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A Step in the Right Direction

Meet the Companies That Are Upcycling Ocean Plastic to Turn the Tides on Shoe Manufacturing

Chris Gillespie

When it comes to carbon emissions, the textile industry is the world's second biggest polluter behind the oil and gas industry. A significant portion of the textile industry's footprint comes from footwear. With their multi-material designs, paper-intensive packaging and short-sighted style and durability, an overwhelming amount of the 25 billion pairs of shoes manufactured each year are not made with sustainability in mind.

Fortunately, apparel and footwear companies around the world are realizing that they can lessen their own carbon footprint while simultaneously working to help solve another environmental crisis: the amount of plastic in our oceans. After recovering, or in some cases, intercepting, discarded plastic from coastal habitats, manufacturers are able to upcycle the plastic into materials which can be used to make most, if not all, of a brand new shoe.

With this in mind, if you or your family are in the market for new shoes this fall, whether for back-to-school or for early holiday shopping, consider supporting one of these innovative, ocean-friendly shoe brands.



Adidas Parley mid-sole is 3D printed from recycled ocean waste. Image:www.arch2o.com.

Adidas

In 2015, iconic sportswear brand Adidas partnered with Parley for the Oceans with the goal of using ocean plastic to make high-quality athletic wear that would be indistinguishable from goods made with virgin plastic.

Nearly five years later, Adidas and Parley have sold over a billion dollars' worth of shoes crafted from upcycled ocean plastic and have helped keep over 2810 tons of plastic waste out of the ocean. In addition to this, Adidas has begun incorporating recycled plastic into their clothing, completely eliminated plastic bags from their stores and aims to use 100% recycled polyester in their products wherever possible by 2024.

Learn more at adidas.com/us/parley.

Sperry

As a brand that specializes in boat shoes and other nautical-inspired footwear, Sperry feels a special obligation to keep the oceans that their products evoke clean and healthy. Earlier this year, Sperry released their new Sperry BIONIC® Collection, which creates shoes using BIONIC's signature yarn which is spun from plastic recovered from marine and

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SUSTAINABLY CRAFTED SPIRITS

Appalachian Gap Distillery Gets It Right



Tasting room entry. Recycled timbers and a used culvert form the entry roof. Inset: Sign and solar panels. Note the tiny solar panel used for signage lights. All images courtesy Lars Hubbard.

Jessie Haas

In 2010, two Vermont home-brewing enthusiasts, Lars Hubbard and Chuck Burkins, took a weekend distilling course in New York State, which turned into a new, sustainable business. Appalachian Gap Distillery in Middlebury, Vermont produces hand-distilled rum, gin, whiskey, and other spirits using 100% solar power and are available for sale on line and in Vermont liquor stores, as well as at locations in Massachusetts, New York, Oregon, and Illinois.

What's in the name, which doesn't automatically imply Vermont to many? The AppGap website reminds us that the Green Mountains are part of the Appalachian range. According to local usage, a 'gap' is an opening between mountains that runs east to west; the gap in question is on VT. Route 17, the highest point on the road between Bristol and Waitsfield.

Appalachian Gap produces hand-crafted spirits made with mostly local

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FARMS, HARVEST AND CLIMATE CHANGE

Jessie Haas

"A dry year you worry, a wet year you starve," goes the cheery old Vermont saying, and it's worse lately. These are stressful times for farmers, with the anniversary of Tropical Storm Irene a reminder that the placid stream beside your field could someday leap its banks and sweep that field away.

The Northeast has seen a 71% increase in heavy precipitation events over recent decades, alternating with droughts. In 2019, excess spring rains, following on a wet fall and snowy winter, lead to delayed planting. Corn should be knee high by the fourth of July, but this year, in many places, it was more like ankle high, if it had gotten planted at all. With soup-like spring soils becoming the new normal, although we



Climate-related disasters such as flooding possibilities require adaptation to face our future. Image: agriculturewire.com.

have more frost-free days than we used to, the growing season for many farmers is actually shorter.

And weirder. This spring was cool as well as wet, plants were slow to start

growing, and in many places, fruits and berries ripened two weeks to a month later than normal.

Soupy springs often lead into hot dry summers. Knee-high corn and other more mature plants are in a position to benefit from hot sun, but young, tender plants do better with cooler weather. Farmers can plant shorter-season crops to compensate, but these may be less productive. A switch from annual crops, like corn, to perennials, like hay, can be a strategy but increased humidity can make drying hay more difficult and affects the harvest of other crops as well.

But farmers are taking action. Researcher Alyssa White, UVM's liaison with the USDA Northeast

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Hopefully we have not forgotten to mention anyone. It is your help that paves the way to a sustainable future.

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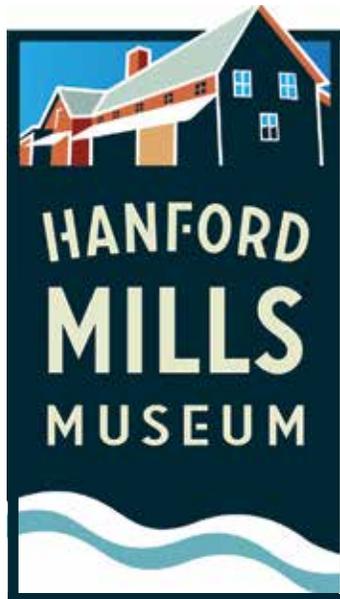
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From a reader:

LANDSCAPE COMPANIES AND HOMEOWNERS:

Please take note regarding leaf blower dangers

In response to an article we ran in the October 2018 edition of Green Energy Times (www.greenenergytimes.org/leaf-blowers), we recently received this comment from John in Westchester county, NY:

I live in Westchester County, NY. The county and my town both have "no idling" law for autos. Can you create this statistic: "A WORKER OPERATING A 4-STROKE GAS-POWERED LEAF BLOWER FOR 30 MINUTES IS EXPOSED TO THE SAME POLLUTION OF A 2016 TOYOTA CAMRY IDLING FOR 30 MINUTES"?

An eye-opening statistic like that would put pressure on landscape company owners to not expose their workers to pollution. Homeowners might act, too. And I see county and town officials being forced to act on leaf blowers, given that they have a "no idling" law on the books. Thank you. Please help.

John, thank you for your concerned words. This is indeed a topic and issue that is worth taking note of. The "no idling" law in the state of VT and your county in NY is definitely an issue we wish would be addressed more seriously.



Upwards of 170 American cities in 31 states have leaf blower restrictions in place. Image: Dean Hochman, FlickrCC.

Idling is a cause of many health issues, let alone the emissions from idling that add to the CO2 levels in the environment. Don't be afraid to speak out. Let businesses where you see idling as a problem know about your concerns and request that they put up 'No Idling' signs. Every effort is worth it.

– Nancy Rae, publisher of G.E.T. ♻️

Boosting Global Immunity through Community Resilience

Jennifer White

Our healthcare system in this country is not well. At the very least it is not affordable, but at most it seems more suited to diagnosing and treating sicknesses than to recognizing and enhancing wellness. It is at its best when we are feeling our worst—during acute care interventions when our life needs saving and as the long-term management of symptoms becomes a lifetime prescription for medications.



As it turns out, if we are not well before we get sick, then the course of our illness can be prolonged and the treatment we receive can be less effective, not to mention more expensive. Deliberately attending to our health before disease strikes allows us to feel better overall and also gives us the reserve we need to recover more quickly.

A common-sense shift in focus back to the basics of prevention—getting adequate sleep, exercising, eating well, avoiding toxins, reducing stress, having strong social bonds—strengthens our immune response and promotes individual resilience.

Because our world's ecological system is also suffering from multiple maladies and imbalances, not to mention a high fever—our global immunity too could also use some support and enhancement. In the midst of the climate crisis we find ourselves and our cities dealing with one acute, life-threatening emergency after another and, in between, managing the long-term symptoms of world-wide disease.

But there is a shift happening within institutions and municipalities around the country and around the globe—one that proactively and collectively builds our capacity to avoid total catastrophe and lessen the impact of disasters when they occur. Community resilience is a collaborative, holistic approach that seeks to improve the wellbeing of residents and boost the immune system of whole neighborhoods and towns.

Unlike sustainability initiatives, which tend to

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U.S. CITIES BOOST CLEAN ENERGY EFFORTS

Scorecard of 75 large U.S. cities reveals the top 10

U.S. cities are ramping up their clean energy efforts, notably with stricter energy-saving rules for buildings, but only a few cities appear on track to meet their community-wide climate goals, according to the 2019 City Clean Energy Scorecard, released today by the nonprofit American Council for an Energy-Efficient Economy.

For the first time, the ACEEE Scorecard tracks policy efforts to advance renewable energy in addition to energy efficiency, because both are needed to build a clean energy future and address climate change. It is the most comprehensive national report that tracks city progress toward climate goals.

The scorecard shows that cities took more than 265 initiatives to advance efficiency and renewable energy between January 2017 and April 2019, ranging from modest but practical efforts such as Philadelphia's teleworking for public employees, to cutting-edge policies such as Washington, DC's new high-performance standards for existing buildings.

Yet the scorecard also reveals that most cities with climate goals are either not on track to achieve them or are not yet tracking progress. One-third (26) of the 75 cities surveyed have yet to even set greenhouse gas (GHG) reduction targets. Of the 49 with targets, 22 are not yet fully tracking their progress. The remaining 27 have data, and of those, eight are not projected to be close to achieving their targets and eight are projected to make substantial progress but still fall short. Only 11 are on track to meet their GHG reductions goals.

Cities vary widely in their policies and performance. The scorecard, which ranks cities on more than 50 metrics, has these key findings:

- Boston retains its first-place ranking, earning 77.5 out of a possible 100 points. It's followed by San Francisco, Seattle, Minneapolis, Washington, DC, New York City, Los Angeles, Denver, Austin, and Portland. This year, Minneapolis adopted policies requiring homes and apartment buildings to disclose their energy use to buyers or renters. New York City recently established programs calling for large buildings that benchmark energy use to post their energy performance ratings.
- Cincinnati, Hartford, and Providence are Cities to Watch. They did not make the top 10 but stand out for adopting several major clean energy policies and programs since early 2017, improv-

ing their ranks since the last scorecard. Hartford created an energy improvement district, began converting its streetlights to LEDs, and has taken steps to improve location efficiency through improvements to the zoning code.

- Cities expanded efforts to save energy in new and existing buildings. Since 2017, nine cities—Las Vegas, Mesa, New York, Philadelphia, Phoenix, Reno, San Antonio, St. Louis, and Tucson—adopted more-stringent building energy codes and five advocated for their states to do so. In addition, eight cities—Chicago, Denver, Minneapolis, New York, Reno, Salt Lake City, San José, and Washington, DC—adopted efficiency requirements for existing buildings.

• Cities increased their push to reduce GHGs from the transportation sector but not as much as they did with buildings. To slash emissions, they need to accelerate their action. Since 2017, nine cities developed targets to increase public transit, biking, and walking in lieu of driving.

Some cities are engaging with and investing in low-income communities and communities of color. Still, they have significant room for improvement. They can tap planning models—like those used in Minneapolis, Providence, and Seattle—to jumpstart their activities.

"Cities are making impressive clean energy gains—taking big steps to waste less energy and encourage more renewable power. But they have more to do," said ACEEE senior research manager David Ribeiro, the lead report author. "Cities must continue their push for innovative buildings policies, take greater steps to tackle transportation emissions, and better track progress to know which investments have the greatest impact. With their innovation,

ingenuity, and resolve, they can build prosperous and equitable low-carbon communities."

Boston's Mayor Marty Walsh said: "Nearly three quarters of Boston greenhouse gas emissions comes from our buildings. We're working hard to improve the performance of those buildings and looking at how new ones can be built smarter. If we're to achieve carbon neutrality by 2050, we have to accelerate our actions and lead by example. That's why we've already surpassed our municipal climate goals and reduced emissions by 37 percent. I'm proud of Boston for leading the rankings once again and am inspired by other cities for their bold action."

The 2019 report, our fourth ranking of cities, scores 75 large U.S. cities, 24 more than our previous edition in 2017. It includes all 25 cities participating in Bloomberg Philanthropies' American Cities Climate Challenge, eight of which

land on ACEEE's top 10 list. This expanded Scorecard adds city efforts to encourage renewable energy, the impact of their policies, and their investment in and engagement with low-income communities and communities of color. Because of these extensive changes, we caution against simple comparisons to past scores and ranks.

The Scorecard, using information collected as of April 1, 2019, ranks cities in five policy areas:

- Local government operations. Austin, Boston, and Orlando tie for first place in this area. They have policies to increase efficiency in city government, procurement, and asset management.
- Community-wide initiatives. Washington, DC takes top honors, followed by Seattle. They have GHG reduction goals, strategies to mitigate urban heat islands, and policies or programs to plan for distributed energy systems such as on-site renewables.
- Buildings policies. Boston ranks first, followed by New York, San José, Seat-

tle, Los Angeles, and San Francisco. These cities have adopted or advocated for stringent building energy codes, devoted resources to building code compliance, and used incentives or requirements to address energy consumption in existing buildings.

- Energy and water utilities. San Diego stars in this category, followed by Los Angeles, Boston, Chula Vista, Minneapolis, and San Francisco. Their energy utilities have efficiency programs delivering significant savings, and the cities and utilities are working together to increase their use of renewable energy.
- Transportation policies. San Francisco takes the top spot, followed by Washington, DC, Boston, Portland, and Seattle. These cities promote public transit, efficient vehicles and vehicle infrastructure, and freight system efficiency.

"Year after year it is tremendous to see cities from every corner of the country

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Affordable Used Electric Cars

David Roberts

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

We first explored availability of used electric cars two years ago and the market has continued to expand since. The increased supply of used electric cars is primarily driven by people leasing electric cars to take advantage of federal tax credits, reduce the risk of depreciation, and allow them to keep up with new and updated models at relatively low cost.

Leasing remains popular for both types of electric cars, including plug-in hybrid vehicles (PHEVs) powered by batteries for 10-50 miles before seamlessly switching to running on gasoline for extended range as well as all-electric vehicles (AEVs) powered solely by batteries with ranges of 80 to 300-plus miles before recharging is needed.

Both varieties of EVs can be charged

Model	Electric Range	Minimum Price	Median Price	Number Available
Plug-in Hybrid				
Audi A3 e-tron	16	\$ 16,400	\$ 27,600	17
BMW i3 with REX	72-126	\$ 13,800	\$ 22,600	31
Chevrolet Volt	38-53	\$ 7,000	\$ 19,400	127
Ford C-MAX Energi	19	\$ 8,000	\$ 15,000	94
Ford Fusion Energi	19	\$ 7,000	\$ 17,000	101
Honda Clarity PHEV	47	\$ 20,000	\$ 26,200	36
Toyota Prius Plug-in / Prius Prime	11-25	\$ 8,000	\$ 20,400	116
All Electric				
Chevrolet Bolt	238	\$ 21,000	\$ 25,000	60
Chevrolet Spark EV	82	\$ 9,800	\$ 10,500	24
Fiat 500e	84	\$ 7,400	\$ 10,800	23
Ford Focus Electric	76-115	\$ 9,000	\$ 11,300	13
Kia Soul Electric	93-111	\$ 13,000	\$ 15,000	11
Nissan LEAF	84-150	\$ 4,500	\$ 13,000	89
BMW i3	81-153	\$ 17,300	\$ 20,430	10
Smart ForTwo Electric	58	\$ 5,000	\$ 6,400	24
Tesla Model 3	220-310	\$ 38,800	\$ 47,900	52
Tesla Model S and X	200-370	\$ 33,000	\$ 58,300	130
Volkswagen e-Golf	83-125	\$ 12,100	\$ 14,400	34

by plugging into a standard 120V home outlet overnight to get about five miles of range per hour of charging. Access to 240V power speeds things up to 10 to 20 miles of range per hour of charging depending on the vehicle and charging power. Some AEVs also include DC fast-charging capability which provides an 80% charge in less than an hour.

The table below summarizes used electric car pricing and availability based on a search of cars.com in late August 2019. There were about 990 used plug-in

vehicles advertised within 250 miles of White River Junction, Vermont. The table excludes a few lower availability models, so the actual number is somewhat higher. In addition, some buyers have looked further afield and had cars shipped from larger markets in the south and west, so broadening your search area could be worthwhile.

Used Electric Car Pricing and Availability

Cars.com within 250 miles of White River Junction, VT as of August 2019

Monetary incentives for new electric car purchases, like the federal tax credit, generally do not apply to used vehicles. There may be exceptions to

this, so check online for information on incentives available in your area. Non-monetary incentives, such as access to carpool lanes, may be available regardless of whether you purchase a new or used electric car.

Additional considerations for those looking into used EVs in the northeast include:

- Electric cars have proven to be extremely reliable, but getting a car checked out by a qualified mechanic before buying can help avoid any costly

surprises. Electric car batteries are one of the most expensive components to replace. Fortunately, the batteries are engineered for eight to 10-plus year lifespans, and the majority continue to work well. Smartphone apps and devices are available for a few models that can connect with the on-board diagnostic systems to provide a detailed report of battery health.

- Many electric cars have increased range over time. For example, a 2013 Nissan LEAF has 75 miles of range, while a 2019 LEAF will have 150 or 226, depending on the model. FuelEconomy.gov is an excellent resource to check estimated vehicle range when the vehicle was new and compare to current estimates provided by a fully charged used EV to better understand the battery health.

- As the above pricing table indicates, there is significant variation in prices depending on the model, range, condition, dealer and other factors. Shopping around and negotiating can help get the best deal.

- Some EV models destined for the northeast are shipped from the manufacturers with "cold weather packages" that increase performance in colder temperatures with battery heating systems or more efficient cabin heating. It is worth checking on the availability of these options as used EVs coming from other parts of the country may not have these options.

- DC fast charging is often optional. We highly recommend this for those considering AEVs, so check the vehicle specifications for this.

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

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

ELECTRIC BUSES ARE HERE! UPPER VALLEY AND BURLINGTON

George Harvey

Many readers might recall an article that appeared in the June, 2017 issue of Green Energy Times, "Electric Bus Trials in Vermont and New Hampshire" (<http://bit.ly/VT-NH-ebus-trial>). That article reported tests at Advance Transit, which operates in the Upper Valley of Vermont and New Hampshire, and Green Mountain Transit, which operates in Burlington. The two companies were among several that tested the BYD bus, but they were especially interested in conditions in New England, including cold weather and hilly terrain.

Last year, Vermont's Senators Bernie Sanders and Patrick Leahy and Representative Peter Welch wrote to Transportation Secretary Elaine Chao in support of a grant application to acquire buses for these areas. That effort has borne fruit, as a grant for \$3 million has been awarded.

In a press releases, Leahy, Sanders and Welch are quoted as saying, "Investments like these create a cascade of benefits for our community. Updating our state's public transit options to reflect the changing climate will mean more Vermonters trad-



BYD e-bus in Copenhagen. Leif Jørgensen, Wikimedia Commons.

ing car rides for bus rides and fewer carbon emissions in our atmosphere and will make our rural communities more resilient. At a time when global climate change is already causing devastation here at home and around the world, from more frequent and stronger hurricanes, to wildfires, drought, and flooding, this is exactly the kind of investment we should be making. It's also crucial to make sure that investments in clean energy are not limited to urban areas. This project's focus brings those benefits directly to Vermont's rural communities."

