools and conferences. As a six continent world bicycle traveler, his books include *How to Live a Life of Adventure: The Art of Exploring the World* (HowToLiveALifeOfAdventure.com). In the summer 2017, he rode his bike 4,100 miles from Oregon to Bar Harbor, Maine. Learn more at: frostywooldridge.com. ♻️



SEON's HOME TOUR

George Harvey

The Sustainable Energy Outreach Network (SEON) is deeply involved in the building trade and related areas of work in the built environment. Some of the members are architects, some are contractors, some provide services, some supply products for homes, and at least one, BuildingGreen, is a publisher. The members are mainly local to southern Vermont, southern New Hampshire, and western Massachusetts, but a few come from much farther away; one has its headquarters in Oshkosh.

SEON provides a lot of informational services to its members. This is especially important in the building professions, because they are undergoing very rapid evolution. Resilient and sustainable systems that are needed to reduce our energy needs and provide durable structures were hard to imagine only a few decades ago. Also, the need to live sustainable lifestyles is becoming ever greater.

The services SEON offers are not limited to its members, however. As part of its outreach, it is having its third Annual Home



Duffy/Lundgren residence, Londonderry, VT; rt: Paggi/Nadeau residence, Marlboro, VT. Courtesy Images.

Tour on September 29, 2018. Six houses in southwestern Vermont are open for registered tour visitors. The self-guided tour is from 10 am to 4 pm. Tickets will be available on the SEON Home Tour website, beginning September 1. (www.seon.info/hometour).

The homes on display show off work and products of SEON's members. Each tour house provides examples of a number of technologies that interested people might wish to see.

Readers of Green Energy Times may recognize the names of SEON's members whose work is on display. For example, home number 4 on the tour is the Duffy/Lundgren residence in Londonderry, Vermont. It was built in 1796 and has been upgraded with a view to make it as energy

efficient and comfortable as possible. The project was done under the guidance of the owners, with a 15-kilowatt solar system installed by Integrated Solar Applications and insulation by Vermont Foam. The home has heat pumps for both hot water and general heating.

The number 5 house on the tour, the Brennan Residence in Westminster West, Vermont, is an extensive retrofit of a home built in 1848. The work on this house was done by Mindel & Morse Builders, of Brattleboro, Vermont. The upgrade was completed ten years ago, and so the home illustrates the durability possible in high-quality sustainable systems. Along with other upgrades, it was furnished with a Stiebel Eltron SOL 25 Plus collection system for a solar water heating system. This was described in GET in 2012. (<http://bit.ly/Stiebel-Eltron-SOL-25>)



SEON has an informative web page covering all the homes in the tour, complete with descriptions of their energy and efficiency systems, names of the companies and people who did the work, and photographs.

SEON's website is www.seon.info. ♻️

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September 29, 2018

seon.info/hometour

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Can the Built Environment Heal the Planet?

THE NEW CARBON ARCHITECTURE: BUILDING TO COOL THE CLIMATE

by Bruce King, *New Society Publishers*, 2017, 159 pages, \$29.99

Book review by N.R. Mallory

Let's face it, CO2 in our atmosphere is the biggest problem humans have ever had to face.

Recent news says scientists have measured a slowdown of the Gulf Stream. It is happening now, much faster than they might have imagined, at a level not expected to occur for another 100 years.

In the past, we thought the solution was to just reduce our carbon emissions. Now it has become clear that is just not enough. We need to remove carbon from the atmosphere and sequester it.

Buildings are not only a huge part of the historical problem but can also be a great solution for the future.

The New Carbon Architecture makes it clear that we need to pursue new building methods beyond efficiency. We should use every resource available to us to draw carbon out of the atmosphere. Buildings give us a great opportunity to sequester carbon.

As I was reading this book, I discovered that Robert Irving, a net-zero builder from Salisbury, NH was also reading it. His first takeaway was that this was something he hadn't thought



of quite in the same way it is presented. Irving said he was assuming that any additional carbon in construction methods would be offset by long term carbon savings realized by our net-zero buildings. The point is that increasing the levels of carbon in the atmosphere is not something we might need to

worry about in 30 to 50 years. The crisis is right now, and therefore we need to think about the carbon we use right now.

Irving thinks we should look at the carbon crises more seriously, and that many people don't think about carbon a lot, including himself. He said, "It's a very complex subject and one really should know the embodied carbon of all materials we use." Many people might say something like "that's way too complex, so let's ignore the whole thing." And this is what the book is about: what building techniques and materials we are currently using that only add to the carbon crises instead of addressing many alternative solutions.

What do the studies show, and what are the options? This is explored from many angles by a network of ecologically-minded professionals. Some of the information seemed a bit confusing, and it is perhaps not always in agreement. But the information presented is always thought-provoking and valuable.

A good start for healing the planet could be by sourcing materials closer to point of use, and the book is great at showing how to accomplish this. Beyond that, there are many choices for the most carbon-friendly structural materials to use. Wood sequesters carbon. Advanced wood technology gives it characteristics that we have never seen it have before, allowing it to be used in new applications such as skyscrapers. Nevertheless,

steel still has applications that were addressed in the book. So does Portland Cement, although the book speaks to new cement alternatives that help us rethink the embodied carbon of concrete. Many other building materials are discussed as well, that make a valuable difference to help to create buildings that will cool the

climate instead of adding to the crises. There are many examples of incorporating locally-sourced materials that help to phase out carbon emissions in building materials.

Buildings can become a big part of the climate solution. The key components are innovation and imagination, along with exploration and learning how to use materials, such as advanced wood products and even plastic from cleaning up the oceans that can be used for making building

Cont'd on p.34





The Strawbale LILAC (Low Impact Living Affordable Community) in Leeds in the UK is an example of the built environment that is a carbon sink. The development alone captured and stores 1,080 metric tons of atmospheric equivalent CO2. Credit: ModCell

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MULTIFAMILY PASSIVE HOUSE VENTILATION DESIGN

HRV OR ERV?

Thomas Moore and Dylan Martello, Steven Winter Associates, Inc.

This article was reprinted from the March 14, 2018 blog at www.swinter.com.

In climates with significant heating or cooling seasons, Passive House projects must have a balanced heat or energy-recovery ventilation system. These systems use a heat exchanger to transfer heat and moisture between the outgoing return and incoming outdoor airstreams. The operation of recovery ventilators reduces the energy required to heat and cool decreasing the building's carbon footprint. Project teams can select either:

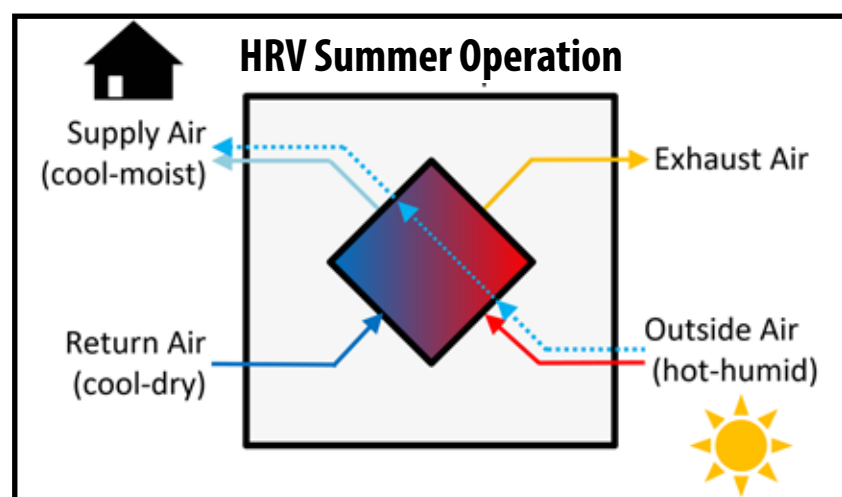
- * Heat recovery ventilators (HRV) that transfer heat from the return air stream to the outside air stream; or,
- * Energy recovery ventilators (ERV) that transfer heat and moisture from the return air stream to the outside air stream.

Deciding between a HRV and an ERV gets more complex when the Passive House concept is scaled from a single-family home to a multifamily program. What the industry has learned from the development of airtight buildings and programs such as Passive House and R2000 is that indoor relative humidity must be controlled through continuous ventilation. The extremely airtight building envelope required of a Passive House, combined with high internal moisture gains from an occupant-dense multifamily program (coming from occupants, kitchens and bathrooms), forces additional moisture management considerations during mechanical ventilation design. Maintaining acceptable interior relative humidity in both the heating and cooling season is paramount for building durability and occupants' comfort. It is appropriate that Passive House professionals claim this simple motto "Build tight, ventilate right!"