This is important, especially because transportation accounts for a large percentage of greenhouse gas emissions

nationally at 29%. In Vermont, the percentage is much higher at about 45%.

The issue of electric buses is not just environmental, however. It is also one of good economy. Electric buses cost about 60% more than their diesel-powered counterparts, but their operating costs are so much lower that the payback time is very short. In fact, the World Economic Forum (WEF) projects that by 2025 about half of all buses in use by municipal transit systems will be electric (<http://bit.ly/WEF-ebus>). The WEF also points out that 386,000 electric buses were manufactured last year worldwide, and 99% of them were manufactured in China. That is a huge market, estimated at over \$50 billion, in which the United States is barely participating.

The bus tested on routes in Vermont and New Hampshire was made by BYD, a Chinese company that has factories in the United States and Canada. The buses purchased for the routes here will not necessarily be from BYD, as there are a couple of relatively small companies in this country making electric buses here. 

Indianapolis Has a Fleet of e-Buses

Early in September, a new bus route opened in Indianapolis. The Red Line is running thirteen BYD K11 buses. Indygo, the municipal transportation organization, has already ordered eighteen more BYD buses to be delivered by the end of the year. The BYD K11 series bus is a very large "e-bus" (electric bus). It is articulated, and it carries up to 120 passengers.

The buses ordered by Indygo are being made in an American factory. BYD is a Chinese company, but its largest shareholder is an American company, Berkshire Hathaway. It is the largest manufacturer of electric vehicles in the world, with products ranging from bicycles to large trucks and mining equipment. Like Tesla, it also produces batteries for vehicles and grid power storage.

Indianapolis plans to replace all of its diesel transit buses with electric buses. The life expectancy of a transit bus is about twelve years, and it plans to run its diesels until the ends of their useful lifetimes, so it should have its fleet entirely replaced by 2032.

According to the U.S. Department of Transportation, a diesel bus emits about ten tons of nitrogen oxide (NOx), 350 pounds of particulates, and 1,690 tons of CO₂ over its lifetime. 

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

Greener School Buses

EarthTalk® From the Editors of E - The Environmental Magazine

Now that school is back in session, those big yellow diesel-fueled school buses are all over the roads again. While they're relatively safe—and definitely old school—they're also big polluters, chugging along at four to six miles to the gallon while creating a cloud of harmful airborne pollutants.

According to the non-profit Clean Air Trust (CAT), some 25 million American kids travelling on half a million school buses every day are exposed to five to 15 times more air toxins than the rest of us. "Those buses travel more than four billion miles each year, and these kids spend three billion hours on [them]," reports the group. "About 90 percent of these buses run on diesel fuel, annually emitting 3,000 tons of cancer-causing soot and 95,000 tons of smog-causing compounds."

If you don't think all that pollution is having a negative effect, think again. A March 2019 study from researchers at Georgia State University found that students did significantly better on standardized English tests and marginally better in math when they spent their commutes riding in school buses retrofitted to reduce emissions by 95 percent as compared to students riding in non-upgraded buses. The researchers conclude that "engine retrofits can have meaningful and cost-effective impacts on health and cognitive functioning."

Luckily the retrofits are easy to come by and relatively inexpensive, especially when you factor in the costs of health care to treat sick kids, not to mention the price tag for raising kids' test scores in other ways. Retrofitting 10 percent of the average school district's bus fleet in Georgia, for instance, would cost less than \$100,000, a drop in the bucket of the state's \$10.6 billion K-12 public schools budget.

And beginning in October 2018, the U.S. Environmental Protection Agency (EPA) set aside \$9 million to help pay for upgrading older diesel school buses nationwide. School districts and other public agencies charged with transporting

school kids can apply for rebates of up to \$20,000 per bus to help cover the retrofits on up to 10 buses.

Retrofitting is a great start, but even better would be replacing old buses with new, more efficient all-electric models. But few school districts can justify the \$300,000 price tag to replace perfectly functional older diesel buses. That didn't stop the school district in White Plains, New York, though, which purchased five electric buses last year with financial help from the local utility, Consolidated Edison, and a grant from the state.

These outside contributions helped bring the final cost to the school district down to something along the lines of buying new diesel buses. While ConEd gets the benefit of good public relations and good karma, it also gets to use the buses during the summer as excess electricity storage that can be moved around to where it's needed most (when the air conditioners are blazing). White Plains is hoping other school districts across the country will follow a similar model to clean up their acts.

Contacts: Clean Air Trust, cleanairtrust.org; "School bus emissions, student health and academic performance," sciencedirect.com/science/article/abs/pii/S0272775719301530#.

EarthTalk® is produced by Roddy Scheer & Doug Moss for the 501(c)3 nonprofit EarthTalk. See more at <https://emagazine.com>. Send questions to: question@earthtalk.org.



Research shows that replacing or retrofitting dirty old diesel school buses can reduce the pollution inhaled by students significantly and can even lead to better health and higher standardized test scores. Credit: madame.furie, FlickrCC.

VOLKSWAGEN BEETLE ELECTRIC RETROFIT



If you have a classic Volkswagen (VW) Beetle sitting in your garage, it may have a new life ahead. VW announced it will make electric conversion units for those old bugs. The eBeetle (eKäfer, in German) will have a range of just over 120 miles and a top speed of over 90 MPH. VW is also looking at converting the VW Bus and the Porsche 356. Perhaps other car makers should take note. 🌱

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Can EV Charge-Site Operators Make Money?

Randy Bryan



EV Charging Station. Image: Wikimedia Commons

We keep hearing that there aren't enough electric vehicle (EV) charging stations out there. Yet, the auto market is moving to electric drive, and the EV share of the market is growing at over a 30% rate. Why haven't more entrepreneurs jumped into this car-charging space?

The short answer is that it is difficult to make money providing charging services; occupancy is low and capital and operating costs are high. This is important.

Occupancy: EVs are now about 3% of new vehicle sales, and sales have climbed rapidly. But EVs make up less than 1% of vehicles registered. That means not enough EVs are on the road to make sufficient demand. Even more importantly, 80% of EVs are charged at home. Convenient for the owner but tough on charging station operators. Revenue is low so far.

Capital Costs: Charging equipment is expensive. The charging stations are essentially a custom build in small batches. That means all the product design and manufacturing setup costs are heaped on small build batches. Installation costs are high, too, associated with bringing sufficient power to the charge station location.

Another problem for charging network operators is multiple standards. Tesla has a proprietary standard. Japan developed one (Chademo), and the U.S. did, too (SAE). That's ok, but the car fueling market has one standard world-wide, and that uniformity is an expectation for EV drivers. So, charging operators must accommodate the multiple standards.

Operating Costs: Electricity is also tough to make money on. Recall that people charge most EVs at home and are familiar with these costs. In NH, it's about 16-17¢/kWh. Charge service operators may get some discounts for buying in volume but add to that the other major hit of "demand charges." Demand charges are higher rates according to the highest power demand for commercial accounts in any month. They are intended to capture the extra cost associated with building out the grid network for maximum power demand. Demand charges are low if your demand is steady, but charging cars is a spikey business. High power requirements for short times and low occupancy can nearly double the cost of electricity.

Yet another issue is that most states have forbidden reselling electricity by anyone other than (regulated monopoly) utilities. This means that EV (charge) service operators (EVSOs) must invent some other metric to charge by such as charge time, space time, session initiation, and other means must be used. But slower charging cars will incur much higher charge cost.

The result of all these high costs is that even a large, well run, EV charging network operator will need to charge its customers nearly double to triple what they pay at home for public charging. Ouch. Small operators (entrepreneurs) have it even worse.

Compare that to the early days of gasoline cars. Gasoline started as a useless and dangerous byproduct of making kerosene, and oil companies were only too happy to get some revenue for this stuff. Making money as a reseller of gasoline was easy in the early decades. That easy profitability has disappeared now that oil companies have priced in the value of gasoline.

There are successful charge system operators: Tesla is doing well. However, their charger network is subsidized by car sales, not profit expectation. It just has to keep the customers and salespeople happy.

Some utilities have developed new rates without demand charges for just EV charging, and some states will allow re-selling electricity for EV charging. But these policy fixes are too piecemeal to count on for EVSOs.

EVgo recently announced that they have a stable and working business plan as an EVSO. Others have been successful, too. Chargepoint makes money off selling chargers and back office support for EVSOs. Greenlots has partnered with VW Electrify America to provide back office functionality. Some oil companies are moving in, too. And many individual sites are running their own charge stations. The businesses are run lean. Some operators have not made it.

Fortunately, Volkswagen stumbled into providing several billion dollars in fines (Dieselgate) that are targeted (EPA and Electrify America) to help fund the build out of charge station networks. This funding has helped solve (temporarily) the capital costs of charge networks and additional charge station locations are coming online. But this doesn't address the costs of electricity.

Is there a silver bullet for charge-service operator success? Not yet. As Kermit the Frog once said, "It ain't easy being green." New Hampshire allows resale of electricity by EVSOs, but its utilities are dragging their heels on demand charges. This area is so important to the success of EVs. Make sure your representatives understand the importance of this problem and that New Hampshire should help..

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

E-biking To and From Work in Rural VT Makes Sense

1,250 Miles and Counting ...

N.R. Mallery

Bren Alvarez's story is a great example of how one can benefit by using an electric bike for transportation to and from work, as well as for errands and recreation. Bren is an architect and works in Burlington, VT.

When Bren Alvarez lived in Burlington's Old North End, she used an ordinary bicycle to get around. But buying a home five miles away, at the far end of North Avenue sent her off her bike and into a car, which she thought that she had to rely on to get to her job downtown, and everywhere else. But this all changed after meeting and falling in love with Angela M. Angela M, is the name she gave to her new electric bike.

Here is what Bren had to say about her new life experiences with an electric bike.

"Just this morning I saw the little odometer on my bike registering 1,250 miles! Those are 99.9% commuter miles, to work, to local meetings, to grocery shopping and even to the doctor and dentist. It feels so very good to start and end the workday on Burlington's world-class bike path and nice to know that there are 1,250 miles of exhaust fumes that didn't mingle with our sweet lakeside air.

"Full disclosure: I'm a seasonal rider and my long commute is made possible with a sturdy reliable German-issued Kalhoff electric bike. I call my e-bike Angela M and without which I could not:

- ✓ navigate the east-bound Main Street traffic without wobbling out of bounds,
- ✓ enjoy the headwinds and the westerly gusts on the bike path,
- ✓ be unconcerned about riding in the dark and the rain and the otherwise,
- ✓ feel worry-free about the luxury commute time which also counts as mental health and physical fitness time,
- ✓ enjoy door-to-door home to office without dealing with parking, parking meters, and parking tickets,
- ✓ do some grocery shopping on the way home. The paniers can hold two large bags of groceries and their weight doesn't matter."

And in case you're wondering, according to the EPA, 1,250 miles of driving an average car produces 1058.22 pounds of carbon dioxide.

Rural states, such as Vermont, clearly need to reduce their environmental and economical footprint in order to attain a sustainable future beyond our current reliance on fossil fuels. Our fossil fuel-based transportation systems are a huge part of the problem. We need to look at all solutions and moving to electric vehicles of all kinds, including bicycles, is just one small part of the answer.

Bren's experience has led her awareness to bicycle safety and concerns for a healthy bike culture. "The Burlington Bike path offers a perfect alternative for the seasonal commuter that I am and will probably always be," she added. Having been extremely dubious about the proposed improvements to North Avenue road safety in the area, she enjoys the three-lane solution but would have preferred a Share the Sidewalk option over a Share the Road bike lane approach for her neighborhood link to downtown.

Safety while riding is important for the rider, the pedestrian and the driver

of motor vehicles. While bike paths are great, what about where there is not a bike path or on the roads to and from one? Should cities dedicate space in high traffic areas for bike lanes when it could lead to more congestion on our roadways? Is this a solution or a problem? Are there other solutions? Bren thinks sharing side-walks may be a viable option. She noted, "With respect to safety, additional or wider shared sidewalks for bike and pedestrians would be essential for everyone, drivers, bikers and walkers alike would need to be aware and respectful of one another and of the rules of the road, walk and/or path." This and other possible solutions need to be discussed.

Let's keep the conversation going and figure out what will work best for our rural state and communities. Many communities across our country and many other countries rely heavily on using bicycles for transportation to and from work. Let's make it work for us, too.

Here are some helpful links to make your experiences on an e-bike safer and lots of fun, too:

E-BIKE SAFETY:

- <https://www.bicycling.com/e-bike-safely/>
- <http://www.ebikeschool.com/safety-tips/>

BIKE MAPS AND ROUTES:

- VT: https://www.localmotion.org/maps_routes
- NH: <https://www.nh.gov/bikeped/maps.htm>
- NY: <https://albanybicyclecoalition.com/maps/>, <https://bikehudsonvalley.com/bike-maps>, <http://alloveralbany.com/bike-paths>
- Bike rides, tours, trails throughout New England: <https://bikenewengland.com/riding-nh/>
- A go-to guide for designing bike infrastructure: <https://nacto.org/guide/>.
- Local Motion is a VT advocacy organization: localmotion.org.

This article was first published on the Sustainable Transportation Vermont blog that is dedicated toward a greener, healthier transportation system. Read the original article by Julie Campoli at <https://www.stvt.org/Alvarez>. ♻️



Bren and her dog, Rojas, heading to the office. Courtesy photo. The mural behind them is by Ethan Azarian.

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Norwich, Vermont's Union Village Solar

A First of Its Kind Mixed-use Community Residential and Commercial Project

George Harvey

The Norwich Union Village Solar Project (NUVSP) in Vermont went online in August. It is a mixed-use community residential and commercial project, half owned by a total of sixteen households within the community and half by an investor. It was designed, permitted, built, and will be operated by Norwich Solar Technologies (NST).

NUVSP is one of only a few mixed residential and commercial community solar projects in Vermont. One earlier project was the subject of a Green Energy Times

article, "Thetford Strafford Community Solar," in its October, 2018 issue (<http://bit.ly/Thetford-Strafford>).

The residential community members who signed on to the project were participants in a Solarize Norwich campaign that was promoted by the Norwich Energy Committee (NEC). Linda Gray, a NEC member, told us that Norwich has done a Solarize Norwich campaign every year since 2012, typically seeing 25 to 30 households get solar systems as a result. The Town of Norwich has one of the highest percentages (25%) of households (325 out of 1300) that have



Owners on tour of their photovoltaic system and guests. Photos: Norwich Solar Technologies.

adopted solar. She had praise for NST saying, "I want to give credit to Troy McBride and Norwich Solar Technologies for their willingness to give this project so much time and for their patience." She said that developing a mixed-use community solar project is more difficult than simpler solar systems because of all the different coordination that has to be done.

As one of NST's Community Impact Investors, Paul Bozuwa worked with NST to set up a limited liability corporation as the investor for the commercial half of NUVSP. It is supplying electricity credits from the project to the Norwich Fire District

and the Town of Fairlee through net-metering. Because the solar credits are being sold under a long-term contract to municipal entities, the investment is considered to be low risk and qualify for low bank interest rates. Bozuwa said that one of the things that attracted him to the project was that the off-takers, owners, builders, and others involved were local to the Norwich area.

Mascoma Bank provided financing for the commercial half of the project and several households. Mascoma is a B-Corp, set up for public benefit. It has significant experience

with financing both residential and commercial solar systems, a fact that can benefit customers a great deal.

Troy McBride, the Chief Technology Officer and co-founder of Norwich Solar Technologies, told us a bit about the array itself. NUVSP has 648 solar panels made by Risen Energy. Each panel is rated to produce 330 watts. It has twelve

Fronius inverters. The array is rated at 150 kilowatts (AC).

The solar photovoltaic system is located on a little hillside. It is set back about 1,000 feet from Union Village Road and is mostly out of view because of trees that grow along the road and hillside. McBride described the system as having "great solar exposure without being highly visible." At the request of the owners of the land, the electric lines carrying power from the array to the electric grid connection were buried, putting them not only out of sight, but out of harm's way. Brite-Lite Electric and Green Mountain Power worked together to complete the 1000-foot underground interconnection.

Linda Gray mentioned that there was no ribbon cutting for the mixed-use system. Instead, McBride gave a tour to the owners soon after the array began delivering electricity to the grid. And now, the sun has taken up its role of providing clean electricity to all involved.



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LITHIUM VS. LEAD-ACID BATTERIES: COMPARING TOTAL COST OF OWNERSHIP

Craig Quentin, Applications Engineer, RELiON Battery

Compared to lead-acid batteries, lithium iron phosphate (LiFePO4) batteries offer users practical advantages such as lighter weight and hands-off operation. These batteries also have longer lifetimes which makes for far less frequent battery replacements and service calls.

But many first-time buyers of LiFePO4 batteries wonder if their higher purchase price compared to lead-acid batteries makes sense in terms of total cost of ownership.

Do LiFePO4 batteries cost more, or less, than lead-acid batteries over their operation lifetime? In this article, we present the results of a simple calculation that compares the total cost of ownership of a LiFePO4 battery compared to three lead-acid technologies.

ELEMENTS OF TOTAL COST OF OWNERSHIP

To estimate of the total cost of ownership of several battery technologies, we performed a simple cost calculation of a LiFePO4 and three equivalent size (BCI Group 31) off-the-shelf lead-acid battery technologies: flooded

lead-acid (FLA), Absorbent Glass Mat (AGM), and Gel. We took into account the most important factors such as:

- **Initial cost of the battery.** The up-front retail cost of the battery, the largest cost of initial installation.

- **Labor cost of installation.** A nominal cost of installing a battery, often performed by a skilled technician who, in some cases, must be scheduled and dispatched to the customer's site. This cost is approximately the same for each battery type, however, the process must be repeated multiple times with lead-acid batteries over the life of a single LiFePO4 battery.

- **Labor cost of maintenance.** In the case of flooded lead-acid batteries, for example, this includes checking and topping off water levels and cleaning acid residue off the battery and often the surrounding area, as well as cleaning and/or replacing nuts and bolts and cables that have become badly corroded. Lithium batteries require no maintenance during their lifetime.

- **Battery replacement costs.** Includes a new replacement battery plus the cost of removal and installation by a qualified technician.

- **Cost of charging.** The nominal cost of electricity for charging the battery. It includes the need for overcharging lead-acid batteries to avoid stratification (the accumulation of lead sulfate on the battery's plates). In our calculations, we assumed a DOD (depth-of-discharge) of 80% on all batteries before recharging was necessary.

Along with the initial cost of the battery, perhaps the most critical factor in estimating the total cost of ownership is the specified lifetime of the battery in terms of the number of cycles until end of life.

For our calculations, we took end of life to be when each battery fails to deliver 50% of its initial capacity for lead-acid batteries and 70% for LiFePO4 batteries.

The Estimated Cycle Life table shows the retail price and expected number of cycles until end of life, taken from retail websites and the manufacturer's published data sheets, of the four batteries used in this analysis.

ESTIMATED CYCLE LIFE		
BATTERY	RETAIL COST PER BATTERY (USD)	ESTIMATED LIFE (TOTAL CYCLES)
Flooded Lead-Acid	\$185	500
AGM Lead-Acid	\$270	400
Gel Lead-Acid	\$400	1,000
RELiON RB100 LiFePO4	\$1,050	7,100

THE RESULTS

The total cost of ownership of each battery was calculated over a single lifecycle of the lithium battery since it has the longest life of all four batteries. Each of the three lead-acid batteries requires multiple replacements over the life of the lithium battery. Assumptions for this calculation include: electricity cost for charging of \$0.12/kWh, battery maintenance costs of \$10/hour, and installation and replacement costs of \$25/hour.

The table below shows each factor in the overall total cost of ownership for each battery as well as the total cost of each battery per cycle. Based on the specified lifetime of each battery and their retail prices, the total cost of the LiFePO4 is far less in terms of each cycle and in terms of the overall cost of ownership. While the lead acid batteries have a far

TOTAL COST OVER LIFE COMPARISON

COST FACTOR	FLA	AGM	GEL	RELiON RB100
Purchase Cost	\$185	\$270	\$400	\$1,050
Installation Cost	\$25	\$25	\$25	\$25
Maintenance Cost	\$525	\$40	\$40	\$0
Charging Cost	\$970	\$970	\$970	\$850
Replacement Cost	\$2,600	\$5,450	\$3,000	\$0
Replacement Labor	\$700	\$1,000	\$375	\$0
# of Replacements	(14)	(20)	(7)	(0)
# of Cycles Over Life	(500)	(400)	(1,000)	(7,100)
TOTAL COST OVER LIFE	\$5,005	\$7,755	\$4,435	\$1,925
Cost Per Cycle	\$0.67	\$0.92	\$0.55	\$0.27

lower up-front cost, they require frequent replacement.

The total cost of ownership, including charging costs, of the LiFePO4 was \$1,925. That's 51% less than the Gel battery, the most economical of the three lead-acid batteries.

SUMMARY

LiFePO4 batteries reduce the inconvenience and expense of replacement and service calls, and they lend peace of mind to many users when it comes to demanding applications. As this article shows, LiFePO4 batteries are also beneficial to the bottom line. ☺

"We love to boondock and enjoy nature and our LiFePO4 lithium battery upgrade has been a game changer. Lithium technology provides us complete freedom to live off-grid in our RV. No more battery anxiety, and, without a doubt, the best money we've ever spent on RV upgrades. I can honestly say we will never own a RV without using lithium batteries."

- Aaron Jones, JonesN2Travel

Lead-Acid Technologies in Comparison to LiFePO4 Technology

- Lead-Acid
- AGM
- Gel

Calculation Parameters:

- Electricity cost for charging of 12c/kWh
- Battery maintenance costs of \$10/hr.
- Installation and replacement costs of \$25/hour

LiFePO4 Results Over Lifetime

- Total Cost of Ownership = \$1,925
- 51% less than competing lead-acid technologies
- Average cost per charge was \$.027



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SOLAR BUSINESS IN A BOX

David Blittersdorf



We often get asked, "when is the best time to go solar?" Our answer is always a resounding "now!"

For the planet, there has never been a bad time to go solar — with the carbon crisis we're facing, our planet needs more renewables, and fast.

For the individual though, there is currently a powerful incentive to move to solar before the end of the year. And the opportunities might be even bigger than you think.

Today, new solar owners are eligible for a federal tax credit of 30% of a project's cost. That means a new solar owner can deduct 30% of the total project expense off of their tax bill immediately. Depending on the project's size and a person's tax liability, a smart solar owner can get their tax bill down to almost nothing. In fact, if your tax liability is too small to use the whole 30% credit by the end of the project's first year, the remaining federal credit can be transferred forward for up to 20 years.

This solar Investment Tax Credit (ITC) program has been extremely effective at encouraging the deployment of renewables in Vermont and across the country. However, the program's incentives are about to decrease dramatically. The first reduction of the ITC begins on January 1, 2020. The current solar tax credit of 30% will drop to 26% at the end of this year, then to 22% for projects beginning in 2021, and finally down to 0% come 2022.

These solar tax incentives completely disappear in two years, so a smart homeowner or investor needs to act now to fully realize the potential of a solar investment.

While these savings apply to a simple home solar array, there is currently an opportunity for almost any Vermonter to take advantage of these savings at a much larger scale.

At AllEarth Renewables, we have pioneered an approach we call "Solar Business in a Box." The approach is actually quite simple, and it greatly expands the opportunities for savings for any Vermonter who pays taxes.

The process begins with the establishment of a Limited Liability Company (LLC), a straightforward and inexpensive process. The LLC is specific to the solar project and functions as a basket, holding all of the project's assets, liabilities, and costs. Additionally, the LLC establishes a liability barrier between your personal assets and the solar project, helping to mitigate risk in the event of any litigation or other issues.

This LLC, or "Solar Business in a Box," creates the vehicle to not only realize tax credit savings but also create long-term revenue. Here's how it works: Vermont's current solar permitting structure allows for inexpensive and streamlined permitting for projects up to the 15kW AC net-metering cap. For AllEarth Renewables, this has traditionally meant a three-solar-tracker array. However, any type of array up to the 15kW cap qualifies.

Power from this array is monetized through a Power Purchase Agreement (PPA). The project will be interconnected to Vermont's distribution grid through the state's net-metering program. Power generated by the project can be sent to any other customer, or "off taker," in the utility's service area. The PPA establishes a business relationship between the project LLC and the off takers, who pay you for their power usage, providing you with monthly revenue. Typically, the PPA sells solar power to the off taker at a 5-10% discount from their previous electric bill. The investment return is significant. A project developed in this manner can realize the owner a 15-40% ROI over a 20-year period!

As an additional incentive to act now, in Vermont, there is an additional 7.2% tax credit for businesses, such as LLCs. A business can expense 85% of the cost of a solar system over five years. If the system is installed in 2019, you can take 100% Bonus Depreciation and apply all the expense to this year's

Cont'd on p.17

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- Local Resident Westminister, VT

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BOYS & GIRLS CLUB OF MANCHESTER, NH GETS 2 SOLAR ARRAYS

Green Energy Times Staff

The Boys & Girls Club of Manchester has three new solar arrays at two New Hampshire sites. ReVision Energy, which has offices in Maine, New Hampshire, and Massachusetts, installed a total of 408 solar panels on three rooftops. An 81.3 kilowatt (kW) system was installed at the Union Street Clubhouse in Manchester, and two systems, with a combined capacity of 49.3 kW, were installed on the Pool House and Stebbins Family Hall buildings at Camp Foster in Bedford.

Together, the three solar systems are expected to produce about 150,000 kilowatt-hours of electricity each year.

According to ReVision Energy, this will reduce the carbon footprint of the Boys & Girls Club by about 152,000 pounds of carbon dioxide annually which is the equivalent of planting 81 acres of forest.

The array was financed by a five-year power purchase agreement with local impact partners. Under the agreement, the Boys & Girls Club of Manchester has no upfront costs, and its electricity rate is guaranteed for the term of the contract, as it reduces its carbon impacts. The agreement has a buyout clause that can be exercised at the end of the five years. Overall, the three solar systems

are expected to save the club about \$845,000 over the lifetimes of the systems, if the buyout is exercised.

The Boys & Girls Club of Manchester is one of the 53 founding organizations of Boys & Girls Clubs of America. It began working in 1907 and is currently trying to raise \$5.85 million for a series of renovations at the sites of the solar arrays. Though it has an annual membership of 2,600 boys and girls, the fundraising drive is to be able to serve



Members and staff of the Boys & Girls Club of Manchester gather at the new Stebbins Family Hall at Camp Foster in Bedford. Photos: ReVision Energy.



Solar array on the Union Street Clubhouse.

more children. The solar arrays, however, have been covered by the power purchase agreement and that part of the renovation has been covered. The web site for the Boys & Girls Club of Manchester is www.mbgcnh.org.

The web site for ReVision Energy is www.revisionenergy.com.



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Best Roofs for Solar Do you have questions if rooftop solar will work for you?

Taylor Kimbrell

Solar photovoltaic (PV) power is a great option when looking to reduce your energy bills and carbon footprint. As with any project for your home, there are several factors that need to be considered, including if your roof is compatible. A roof-mounted solar system is a great option, as it is the most cost effective, and it helps to extend the lifespan of your roof. However, not all roofs are ideal for a solar system. There are several factors that go into determining if your roof is a good fit for a solar system. These factors include roof orientation, pitch, roof components, material, load bearing, shading, and age. While your roof does not need to be a perfect fit in all these categories, as very few are, it is a good idea to be aware of how all these factors can affect the placement and size of the solar system for your home.

Roof Orientation – The roof plane that is best for a solar system is one that is facing south. This allows the panels to get the optimal amount of sun. The closer the direction the roof is to 180 degrees south the more efficient the solar system will be at capturing the sun's rays and converting



Rooftop solar arrays on shingled roofs, which are generally ideal roofs for solar, but other roofs are also good. Installed by Apex Solar. Courtesy photos.

them into energy. (See the article in the January 2019 issue of G.E.T. "Non-traditional Solar Orientation" for other solar array orientation solutions <http://www.greenenergytimes.org/2019/01/15/non-traditional-solar-orientation/>).

Pitch – The ideal angle (slope) for your roof is between 30 and 45 degrees from horizontal. This allows the panels to be at the optimal angle to absorb the energy from the sun when it is most seasonally advantageous for maximum production of your electricity.

Vents, Chimneys, and Dormers – If possible, you'll want to avoid installing solar panels near any vents, chimneys, or dormers. These elements can cause shading on the panels which can slightly reduce energy production.

Roof Material – The best roof materials for a solar system are asphalt shingles or metal. This is due to their durability and long lifespan. Slate tiles and cedar shingles are more fragile, and so it is not recommended to install panels and their supports on them. Therefore, most solar installers will only install on asphalt shingle, standing seam and corrugated metal roofs.

Load Bearing – On average, solar panels add an additional three pounds per square foot. The average roof should be able to withstand the additional weight of the panels. It is important to note that if a roof installation alters the load significantly, or unevenly, an engineer should be consulted.

Shading – While we love beautiful trees in our yards, it is preferable for them to be in a spot that won't cast any shadows on the solar panels. Therefore, the best roofs have minimal shading from trees in the yard.

Age – If your roof needs to be replaced in the next eight to ten years, it's a good idea to have it replaced before you have your solar system installed. Once installed, solar panels protect your

roof, at least the area of the roof that they cover, from the elements that can cause damage to it and this can extend the life of the roofing.

Solar systems are a great investment to make for your home and for the environment. When selecting a solar installer, bring up these factors that determine your roof compatibility for a solar system. They should be able to discuss them with you and help you determine how a solar system would be best positioned on your roof.

When making the switch to solar, understanding the compatibility of your roof with a solar system is a great first step in producing your own clean energy.

Taylor Kimbrell is the Vice President of Sales and Marketing for Apex Solar Power and Roofing in Queensbury, NY. Learn more at www.apexsolar-power.com / 518.309.2786. 



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SOLAR POWER AND FARMING WORK TOGETHER BEAUTIFULLY

George Harvey

We have seen a number of studies from the Fraunhofer Institute in Germany that look into combining solar power and agriculture on the same land. They show that some crops, such as hay, can be grown as well under solar panels as in the open. In fact, in one instance, potatoes were more productive under solar panels than they were in the open.

Now we see a study from the University of Arizona that goes further. The crops under the solar panels benefit from the shade in a sunny environment, but they also require less water, which is important in much of the country.

The practice of growing crops under solar panels is called "agrivoltaics." An article, "Agrivoltaics: Solar Panels On Farms Could Be A Win-Win," which appeared at the web site Civil Eats, describes its pursuit in Massachusetts (<http://bit.ly/2kqgcii>).

CleanTechnica had articles on Fraunhofer's work (<http://bit.ly/2m0kCwL>) and the study at the University of Arizona <http://bit.ly/2kvtOZO>. ♻️



Test of solar over crops. Image courtesy of the Fraunhofer Institute.



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FEDERAL

FEDERAL INVESTMENT TAX CREDIT

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

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

USDA RURAL DEVELOPMENT PROGRAM

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

- Finance the purchase of renewable energy systems, and make energy improvements; energy audits. Funding is awarded on a competitive basis; grant funding cannot exceed 25% of eligible project costs and combined loan guarantees and grants cannot exceed 75% of eligible project costs.
- Applicants include Feasibility studies/regular REAPs: agricultural producers and rural small businesses. Energy audits and renewable energy development assistance: local governments, tribes, land grant colleges, rural electric coops, public power entities. Grant must be used for Construction or improvements, purchase and installation of equipment, energy audits, permit fees, professional service fees, business plans, and/or feasibility studies. Find more at www.rurdev.usda.gov/NH-VTHome.html or call 802-828-6080 in VT or 603-223-6035 in NH

BIOREFINERY ASSISTANCE PROGRAM

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

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

- Increase the energy independence of the United States
- Promote resource conservation, public health, and the environment
- Diversify markets for agricultural, forestry products and agricultural waste materials
- Create jobs and enhance economic development in rural America
- For more information go to www.rurdev.usda.gov/BCP_Biorefinery

REGIONAL

NEW ENGLAND GRASSROOTS ENVIRONMENTAL FUND

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

- Must be volunteer driven or have up to 2 full time paid staff or equiv.
- have an annual budget up to \$100,000
- "Seed" grants of \$250-\$1,000 and "Grow"

grants of \$1,000-\$3,500

- Go to www.grassrootsfund.org/grants/ or call 802-223-4622 for more info.

VERMONT

CLEAN ENERGY DEVELOPMENT FUND

The Small Scale RE Incentive Program, administered by Renewable Energy Resource Center (RERC), provides funds to help defray the costs of new solar thermal and advanced wood pellet heating systems.

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

- Retail sales of "Advanced Wood Boilers" are exempt from Vermont's 6% sales tax. <http://tax.vt.gov/exemptions>,

• **Details at <https://fpr.vermont.gov/woodenergy/rebates>**

• Windham County

- For residential low- and moderate-income residents there is a pellet stove program. Contact the Windham and Windsor Housing Trust for more information: Tara Brown at 802-246-2119

- For wood heating (pellet or chip boilers/furnaces) in municipal buildings, schools, and non-profits contact the Windham Regional Commission: Marion Major at 802-257-4547 ext. 109 or windhamregional.org/energy/wwh

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

Pellet Sap Evaporators:

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

Other Utilities Heating Offers

- Members of Washington Electric Co-op (WEC) can get a \$1,000 rebate on approved pellet boilers/furnaces and \$500 for pellet furnaces; \$250 for qualifying pellet stove or wood stove installed by a qualified installer. This can be added to the CEDF and EVT incentives for a total of \$7,000. Call WEC for details: 802-223-5245.

- Members of the Vermont Electric Co-op can get a \$150 credit on the purchase of an approved pellet stove: www.vec/energy-programs.

VT TAX CREDITS

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

Tier III programs

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

EFFICIENCY VERMONT

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

Lighting

- Special pricing on select ENERGY STAR®

LEDs at Vermont retailers.

- LEDs for indoor growing: \$100 back for qualifying fixtures

Weatherization

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

Appliances (must be ENERGY STAR)

- Dehumidifiers \$25 - \$40 rebate
 - Clothes Dryers - \$200-\$400 rebates
- #### **Heating/Cooling/Water Heating**
- Central wood pellet boilers and furnaces: \$6,000 rebate (in partnership with CEDF)
 - Heat Pumps:
 - -Air-to-Water System: \$1,000/ton rebate
 - -Centrally-Ducted System: \$800/ton rebate
 - -Ductless Heating & Cooling System: \$400-\$500 discount at participating distributors
 - Heat pump water heaters: discounts up to \$600 at participating distributors
 - Window air conditioners: \$200 for select ENERGY STAR Emerging Technology models
 - Smart thermostats: up to \$100 back for select ENERGY STAR models.

Wood Stove Change-Out CEDF Change-Out (customer must have an existing/installed non-EPA certified stove to change-out):

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

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

Residential New Construction

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

Commercial and Institutional

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

Other Opportunities To Save

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

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Public Utilities Commission

NH PUC: Get up-to-date information at <https://www.puc.nh.gov/Sustainable%20Energy/RenewableEnergyRebates.html>

Commercial Solar Rebate Program

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

Incentive levels for PV systems are as follows:

- \$0.40/watt (lower of AC and DC) for new solar electric facilities (Step 1 application received on or after March 19, 2018); and
- Expansions to existing solar systems are not eligible.
- Incentive levels for solar thermal systems are as follows:
 - \$0.12/rated or modeled kBtu/year for new solar thermal facilities fifteen collectors in size or fewer;
 - \$0.07/rated or modeled kBtu/year for new solar thermal facilities greater than fifteen collectors in size;
 - Expansions to existing solar systems not eligible.

Contact ClSolarRebate@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. Please refer to the Residential PV program:

Residential Solar/Wind Rebate Program

-Effective January 2, 2018, this program offers rebates to qualifying NH residents who install photovoltaic (PV) or wind turbine electrical generation systems. Rebate levels are \$.20 per watt of panel rated power up to \$1,000, or 30% of the total facility cost, whichever is less. *Check for updates at <http://www.puc.state.nh.us/Sustainable%20Energy/RenewableEnergyRebates-SREG.html>*

Residential Solar Water Heating Rebate Program

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

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

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

Residential Wood Pellet Boiler/Furnace

- 40% of installed system up to \$10k
- Must meet thermal efficiency and particulate emissions standards www.puc.nh.gov - Sustainable Energy or tel. 603-271-2431 for more information and current program status

LOCAL INCENTIVES

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

- *These are offered on a town-by-town basis.*
- The state also has passed PACE (property-assessed clean energy) enabling legislation which will allow towns to use the PACE mechanism to finance clean energy projects through property taxes
- Visit <https://www.nh.gov/osi/energy> for more information.

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

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

NHEC offers incentives for Level 2 Electric Vehicle Charging Stations.

- For Commercial and Municipal Members - Incentives are up to \$2,500 per charging unit. A maximum of two charging units may be installed

off-peak hours at a rate that is lower than the basic residential rate.

NH Home Performance with ENERGY STAR

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

- Visit www.NHSaves.com/HPWES for more information and an online Home Heating Index calculator

NH ENERGY STAR Homes

- Incentives for new homes which meet ENERGY STAR guidelines. Incentives include
- HERS rating fees paid by the utility, rebates for ENERGY STAR lighting, appliances – up to \$4,000 based on the HERS score.
- Visit www.NHSaves.com/newhome for more details.

NHSaves Residential ENERGY STAR® certified Products Program

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

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

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

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

NHSAVES Online Store

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

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

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

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

NHSaves: nhsaves.com

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

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

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

Other NH Electric Utility Programs

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

- Visit www.NHSaves.com/resource/ for individual utility contact information.