In New York City where the multifamily Passive House market is rapidly growing, there is a significant heating season and a demanding cooling season with high humidity (Climate Zone 4A). With this seasonal variation, there are four primary operating scenarios for a HRV or ERV that need to be considered during design:

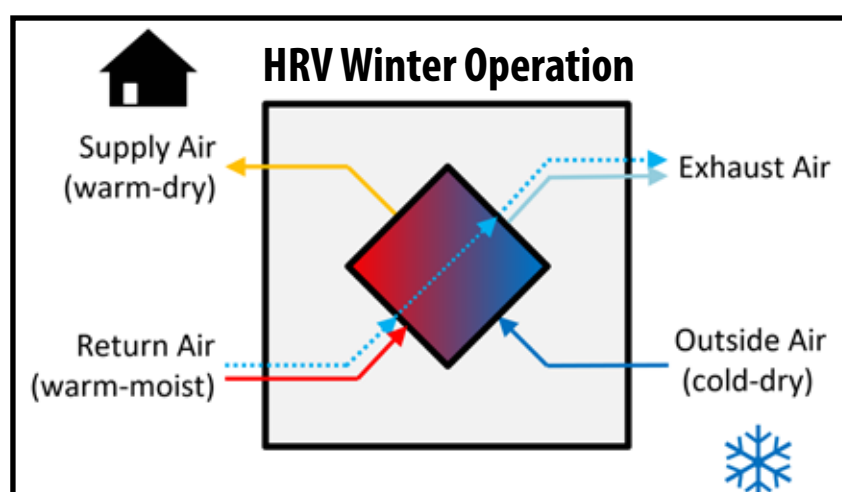
Summer Condition – HRV

A HRV operating in the summer (hot-humid exterior air and cool-dry interior air) introduces additional moisture to the building through ventilation. Heat is transferred from the incoming outside airstream to the return airstream leaving the building which cools supply air, but exterior moisture is not removed from the incoming air. The building's dehumidification load increases as a consequence of additional moisture from the outdoor air. *CON*



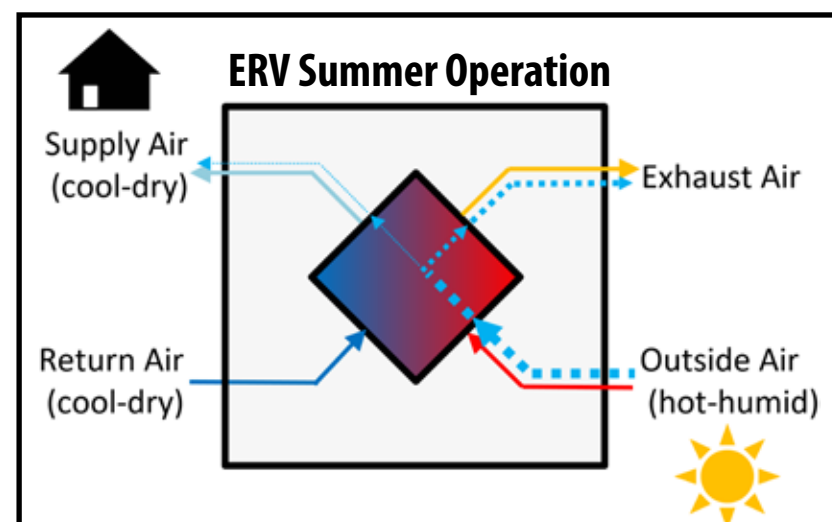
Winter Condition – HRV

A HRV operating in the winter (cold-dry exterior air and warm-moist interior air) exhausts the moisture generated by building occupants. Heat is transferred between the two airstreams at the recovery core, but moisture in the return air is not transferred to the supply. As a result, controlling interior relative humidity in the winter can be less challenging with a HRV. *PRO*



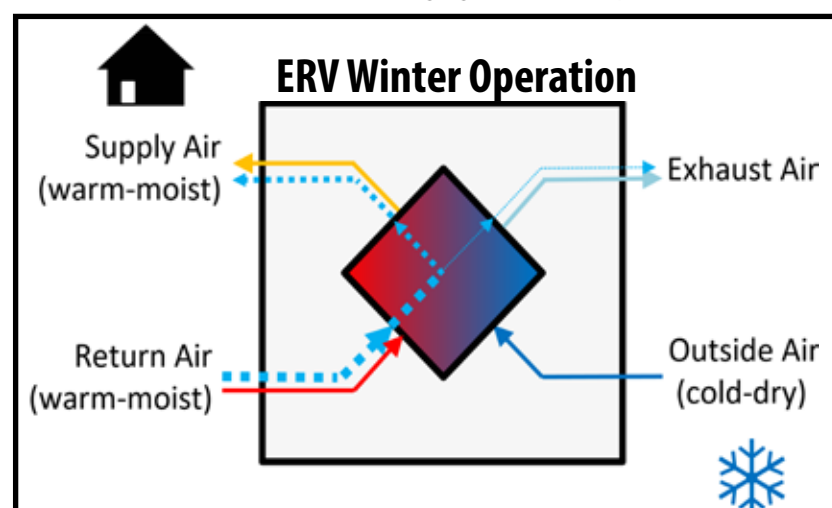
Summer Condition – ERV

An ERV operating in the summer (hot-humid exterior air and cool-dry interior air) reduces the amount of moisture in the outside air that is delivered to the interior. Heat and moisture are transferred to the exhaust air stream, reducing both the cooling and dehumidification loads associated with ventilation. *PRO*



Winter Condition – ERV

An ERV operating in the winter (cold-dry exterior air and warm-moist interior air) transfers both heat and humidity to the supply air at the recovery core. As a result, controlling interior moisture levels can be more challenging with winter operation of an ERV. *CON*



There are pros and cons of these primary operating conditions. Project teams should evaluate these situations identifying the highest risk scenario in relation to their climate and building program. The overarching Passive House design intent is to reduce heating and cooling demand, decrease equipment size, and minimize annual energy consumption, all while maintaining occupant comfort and building durability. Being mindful of the Passive House design intent will help guide this presentation.

Let's consider the primary operating conditions, starting with summer operation. Good Passive House design should result in decreased cooling loads and thus require smaller cooling equipment capacity. A HRV introduces additional moist air to the conditioned building in the summer. This may be problematic if there is a need for dehumidification, but there is no need for sensible cooling because the temperature in the space is already low. Since dehumidification will only happen when the cooling system is running (unless supplemental dehumidifiers are installed), the occupants might experience prolonged periods of high humidity and discomfort. Generally speaking, residential occupants are comfortable in higher summer set-point temperatures only if the indoor relative humidity is kept between 40% and 60%. If the latent load cannot be met and the relative humidity increases beyond 60%, the majority of occupants will no longer be comfortable. As such, ERV operation in the summer may be desirable when you consider that an ERV will aid in removing moisture from the incoming air and help maintain a lower dehumidification load. This aligns with the Passive House design intent to maintain occupant comfort and reduce annual energy consumption.

Now, let's consider the winter operation. When evaluating the risk to building durability, winter building operation poses the highest condensation potential. During cold periods, heat is conducted through the building envelope. This can result in cold interior surfaces ideal for condensation, especially at the least efficient components, such as windows and doors. Condensation risk is increased by moisture generated from an occupant-dense multifamily building; the higher the interior relative humidity, the higher the surface temperature where condensation can form. Even with high performance window components, the risk of condensation on windows and doors may be present when the interior relative humidity is high and surface temperatures are near the dew point. Mitigating the risk of interior condensation must be considered during the selection of a HRV or ERV.

Example: As a worst case, let's assume an internal setpoint temperature of 68°F and window frame U-value of 0.275 Btu/hr-ft²-F (1.56 W/M².K);

- with an exterior ambient temperature of 14°F (-10°C), frame surface condensation would occur at 60% indoor relative humidity;

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<< Cont'd from p.28

• with an exterior ambient temperature of 4°F (-15°C), frame surface condensation would occur at 50% indoor relative humidity.

While these relative humidity levels may seem high, they can be easily realized in a new building with a dense population. It is not uncommon in our multifamily projects to have up to six people living in under 1000 ft². The amount of moisture generated by occupant perspiration, cooking and showers, in addition to construction moisture in materials of a new building, can easily drive interior relative humidity to these levels.

Even intermittent window condensation can be problematic from the perspective of mold growth and building durability. Condensation should be avoided in all buildings but should never occur in a Passive House where the design intent is focused on durability. These images of condensation all came from new construction projects in the last five years and were caused by all of the factors mentioned in the picture to the right:

Remember that an ERV operating during the winter transfers some of the moisture generated inside the building back to the incoming supply air. A HRV operating under the same winter conditions exhausts internally generated moisture, helping to control indoor relative humidity and condensation risk. This seems like a cut-and-dry argument for the exclusive use of HRVs, right? It is not that simple. The amount of moisture that is recirculated by an ERV can be decreased with a centralized system through various control strategies and through the shear fact that the moist air from one apartment



Condensation as a result of high indoor relative humidity and low ambient temperatures.

will be mixed with a much greater volume of air headed back to the ERV. This is in contrast to unitized ERVs, where the majority of the internal moisture gains would be returned back to the supply air of each apartment. If we assume that all apartments are not experiencing high humidity levels at all times, the shear mixing of these streams will reduce the amount of moisture that can be returned to any one apartment.

During periods when most apartments are likely to see increased humidity, such as the early morning and evening, moisture transfer of a central ERV can be controlled with partial recovery core

bypass or by controlling the speed of the enthalpy wheel. This acts to reduce the latent moisture transfer efficiency from return to outdoor airstreams. As a consequence, the sensible heat transfer efficiency is also reduced temporarily. Our analyses show supply air relative humidity can be reduced 10 – 15% with moisture recovery control. This additional functionality makes central ERVs a viable option when applied to a multifamily Passive House in the winter.

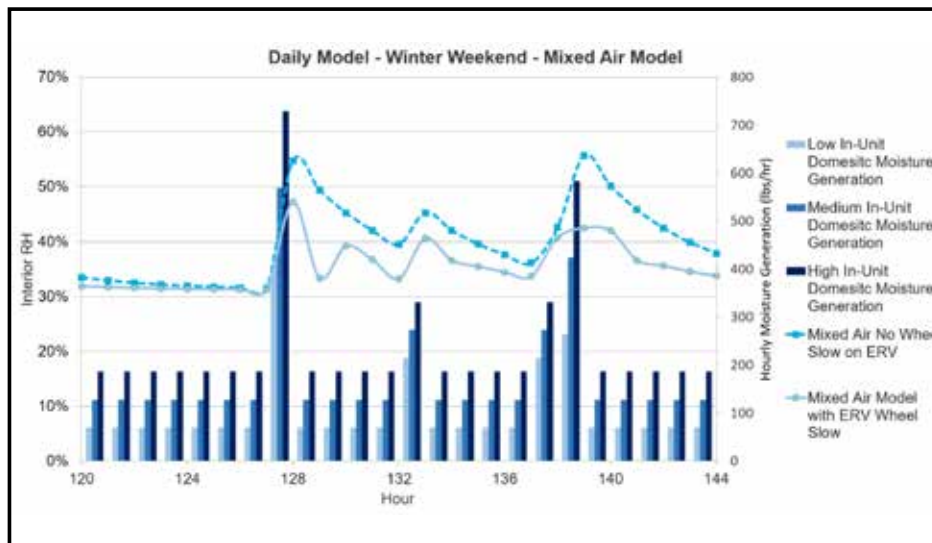
Example: The data shown in the graph represent a multifamily Passive House building operating a central ERV in a New York City winter. The analysis assumes an equal mix of low, medium, and high humidity generation scenarios, demonstrating possible apartment types in a multifamily building. The interior relative humidity peaks in the morning and evening at 55%. With the addition of moisture recovery control and a decreased enthalpy wheel speed, the peak relative humidity is decreased 10 to 15%, resulting in an interior relative humidity of 45%.

There is no prescriptive path for HRV or ERV selection. However, centralized ERVs can be operated to control supply air moisture content in both winter and summer. This makes ERVs an attractive option for multifamily Passive House buildings in New York City. Learn more at www.swinter.com.

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Presented by Steven Winter Associates, Inc.

The authors work for Steven Winter Associates, Inc. Thomas Moore is a Building Systems Analyst. Dylan Martello is a Senior Building Systems Consultant. ♻️



Winter building operation showing decreased supply air relative humidity resulting from central ERV enthalpy wheel speed reduction.

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A Recycled, Green Option from a Green Manufacturer

Evan Lawrence

Builders looking for an exterior finish material with the appearance of wood but which stands up better to weather and insects have a new choice, Boral Tru-Exterior siding and trim.

"It looks like wood and feels like wood, but it doesn't act like it," said Boral product manager Aaron Sims.

Six years in development, Tru-Exterior siding consists of a proprietary polymer blend encapsulating highly refined fly ash, a by-product of coal combustion that would otherwise go to a landfill. Fly ash is endorsed by the U.S. Green Building Council and the U.S. Environmental Protection Administration for use in construction materials. The siding has

The siding comes in 16-foot lengths in seven styles. It accepts most fasteners and doesn't need adhesives or sealants. It carries a 20-year limited warranty.

The product "is especially good for homeowners," Sims said. "It doesn't rot or decay." Wood can swell, shrink, warp, or crack in response to changing temperature and moisture. In contrast, Tru-Exterior siding "is very stable, and insects don't eat it. Animals may try it, but they usually give up. It has incredible termite resistance." It's also fire-resistant, with an ASTM E84 score of below 35. "That's very low," Sims said.

Unlike vinyl and some composites, the material can be painted any color with exterior latex paint. "We're mostly focused on the residential market," Sims said. "The siding products are high-end premium. We sell to a lot of historic districts on the East Coast."

Boral manufactures Tru-Exterior products in a LEED silver-certified factory in East Spencer, N.C. The company purchases renewable energy credits, powers its facilities with alternative energy sources, and has its own waste water management systems. It belongs to the U.S. Green

Building Council and was a founder of the Climate Registry.

Locally, Boral products are available at Oakes Bros., Inc. in Bradford, Vt. One local project that is using the product is for a vacation home on Lake Sunapee in New Hampshire.


"The house is on the lake and had some pretty extreme decay," said Dale Oakes, a manager at the store. "The owner wanted something that would stand up better." They are also using cedar shingles, "which

have natural decay resistance," Oakes said.

Tru-Exterior siding "costs less than cedar and some other products, and more than vinyl siding," Oakes said. However, vinyl most commonly comes in light and pastel colors and to paint it generally requires paints formulated specifically for plastics. "This siding can accept dark colors," he said. "It really looks like wood when it's finished. I used it on my own house."

Oakes had one warning: Builders should use carbide tools and not regular

tool steel. The gritty fly ash "chews tool steel right up," he said.

Evan Lawrence is a free-lance writer in Cambridge, NY, specializing in sustainability, environmental, and health topics. 




This modern-style earth-sheltered home features TruExterior Siding Nickel Gap and Channel profiles. Courtesy images: Boral Tru-Exterior®.






Both of the homes pictured are in Massachusetts and each features two different kinds of TruExterior Siding. The white house features TruExterior Siding Channel Bevel profile and Shiplap profile in a vertical orientation.

a minimum of 70% recycled content, as certified by SCS Global Services and is Cradle to Cradle certified.

"Through the burning process, the ash becomes very spherical," Sims said. "It has unique properties." Although fly ash contains some toxins found naturally in coal, the polymer keeps them from leaching, Sims said. To ensure the safety of its employees and customers, Boral tested the siding for toxins and found that they were below detectable levels.




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RH Irving Wins 2017 Net-zero Home of Year Award

George Harvey

Bob Irving, of R.H. Irving HomeBuilders in Salisbury, New Hampshire, has been building high performance homes for over thirty years. His goal for that whole time has been to build homes that are exceptionally efficient and sustainable, while being comfortable and affordable.

If you believe that makes R.H. Irving one of the most knowledgeable experts of passive or net-zero energy homes in New England, your opinion has been confirmed. NHSaves gave R.H. Irving the first place award for its 2017 Drive to Net Zero Home Competition, for work completed on a home in Cornish, New Hampshire. NHSaves was created by the utilities to provide the information, support, and incentives so customers could save energy, reduce costs, and protect the environment. The awards it gives are intended to help further those goals. This is the first time this particular award has been given.

As with most buildings, the Cornish



NHSaves Drive to Net Zero Home Competition winners. Bob Irving is shown in the back row (red shirt and beard) holding his first place award. Courtesy photo.

house was an effort undertaken by a number of people and organizations. Kaplan Thompson Architects of Portland Maine, a firm specializing in beautiful, net-zero energy buildings, provided the original design. Green Energy Times has run articles about their work, most recently in the "The 'Greenest Building' in Portland, Maine," which appeared in August, 2017 (bit.ly/greenest-in-portland).