Business Programs

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

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

NH Weatherization Assistance Income-Eligible Programs

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

Visit <https://www.nh.gov/weatherization.htm> for application criteria, FAQs and local program contacts

MASSACHUSETTS

Commonwealth Solar Hot Water (SHW) Programs

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

- Homeowners are eligible for a base rebate amount of the lesser of \$4,500 or 40% of the installed cost. The system may also be eligible to receive additional funding ("adders") which increase the amount of the rebate. Adders are detailed in the program manual at http://files.masscec.com/SHW_Manual.pdf
- Visit <http://www.masscec.com/shw>

MassSave Heat Loan SHW

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

Energy Efficiency

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

Mass. Solar loan Program

Mass Solar Loan focuses on connecting homeowners who install solar PV systems with low-interest loans to help finance the projects.

- The \$30 million partnership program between Massachusetts Department of Energy Resources (DOER) and MassCEC, will work with local banks and credit unions to provide financing to homeowners interested in solar electricity. DOER's program expands borrowing options through lower interest rate loans and encourage loans for homeowners with lower income or lower credit scores.

- Since 2008, the solar electric industry in Massachusetts has grown into a robust economic sector with over 1,400 businesses and 12,000 workers, with enough solar electricity installed in the Commonwealth to power more than 100,000 homes.

- Mass Solar Loan will continue to grow this sector, while allowing more homeowners the ability to achieve the cost savings and environmental benefits of this clean, renewable energy source. www.masssolarloan.com.

The most updated loan principal buy down rate based on household income can be found For Residential Members – Incentives are up to \$300 per charging unit. By participating in the residential program, at <http://www.masssolarloan.com/>.

- Renewable Thermal Infrastructure Grant Program: <https://www.mass.gov/funding>

DEPT OF ENERGY RESOURCES

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

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

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

MA SMART INCENTIVE

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

MA STATE INCENTIVE

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

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

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

HEATING PROGRAMS

- The Commonwealth Woodstove Change-Out program, a partnership between MassCEC, the Massachusetts Department of Environmental Protection and the Department of Energy Resources, offers rebates to assist Massachusetts residents in replacing non-EPA-certified wood stoves with cleaner, more efficient EPA-certified wood or pellet stoves. Woodstove Program Info: <http://bit.ly/mass-cec-woodstoves>

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

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

ELECTRIC VEHICLES

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

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NYSERDA

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

EV Incentive from National Grid

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

- Energy Rebates: <https://NG-energy-rebates>

National Grid: Heat Pumps

Total incentive amount not to exceed

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

Home Energy Waste

Getting a home energy assessment can help you take control of your energy costs, identify where your house is using the most energy and which improvements would have the biggest impact on your bottom line. Heating and cooling costs frequently account for 50% of residential energy bills. Identifying your energy waste can lead to big savings. Visit: <http://bit.ly/ny-nrg-waste>.

RENEWABLE ENERGY/NY-SUN

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

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

The Megawatt (MW) Block Dashboard

provides real time info on the status of block and current incentive levels by sector and region. Block status is updated as applications are submitted, so check for current status. <http://bit.ly/MW-block>

Residential and Small Business

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

Commercial and Industrial

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

Commercial Energy Storage

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

Community Solar

- <http://bit.ly/NY-Sun-Community>

Commercial/Industrial PV Installer

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

Residential/Small Commercial

Solar PV Installer

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

Financing Options

- <http://bit.ly/NY-Sun-Financing>

Clean Power Estimator

- <http://bit.ly/NYSUN-power-estim>

Geothermal

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

Electric car

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

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

Utility sponsored incentives & tips:

http://bit.ly/utility-sponsored_incentives

Clean Energy on Farms

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

National Grid

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

- For more utility rebates google the utility name and search for rebates.

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

POND GEOTHERMAL HEATING: HOW DOES IT WORK?

George Harvey

Many people seem to be confused by heat pumps. The fact is that nearly all of us have them in our homes and cars. A refrigerator has a heat pump, extracting what heat it can from the inside of the unit and delivering it into the kitchen. Air conditioners do the same thing, taking heat from a warm place and releasing it into another that is warmer. But it seems odd to be taking heat out of a freezer.

In a common refrigerator, the action of a heat pump starts with com-

pressing a gas, which makes it hotter and denser. Then the heat is removed, so the gas is closer to room temperature but still dense. Then the pressure is released, which cools the gas far below room temperature. Then it is put through a heat exchanger for the refrigerator, which warms it up but makes the refrigerator cold.

A home heating and cooling system can work on the same principle. The really nice thing about this is that it uses far less energy to pump heat than it does to create it. A resistance heater, such as an ordinary space heater, oper-



In the north, a pond has to be deep enough for the heat exchanger to be at least two feet below the ice all winter. This is usually six to eight feet.

ates at nearly 100% efficiency, in terms of converting electricity to heat. But a heat pump can heat just as much using a third of the amount of electricity or less, making it much less expensive than nearly all other ways to heat a home. It may boggle the mind, but it is true. And it can also run the other way to cool a building in the summer.

There are a number of different ways to run a heat pump. One is to extract heat from the outside air, which is how air-source heat pumps work. That is a good solution, compared to most other heating systems. It is like running an air conditioner



In areas of the south, where the major load is cooling, a shallower pond that does not freeze solid can be sufficient. Photos courtesy of AWEB Supply.

backwards. It has the flaw that the outside temperature can drop below the heat pump's limits, which it will do at temperatures between -10°F and 20°F, depending on the unit. (Inexpensive heat pumps that mount in windows are not good for low temperatures.) Another failing of air-source heat pumps is that there are very much more efficient ways of extracting heat than taking it from outside air, which is not all that good at transferring heat under any circumstances.

Geothermal heat pumps address the major issues of air-source heat pumps. They extract heat from the ground or wa-

ter. These sources are not just warmer than the air on a bitter cold night; they are also much better at moving heat.

There are a number of ways to set up geothermal heat pumps. The heat exchangers on the outside of a building can be buried below the ground surface, which means a large area has to be excavated. Or they can be in drilled wells. Both of these solutions are rather costly, but for those fortunate enough to have it, there is an alternative.

An alternative solution to costly drilling is to put the

outside heat exchanger into a body of water. Of course, a pond or river used for this purpose has to be large enough, and the question of whether it is or not should best be answered by someone who can do the calculations involved.

Most solutions to water-based geothermal heating pumps involve long stretches of flexible pipes that are looped over and over, lying on the bottom of a pond. To be flexible, these pipes need to be made of some sort of plastic, which is not very good at transferring heat, and this is why they need to be so long.

Cont'd on p.17

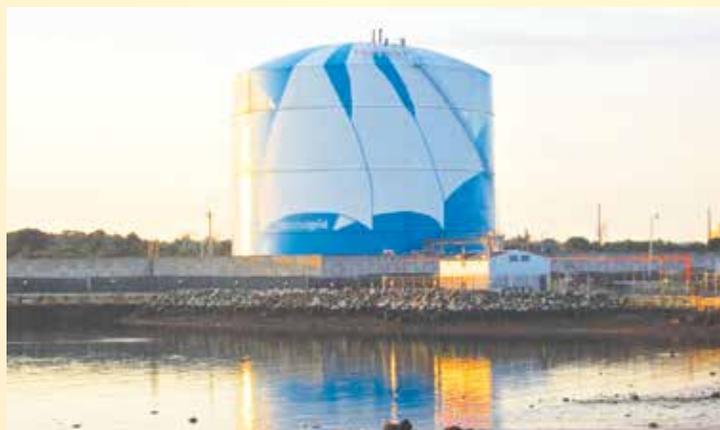
The Impacts of Natural Gas on Our Planet

George Harvey

Methane can be found all over the world. It is the primary ingredient in natural gas, the fossil fuel drawn from the Earth, and in renewable natural gas, which is produced at landfills and biodigesters. It has many uses for heating, for generating electricity, and as a chemical feed stock. But it is a powerful greenhouse gas, causing climate change, and many scientists believe that replacing coal with natural gas as a fuel is not a significant improvement.

To understand the problem with natural gas as a fuel, we should think about how it is extracted, transported, and used. Much of our natural gas comes from fracking, fracturing rock formations so gas bound inside them will be released.

While the gas companies claim that fracking is safe, there are a number of reasons for concern. Fracking is achieved by pumping chemicals underground, and some of these chemicals are toxic. Since fracking involves breaking up rock, it is conceivable that it would release methane and fracking chemicals through cracks that are opened to the surface. Disturbing im-



National Grid natural gas storage tank. Fletcher6, Wikimedia Commons.

ages of continuous fires lit on the surface of running water cannot be easily explained as a natural effect of, for example, anaerobic action.

There are other ways that methane can be leaked at extraction sites. Scientists have been able to demonstrate that the amount of methane in the atmosphere is significantly greater at the wells than it is elsewhere. Somehow, though the industry does not want to admit it, the gas is getting out.

Once the gas is extracted, it has to be transported, usually through pipes at high pressure. These pipes can be hundreds of miles long, and pressures can be quite high, so leaks occur. Even at low pressure, there are leaks. One survey of Boston found over 2,000 of them detectable by

equipment in a car. A careful check on this test found even more.

Methane is dangerous not only for the climate, but because it can explode. Gas explosions and fires cause by leaking methane happen regularly in the United States. The fires can be serious enough that entire neighborhoods might burn. Last year there was a series of over 70 explosions and fires in houses in one part of Massachusetts. An explosion in 2010 burned down 35 houses in San Bruno, California. These are just notable examples of events that come about

every few months.

The Trump administration has been pushing natural gas, because it offers jobs and keeps gas prices down. One result of this is that it is a low-cost fuel, and a lot of people are employed. A problem is that the companies doing the fracking have financial difficulties because the price of their product is low. In fact, their problems are so great that a former chief executive of one of the largest fracking companies told an audience at a petrochemicals conference that fracking has been an "unmitigated disaster" for investors in shale companies (CleanTechnica - <http://bit.ly/fracking-losers>).

Because a glut of natural gas in the U.S. has put jobs into peril, the administration has been trying to increase exports.

This is a dubious benefit, because other countries have been doing the same thing, increasing the supply. Meanwhile, demand for natural gas has gone flat worldwide.

The petrochemical industry has been looking for new markets for natural gas. Some gas producers have decided that it would be a good idea to switch from oil to gas for chemical feedstocks for the plastics industry. Of course, this has come about at just the point when countries are beginning to understand the dangers of plastics in the environment. They are in ocean gyres; they are in polar snow. They are found in our food and in the air. And they are causing environmental destruction.

Even as we stop using fossil fuels for heat and electricity, and as we give up on plastics, I believe there will continue to be reasons to use methane. With reduction in fuel and feedstock uses, however, it will not be necessary to use so much. It will also not be necessary that it be extracted from the Earth. It can be produced by landfills and biodigesters. The U.S. Department of Agriculture projected a need for over 10,000 biodigesters for farms alone. The number of biodigesters that might be put to use for waste treatment is probably much larger. And the methane that they capture, which otherwise would have gone into the environment, should be put to use.

It looks like fracking might be short-lived. We can hope. 

POND GEOTHERMAL HEATING

Cont'd from p.16

Another approach to water-based geothermal heating was developed by Alan Watts of AWEB Supply, which has been installing its systems since 1995. This was first reported in Green Energy Times in the issue of April, 2018 (<http://bit.ly/GET-AWEB>).

AWEB Supply sells SlimJim® heat exchangers, made of stainless steel, and Geo Lake Plate®, made of titanium. These materials transfer heat far more efficiently than plastics. This means that the amount of piping needed for the heat exchanger can be greatly reduced, allowing for a rather compact system.

AWEB Supply's heat exchangers can be used for any geothermal-style system near a sufficient body of water. For a small house, that might mean as little as one-third of an acre, providing the pond is deep enough – perhaps six to eight feet. The systems are connected to heat pumps at the buildings they heat and cool by buried pipes, through which water flows. The systems are not exposed to freezing temperatures, so no other chemicals are needed.

AWEB systems can also be used on much larger systems. For example, one of the larger systems AWEB installed is for Disney Barracks, one of the largest buildings at Fort Knox. The fort built a pond for this just to provide the water.

Anyone who lives on a pond or river might do well to think about having a water-based geothermal system from AWEB. While AWEB does not sell directly to consumers, the company is happy to refer customers to contractors in their areas who can undertake installation. Chris McCaskill, one of the owners of AWEB, told us, "It's worth giving us a call." He can be reached at Chris@awebgeo.com, or by calling (225) 928-2630. AWEB's website is awebgeo.com. ♻️



A pond being built with geothermal for heat.

SOLAR IN A BOX

Cont'd from p.10

taxes. Next year, though, the Bonus Depreciation drops to 67%, and in 2021 it goes down to 33%.

When the federal and state tax credits and savings are combined, your first year out-of-pocket cash is usually reduced to about 50% of the total solar system cost.

Financing a project this size may seem elusive to many Vermonters, but the truth is it has never been easier for a Vermonter to finance a solar installation. VSECU is currently offering no-money-down full solar loans for projects up to 15kW. Through PPAs you can begin immediately generating monthly income above the costs of loan payments. Over time, the high return on investment is a rate that any large-scale investor would be envious of.

Opportunities are rare for low-risk,

WINNER OF 76WEST GRAND PRIZE UNVEILS INNOVATIVE NEW SOLAR SOLUTION

Skyven Intelligent Mirror Array™ installed at Copses Farm in Valley Falls, NY

George Harvey

The New York State Energy Research and Development Authority (NYSERDA) runs the 76West competition to encourage growth of clean energy. According to its website, it is "designed to further develop the regional community of clean energy technology innovators, industry experts, educators, and investors, as well as help startups get early users for their technologies." The competition is limited as to the types of businesses involved and how they can have impact in the eleven counties the rules designate as the Southern Tier (<http://bit.ly/NY-76West>).

In 2017, the 76West Grand Prize went to Skyven for a technology the NYSERDA called one of the first renewable solar solutions for industrial steam in the world. Now the first installation of that technology, manufactured in New York, has been completed. Skyven calls the array the Intelligent Mirror Array™. It was installed at Copses Farms in Valley Falls, New York. This is the second installation of the technology in the country.

Skyven's technology concentrates sunlight on a thermal collector, and the heat is transferred to water. Skyven, which is based in Texas, worked with Cameron Manufacturing and Design, which is based in the Southern Tier town of Horseheads, NY to build systems locally.

Copses Farm is a 2,600-acre dairy operation with 720 cows. Each time its equipment is used, it must be cleaned thoroughly. To do this, it needs 50,000 of very hot water annually. Heating this



Ken Desbois from the Radiant Store in Troy, NY installed this renewable industrial steam solar system at Copses Farm in Valley Falls, NY. Photo courtesy of Terrence Moag.

water requires a lot of energy, but with the Skyven mirror system, this energy can be renewable and free of emissions. The system at the Copses Farm is not large, as it has only nine solar panels. The panels appear to be about the size of a large solar photovoltaic panel. The system was designed and installed in a collaborative effort between Skyven and the Radiant Store. Ken Desbois from the Radiant Store installed the system.

As the Grand Prize winner, Skyven was awarded \$1 million in 2017. Arun Gupta, founder and CEO of Skyven, said he was attracted to doing business in New York

by the 76West competition. Because the award required a business presence in the Southern Tier. He looked at the local businesses to see which he thought was best, and partnered with Cameron Manufacturing and Design in the end.

Another New York business with experience with Skyven's new type of solar system is The Radiant Store. Terrence Moag, CEO of Radiant Store Inc., said, "Skyven's Intelligent Mirror Array™ is a giant step forward in the solar thermal market by providing concentrated solar technology to industrial and commercial businesses on a global scale at a fraction of the cost. The market for this technology is truly massive. I am really impressed with the performance of the system and thrilled our technical team at Radiant had the opportunity to install the system which will help New York reach its clean energy goals."

The 76West competition is held every year. Each year, its Grand Prize awards \$1 million. A second-place winner gets \$500,000, and four other awards are made, each coming to \$250,000, so the amount awarded is \$2.5 million annually. The competition is now four years old.

The Skyven system is sold for industrial use only, at present. We do not have information on when, or whether, it might become available for residential use. The company, however, is rather young, as all 76West contestants must be, and will doubtless continue to develop this new technology.

Learn more from Terrence Moag at the Radiant Store: tmoag@theradiantstore.com or 518.376.1884. ♻️

good return, and socially responsible investments. However, owning a solar project as a financial investment offers the ability to diversify your financial portfolio to include tangible, real, high-value assets, lower your tax burden, and reduce carbon emissions by supporting greater renewable energy penetration.

We encourage you to think big. The planet demands it. "Solar Business in a Box" might just be the ideal approach for you. Please do reach out to us at AllEarth. We'd love to talk further about helping you making your dreams of owning your own solar business a reality!

David Blittersdorf is an entrepreneur and engineer from Vermont with nearly four decades of experience as an innovative leader in the wind and solar energy industry. David founded NRG Systems in 1982, and AllEarth Renewables in 2004. Their website is: AllEarthRenewables.com. ♻️

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REALIZING MARKET VALUE FOR HIGH-PERFORMANCE HOMES

Jeffrey Gephart, Real Estate Trade Ally Outreach, Efficiency Vermont

The benefits of a high-performance home include affordability, comfort, and durability. These homes have lower energy bills resulting from high insulation values, low air infiltration, high efficiency mechanical systems, and in some cases renewable energy. They're also healthier due to ventilation systems that reduce pollutants, control humidity, and provide fresh air for occupants. Unfortunately, these benefits don't always result in a higher market value for the home.

Appraisers look to the recent past for comparable home sales, looking for homes in a similar location, square footage, and number of bedrooms. For years, new homes were built with little change in energy efficiency so appraisers have grown accustomed to simply performing the sales comparison method of appraisal. This works fine when, to quote the song Little Boxes, "they're all made out of ticky-tacky and they all look just the same."

High-performance homes are built and perform much better for their occupants. While they are typically more expensive to build up front (or to retrofit after they're built), the savings in energy costs often offsets the higher mortgage cost and can provide their owners a lower total cost of ownership.

In Vermont and New Hampshire, few appraisers have had training in appraising high-performance homes. Training can help appraisers know where to look for comparable, high-performance homes or how to use other tools in

their tool box, such as the cost or income capitalization methods of appraisal.

So, if you're looking to sell or buy a high-performance home, what can you do to ensure you're getting the value?

If you're a seller, you can verify your home's energy efficiency features using a qualified, independent, 3rd party verifier such as a Home Energy Rater or a Building Performance Institute certified auditor. Reach out to Efficiency Vermont in Vermont or NHSaves in New Hampshire to identify a verifier that will work for you. Information from these energy efficiency professionals should be transferred to the Appraisal Institute's Residential Green and Energy Efficient Addendum to provide to a potential buyer or to your real estate agent who can include features in your MLS listing.

If you're a buyer, look for energy-efficient and renewable features that will save you money while increasing health, comfort, and durability. If there are opportunities for energy upgrades, rebates exist through state programs like Efficiency Vermont and NHSaves to help cover the costs of improvements and in some cases provide financing. You can also look for "green" loan products through area lenders.