Preferred Building Systems, of Claremont, New Hampshire, produced the modules for the building in their factory.

They custom build highly-efficient building modules. Readers should understand that building modules in a factory has a number of advantages over construction from scratch at the building site. Custom building modules can also mean that the design is unique to the building.

Interestingly, one of the important contributors to building the Cornish House was the owner. He took a hands-on approach in a number of building systems, including the insulation and installation of solar panels.


The problem of getting all the activities of all parties coordinated is a job that requires a good manager and is not always easy. In this case Bob Irving undertook to see the job was done right and brought it to completion. In this job, his award speaks to his success.

The award from NHSaves was based largely on its score under the Home Energy Rating System, commonly called the HERS rating. The HERS rating is based on evaluation of the house for energy use against a reference home with a HERS rating of 100. Older buildings tend to have much higher ratings, and modern, efficient houses have

much lower ratings. A home using net-zero energy, so the amount of energy it uses over the course of a year is equal to the amount it produces, has a rating of 0.

The Cornish House has a HERS rating of -16. That means that the home's utility bill might well be negative, even offsetting the cost of connect fees. If batteries are installed, the house could go off the grid without much difficulty.

R.H. Irving's award does not tell the full story, however, so there are a few things left to add. Cornish House is pretty enough that Bob Irving says it is one of his favorites. The owners have said they are delighted. And we at Green Energy Times are impressed.

R.H. Irving's web page is rhirvinghomebuilders.com. 

Cool Ways LEDs Are Helping the Planet See the Path

Green Energy Times Staff

It seems like every time we turn around, we get another impressive update from LEDdynamics. It was just last April that we published our latest article on one of their products, "LEDdynamics™ Gro-Lights" (bit.ly/leddynamics-grow-lights). Now, we have something exciting to share.

Some time ago, LEDdynamics acquired another company, Prolume, which had started as a company making signs with LEDs but has been specializing in architectural lighting of late. The Prolume Division's website, www.prolumeled.com has a stunningly beautiful gallery of its work, which includes lighting for the U.S. Mint, White House Visitors Center, museums around the country, bridges, and more.

Here is a collage of a few examples of what you will find at the Prolume website. There is lots more where these came from. Enjoy.



All photos courtesy of Prolume.

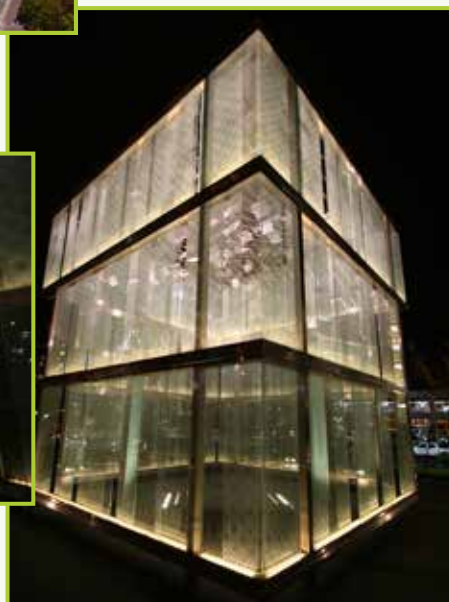


Miniature millinery shop dollhouse, Shelburne Museum, VT. Series LIA fixtures illuminate doll house miniatures and cases in the toy and variety unit. Lighting design: Richard L Kerschner.

North Bank Bridge Boston and Cambridge, MA. Series LIA fixtures were used in the handrails to illuminate the pathway along this bicycle-pedestrian bridge connecting Cambridge and Charlestown. Photo: Mark Flannery.



911 memorial at Boston Logan International Airport, Boston, MA. Series RIA fixtures mounted within the memorial's framing uplight the glass panels at Boston's Logan International Airport. Photography: Jay Lehrhaupt.



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MA Schools Awarded Funds for Clean Energy Educational Programs



Greater Lawrence Technical School. Courtesy photos.

The Baker-Polito Administration announced \$480,000 in funding to three high schools for hands-on learning and academic training programs that prepare students to pursue clean energy in science, technology, engineering, and mathematics (STEM) programs in higher education and careers. The funding was announced at MassCEC's New Bedford Marine Commerce Terminal, where a group of students currently participating in the Learn and Earn program were given a tour of the facility as well as a presentation from offshore wind developer Vineyard Wind.

"Massachusetts is home to a thriving clean energy sector, and this investment in our students will help build a workforce that will sustain the Commonwealth's vibrant innovation economy for generations to come," said Governor Charlie Baker. "Providing new opportunities for STEM education for our students

will reinforce the Commonwealth's position as a national leader of innovation."

"Designing curriculum that exposes high school students to STEM-related fields will help develop the next generation of Massachusetts workers," Lieutenant Governor Karyn Polito said. "By creating these new, innovative opportunities for hands-on learning, our administration is helping students to gain the necessary skills to compete in the Commonwealth's innovation economy."

The Learn and Earn program provides grants to schools for programs to prepare high school students for higher learning opportunities and careers in clean energy and STEM fields. Selected applicants will design and deliver a training program to high school students that provides career exploration, work readiness training, paid work-based learning that focuses on clean energy and dual enrollment that provides credit from a high education institution.

"Building the pipeline of students interested in studying and working in STEM is critical for the Commonwealth," said Education Secretary James Peyser. MassCEC CEO Stephen Pike echoed this thought, making clear that a highly-skilled workforce is critical to the continued success of the state's clean energy industry.

Since the Learn and Earn program launched in 2014, 283 high school students have participated, receiving employment during the summer

as well as academic training with a curriculum focused on clean energy during the school year. MassCEC anticipates at least 60 students will participate in the 2018 Learn and Earn program, including 40 students from Gateway Cities.

MassCEC awarded \$160,000 to each of the following institutions:

Essex North Shore Agricultural and Technical High School: Students will spend the year retrofitting a vacant building on campus and will use clean energy technologies to create

a more energy efficient space by installing LED lighting, automatic flush toilets and auto on/off faucets, a heat pump electric hot water heater and a heat pump/AC split system.

Greater Lawrence Technical School: Students will research, develop and implement clean

energy fuel sources through the design and planting of green roofs along with growing algae for transportation (biofuel). Students will learn the importance of design and technology as it relates to solving energy, social and community issues.

Norfolk County

Agricultural High School: Students will take part in a new academic course during the 2018-2019 school year entitled, "LEED Prep Green Building". Students will build clean energy educational mobile carts and concentrate on systems employing battery storage.

MassCEC also awarded \$120,000 to Commonwealth Corporation to provide technical assistance along with its Signal Success Curriculum to each school. The curriculum includes hands-on work readiness training designed to help students develop essential skills for future success.

According to MassCEC's 2017 Clean Energy Industry Report, employers would benefit from educational development in clean energy and STEM topics. Nearly three quarters of employers reported hiring difficulty over the last year, with 47% of employers citing insufficient qualified candidates as the most significant barrier to hiring. ♻️



Essex North Shore Agricultural and Technical High School.



Norfolk County Agricultural High School.

COURT RULES FOR YOUTH

Cont'd from p. 1

the courts under the last administration. The arrival of the current administration brought a change in government tactics. The attacks on the case have been extraordinary, with constant attempts to block progress.

The courts have been mostly unsympathetic to those attacks. While one of them did delay the case somewhat, setting the court date for arguments back from February to October of this year, it looks like the time for making those delays is over. The Supreme Court denied a Trump administration application for a stay and maintained the court date of October 29, 2018, as set by the District Court.

This case has levels of complexity that are daunting. The implications of the court decisions that have been

made so far may be difficult for a layman (such as myself) to understand. But a few very simple observations might be worth making.

One is that as this case has gone through the court systems, the decisions were very often unanimously against the federal government. In the case of the latest decision, the Trump administration asked the Supreme Court to slow or delay the case, and the decision that the youth plaintiffs have a right to sue over the quality of the environment they will live in in the future was unanimous. Justices appointed by conservative Republican presidents sided with the youths against the Trump administration.

It will be interesting to see where this goes in October. ♻️



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Barbara Whitchurch

On March 30, 2018, Efficiency Maine (efficiencymaine.com) designated the Maine Coast Waldorf School (mainecoastwaldorf.org) as a certified Maine Advanced Building. Designed by the architectural firm Briburn of Portland, Maine, the building far exceeds many of this certification's requirements.