Vital Communities based in the Upper Valley of New Hampshire and Vermont has helpful tips for buyers and sellers through Green Real Estate content on their website.

If you're seeking financing, providing the Green Addendum with information on green features early in the process no-

tifies the lender that they have a special property type that requires additional research and likely expense in hiring a competent appraiser. The Appraisal Institute has a cover letter template to accompany the Green Addendum explaining its purpose for lenders who may not be familiar with it.

The Vermont Association of Realtors® will be conducting their third, Vermont Green Real Estate Symposium on October 23, 2019 at Killington Mountain Resort, Killington, VT. The Symposium offers a day's worth of continuing education credits for real estate professionals. For those seeking to buy, sell, or build a high-

performance home, the Symposium will cover what is needed to realize the true contributory value of high-performance home features.

Links:

- 1 Efficiency Vermont - efficiencyvermont.com
- 2 NHSaves - <https://nhsaves.com>
- 3 Residential Green and Energy Efficient Addendum - appraisalinstitute.org/green-bldg-resources
- 4 Vital Communities - vitalcommunities.org/greenrealestate
- 5 Appraised Value and Energy Efficiency: Getting It Right - appraisalinstitute.org/AI-BCAP_Flyer.pdf
- 6 Vermont Green Real Estate Symposium - vermontrealtors.com/green19



Attn: REALTORS!
Green Real Estate Crash Course
3 dual VT/NH CE credits
Nov. 19 in Lebanon, NH
Register Online

Free Online Resources
vitalcommunities.org/greenrealestate

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Energy Audit Recommendations for Your Home

This is the second in our home-inspection tips series

Michael Canavan

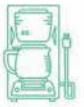
Now that you have received your Home Energy Audit report, how do you understand the report and what does it mean to you, the homeowner? The report generates recommendations that provide the highest energy performance with payback periods of less than ten years. The recommendations are listed for how quickly the savings can be generated based on the cost of material and installation along with the local cost of energy being used in the home. Each homeowner should decide which upgrades he or she may want to do over time and not be concerned about having to do them all at once. Do some of the simple ones (light bulbs) and see the change in savings, then move on to another recommendation. How fast you do them is dependent on your own comfort level.

The report has two levels of recommendations.

The first group will help you save energy now, items such as chang-

ing to LED lights; tightening doors and windows; adding insulation in attic and basements; and sealing and insulating ductwork. This group can be done by the homeowner with a small amount of training via YouTube videos and reading directions on packaging. This group is intended to help you use less energy by reducing energy losses with small efficiency upgrades and adding to your home's comfort level with easy changes. The return on the investment in these upgrades is usually less than two years.

The second group is for planning purposes as equipment, building systems and appliances need upgrading or replacement. This group includes air conditioning, heating systems, water heaters, roofs, appliance upgrades and window replacements. For this group, you, the homeowner, will need to research information on the systems, efficient use of energy, cost, and changes within the home's space. The research should also include reviews for companies that are recommended by homeowners that have

ENERGY COST ESTIMATES BASED ON TYPICAL USAGE IN BRADFORD, VT					
					
HEATING	COOLING	LARGE APPLIANCES	SMALL APPLIANCES	LIGHTING	HOT TAP WATER
YEARLY BILL \$4,363	YEARLY BILL \$0	YEARLY BILL \$394	YEARLY BILL \$210	YEARLY BILL \$80	YEARLY BILL \$311
MONTHLY BILL \$364	MONTHLY BILL \$0	MONTHLY BILL \$33	MONTHLY BILL \$18	MONTHLY BILL \$7	MONTHLY BILL \$26
POTENTIAL SAVINGS \$1,832	POTENTIAL SAVINGS \$0	POTENTIAL SAVINGS \$13	POTENTIAL SAVINGS \$0	POTENTIAL SAVINGS \$0	POTENTIAL SAVINGS \$69
SEE MORE					
TOTAL ESTIMATED COST \$5,358		TOTAL AFTER UPGRADES \$3,444		POTENTIAL SAVINGS PER YEAR \$1,914	

Graph and Chart designed with Energy Tool from NACHI

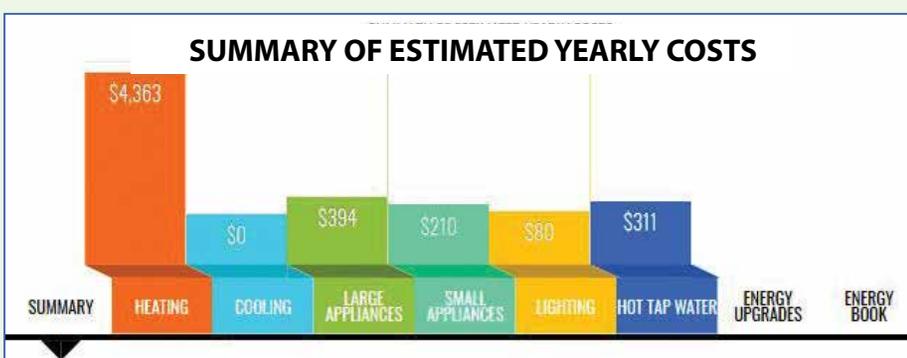
used those companies or the suppliers that those companies use, and how you feel they interact with you. You will need to be comfortable with their knowledge of the equipment that they will install in advance of upgrade or replacement of your systems.

One of the reasons for doing the Home Energy Audit is to save money on your home's energy cost. Simply put, your savings is the cost of energy used before improvements minus the energy cost after the improvements. The return on the improvements equals the cost of the improvement divided by the difference in energy saved, which pays for the improvements for over a period of months. The return on the investment in these upgrades is usually two to ten years.

Doing the energy improvements recommended in the Home Energy Audit will increase the comfort of your home and increase its value by being more energy efficient. Homes that have energy-efficiency upgrades show that the home has been maintained, which generally will receive a higher resale value.

G.E.T. has current listings of incentives by federal, regional, and state for available programs for payment assistance at WWW.DSIREUSA.org.

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



IPCC ISSUES GLOBAL GUIDE TO THE USAGE OF LAND

*"Governments challenged the IPCC to take the first ever comprehensive look at the whole land-climate system."
 – Hoesung Lee, IPCC Chair*

J. D. Kaplan

In the July 2019 issue of G.E.T. ("Movement On Decarbonization," <http://www.greenenergytimes.org/back-issues-download/>), I said that it is certain that we had better start unwinding carbon if we expect to survive.

There is uncertainty, though, in a few carbon quantities otherwise well fleshed out. That means that a wildcard may give us plenty of time, or it may halt, spilling oceans onto land masses. The persistence of sunken carbon dioxide in certain places around the globe—perhaps a feedback loop has an expiration date—leaves the possibility of total survival on an unknown time scale.

The most salient Joker's Parcel, if you will, might be the Russian permafrost. This is mentioned in the new report from the IPCC1, which issues guidance on the usage of land. Here, I'd recommend the dry language of a report meant for bureaucrats and policy wonks over major media any day. The argument is made that uncertainty within climate change science should motivate expenditure to manage land more carefully, rather than to pull back and ready the life boats. Who wants to endure paranoia?

In a set of guidelines that include ecologic results, quantities of CO2, and exploration of socioeconomic outcomes, the choices people make in their usage of land is hashed out.

The IPCC has produced a volume in as much detail on this subject as anyone with money to invest could



The way we divide up and use the land matters very much to climate change, says the IPCC. Image: Thomas Ehrhardt, Pixabay.

Every statement in this report carries a weight rating, of a sort, a stated level of certainty among IPCC contributors. Competing viewpoints aren't lost, in this way. It also isolates areas of uncertain outcomes—wild cards, up in the air literally but with boundaries to the havoc we fear from them.

The reading is dry and the structure is technical, but the report does

ever ask for. There are numbers and keen observations regarding the farming or development of land, projects to convert it between those or, say, back to wetlands from a respectable career as the footprint of a shopping mall, and policy that affects land & people anywhere. The Special Report is around 1500 pages and offers all the science and reason that officials, land owners, and investors might use to best manage their land, all reasonable end-games considered.

Special attention is given to food security, as the potential for conflict sprouts up just where humans begin to hold the land higher in value.

a stellar job of explaining why being sustainable ecologically might have an economic benefit. The IPCC also makes clear why local action about the forests and the land may affect regional climate no matter what the CO2 level is around the globe. Some benefits of advancing carbon-related action right away are presented. Policies reaching for CO2 reduction can be designed to benefit the poor rather than taxing them, to empower women and minority groups in a population rather than sidelining them, and even to knit a fabric of collaborators in a society that might otherwise be headed for conflict by way of eco-limitations and stress.

A great mass of detail is presented therein, exploring a wide variety of situations a government may confront. It addresses all levels of material wealth and considers the full spectrum of developed states. More than half of the contributors are from developing countries, so it reflects a serious mix of progress around the world. It may also reflect its challenges, but it is at least as dedicated to looking forward and meeting challenges as the best of the actors in the land trust movement in America.

The report can be found at www.ipcc.ch. If you're unfamiliar with the group that produced the report, there is an objective writeup from an outside party at UCSUSA.org.

J. D. Kaplan is a certified remote pilot and a former member of the I.T. crowd. He is a reader in the areas of bioelectromagnetics and cryptocurrency. He lives and works at or above sea level near Boston. ♻️

US CITIES SCORECARD

Cont'd from p.3

ramp up their efforts to reduce climate pollution and improve lives for urban communities," said Antha Williams, Environment Programs Lead at Bloomberg Philanthropies, a major funder of the ACEEE report. "The Scorecard documents the incredible growth of the field and Bloomberg is proud to support these

efforts through initiatives like the American Cities Climate Challenge."

Lois DeBacker, managing director of The Kresge Foundation's Environment Program, also a major Scorecard funder, said: "It is vital that cities move quickly to reduce their carbon emissions and that they do so in ways that engage and benefit all residents, including low-income communities and communities of color. ACEEE's City

Clean Energy Scorecard offers a clear guide for local leaders to learn from one another how to transition to clean energy in an equitable manner."

The American Council for an Energy-Efficient Economy acts as a catalyst to advance energy efficiency policies, programs, technologies, investments, and behaviors.

The scorecard report is at: <https://aceee.org/research-report/u1904>. ♻️

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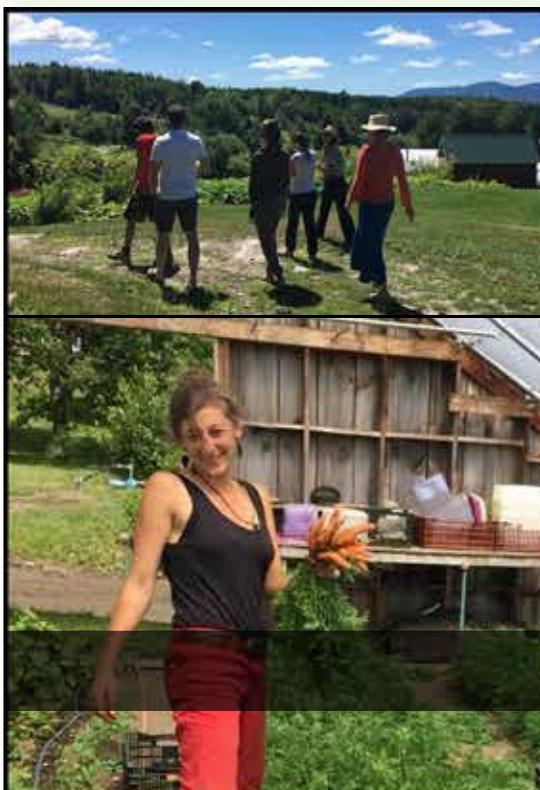
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RESILIENCE IN LEBANON, NEW HAMPSHIRE

It Takes a Community of Exemplary People and Projects.

George Harvey

Shaun Mulholland, the City Manager of Lebanon, New Hampshire, has a lot to do, even without worrying about energy and climate change. He is very much aware of the need for planning for the future, planning that is all the more difficult because the environmental needs are a moving target, and the technologies available to meet them are constantly changing. His job is all about economics. And it is also all about ensuring that Lebanon is a nice place to live. But it is also all about resilience and emergency management.

Speaking on the issue of sustainability, Mulholland emphasized to Green Energy Times the complexity and extent of the job, "One person cannot do all the work." Far too much for a city manager, the subject may even be too big for a single dedicated Energy and Facilities Manager. Fortunately for Lebanon, there are many people already deeply engaged. Lebanon is a hotbed of activity for solving the problems of energy, efficiency, pollution, and climate change. There are many stories begging to be told of many active people and many organizations engaged in many active projects.

Lebanon started working on sustainability and climate change years ago. Its emissions began to come down in a meaningful way a few years ago, when it started to flare the methane coming from the landfill, one of its biggest greenhouse gas problems. Lebanon's City Council moved the issue along more, when it committed the city to abide by the goals of the Paris Climate Accord. Then last summer, the city undertook a comprehensive greenhouse gas inventory with help from the UNH Sustainability Institute.

A landfill gas project is nearing the point where it will be turning that gas from a problem to an asset, in which the gas is no longer flared but used for energy. The landfill is divided into sections of ten to twenty acres each. One is capped to prevent methane from escaping. The trash in another has to be dug up, so it can be lined and capped. About ten acres are in use as a landfill, and part of this is capped. About six acres are to be permitted for future use. Gas extracted from the landfill is largely methane, which is a powerful greenhouse gas that should not be released, but which can be used for a lot of things, including generating electricity and heating buildings. So, a gas that is dangerous to the environment is at the same time a fuel that could reduce costs for the town.



Double rainbow at sunset on the ramp at Lebanon Airport (LEB). Photo submitted by Charles Freeman. All images downloaded from the LebNH Photo Gallery: <https://lebanonnh.gov/710/LebNH-Photo-Gallery>

James Donison, Director of the Department of Public Works (DPW), has been very active on the landfill gas project, overseeing each of the various stages of activity. To give an idea of the size of these projects, the city has allocated \$2.8 million, but more may be coming. Donison told us about the city's vision also to have a biodigester that would convert organic waste from the region into compost and bio-methane, reducing the electricity needed to operate the water treatment plant, supplying heat in addition to electricity from the landfill gas project. Organic waste will produce methane as it decomposes in nature and using it to produce electricity or heat converts it to carbon dioxide, which is a far less powerful greenhouse gas.

Clifton Below is the Assistant Mayor of Lebanon, chair of the Lebanon Energy Advisory Committee (LEAC), a former state senator and member of the NH Public Utilities Commission. He has been heavily involved in energy issues locally, state-wide, and across the region, having helped to write five pieces of NH legisla-

tion this session alone. Perhaps the most important of these involves municipal aggregation (see separate article on this page). Aggregation is important because it makes it possible for residents of the city to reduce energy costs and move quickly to renewable electricity at the same time.

Below's longtime active interest in energy has been valuable as he currently sits on the Grafton County Delegation Executive Committee, the Planning Board of the City of Lebanon, and the Steering Committee of the National Council on Electricity Policy. He is also engaged in transportation issues and sits on Lebanon's Pedestrian and Bicycle Advisory Committee.

In addition to his role as Assistant Mayor, Below chairs the Lebanon Energy Advisory Committee. He is actively involved in each of its subcommittees, which include solar, electric vehicles and municipal aggregation with a streetlight subcommittee recently put down as the project moves into the implementation phase under the Department of Public

Works. City Manager Mulholland has also given Below permission to attend any city staff meeting relating to energy issues, and he has put hundreds of hours into helping with the city's energy-related projects.

Lebanon is actively working with Dartmouth College on Lebanon Community Power – the city's municipal aggregation program. (See "New 'Community Power' Legislation" on page 20.) Below recently joined Steffi Muhanji and Associate Professor Amro M. Farid, both of the Thayer School of Engineering, Dartmouth College, along with Energy and Facilities Manager Tad Montgomery in authoring a peer-reviewed paper for the International Symposium on Technology and Society. The paper examines the potential for shared integrated grids to build resilience and increase the deployment of renewable energy. The focus of the paper is Lebanon Community Power, the city's municipal aggregation project, in light of the community aggregation bill (SB286) that recently passed in New Hampshire. It specifically looks at the use of blockchain technology to enable the local trading of locally-produced energy. It foresees a market structure that "continues to evolve and embrace new technologies – under a nimble, flexible mode of governance."

In addition to the projects already mentioned, Lebanon has been working on energy retrofits on the city's buildings. It is taking ownership of the streetlights in order to install a more efficient LED lighting system in which lights can be adjusted both for time of day and to make up dimming as the lights age. It is installing roughly 800kW of solar arrays on city buildings in its first solar project. It is looking into hosting public electric vehicle charging stations. It is working on improving city heating systems so they can run on biofuel instead of oil or propane. Each of these efforts has its own heroes.

Clearly, the expectation in Lebanon is that the one thing that we can count on in the future is change. There are many other people in the city who are actively engaged in furthering that change. The City Council, the Planning Office, the Lebanon Energy Advisory Committee, the citizens group Sustainable Lebanon, and others are deeply involved. All of them are actively working to bring benefits to residents' lives while reducing Lebanon's carbon footprint and keeping costs down. Many more people are worthy of mention than we can name here.

The web site for the City of Lebanon is lebanonnh.gov. ♻️



View of Lebanon from Storrs Hill. Photo from Delaina Carlson.



Springtime culture and greenery coming into bloom at Colburn Park, Lebanon. Get there by bus (Advance Transit), by bike from the rail trail, walk from town or maybe a carpool to visit the incredible farmer's market for local food and activities throughout the town. Photo: Rebecca Owens.



When the water level gets low enough in the winter you can walk out onto the sandbar by the rail trail for a new perspective on Mascoma Lake. Photo from Jerry Halstead.

NEW “COMMUNITY POWER” LEGISLATION A GAME CHANGER FOR ENERGY IN NEW HAMPSHIRE?

Henry Herndon

“Community Power” legislation recently signed into law has the potential to transform the way local governments in New Hampshire interact with their energy systems.

Under a Community Power program, local governments can procure and provide electricity to their residents and businesses on a competitive basis. By bypassing outdated regulations and legacy technologies, the Community Power programs can harness private-sector innovation to lower costs for their customers and provide other energy services. Electric distribution utilities (e.g., Ever-source, Liberty Utilities, NH Electric Cooperative, and Unitil) continue to deliver the electricity over their poles and wires.

After approval of Community Power programs at town meetings (or the equivalent for cities and counties), all customers not already on competitive supply are automatically enrolled but can choose to switch back to their regulated utility or to another supplier.

At least eight states currently enable similar types of programs, sometimes referred to as “municipal aggregation” or “community choice aggregation.”

Lebanon Community Power, managed on behalf of the city by the Lebanon Energy Advisory Committee (LEAC), is on track to be New Hampshire’s first Community Power program. Numerous other



The City of Lebanon, NH incorporates Community Power plans to develop renewable energy projects within the city to supply electricity to the community as a whole in an effort to provide clean, affordable power to the community. Image: Wikipedia.

local governments are considering establishing Community Power entities to take advantage of the new legislation. Community Power programs can be implemented at the municipal or county level.

A growing number of New Hampshire communities are setting renewable energy targets, with at least a half a dozen aiming to achieve 100% renewable electricity supply by 2030. The Community Power law will likely play an important role in enabling cities and towns to achieve their renewable energy goals.

Beyond Bulk Energy Purchasing Beyond simple energy procurements, the Community Power law (SB 286-FN-LOCAL) equips users with various other capabilities.

For example, Lebanon Community Power plans to develop renewable energy projects within the city to supply electricity to the community as a whole. The City of Lebanon has appropriated \$2.85 million for the development of a one-megawatt (MW) landfill gas-to-energy power plant. The City is also considering options for large solar projects which could similarly provide electricity directly to city businesses and residents.

Another area where the law expands local control relates to smart meters and electric grid modernization. Grid modernization, a concept currently under study by New Hampshire energy regulators, seeks to accelerate and harness customer adoption of distributed solar, energy storage (batteries), electric vehicle charging infrastructure, and other technologies.

Grid modernization requires smart meters that can track energy production and consumption throughout the day. The vast majority of energy meters owned by electric utilities only log energy data once a month. Under the new legislation, Community Power programs may deploy their own smart meters and use them to unlock a suite of new pricing options both for energy consumption, and as payment for power from solar, household batteries, etc.

Process for Implementing “Community Power”

The first step for a local government to implement a Community Power program is for the local governing body, whether it be a select board, town council, city council, or county commission, to form an electric aggregation committee to develop a Community Power plan. Multiple towns, cities, or counties may group together to form committees to develop these plans. Once finalized, Community Power plans must be approved by the local legislative body (e.g., town meeting, city council).

Related Legislation

At least two other energy bills may impact the implementation of Community Power programs in New Hampshire.

SB 284, also recently signed into law, enables for the creation of a statewide, multi-use online energy data platform. Implementation of some of the more sophisticated aspects of Community Power relating to smart meters and dynamic pricing will rely on modern data collection and processing.

Another bill, HB 365, which would increase the allowed size for net-metered renewable energy projects from one megawatt to five megawatts, was vetoed by Governor Sununu. Cities and towns hoping to use Community Power programs to develop their own renewable energy systems will likely be looking at projects in the range of one to five megawatts.

During the legislative session, both the House and the Senate voted for HB365 with strong enough margins to override a veto. It remains to be seen on veto override day this September whether those votes will hold.

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

COMMUNITY GARDENS



Top: Canillas Community Garden: 35 raised beds, a spiral perennial garden, herb gardens, bean tepee, pollinator garden, and more.

Below: Kilton Library Garden - Fall. Photos from Patricia McGovern.

RECYCLING AND WASTE



The Lebanon Recycling Center. The flowering tree was planted in memory of Barbara Whitman, a Lebanon resident who was a longtime volunteer on the Household Hazardous Waste Committee. Photo from Pat McGovern.

RECREATION FOR ALL SEASONS



Right: first photo: A rainbow after a baseball rain break at Logan Field. Second photo: A view of the 2019 Full Moon Fiesta event held by Lebanon Recreation and Parks each year at Storrs Hill Ski Area. Photo from Stephanie Vallee.

YELLOW HEAT

Keeps fossil fuels in the ground

George Harvey

Tom Leue, a businessman living in Ashfield, Massachusetts, has invented what he calls "yellow heat." It can allow conversion of oil-burning boilers to run on recycled vegetable oil, which Leue calls "yellow grease." Since the vegetable oil is from plants raised as crops, burning it can come very close to being carbon-neutral, with the only fossil fuels involved being those used to grow and transport the crop and to provide electric power to the boiler. Since the oil has already been used for its intended purpose, his system is rated as being nearly carbon-neutral by the EPA.

Leue's invention, however, goes a bit beyond being potentially carbon-neutral in some important ways. First, it is almost exquisitely simple to convert most conventional oil burners to use it. Second, it is almost exquisitely simple to convert used vegetable oil to be used as fuel. Finally, it uses oil so inexpensive that it can be very cost-



Yellow Heat's oil burner does not use fossil fuels to heat your home or business. Image courtesy of Thomas Leue.

effective.

What Leue invented is a variation on the Babington principle. Instead of oil being run through a nozzle, it is allowed to drip onto a ball with a slightly pitted surface and blown into a mist by a jet of air. This means that there is virtually no restriction on the type of oil used, as long as it has the correct chemical characteristics. Fuel oil could be used and would work fine, if the user is willing to put up with the environmental and economic costs involved. But, so would the dark, overworked oil in the bottom of an



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overworked fryer at the end of the day.

Preparing vegetable oil for use as fuel has historically been done in two ways. It could be filtered to remove all unwanted materials, from pieces of bread to tiny particulates, and then fed into a specially adapted burner or engine. On the other hand, it could be converted into a substance more like diesel or home heating oil through a chemical process using other feedstocks in addition to vegetable oil and producing chemical wastes, for use in a conventional engine.

Yellow heat allows use of rather dirty fuel, filtered to eliminate French fries and bits of tempura. It need not be otherwise altered, because the system with the ball and air jet is very hard, or even impossible, to clog.

Yellow heat is pretty much ideal for certain kinds of restaurants, where vegetable oil is widely used for frying. At the end of the day, such a restaurant is very likely to have a fair amount of used oil to get rid of. A dealer in waste oil might pick up such waste oil and actually pay for it, but not much. Leue said the price of such oil is gen-

erally less than 30¢ per gallon. Instead of the meager amount of money, the owner of the restaurant can use the scrap oil to replace expensive fuel oil.

Leue has a program under which oil is collected from restaurants, filtered, and sold to customers. He has guaranteed that the price will be at least \$1 per gallon below that of home heating oil. The program operates for customers in the Ashfield, MA area only and has limited availability, however.

There are other advantages in using vegetable oil as fuel. One of these is its relative lack of danger in the case of a spill. Used vegetable oil is a biological product, and in some parts of the world can be sold for human consumption. Leue said, "It might attract mice, but that is not an environmental danger." By contrast, if home heating oil is spilled, it needs to be cleaned up, and that can cost a lot of money.

Tom Leue can be reached at (413) 628-4533 or vegheat@gmail.com. The Yellow Heat website is yellowheat.com. ♻️

Keeping Warm with Our Masonry Heater

Dan Crosby, Local Energy Solutions

We have no oil furnace. Instead, we heat our 1900 sq. ft. home in Bethlehem, NH by burning 3.5 to 4 cords of wood each year in our masonry heater. A masonry heater is an option that I would encourage everyone to consider for a newly constructed home, and it may also be an option for retrofitting an existing home. We rely on our masonry heater to keep our house warm, but many people who have masonry heaters do have another heating system. If they are away for multiple days in the winter, their other system can keep their house warm. Once back home, however, using the masonry heater causes the other system to run much less, or not at all.

So, what is a masonry heater? Its core, which can withstand very high-temperature fires, is surrounded by some type of facing material, such as brick. The exhaust does not go directly from firebox to chimney, but takes a much longer path through heat-exchange channels in the core, thereby heating the large thermal mass of the heater. This heat is then released evenly between the, at most, twice-a-day burns. Depending on the outside temperature, sometimes we burn just once a day. Twice a day is typical for us in midwinter.

A masonry heater offers several advantages. The rapid, hot burn of the wood allows a more complete burn, reducing the amount of wood needed to produce the same amount of heat as compared to a metal wood stove. The hot, clean burn means less frequent chimney cleanings. In 17 years, I have never had to clean our chimney. Also, with the exception of the metal and glass of the fire box door during and right after a burn, the surface temperature of the heater never gets so hot as to cause burns from a quick



A masonry heater uses wood efficiently and can be the primary heat source for your home. Dogs like them, too. Image: Dan Crosby.

touch. In fact, it is very pleasant to lean right against the heater during a cold winter evening. Since a glass door for the fire box is common, and a typical burn may last 1.5 to 2 hours before we close our chimney-top damper, we have ample opportunity to enjoy the fire. Masonry heaters are attractive, too. They can look quite different depending upon what material is used for the outer layer. Brick, soapstone, adobe, fieldstone, river stone are just some examples. If you want to, your design can also include heated benches.

How about the cost? The initial cost of a masonry heater is more than, say, an oil furnace, but then costs less for fuel. Our brick-faced, relatively simple, masonry heater cost about \$13,500, including its foundation, the heater core, facing material, and a two-flue chimney I asked them to build. Let's assume

we use four cords of wood per year, which is equivalent to about 700 gallons of heating oil. Since I work up our wood myself, our wood is "free" (Hmm...). If we had purchased wood at \$200 per cord, our annual costs would have been \$800.

If we had installed a new oil furnace, our initial investment would have been much lower, but our annual fuel costs would have been much higher. A new oil furnace installation would only have cost around \$4000, less than a third of the cost of our masonry heater. However, we would have used about 700 gallons of fuel oil each year. Using the average cost of heating fuel from 2001 to 2018 (about \$3.00/gallon according to the NH Dept. of Energy), we can do a rough comparison of my actual costs for heating my home using the masonry heater with what it would have cost if I had installed an oil furnace.

So, my actual cost for heating my home with the masonry heater was just the initial cost of the heater: \$13,500. If I had actually bought four cords of wood each year at \$200/cord, then my cost for fuel over 17 years would have been \$13,600 (17 years * 4 cords per year * \$200 per cord). The total cost would have been about \$27,000. If we had instead installed an oil furnace for \$4,000, we would have paid another \$2,100 annually for fuel oil. Over the course of 17 years, we would have spent roughly \$36,000 for 12,000 gallon of fuel oil, and our total cost would have amounted to nearly \$40,000. So, a masonry heater can definitely make economic as well as environmental sense. It can even make sense as a retrofit. How much and which type of fuel you use and to what degree you use your masonry heater instead of your current system will influence your payback time.

For more information about masonry heaters, including a gallery of photos, check out the website of the Masonry Heater As-

sociation of North America (mha-net.org).

Dan Crosby, lives in Bethlehem, NH. He is a member of the Ammonoosuc Regional Energy Team (ARET), an all-volunteer non-profit organization that supports economically and environmentally sensible energy practices. Contact them at www.ammenergy.org. ♻️

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Space and water heating represent a large portion of the energy used in homes in the Northeast. Most of this energy comes from fossil fuels, and combined, space and water heating account for 60 to 70 percent of a building's greenhouse gas (GHG) emissions. Switching to renewable sources of heat to displace fossil fuel heating is essential for the reduction of GHG emissions. Accelerating the adoption of renewable heating and cooling (RH&C) technologies is part of the solution for tackling emission reductions and for helping states and cities meet their long-term energy and climate goals.

States have been incentivizing the adoption of RH&C technologies such as air source heat pumps, ground source heat pumps, solar hot water, and modern wood pellet boilers for several years. But even with the availability of incentives and rebates, the RH&C market has been slow to grow making it harder to meet aggressive climate goals. For example, Massachusetts' Comprehensive Energy Plan, which describes the need to invest in and install RH&C technologies, estimates that 20-30 percent of homes (half a million to three quarter million homes) in the state need to install heat pumps by 2030 to meet the state's climate goals. How can Massachusetts and other states help transition the thermal sector to renewable technologies?

Part of the answer lies in understanding the challenges and market barriers that RH&C technologies face. First, the public has little awareness of these technologies. Second, economics — fossil fuel prices are currently low and RH&C equipment costs are high. Lastly, RH&C installers have limited capacity both to work outside their local area and to meet increased demand leading up to and during the heating season.

States, cities, and

towns are trying to adapt for renewable heating technologies a very successful and widely replicated group-purchasing community campaign program for residential solar photovoltaic (PV) called "Solarize." Since 2008, the Solarize model has been widely replicated across the country. It began in Portland, Oregon and tripled the number of PV systems installed

there in six months at costs 20% lower than the average system price. Subsequent Solarize campaigns in other parts of the country have likewise demonstrated the effectiveness of creating demand through local outreach with community bulk-purchasing discounts. Solarize is an attractive proposition for a sector trying to get to scale.

The Solarize model owes its success to a few simple strategies that have driven down costs and ensured high-quality installations:

- Bulk and discount pricing
- Program sponsorship and support by a trusted organization, such as a community group or state energy office
- An easy sign-up process
- Consistent messaging and coordinated outreach activities
- A limited sign-up period with deadlines for customer enrollment
- A dedicated campaign leader and a team



Heating with a ground source heat pump is an effective way to reduce emissions.

of community volunteers.

By employing these strategies, Solarize communities in Connecticut achieved 24 to 65 times the rate of new solar installations than over the previous seven years and at 20 to 30% of the cost. In Massachusetts, the number of solar installa-

tions more than doubled in participating communities as a result of the Solarize campaigns.

Several municipalities across the U.S. have deployed Solarize strategies for the thermal sector. These community campaigns go by several names, most commonly "HeatSmart," and colloquially as "thermalize." Recently, state energy offices in Massachusetts and New York have rolled out RH&C community campaign programs with their support.

HeatSmart campaigns offer a variety of RH&C technologies: air source heat pumps, ground source heat pumps, heat pump water heaters, solar hot water systems, and modern wood pellet boilers. Like Solarize campaigns, HeatSmart campaigns are organized and managed by municipalities, counties, and community groups. Campaign programs may offer a suite of RH&C

technologies as part of their program, or they may only offer one. Each community campaign program deploys an outreach strategy, which varies both in target audience and in approach. Some campaigns have targeted Solarize participants and other early renewable technology adopters; others have relied on active community groups such as Mothers Out Front to spread the word. More sophisticated programs

have used data "scraping" software that uses demographic information and other indicators to identify those homeowners most likely to benefit from RH&C.

Early HeatSmart programs have already provided important insights on program design and success. HeatSmart programs are driving RH&C market adoption, though not at the cost reductions or rates achieved by Solarize.

Cont'd on p.36



Volunteers are an integral part of HeatSmart community campaigns. Images: HeatSmart Tompkins



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BUILDINGS TO COOL THE CLIMATE

Kai Starn

The Intergovernmental Panel on Climate Change (IPCC), viewed as the most credible source of climate change research, issued an alarming report¹ on October 2018 removing all doubt on this critical topic. Absent aggressive action, the atmosphere will warm up by as much as 2.7° F above preindustrial levels by 2040, inundating coastlines and intensifying droughts and poverty. The significance of this report is that major effects of climate change will occur in our lifetimes.

The building construction sector has a critical role in reducing carbon emissions immediately. As nations all over the globe tackle operational emissions from buildings, we must now address our total emissions impact. Life-cycle emissions resulting from buildings consist of two components: operational and embodied. A great deal of effort has been put into reducing the former, as it has been assumed to be higher than the latter. Studies have revealed the growing significance of embodied emissions in buildings, but its importance is often underestimated in energy-efficiency decisions.

According to the Embodied Carbon Review 2018² by Bionova Inc., embodied carbon is the total impact of all the greenhouse gases emitted by the construction and materials of our built environment. Furthermore, during their life cycle, the same products also cause carbon impacts when maintained, repaired, or disposed of. As opposed to carbon from energy use which accrues over time, consider the carbon “front-loaded” onto the overall carbon account on day one of operation. To illustrate the timescale of embodied energy and operational energy, according to Bionova, “... embodied carbon and the operating carbon of new buildings have the same overall impact until 2050...” assuming a steady rate of new construction from 2020 to 2070. Furthermore, increases to grid and operational efficiency only magnify the proportion of carbon emissions associated with materials.

Nations worldwide are recognizing the importance of addressing total emissions and the immediate benefit of low-carbon materials. There are two approaches comprising immediately practical and more advanced concepts that require development and implementation in the coming years.

Low-carbon standards are essential to reduce embodied carbon, but here in the U.S.,

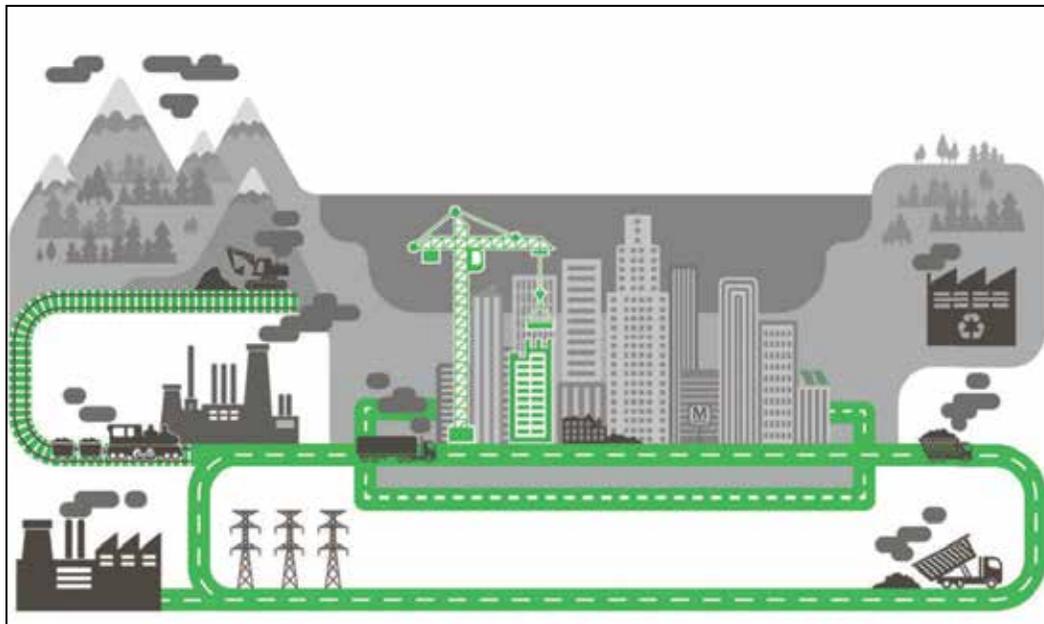


Illustration: Embodied carbon emissions arise from the life-cycle material flows of buildings. Images courtesy of Bionova Ltd.³

resolutions take years to implement. State laws such as “Buy-Clean California Act” will start to require Environmental Impact Declarations, or EPDs, reports on use of concrete, steel, glass, and timber in the next couple years. Other states look to pass similar acts, and the trend, in this author’s opinion, will gain momentum.

Reusing existing buildings and materials is the lowest carbon investment, and structures can specify smart carbon alternatives, but for new construction, green ratings such as the Living Building Challenge (LBC) and Leadership in Energy and Environmental Design (LEED) v4 offer immediate strategies to assess and create carbon smart design alternatives.

Whole Building Life Cycle Assessment (WBLCA) is employed in LEED and LBC to

analyze environmental impacts throughout the entire span of a project. The tool combines an estimate of the quantity and types of materials and verified ecological effects not limited to emitted carbon, ozone depletion, and smog creation, gathered from assessments known as EPDs, which are the building blocks of a WBLCA.

Steven Winter Associates, Inc. (SWA) uses the One Click LCA by Bionova software to assess the environmental impacts associated with structural materials as early as schematic design. Besides allowing teams to make more informed design choices, WBLCA is also now part of sustainability rating systems, including the LEED v4.