In addition, the school recently received certification from the Passive House Institute of the United States (phius.org), the highest voluntary energy efficiency standard in the world, making it the first Passive House-certified high school in the United States.

An article by Katy Kelleher ("Designing for Change," July, 2018, *Maine Home + Design Magazine*) quotes Christopher Briley and Harry Hepburn, Briburn's founding principals, "We're super jazzed about how the school came out," Briley says. "It's the best feeling ever, to walk into that school and see kids and teachers using it. It's their everyday building." Rather than the standard rectangular brick building, these high school students get to learn beside airy windows and under solar panels. According to Hepburn, who was the lead architect and LEED AP Professional, "They didn't want something that would feel institutional. It was a lot of fun to play with shape, color, and material, while making sure it was up to our standards."

The Specifications

The two-story, 10,600-square-foot building accommodates 70 students and incorporates the following features that led to the certifications:

- The walls are highly insulated with dense-packed cellulose. The east, west and south walls are 8" thick, overlaid with 4" of rigid foil-faced polyiso foam board, yielding an R-value of 51.6. The north wall is 8" thick, overlaid with a 9" Larsen truss system, both filled with dense-packed cellulose yielding an R-value of 61.4.
- The main roof is constructed of 16" TGIs, yielding an R-value of 55; the roof over the Great Room has 24" TGIs, yielding an R-value of 82; and the flat roof

over the entrance section yields an R-value of 70. There is also 4" of insulation around and under the slab.

- Sophisticated building membranes and tapes from Siga (<https://www.siga.com/>) and Huber Zip System (<http://www.huberwood.com/>) control the ingress of moisture from the outside and prevent interior moisture from migrating into exterior walls in the winter.
- Intus (<https://www.intuswindows.com/>) triple-glazed windows and Reynaer (<https://www.reynaers.us/>) exterior doors, from Lithuania and Belgium, respectively, yield high R-values and excellent air sealing as well.
- Southern orientation of the building allows for maximum solar gain.
- Window openings are strategically located to capitalize on solar heat gain in the winter; deep southern overhangs help prevent overheating during warmer months.
- Interior LED lighting is tied to occupancy sensors.
- Mitsubishi (<https://www.mitsubishicomfort.com/>) ductless mini-split heat pumps provide efficient heating and cooling. Internal heat gains from people, lighting, and equipment provide significant heating in the winter; heat pumps make up the difference -- if needed).
- Three RenewAire Energy Recovery Ventilators (ERVs) use exhausting air to precondition incoming fresh air to minimize energy loss.
- A 33kW roof-mounted solar electric system, designed and installed by Maine Solar Solutions (<https://mainesolarsolutions.com/>), is modeled to produce at least as

much electricity as the building is projected to use. The solar system is operated under a Power Purchasing Agreement (PPA), in which Maine Solar Solutions owns the array and has a long-term contract with the school to purchase the electricity it produces for a low-cost, fixed rate.

Warren Construction Group was the general contractor/installer for the project. According to Peter Warren, "(We were) proud to be part of a committed team brought together to plan and create one of the most environmentally conscious schools built in recent history. The school now has the benefit of tight, efficient, high-quality space that is really fantastic to be in. The Waldorf community will be well served for years to come."

A Bit of History

The school was founded in 1984 as Merri-coneag Waldorf School, serving students in early childhood through eighth grade. In 2007, Waldorf opened a high school in New Gloucester, but the board and faculty have always held a vision of a beautiful, energy-efficient building on the adjoining property. As the high school enrollment climbed toward a record 70 students, the time was at hand to make a move.

"The new high school location in Freeport really strengthens our overall school," Admissions Director, Lynn Baird, said in a news release. "Not only are we more accessible, but we now have endless opportunities for connection, interaction and collaboration among teachers and students across grades K through 12." These opportunities include tutoring, "big brother/sister" programs, and all-school games days.

The building project also included an expansion of the school's Community Hall for new faculty offices, a commercial kitchen/café, and an additional music/performing arts space. To create these sustainably designed additions, Maine Coast Waldorf School partnered with Kaplan Thompson Architects of Portland.

Passive House buildings are also known for their comfort. The temperature is uniform throughout; fresh air is continuously circulated; the southern exposure affords great light. So, it is with the Maine Coast Waldorf High School. Windows afford beautiful views and plenty of light, enhancing the feeling of being connected to nature -- and hopefully encouraging a feeling of stewardship for the land.

Passive House design/construction is supported by certified builders, designers, consultants and raters, each with a respective designation: CPHB, CPHD, CPHC, and CPHR. More information is available from Efficiency Maine, Vermont Passive House (vtph.org), and Efficiency Vermont (efficiencyvermont.com). ♻️



Maine Coast High School: Inspiring spaces and a permanent home. Above: front exterior view; rt: multipurpose room are shown. Courtesy photos: Kevin Morris Photography



Barbara Whitchurch is a freelance writer and a board member of Vermont Passive House. ♻️

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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...

Businesses ‘Incentivize’ Employees
Cont'd from p. 18

another way some companies are stepping up in terms of promoting sustainability. Bank of America offers employees \$500 off the installation of solar panels on their home rooftops, as well as a \$3,000 reimbursement incentive for those staffers who buy a hybrid, compressed natural gas-powered, or “highway-capable” electric vehicle. Reinsurance giant Swiss Re’s COyou2 initiative grants employees up to half of the costs associated with shrinking their personal carbon footprints. The company makes upwards of 2,000 employee grants a year accordingly to help staffers replace aging appliances with newer energy-efficient models, beef up the insulation in their homes and switch over to hybrid and electric cars.

Similarly, staffers at the Vermont Energy Investment Corporation (VEIC) can access company funds to help defray costs associated with the purchase of energy-efficient appliances, hybrid or electric cars, home energy assessments, CSA (Community Supported Agriculture) memberships, composting supplies or anything else that will serve to cut their own household environmental impacts.

Contacts: “Avoiding meat and dairy is ‘single biggest way’ to reduce your impact on Earth,” goo.gl/8eScEF; Baltimore’s Live Near Your Work, livebaltimore.com/ live-near-your-work; Swiss Re COyou2, www.swissre.com/corporate_responsibility/ coyou2_programme.html; VEIC Sustainability Benefits, www.veic.org/company/brands/ sustainability-benefits.

EarthTalk® is produced by Roddy Scheer & Doug Moss for the 501(c)3 nonprofit EarthTalk. Read more at earthtalk.org or send questions to question@earthtalk.org. ♻

THE NEW CARBON ARCHITECTURE
Cont'd from p. 27

blocks. As we discussed in the last issue of *Green Energy Times* (Issue #50, p. 27), you can even grow your insulation and bricks! The book reveals great value and benefits that we can get by not ignoring the carbon crises we now face. Irving concluded, “It’s not the end-all, be-all book about carbon, but it’s hugely important especially to folks like us who actually care about the subject. It’s gotten a lot of people to think, including me, about things we need to learn and how to do better. It provides some ideas and thoughts for some of these better ways. So, I think it’s a valuable book at this time.”

Thanks to Bruce King for these solutions and to Bob Irving for his comments.

N.R. Mallery is the publisher of Green Energy Times. ♻

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Ingredient of the Month

Molecules Just Do Not Stay Put

Larry Plesent

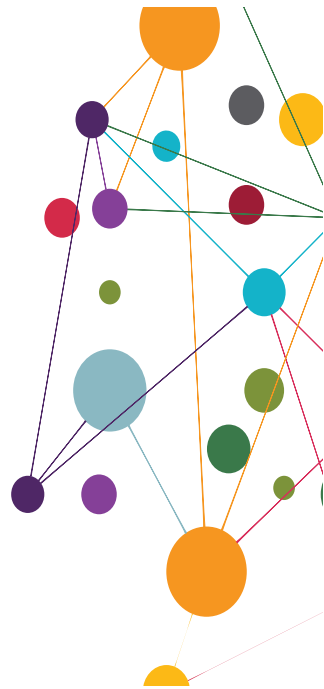
Molecules just don't like to stay put. They're likely to run off and hook up with the first available oxygen or hydrogen they find sitting on the nearest barstool. Having essentially no weight, they are off like a prom dress at the drop of a hat and blown about on the fickle breezes of fate. Molecules, the tiny building blocks of matter; disseminate ceaselessly through space and over time.

And that goes double for all sorts of molecules we use to make our lives easier, such as pesticides and herbicides for instance. They just don't stay put.

All life is related genetically. We share base DNA with the green plants and with the squirrels. All across this hugely small planet living things are much more alike than they are different.

This is why the things that we use to kill other species can also make us sick or die.

So, I cannot help but to be saddened by the continued contamination of our molecule recycling ecosystem by factory farming governed by short-term financial



goals. Those darn molecules! If only they would stay where they belong instead of drifting into the water supply, raining down on the children, being breathed into the lungs and onto the skin of every animal or human that happens by their orbit.

Once inside herbicides and pesticides damage tissues, organs, growing children, babies and pets. Delayed symptoms of 20 to 30 years lull farmers and their neighbors into a false sense of security; only to be devastated later (physically and financially) by medical issues and the side effects of the still relatively primitive state of current medical

knowledge.

We live in the Age of Unintended Consequences. Over the short term, short sighted policies have brought vast temporary wealth and security to billions. But at a price our grandchildren may be loath to pay.

Change always begins in the mind. We



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NH SOLAR SHARES

Cont'd from p.11

outreach and recruitment will begin soon.

In 2017, NH Solar Shares was awarded a \$75,000 CDFA Business Tax Credit Grant which allows businesses to target a portion of their NH BET and payroll taxes to support the Solar Shares' effort. "We owe a big thanks to all of our business sponsors including Northway Bank, Common Man, Dunkin Donuts, EVP Marketing and Media, Mauchly Electric, M.E. Latulippe Construction Inc., Pemi Tree Works and Revision Energy. We hope more local businesses will take part in NH Solar Shares, with a donation of any size" said Jones. There is still room for more businesses to pledge their support via the tax credit program by September 30, 2018. Please visit: www.nhcdfa.org/taxcredits/current-projects/

Interested donors, volunteers, and families wishing to participate should contact Sandra Jones, NH Solar Shares, 603-536-5030 or sandra@plymouthenergy.org. For more information, visit www.nhsolarshares.org. NH Solar Shares LLC is a wholly owned subsidiary of the Plymouth Area Renewable Energy Initiative - a 501-C 3 Not for Profit Tax Exempt Charitable Organization. ♻️

The Littleton Food Co-op: Energy Efficiency in Action

Bob O'Connor

Saving energy is not only good for the planet but also good business. Since its recent 11,500 square foot expansion, the Littleton Food Co-op in New Hampshire has reduced its per-square-foot heating costs by a whopping 44%! It also reduced its electricity bill by 39%! Some of these fuel savings resulted from some pretty standard processes such as deep

insulation in walls and roof along with triple glazed windows installed by Trumbull-Nelson Construction. Converting lighting to LEDs (light emitting diodes) reduced the electric bill but efforts to reduce energy costs did not stop there.

CFW Electric installed 105 solar panels located on the roof to reduce the amount of electrical energy the store must obtain from the grid. Making use of a law of physics, lowering all of the light fixtures suspended from the ceiling allowed lower powered light sources to produce the same illumination in the store. Have you ever felt when shopping in some stores that you needed a jacket in the aisles surrounded by open coolers? Installing doors on older coolers and having doors on all of the new ones saved energy



105 solar panels located on the roof of the store and open bins help to reduce the amount of electrical energy the store must obtain from the grid. Photos courtesy Bob O'Connor.

and solved this problem. Certain display cases, such as fresh produce, have remained open because of popular demand (the very nature of co-ops make them sensitive to the wishes of their members). To reduce energy costs in these open coolers, the cooled air flow is carefully directed to reduce the amount of cold air flowing into the aisles. At the end of each business day, the lights in these cases are shut off and curtains are drawn to further prevent cold air moving into the aisles. Rodney Mitton, one of the managers of the co-op, said these last techniques have resulted in a much warmer store at the beginning of each winter day.

The Littleton Food Co-op is one of the few places in New Hampshire where the beer you take home during the winter months

has been cooled by pure, cold mountain air! During these cold months, instead of running large compressors, cold air from the outside is circulated through many of the large coolers. When the compressors are in use, the waste heat produced is used to pre-heat incoming water to the hot water system.

Motion detectors in many areas make sure that lights are on only when there is activity in these places. While not decreasing energy use, the display cases in the produce section were made by Gallen Career and Technology Center students to the exact specifications the co-op desired. This goes along with the co-op's guiding principle to make use of locally produced products. The electrical vehicle charging stations located in the parking lot are used at a much higher level than expected. With many automakers coming out with new electric vehicles and the fluctuating prices of gasoline, this benefit will no doubt be expanded in the coming years.

The next time you visit the Littleton Food Co-op, look around and see a very practical example of how those in the North Country must adapt to the rising cost of fossil fuels and the effects of climatic changes.

Bob O'Connor is a member of the Littleton, NH Energy Conservation Committee. Bob is a retired science teacher and spent 15 years managing a local cable access TV station.



Above: Rodney Mitton pointing to duct supplying external air to cooler. ; Lowered light fixtures suspended from the ceiling allow lower-powered light sources to produce the same illumination as prior to the energy retrofit.

ELMORE ROOTS' PERMACULTURE KNOW-HOW Up in the Treetops, It's Plum Good Pickin'

David Fried



An up close view of the plum orchard, from on top of the ladder, at Elmore Roots Nursery. Painting by Gabriel Tempesta.

There is magic in the treetops. For once, I have the birds' eye view. There are hundreds of them. Red plums are turning purple in the late afternoon sunlight. I lean against my ladder and reach my arm to get that one right there. I see its color changing to that deep purple. I've got it! This one is in the bag.

About six years ago we planted three rows of plum trees in a new field we call "big daddy." Today, I was working the row of a plum developed recently in Wisconsin called "black ice." It is an early plum, and rather tart while sunset orange or red. Then, without much warning, but a hot day or two, it becomes purple and almost blue black and is ready to pick. Ah, the delicious pleasure of giving in to a bite of this plum. Bright red inside and juicy. Each of my shirts gets ruined, one by one, during the weeks of summer when the plums are

ripe on the hill.

Why is it that we can get so many plums and others have a hard time? It could be that we have a lot of plums growing here near each other. Next to the "black ice" is a row of "waneta" plums and next to them, a row of "superior" plums. In nature, wild American plums grow in thickets, where a lot of shoots sprout from their roots and make a self-contained island of plums. You can't even get in

there! This is good for the plums as they get the pollination and wind protection they need. We can mimic this observed trait by planting a plum grove made up of at least four to six different plums cultivars rather closely, about eight to 10 feet apart. They will grow and touch and be a lot closer than trees in an apple orchard, but they seem to like this. In any case, it is good for fruiting.

I climb up my ladder noticing which ones are purple, which ones red, which ones two-tone, and which ones with a spot of brown. These are still good if you can pick them now, while that spot is one half an inch or so. You can cook with them now or freeze them whole for cooking another time. If the spot gets any larger, it will not taste very good. American and Japanese plums get this brown rot spot in certain years. The key is to pick them before it spreads in the plum. It is also a good idea to rake up the drops, and the

ones that have turned all brown and get them away from your plum trees. Their spores circulate from the ground or from each other and back up and into the ones next to them.

I can't really believe how many plums there are. I quickly fill a bag, and then another and another. When a plum is perfectly ripe, it will separate from its twig and sit right in that little plum shaped cup in the natural palm of my hand. No pulling or plucking or effort at all. What I have found growing plums over the years is that all I really have to do is smile. And share them.

The best plum cultivars for our area in northern Vermont are Waneta, Toka, Superior, Alderman, La Crescent, Kahinta, Pembina, Golden apricot and Mt. Royal. They often begin to bear fruit early in life (about two to five years) and do not usually grow very tall (about eight to ten feet). Plum trees have quite the flower show in spring and often have beautiful fall foliage. Many of the plums we have today were developed by professor Hansen in South Dakota in the early 1900s by crossing very hardy wild American plums with very tasty Japanese varieties that were not so hardy before his work with them. These plums are so good and so exotic tasting. Many visitors who I hand a plum to cannot believe that something with almost the flavor of mangoes can be grown right here!

Moving the ladder now into the hazelberts. Must harvest a bunch of them, even when they are not all nice and tan yet inside their fragrant husks. They will continue to turn coffee-brown and ripen indoors in a paper bag, far from the chipmunks, squirrels and blue jays. We like them, but they live for them!

From the treetops I see a lot of plum trees being planted. A lot of smiles. A lot of people going to change their shirts.