LEED v4 has two options available, either self-report purchases of low-carbon materials or conduct a life-cycle assessment to

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compare a user-defined baseline to the proposed design. The latter is the most cost-effective way to make better low-carbon decisions and can be used iteratively during design. The self-reporting method is not as robust and may not necessarily lead to the best options overall. However, the EPD reporting option may become a formality in some projects.

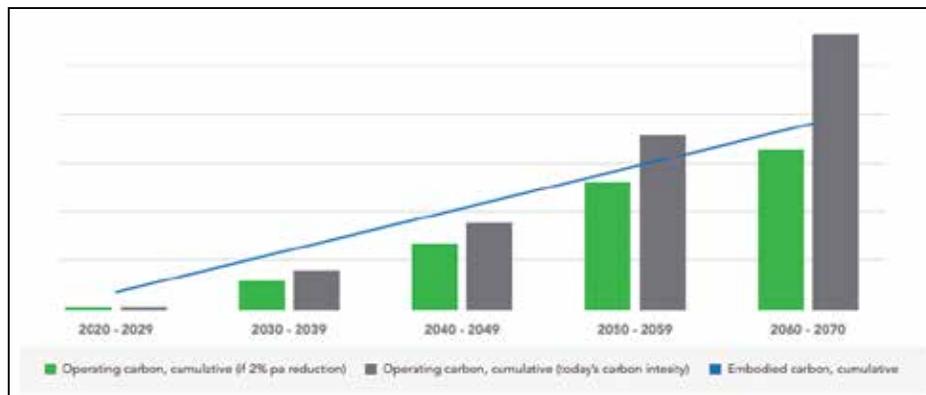
The LBC Material Petal Certification offers a simple, yet rigorous, solution. Projects must directly reduce as much embodied carbon as possible and purchase carbon offsets for the remainder. Placing a financial burden on carbon is an effective policy; however, in our experience, the approach requires a great deal of ownership will.

Absent aggressive action, many effects once expected only several decades in the future will occur by 2040. The IPCC report “is telling us we need to reverse emissions trends and turn the world economy on a dime,” said Myles Allen, an Oxford University climate scientist and an author of the report. Architecture, engineering, and construction teams poised to implement and market, smart carbon design will define themselves as innovative, creative, thoughtful leaders in the industry. What story will your project tell?

^{1,2,3} Footnotes available on the Green Energy Times website with the posting of this article.

Kai Starn is a Senior Sustainability Consultant at Steven Winter Associates. ♻️

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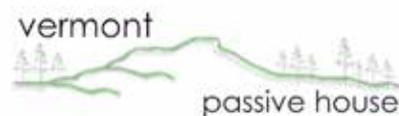


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AEROBARRIER™ – CASE STUDY #2 PARTIAL RENOVATION OF A 1700'S BRICK COLONIAL HOME

Nate Gusakov

This is the third article in our series highlighting our experiences installing AeroBarrier around New England— here's a quick refresher on the technology:

AeroBarrier® is a patented, cutting-edge envelope sealing system that simultaneously measures and seals building envelope air leaks. Here at Zone 6 Energy, we like to call AeroBarrier 'Fix-A-Flat for a house.' In essence, the system involves pressurizing the house (to +100 pascals) with a blower door, setting up a series of tripods with spray nozzles on them (just like mini snowmaking guns), and the introduction of a fine mist of specialized acrylic caulk. From there, much like a balloon with pin holes in it, the pressure drives the sealant to all the small cracks in the building and seals them up. During installation, we monitor the air leakage on our computer and watch the needle drop as the various holes and cracks throughout the house fill with sealant. When we reach our target for leakage, we turn off the machine, clear the air with a few fans, open windows and clean up. The space can be worked in again within about thirty minutes, and once cured, the sealant is a non-toxic, low-VOC substance that is GREENGUARD Gold® certified for use in schools and hospitals.

Here, we share our experiences air-sealing a brick Colonial near Saratoga Springs, NY that was built in 1738!

The project involved partial renovation of the interior of the house as well as two new additions married to the old

brick structure. The owner did not have a specific leakage target in mind but wanted to make use of AeroBarrier's ability to significantly improve the building envelope performance in a single application without lengthy diagnosis or manual air-sealing work.

Our pre-test showed the building to be quite leaky, measuring 11.9 air changes per hour at 50 pascals (11.9 ACH50). By way of comparison, many northern states have adopted a building code that requires all new construction to measure three ACH50 or less, and, to qualify as a Passive House, a building must measure 0.6 ACH50! After discussing the desire to dramatically reduce air leakage while still leaving enough natural infiltration to avoid the need for installed mechanical ventilation, we established a goal of under five ACH50.

Next we prepared the house for AeroBarrier, protecting any finished horizontal surfaces and ensuring that no gaps larger than 1/2" remained in the envelope. AeroBarrier is essentially self-guided (with the sealant only being driven to the places in the building envelope that are leaking), so the confusing prospect of trying to diagnose leakage pathways through new and old interstitial spaces was unnecessary.



In two of these pictures, you can see how even properly-installed spray foam can fail to address many air-leakage pathways. In the bottom picture, a strip of sill-seal struggles to fill the void between new addition framing and old stone. On the left, daylight shows between framing members under a window. AeroBarrier addressed both of these leaks automatically. In under 2 1/2 hours of install time, we were able to bring the house to 4.9 ACH50. This represents a 59%

Top: AeroBarrier installation is underway for the 1700's brick home. Counter clockwise: daylight showing between framing members; air leak between the old original building and the new addition; fully renovated portion of the house. Images courtesy of Nate Gusakov.

reduction in air-leakage, and renovation work commenced the following day!

Nate Gusakov is a Lead Installer for Zone 6 Energy. Zone 6 Energy is a home-grown Vermont company specializing in air leakage diagnostics and consulting. They offer commercial and residential blower-door testing, home energy audits, and AeroBarrier installation throughout New England and upstate New York. ♻️

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Ground Zero: An Adventure in Net-zero Energy Building

Jenna Batchelder



The finished house featuring the photovoltaic array solar panels on the roof of the garage. Photo: NESEA.

To the untrained eye, the Eisinger net-zero energy (NZE) house in Keene, New York, would seem like any other single-family Adirondack homestead. The roof-mounted solar panels aside, the 1974-square-foot home is conventional looking, maybe even quaint, encompassed by trees with a beautiful view of the surrounding mountains and sky. Unless you lived there, you would never guess the amount of work that went into making this seemingly normal home into a self-maintained machine.

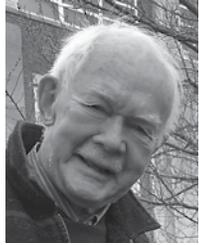
Net-zero, also known as zero-energy building or zero-net-energy building is a building or structure that consumes

zero-net energy, meaning that the total amount of energy used to maintain said building per year is the same as the total amount of energy created on site in that same year. There are endless advantages to this type of building, with a few being improved energy efficiency and subsequent reduced costs for owners, improved energy reliability, complete sustainability, and reduced greenhouse emissions. While these methods are relatively new and initially more expensive than traditional energy solutions, many countries are looking at net-zero as a long-term solution for sustainable living.

Cont'd on p.31

ACCEPTANCE VS. BELIEF

John Bos



In her last ever book "No Time to Spare," Ursula Le Guin writes that if someone asked her if she believed in evolution, she would answer "no."

As a long-time fan of Le Guin's writing, I knew that she had something up her literary sleeve. She then wrote "I don't believe in Darwin's theory of evolution. I accept it. It isn't a matter of faith, but of evidence."

Le Guin goes on to say that the whole undertaking of science is to deal, as well as it can, "with reality. The reality of actual things and events in time is subject to doubt, to hypothesis, to proof and disproof, to acceptance and rejection — not to belief or disbelief."

"Belief," Le Guin posits, "has its proper and powerful existence in the domains of magic, religions, fear, and hope." She sees no conflict between accepting the theory of evolution and believing in God. "The intellectual acceptance of a scientific theory and the belief in a transcendent deity have little or no overlap: neither can support nor contradict the other." Le Guin thinks that belief has no value in and of itself. "Its value," she writes, "increases as it is useful, diminishes as it is replaced by knowledge, and goes negative when it's noxious. In ordinary life," she says, "the need for it diminishes as the quantity and quality of knowledge increase."

Le Guin states that there are areas where "we need belief" because it's all we have to

act upon. "In the whole area we call religion or the realm of the spirit, we can act only on belief." There, she says, belief may be called knowledge by the believer. And she thinks that's "fair," so long as it's fair to also maintain and insist upon the difference between acceptance and belief outside of religion. She states that "In the realm of science, the value of belief is nil or negative; only knowledge is valuable." Moreover, she concludes by observing that "Perhaps acceptance is the secular equivalent of belief."

So what is it with the Trump administration chock full of officials who don't "believe" the science that finds our environment being severely degraded by unrelenting CO2 emissions and the way we live our lives on planet Earth? The fact that they don't accept climate science evidence either rests upon a "belief" that rises from ignorance or, more likely, upon defensive denial in favor of the fossil fuel industry whose dollars help them keep their jobs. Do they "believe" that they will be rewarded in their next campaign? Or in their legacy?

The repeated mantra that we need an experienced businessperson to run the business of America could not be further from the truth. First of all, Donald Trump's business experience from the perspective of a legitimate corporation is non-existent. No chief executive of a major corporation that I know of shares his trait of not liking to read "bothersome" reports — like national security briefing papers. Or even reports from his own EPA headed by Andrew Wheeler, a former coal lobbyist who has been serving as the acting administrator since the scandal-

plagued Scott Pruitt resigned in July 2018. Trump did not "manage" a large workforce at Trump Enterprises; it was, and continues to be, a family affair even from within the White House. Key executives in federal environmental and energy agencies who do have real business experience and do "believe" in denying climate change have been recruited from major fossil fuel and pharmaceutical industries.

For starters, we have Vice President Mike Pence who apparently doesn't "believe" NAS, (National Academies of Science) and other major American scientific organizations are reporting about how humankind (MANKIND?) is causing our climate catastrophe. In 2009 for instance, he told MSNBC, "I think the science is very mixed on the subject of global warming." As governor of Indiana, Pence sued the EPA to block the Clean Power Plan, the Obama-era landmark plan to reduce climate pollution from power plants. And in February 2017 he said, "Just last month, after years of senseless delays, President Trump authorized the construction of the Keystone pipeline and the Dakota pipelines for our energy future and to create American jobs. That's what it means to rebuild our infrastructure and put America back to work."

Moving down the environmentally-challenged hierarchy, we come to the fired Secretary of State Rex Tillerson who walked away from his job as CEO of Exxon-Mobil with a \$180 million retirement package. He has left it to others to fight the lawsuits accusing the company of knowing for nearly five decades that greenhouse gas pollution from their fossil fuel products had a significant impact on the Earth's climate and sea levels. Sinking deeper into the swamp, there is no point in remembering former EPA Administra-



climate change is REAL!

tor Scott Pruitt who "believes" evolution as an unproven theory. His skepticism about a major foundation of modern science such as evolution is in direct conflict with his agency's mandate to make science-based decisions. His "legacy" is being safeguarded by former coal lobbyist Andrew Wheeler.

Space does not permit me to chronicle the anti-earth exploits of U.S. Department of Energy Chief Rick Perry who has long avoided getting pinned down on humankind's contribution to our climate catastrophe. He has said that any action on climate change should be weighed against economic costs, not the public health. Nor Interior Secretary Ryan Zinke who reviewed western national monuments and then ordered the elimination of "burdensome regulations" on the oil and gas industry to drill on federally owned (taxpayer) land.

According to a June 19 New York Times analysis of Trump's elimination of burdensome regulations, there are two types of policy changes: rules already "officially" reversed and rollbacks still in progress. The Trump administration has released an aggressive schedule to try to finalize many of these rollbacks this year; 49 rollbacks already completed with 34 rollbacks still in process for a total of 83 rollbacks.

The priority of the non-acceptors of climate criminality evidence is to trash all the pro environmental regulations put in place during the Obama administration.

It's the economy, stupid vs. the environment. Breathe deeply.

John Bos lives in Shelburne Falls and writes frequently about our climate catastrophe. He invites questions and comments at john01370@gmail.com. ♻️



Smog. Image: Creative Commons

Saving the Earth from Climate Change

George Harvey

The climate situation is rather like a fire in the kitchen. If you act on it right away, it might be possible to put it out with a fire extinguisher, but if you wait five minutes, you probably need to call in the fire department. The fire extinguisher approach is no longer tenable.

Now, having put off acting so long, we need to get very proactive about climate change. Unfortunately, the pace of climate change is far faster than most scientists envisioned. Five years ago, they described different scenarios for what would happen under climate change, including such things as how fast the ice caps on Greenland would melt. Today, those ice caps are at the point they expected for the year 2070. The government



Sunny-day flooding in Miami happens because of rising seas. Photo: B137, Wikimedia Commons, <http://bit.ly/2kol07Q>.

of the United States is not only doing nothing; it is in denial and trying to undo environmental protections. Instead of being proactive, it is in retreat.

Still there is hope. One article that is very specific about why there is hope was "Can We Reach 100% Renewable Energy in Time to Avert Climate Catastrophe?" published at Truthout. It looks into the work of Dr. Mark Jacobson of Stanford University. Ten years ago, he was coauthor of a seminal paper in Scientific American outlining a roadmap to 100% renewable energy. In it, he showed that we could rely 100% on a combination of solar, wind, and hydro power by 2030. Since that time, Jacobson has remained engaged on the issue.

Dr. Jacobson recently said he is feeling more optimistic, rather than less. He is very aware of the bad news, but he also knows that renewable energy from wind, solar, and battery backup has become so inexpensive that natural gas plants, the least expensive fossil fuels around, are being closed because they cannot compete. There is no need for fossil fuels, and without a need, they can be eliminated. ♻️

Floods, Ice, Fires and Drought

Dr. Alan K. Betts



Water is everything to our planet. As I write, Greta Thunberg has reached New York after crossing the Atlantic in fifteen days on a racing yacht, arriving

just ahead of tropical storm Erin. She will be in the United States for the global strike for the climate system on Friday, September 20 to 27, and she will speak to the United Nations on September 23. This is an existential protest by youth who are unwilling to be sacrificed for corporate greed. Indeed, the continued unchecked exploitation of the Earth and the poor by the fossil fuel industries and society is both a crime against humanity and the Earth itself. Capitalism has given rights to corporations, but the Earth still has no rights. Legal battles are underway across the globe to establish the crime of ecocide, the destruction of the Earth's living ecosystem, but this may come too late.

The fossil fuel industry is spending some \$200 million a year on dishonest propaganda and bribes to politicians to protect its \$100 billion in annual profits. We need escalating fossil carbon taxes to reframe the economics and to help pay for both present and future costs. But the highly profitable global consumer economy, driven by fossil fuel, has purchased the silence of millions.

Let us briefly review the global weather and climate perspective. The increasing greenhouse gases have slowed the cooling of the Earth to space, and melting ice and snow has reduced the reflection



Sixteen-year-old Greta Thunberg reached New York after crossing the Atlantic Ocean on an emissions-free sailboat. Thunberg does not travel by air due to the associated carbon emissions. Image: pressenza.com

of sunlight, so the Earth is warming. More than ninety percent of this heat is stored in the oceans. But the Arctic is warming twice as fast as the equator, and this has changed the mid-latitude jet stream towards large amplitude north-south waves that move slowly. In July for the first time, a convective storm in Kansas moving to the southeast, circled back over the Gulf as a tropical storm, forming the weak hurricane Barry that struck Louisiana, causing \$10 billion in flooding damage.

For the year ending with June 2019, the central United States was cool with record precipitation in Nebraska, Kansas,

Oklahoma and Arkansas. It was the second wettest on record for Iowa and Texas. The flooding on the Mississippi River this spring was the longest on record. The eastern and southeastern U.S. was warm, but fourteen eastern states also had record precipitation for the year. The realization is spreading that billions are needed after floods to rebuild levees and build new floodwalls to hold back rising waters in towns. This should be funded by a tax on fossil fuel.

But elsewhere in the northern hemisphere, there were record high temperatures in Europe as well as Alaska, and fires across the warming Arctic, especially in

Siberia. These fires spread soot that darkens the Arctic ice and speeds melting. The very warm air from Europe also blew north over Greenland, and set new records for Greenland ice-cap melt in early August. As the Arctic ice melts, climate changes, and as Greenland melts, sea-level rises.

With Brazil once again encouraging development, more than forty thousand fires were set burning across the Amazon to clear land during the tropical dry season. In India, millions are running out of fresh water. The city of Chennai with 10 million people has a water crisis, with desiccated reservoirs and shrinking ground water supplies. Water is critical for agriculture and crops everywhere, but three quarters of the earth's soils are now degraded as well. An era of environmental collapse is coming, as complex natural systems become destabilized. The rich countries that have the largest carbon footprint carry the largest responsibility.

We need this reminder, even though none of this is good news. Here at home remember local agriculture is critical. Harvest and share your crops and thank your local farmers. Plant a rye-grass cover crop to improve the soil in your vegetable garden. What can you plant to winter over under glass? In early April, we delight in eating spinach and lettuce that was planted in October. Teach your children and grandchildren to grow food and support and educate them when they protest against the corruption in our society. Roots in the Earth can support us through the difficult times ahead.

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

THE COUNTERATTACK AGAINST CLEAN ENERGY IS COLLAPSING

Carl Pope



For two years, the cabal of fossil fools surrounding Donald Trump have leveraged an impulsive president's loathing of his predecessor, tapped their reactionary

right-wing networks, mobilized coal and oil lobbies and political donations, and thrown themselves vigorously into two missions:

Bring back the coal industry and stop the "Stalinist" threat of wind and solar power.

Freeze the transition from oil-powered cars and trucks to electricity by reversing Obama-era plans to encourage cleaner, more efficient vehicle fleets.

In the last several weeks of this August the futility of both these efforts to strangle the future have become clear.

The latest blow to the Trump clean energy rollback was an announcement by California and four major automakers — including Volkswagen, the world's largest — that even if the president can persuade the courts to allow him to roll back the Obama administration's improved regulations on pollution and efficiency standards for cars and light trucks, these companies would guarantee that their U.S. fleets meet a set of slightly modified standards devised by California for the model years 2022-25.

While Ford was the only U.S. automaker to sign, it's still a huge step. (And Ford is hardly a big player.) General Motors

appears to be seeking more credit for its significant investment in electrification, and Fiat Chrysler, having turned itself into a niche brand that proudly produced the world's best 20th-century cars — Jeep SUVs and Ram Trucks — simply whined. (Chrysler still doesn't know how it will comply with the much laxer 2020-21 rules.) Toyota may be watching to see what GM does.

The agreement made clear that the Trump administration's refusal to negotiate with California was rooted in its own stubbornness, not California's unwillingness to make a reasonable offer. It further made clear that the auto industry feels deeply threatened both by the prospect of a U.S. auto market split into two segments — one following strong California innovation rules, the other locked into yesterday's auto technology. It also highlighted the degree to which clear mandates in other markets — particularly Europe and China — are maintaining the pace of progress toward clean, electric vehicles, and a recognition that U.S. automakers must keep up regardless of whether federal standards require that.