David Fried is a writer, nurseryman and fruit grower in northern Vermont. ♻️

Your Brain on Nature

THE NATURE FIX by Florence Williams, W.W. Norton & Company, 2017, 304 pages

Book review by Roger Lohr

The Nature Fix by Florence Williams provides the most compelling argument to date for people to spend more time outdoors in nature based on an increasing amount of biological, psychological and medicinal scientific evidence.

Over the years, efforts have been made to quantify nature's impact on mood, well-being, cognitive functions (remember, plan, create) and sociability. The biophilic hypothesis involves lowering human stress, boosting mental health, restoring attention, empathy, and cognitive clarity. Nature also affects a social component, like the feeling that is shared among people who spend time together outdoors, or people who perform exceeding acts of kindness in the aftermath of a severe environmental event such as a tornado, earthquake, firestorm, and such.

The recommended prescription for getting outdoors in a "nature pyramid" includes quick doses and longer spells in wild places. Specifically, people should:

- Get out in nature nearby on a daily basis for some minutes to distress, find focus and lighten mental fatigue,
- Spend weekly outings at parks or waterways for an hour or so, and

- Go on monthly weekend excursions to natural areas to bolster immune systems.

The top of the pyramid includes annual or biyearly, multi-day wilderness trips. More significantly, such wilderness experiences are invaluable for adolescents or following grief or trauma.

Williams traveled the world over to investigate and experience research on nature's impact on humans. In Japan, she saw "forest bathing" on a sensory walk in the woods on one of the 48 forest therapy trails in the country. In Scotland, they call it "eco therapy." She met with a Korean professor of "social forestry" who introduced her to the world's only college degree for forest healing. In South Korea from 2010 to 2013, visits to the forest increased from 9.4 million to 12.7 million, while in the U.S.A. there was a decline of 25% during the same time period.

The evidence (there are 20 pages of cited notes and credits) about nature's impact involves details with cortisol levels, sympathetic nerve activity, heart rate decline, and hemoglobin in the brain's prefrontal cortex. The book is replete with that type of information, but most people may not be familiar with such neurological details.

One of nature's benefits are delivered through sound – a bubbling brook, bird



Mascoma Lake from along the bike trail near Enfield, New Hampshire. Photo courtesy of Roger Lohr.

tweets in the early morning, the leaves moving in the wind, and so on. But the U.S. Park Service claims that 83% of land in the lower 48 states sits within 3,500 feet of a road, and that within 20 years, 90% of the population will be close enough to hear at least one

Cont'd on p.37

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The Solar-Powered Circle of Life

Jessie Haas

"Plants manage water, and in managing water, they manage heat," according to Australian agricultural pioneer Peter Andrews. This has been born out in a recent study showing that widespread use of cover crops in the Midwest has affected the local climate, producing cooler temperatures and more abundant spring rains.

Previously, farmers practiced summer fallow, leaving fields bare through an entire year between wheat crops. This was thought to benefit soil moisture and interrupt pest life cycles. In fact, what it did was burn up soil carbon, damage the moisture-holding capacity of the land, and increase local heat the same way a parking lot does. Fine dust particles rose into the sky, forming a haze that held heat in but did not nucleate rain. Soil expert Peter Donovan wrote in Recognizing the Soil Carbon Sponge that landscapes of this kind "multiply heat and aridity."

Cover crops, in contrast, shade the soil. The plants transpire water, which forms high convective clouds, and then rain. Local temperatures are cooled by the rainfall. As the clouds dissipate, long-wave heat rays escape into the upper atmosphere.

It is all part of how the the soil carbon sponge functions. Soil is one of the major sinks for carbon, and as such is an increasing focus for climate change activists. When plants store carbon in the soil, it gains structure, becoming rich

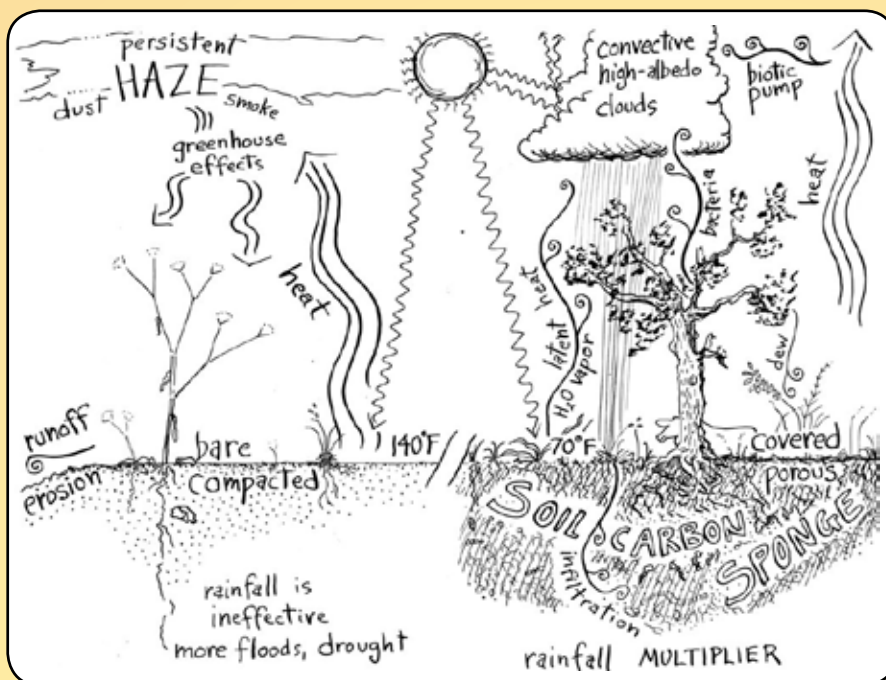


Illustration of the benefits of the Soil Carbon Sponge versus the negative feedback loops of bare compacted soil. Image courtesy Peter Donovan of the Soil Carbon Coalition.

and porous, with air-holes and channels that can also store tremendous amounts of water. In The Drought Resilient Farm, Kansas farmer Dale Strickler wrote of driving past his own farm after a tornado. The ditches around other farms were full of brown water. His were empty. His land, after years of soil-building, had retained all that water and was ready to put it to work.

How do we understand carbon and its relation to climate change? Donovan said that there are two different views. "They do not contradict each other, and it is not about right or wrong here, but these two embody different possibilities or outcomes."

One view sees this essentially as a math problem. There is too much carbon in the atmosphere. Much of that excess was oxidized out of the soil and can be put

back there through changes in farm practices. If we also reduce emissions, we can change the equation and stabilize climate.

The other view sees the carbon and hydrological cycles as linked, part of what Donovan called "the solar-powered circle of life." Carbon removed from the atmosphere and stored in the soil disproportionately affects the earth's heat balance at the surface level – where we live. Carbon built into soil structure holds water, and moist soils are cooler. The moisture supports

plant life; plants shade the soil, cooling it further. Plants also transpire moisture, cooling the air around them. Trees are big air conditioners. So are grasslands and fields planted to cover crop. The transpired moisture carries bacteria to the upper atmosphere; raindrops nucleate around the bacteria and fall, cooling us again, and bringing more moisture, in a virtuous cycle.

This cooling, moistening, and increased plant productivity happen right down at ground level where we can feel it, making life pleasant as we do the work we must do, to reverse the carbon imbalance.

The hydrologic cycle has a powerful effect on climate change, one that has drawn less attention than the carbon cycle. This may be in part because it feels more difficult for humans to influence. But thinking about the soil carbon sponge

gives us a way to understand how we influence the clouds. Soil is something we can build and improve, on a scale from vast rangelands to small back yards. Wherever soil organic matter increases, the soil carbon sponge becomes more healthy and begins to improve the hydrologic cycle. Knowing this, we can begin to dance with the rain, the plants, and the soil microbes to increase the beauty and hospitable nature of our earthly home.

Jessie Haas has written 40 books, mainly for children, and has lived in an off-grid cabin in Westminister West, VT since 1984, www.jessiehaas.com. Links available with the posting of this article on the Green Energy Times website. ♻️

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Your Brain on Nature

Cont'd from p.36

of the projected 30,000 airplane flights per day.

In Finland, 95% of the population spends time recreating outdoors and 50% ride bicycles. It is easy to access forests because 74% of the country is covered by trees and there are 2 million summer cottages for a population of 5 million Finns, who claim the focus on nature correlates to reduced health care costs and mental and physical fitness.

Williams visited Singapore, where 70% of the population lives within 400 meters of green space. The government in Singapore allocates 0.6% of the national budget to develop scenery and greenery.

There are successful nature programs to help people who suffer with PTSD (post-traumatic stress disorder) and ADHD (attention deficit hyperactivity disorder). Outward Bound did a study on a therapeutic adventure program showing nine to 19% of participating veterans who had PTSD improved. Williams includes a discussion about ADHD programs where 6.4 million kids are diagnosed and half of them are taking medication for the malady.

Isn't it about time that more therapists,



The lupine field scenery from Sugar Hill, New Hampshire. Photo courtesy of Roger Lohr.

doctors, teachers, and parents prescribe getting outdoors more often?

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



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Vermont Coffee Company Goes 100% Renewable

By Green Energy Times Staff



Paul Ralston

The Vermont Coffee Company (VCC), known for its organic coffee, has big news. All the energy it uses to roast its coffee now comes from renewable resources.

The move to renewable energy is no accident. Founder & CEO Paul Ralston has been working for years on ways to roast with renewable energy. He said, however, "The renewable energy piece has been a long frustrating road. Early on we tried a coffee roaster that burned wood, but it didn't roast coffee very well."

As of April 2018, both the electricity and thermal energy (gas) used to roast its coffee comes from methane. Even though it's a powerful greenhouse gas, when recovered via anaerobic digestion (AD) methane can be converted into electricity or renewable natural gas.

There are many reasons to encourage the use of AD for energy generation. In Vermont there are more than a dozen digesters located on dairy farms generating electricity from biogas, along with other byproducts such as rich compost, fertilizer and animal bedding. AD also is an effective way to reduce the amount of agricultural pollutants, such as the phosphorus that contributes to Vermont's water quality issues.

Sourcing renewable electricity was the easy part for VCC. Through the process of AD, cow manure is transformed into

electricity which is then fed onto the power grid, just like other renewable resources such as wind, solar and hydro. Electricity produced this way is branded and sold by Green Mountain Power as "Cow Power" and is available to commercial and residential customers for a small premium.

For VCC's thermal energy, methane is captured at a Quebec-based engineered landfill and converted into renewable natural gas. Ralston pointed to the advantages of this system, saying, "The landfill was designed to capture the methane that would normally off-gas into the environment. The biogas is scrubbed, cleaned and



Vermont Coffee Company has invested in energy-efficient roasting equipment making it possible to roast coffee with significantly less energy. Courtesy photos.

By combining renewable natural gas sourced from a landfill with farm-produced electricity, VCC can honestly claim to be selling coffee that is roasted with 100% renewable energy. According to its website, it is the first coffee company in the U.S. to be powered entirely by renewable biogas. ☻



Coffee quality control.

GMP Commercial Electric Mower Incentive

Green Mountain Power is providing incentives for commercial electric lawn mowers that replace older gas-powered units. To qualify, the mowers must be owned by GMP customers and charged in GMP territory. There are other limitations that apply to the offer. Also, because the incentives are being given under a pilot program, only twenty mowers will get the incentives. A number of models of mowers may get incentives, including at least four by Mean Green Products.

Those interested should contact GMP at 888-835-4672 or Eco-Equipment Supply at 802-363-3930.



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BACK TO BASICS: WHAT IS RECYCLABLE?

Raeann Bilow

Being a perfect recycler is tough. Recycling poses size requirements, exceptions to some common rules, and different places to bring different recyclables. And even once you feel like you've mastered recycling in your own local area, you find there are changes from state to state, and county to county, and by locality.

If you focus on all of those differences, it can feel so overwhelming that some can be turned off from the whole process altogether. However, by going back to the everyday items that make up the majority of recyclable materials, you'll be able to breathe easy knowing that you're recycling what you should be – and not recycling the wrong things.

Blue bin recycling

Let's go back to basics. Your blue bin or cart is for a specific set of common items: Containers and paper. If you don't get them picked up curbside, they can be taken to any nearby drop-off center.

Containers and paper are the standard items that belong in your blue bin. These two categories make up the lion's share of the stuff that your local sorting center was designed for. Containers include cans, bottles, jars, tubs, and packaging. Think soda cans and bottles, yogurt tubs, the rigid packaging that electronics come in, whipped cream aerosol cans, and shampoo bottles. Paper includes items made of uncoated fibers. Think office paper, news-



paper, junk mail, shipping boxes, and cereal boxes.

Cleanliness is important to the companies that buy recycling. The containers you bring should always be empty at a minimum and rinsed clean whenever possible. Dirty materials, once mixed in with the rest of materials at the recycling facility, can contaminate entire loads. Paper and cardboard should not

have food stuck on them and should be dry.

Special recycling

Containers and paper go in your recycling bin – You get it. So, what about the many other items that are recyclable – but don't belong in your recycling bin?

There are collection facilities that accept many other items for special recycling. Plastic bags are accepted at most grocery and hardware stores. Batteries are accepted at many retailers and local drop-off centers. Municipal and private solid waste facilities commonly collect a variety of items, including scrap metal (from wire hangers to lawn mowers), fluorescent bulbs, electronics, propane tanks, appliances, and more.

If you're not sure about something, don't throw it in the recycling bin. Either reach out to your local district or throw it in the trash. Here in Chittenden County, VT, you can call the Chittenden Solid Waste District hotline at (802) 872-8111, or check out disposal options for the hundreds of items posted on our A-Z list at www.cswd.net/a-to-z.

Raeann Bilow is a Marketing Specialist at Chittenden Solid Waste District. ♻️

OF TOOTHPASTE TUBES & OLD SUITCASES

Central Vermont Leads the Way in Recycling 'Weird Stuff'

Sally Bellew and Cassandra Hemenway

Do you find yourself cringing each time you put something into the trash, because you believe it can't be recycled? Well, cringe no more. The Central Vermont Solid Waste Management District (CVSWMD) offers a home to more than three dozen hard-to-recycle materials that, otherwise, would end up in the landfill.

The CVSWMD operates an Additional Recyclables Collection Center (ARCC) providing an outlet for dozens of hard to recycle materials (but NOT a regular recycling or trash depot). They describe the ARCC as a "recyclables lab" where they experiment with finding viable markets for recyclable materials that often end up in the landfill. This is not new for CVSWMD.

Thirteen years ago, before anyone else was collecting food scraps on a large scale, the CVSWMD partnered with local compost facilities and began knocking on doors at local restaurants and grocery stores. Quickly, they accrued a handful of businesses willing to pay a little extra to have their food scraps hauled to a compost facility instead of the landfill. Quickly, the Business Organics Program grew to over 100 businesses diverting food scraps out of the trash, and by 2016, the private sector was ready to try it out. At that time, the district transitioned its forward thinking food scrap hauling program and focused more on the ARCC.

"Everyone thought we were crazy," said Cassandra Hemenway, CVSWMD Outreach Manager, "but gradually it caught on and other organizations started doing the same thing. Eventually, parts of the Vermont universal recycling law were modeled after our programming."

So, if it worked with food scraps, might the same "collect-it-first-and-they-will-come-for-it" model be applied to other materials like batteries, electronics, books, potato chip bags and toothpaste tubes? CVSWMD decided

to give it a try. In 2012, using a model from EcoCycle in Boulder, CO, their ARCC opened in a corner of their warehouse. It was called Free Fridays and folks could bring in about a dozen odd and sundry materials normally kept out of the usual recycle bin. Since that first start, the program took off and started accruing costs in the form of staff time and transportation, and eventually grew over 25% per

year, requiring a full time staff person, plus several part timers and a crew of volunteers. Because it continues to cost the district to operate, they had to come up with a fee schedule to at least partially cover the cost of providing the popular service.

Now the ARCC is open three days a week, plus every 3rd Saturday of the month and has a volume-based fee that ranges between \$2 and \$20 per load depending on how much material is brought in. (Most people bring between \$2 and \$5 worth). The ARCC accepts plastic and metal bottle caps, drink pouches, textiles, shoes, pellet bags, granola bar wrappers, DVD's, CD's, ink and toner cartridges, skis, snowboards, books, propane tanks, electronics, and much more.

Markets for some of this "weird stuff" have been found out of state. Many of the materials are processed through Terracycle, a company that works with corporations to collect hard to recycle materials.

The ARCC is rightfully proud of having kept thousands of tons of material out of the landfill, collecting hard to recycle materials that don't belong in your regular blue bin recycling but do have a way to get remanufactured. Learn more at cvswmd.org.

Sally Bellew is an environmental enthusiast who lives in Wilder, VT. ♻️



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