As Rep. Debbie Dingell, D-Mich., often seen as the D.C. voice of the American auto industry, pointed out, "This industry is more fragile than many realize. If the United States is to be competitive, we have to stay at the forefront of innovation and technology, which will help us transition to the next generation of more fuel-efficient vehicles."

And what of the other flank of the Trump assault on climate progress: His promise to bring back "beautiful" coal? The last month has seen a slew of announcements making utterly clear that the coal industry is on the way out as a source of electric energy.

The Energy Department has conceded that coal's share of U.S. electricity generation will continue to plummet — from more than 50% a few years ago, to 30% in 2017 and a forecast of only 24% this year. The largest coal power plant to fall thus far — American Electric Power's behemoth Rockport, Indiana, facility — has announced it will shut down. An all-Republican body of utility regulators in Georgia required Georgia Power not only to shut down much of its coal facilities, but also to embrace renewables, rather than natural gas, as the replacement. One analyst called this "the worst month for coal power in decades."

Coal's bleak future didn't just hit utility operators. Yet another set of coal mining operators headed for bankruptcy courts, with Blackhawk Mining unable to sustain its Appalachian operations. This followed four other bankruptcies in the previous four months: Blackjewel on July 1, Cambrian Holding on June 16, Cloud Peak Energy on May 10 and Trinity Coal on March 4.

Many of the bankruptcies came because mining companies wanted to shed their commitments to provide pensions and health care for retirees, as well as to clean up the environmental disaster left behind by many of their operations. And since Republicans in Congress had allowed the tax that provides funding for health care for coal miners suffering from black lung disease to expire, just as poorly regulated working conditions have triggered a major black lung epidemic, miners were forced to mobilize to try to make their alleged pal in the Oval Office, not to mention Senate Majority Leader Mitch McConnell, make good on at least some of their boasts about

making life wonderful for coal again. When the miners arrived in Washington D.C., McConnell gave them the brush-off in a perfunctory meeting after which they said he had treated them rudely.

None of this has stopped the coal industry's barons from cozying up to Trump. Bob Murray, for whom a pledged bail-out was one of Trump's unfulfilled promises, still came through with a major campaign fundraiser in Wheeling, West Virginia. But as the 2020 election season heats up, it appears that while coal mine owners might still love the president, his efforts to rescue coal-fired power and oil-fired transportation from history's verdict had collapsed — making clear once again that it's time to move beyond carbon.

Links available online at greenenergy-times.org.

Carl Pope is the former executive director and chairman of the Sierra Club. He's now the principal advisor at Inside Straight Strategies, looking for the underlying economics that link sustainability and economic development and serves as a Senior Climate Advisor to former NYC Mayor Michael Bloomberg. He has served on the Boards of the California League of Conservation Voters, Public Voice, National Clean Air Coalition, California Common Cause, Public Interest Economics Inc, and Zero Population Growth.

Mr. Pope is also the author of the books: *Sahib, An American Misadventure in India* and *Hazardous Waste in America*. Carl Pope is the co-author with Michael Bloomberg of *Climate of Hope: How Cities, Businesses, and Citizens Can Save the Planet*.

First Net-Zero Multi-Family Building in Region to Open

How Twin Pines Set the New Gold Standard for Sustainable Living in West Lebanon, New Hampshire

Chris Gillespie

Affordable housing developer Twin Pines Housing Trust will make history this fall by opening the first net-zero, multi-family building in the Granite State. Located across the street from the Kilton Public Library in West Lebanon, New Hampshire, Tracy Community Housing will also be the first net-zero multi-family building of any significant size in all of northern New England, measuring at 29,000 square feet.

Similar to Wentworth Community Housing, which Twin Pines opened earlier this summer in nearby White River Junction, Vermont, Tracy Community Housing's twenty-nine units are restricted to households earning up to 60% of the area median income. In Grafton County, where Tracy Community Housing is located, this equates to a single individual making roughly \$37,000 a year or a family of four making no more than about \$53,000 annually.

Twin Pines Executive Director Andrew Winter said that, in addition to providing an affordable housing option, Tracy Community Housing will help "reinforce the residential nature of Tracy Street and improve the overall quality of the housing stock in the neighborhood."

Although Tracy Community Housing is not the first multi-family building on Tracy Street, its infrastructure and design are certainly one-of-a-kind. Designed by energy-efficient design leader Bill Maclay of Maclay Architects and project managed by Tim Estes of Estes & Gallup, Tracy Community Housing reaches net-zero through a combination of impeccable insulation and extensive solar paneling.

Designed and installed by Norwich Solar Technologies, Tracy Community Housing's solar array consists of 384 solar panels and will be able to generate



Above: When it opens this fall, Tracy Community Housing will be a sleek, stylish and sustainable addition to W. Lebanon's residential area. Twin Pines was able to maximize the number of solar panels by challenging multi-family building design conventions. Photos: Courtesy of Twin Pines Housing and Norwich Solar Technologies.

185kW. In order to ensure maximum coverage, Norwich Solar installed solar panels on the roof of Tracy Community Housing as well as on top of the building's south side façade. To complete the array, Norwich Solar built a freestanding solar arbor, which, Winter says, will provide residents with a shaded area to park bicycles or relax at a picnic table.

The yield of this solar array will cover the base electrical needs of the building, including heating and cooling, thanks to a series of Mitsubishi air source heat pumps. Similar to Wentworth Community Housing, Tracy Community Housing also utilizes an energy recovery ventilation (ERV) system, which will use the heat of the air exiting the HVAC system to precondition the air entering the HVAC system.

In terms of insulation, Tracy Community Housing uses triple-glazed windows and air-sealing to remain energy tight. Twin Pines worked with the experts at SIGA to ensure that Tracy Community Housing has as strong of a building envelope as possible.

"When it comes to energy efficiency, air-sealing is critically important," said Winter. "Working with SIGA was great. They had their representatives meet with our construction team to make sure that everyone knew exactly how to apply the product and how to tell if we reached the best seal."

All of these measures will help Twin Pines reach their goal of getting Tracy Community Housing certified by the Passive House Institute US. According to Winter, Twin Pines has been collaborating with Karen Bushey of Efficiency Vermont and Chris West of Eco Houses of Vermont to better understand and meet the Passive House certification requirements. So far, Winter says, the blower door tests have been very promising.

Even Tracy Community Housing's location promotes sustainable living. By being within walking distance to West Lebanon's Main Street, as well as in close proximity to Advance Transit's Red, Green and Orange bus lines, residents can easily forgo frequent use of their individual vehicles. In fact, Twin Pines was able to use both of these factors to make a case to the City of Lebanon to waive their parking lot size requirements for new multi-family buildings. As a result, Twin Pines was able to reduce the amount of impermeable pave-

ment needed for the project.

As development on Tracy Community Housing wraps up, Twin Pines plans to celebrate their historic achievement by sharing their experience with their peers at the Better Building by Design conference in South Burlington, VT next February and by implementing their hard-earned knowledge into upcoming projects, such as a new development site in Hanover, NH.

"We're already applying the techniques we've learned on Tracy Street, in terms of air sealing and construction simplification, into other projects," said Winter. "It's been challenging, but we have learned a lot from it."

For more information on Tracy Community Housing and Twin Pines Housing, visit twinpineshousing.org.

To read G.E.T.'s previous coverage of Wentworth Community Housing, visit greenenergytimes.org.

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

This article is No. 2 of a G.E.T. series on net-zero housing in the Northeast.

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Project image: Nelson Cabin - courtesy Stefan Hampden of CAST architecture

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Do-It-Yourself Energy Upgrades: DOORS

#2 in our new DIY Series,
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David Keefe

It sure is annoying when your exterior doors leak a bunch of air – cold air in, or your warm air out, or both - but there are things you can do to tighten them up.

First, consider a storm door if you don't have one. Storm doors protect your primary door by keeping the weather off it, and they provide another layer between you and the winter chill. Many people love to open the primary and let the sun in through the storm door on pleasant days. Choose one with "Low-E" glass. That means it has an invisible coating that reflects more of the heat back into the house.

Before weather-stripping a door, make sure it operates smoothly and latches properly. This may involve tightening or replacing hinge screws. Reposition the strike plate (the metal device on the frame that the door latch slides into) if needed. Some strike plates are made of two pieces and are adjustable. Sometimes additional hardware items can help tighten an old door, but be sure that the door is still safe.

If you have a newer home or replacement doors, they are probably so-called "pre-hung," which means they come from the factory already installed in their jambs and often with trim. These frames commonly have a weather stripping, commonly of vinyl, on the sides and top. It is inserted into a slot and can be removed and replaced easily if it has become worn or has been torn up by the cat. If you have a steel door, you might have magnetic weather strips like that on your refrigerator. It can be replaced in the same way.

Pre-hung doors commonly have adjustable thresholds. Open the door and look down. See those three Phillips screws? They move the threshold up and down.

Door weather strips come in a

variety of materials and shapes. The inexpensive aluminum and solid vinyl ones may not be the best choice. Vinyl flaps or bulbs aren't soft enough to seal well and they deteriorate in the sun. A better choice is vinyl-coated foam, EPDM rubber, or silicone.

Weather strips are either compression seals or wipe seals. Compression seals, where the moving part pushes directly down on the seal without sliding across it, should be soft and squishy and are best made of rubber or silicone. Wipe seals, where the parts slide against each other, need to have low friction and are best made of polyethylene, nylon brushes or silicone. You might have old ones made of brass.

If you have older doors, they might have steel interlocking weather strip on the door and the frame (which works OK if it's not too beat up), or they might have layers of foam strips, or they might have nothing. The vinyl-coated foam mentioned above (the most popular brand is called "Q-Lon") is also available mounted in a wood or metal strip that can be nailed onto the stop (the piece that the door hits when you close it) or can replace the stop altogether.

You can also use a soft seal on the existing stop, and a polyethylene V-shaped seal (such as Schlegel Polyflex or 3M V-seal) mounted on the frame to contact the door when it is closed. These can respond well to drafts: the 'v' is forced to open wider, blocking drafts.

For the bottom of the door, you can choose a door shoe or a door sweep. A

shoe wraps around the bottom of the door and has fins or bristles to contact the threshold when the door is closed. A sweep mounts on the inside or outside of the door. In general, a brush-type seal is preferable to a flap, because it conforms to irregular surfaces better and doesn't drag on the floor as much. Sometimes in older homes the floor is uneven and there's no room under the door when it opens. In that case, you can get a sweep that has a mechanism to lift the seal when the door opens and lower it when the door is closed.

Don't forget about the frame and trim. Caulk any cracks in the frame, where the trim meets the frame and wall, and where the threshold meets the floor.

Don't forget the door leaf itself. Especially with older wooden doors, cracks can develop in the wood panels or joinery. These can usually be fixed by caulking neatly and appropriately, and repainting or finishing.

Consider other features. A door may have built-in glass lites, and these should

be in good shape. And don't overlook the obvious – things such as old mail slots.

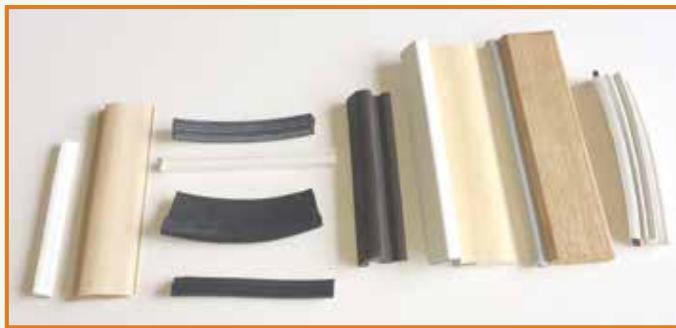
You can find these materials online, but first check with your local retailer. Show them this article. Maybe they will stock these things if they know you want them, and it's good to support your local businesses.

Next time we'll talk about windows.

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



Steel, aluminum and plastic brush sweeps, door shoes on lower right.



From left: polypropylene V-seal, EPDM rubber, vinyl-coated foam, silicone, magnetic. Courtesy images.

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CHANGING THE ROOFING EQUATION

Basics for an Efficient Roof

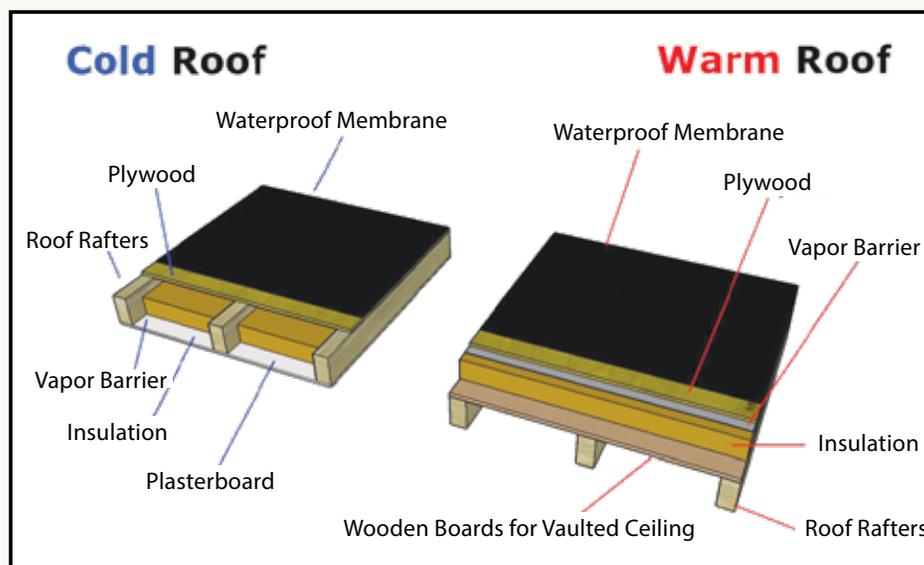
Bob Tortorice

Roof covering materials, whether they are basic shingles, solar shingles, architectural shingles or metal coverings, have very little effect on the energy efficiency of one's home. Real energy efficiency, along with a more comfortable living space and lower heating and cooling costs, is found in the structure of the roof and whether it's vented or insulated, not in the covering material.

Traditionally, building professionals have used the time-honored practice of venting northern attics to prevent temperatures of up to 140° from entering a home's living space (usually the bedrooms), and prevent moisture from condensing in the attic. This construction process is known as a "cold" roof. With a "cold" roof, the air barrier (typically sheetrock) and fiberglass insulation are in contact with each other and located at the ceiling / attic floor. Its purpose is to prevent heat from entering and leaving the living space while allowing moisture to leave the living space and be vented to the exterior through ridge or gable end vents.

A "hot" roof, on the other hand, is not ventilated but keeps the heat out of the attic because the insulation is installed directly onto the roof sheathing, or attic rafters. A "hot" roof keeps the heat out of the attic space, thus allowing this normally unused space to be part of the home's living space.

With that in mind, should a homeowner opt for a "hot" or "cold" roof when they build or retrofit their home? In



In a "cold" roof system, the air barrier and insulation are in contact with each other and located at the ceiling/attic floor. This design prevents heat from leaving or entering the living space while moisture is vented. "Warm" roofs are not vented and have the insulation installed directly on the roof sheathing. Image: <https://www.spacetwo.co.uk>.

either case, with the 2015 energy code slated to take effect September 15, 2019, the R value for attic floor insulation is R49 whereas the hot roof or vaulted ceiling is R38. These R values are for both climate zone 5 and 6. The examples from a home we insulated in the Conway, NH area, with two separate attics, may help you decide.

One is a full-height walk-up attic, where the floor of the attic is insulated, and typical soffit and ridge vents are installed, which created a "cold" roof. The second

attic is much smaller, no higher than three feet, and has typical drop down stairs. In this space, we chose to insulate the rafter / roof of the attic, thus creating a "hot" roof.

On an 85° day, we inspected both spaces. First, we opened the door to the full attic and the four of us on the tour were literally pushed back by the heat. The bedroom below was comfortable, so the attic floor insulation was doing a decent job, but being in the attic for more than a minute or two was unbearable.

When the stairs to the smaller attic were dropped down, we immediately noticed no temperature difference between the attic space and the temperature on the second floor. The home's owners were delighted with their new temperature-controlled storage space.

From these examples it's easy to see that when insulating your attic a "hot" roof is far more energy efficient than a "cold" roof when you want to add usable space to your home, no matter what roof covering you choose. Along with excellent energy efficiency, you will gain extra living space that's comfortable to be in.

Bob Tortorice has over 31 years of green building experience. He is the owner of Building Alternatives, Inc. and Alternative Energy Audits in Franconia NH. Bob is a member of the Efficiency VT program. Call 603-823-5100 or visit www.buildingalternatives.com. 



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NHSaves Net-Zero Competition Winners

George Harvey

NHSaves is a partnership of the New Hampshire utilities, Eversource, Liberty Utilities, New Hampshire Electric Co-Op, and Unitil. Last year, it established the annual Drive to Net Zero competition to showcase especially high-performance homes, designed to achieve net-zero energy use, that have been built in New Hampshire.

NHSaves has announced the winners of its second annual Drive to Net Zero competition. The first prize went to Unity Homes, with Eversource as the utility partner, for a 3,570 square foot home in Newbury, New Hampshire, belonging to Janet Taft. During the awards, Ted Benson, founder of Unity Homes and Bensonwood commented, "There is no reason that buildings today are not super-energy-efficient." It is worth noting that those words apply to all buildings, regardless of size or price.

A home belonging to Mark and Elizabeth Peterson of Sutton placed second. It was built by Matthew O'Clair of Newbury, with Eversource as the utility partner.

A home in Etna, NH belonging to Bruce and Wendy Williamson, won third place. It was built by Domus Custom Builders, also located in Etna, NH and owned by Bruce Williamson. Liberty Utilities was the utility partner.

The Petersons, who won second place, sent us a very nice description of the process they went through to get their award-winning home built. It illustrates Ted Benson's comment well. Here is some of what they said.

"We decided to build an insulated concrete form (ICF) home due to the energy efficiency, durability, and low maintenance. Our home site is southeastern orientation to maximize solar energy. The lot is sandy with good drainage. We plan on landscaping the lot with permaculture design for sustainability and self-sufficiency.

"Mark contracted with Matt O'Clair, a



The second place winning home of the NHSaves Net-Zero Competition. Photos: Elizabeth and Mark Peterson.

local builder who had done many modular homes and SIP (structurally insulated panel) homes. We used Nudura ICF blocks from Atlantic Builders Supply Northeast Inc. Joe Harnois was instrumental with education about ICF building and design. We worked with Loewen Window Center

for our Kohltech double glazed tilt and turn windows and Therma Tru outside doors. Insulation was blown in cellulose in the ceiling and in the walls in our wood-framed seasonal room from Quality Insulation. We have a 39-solar-panel, 11kW [photovoltaic] system on our metal roof from ReVision Energy. The house has an air exchange system. We have LED lighting inside and outside and Energy Star appliances.

"We decided to heat and cool our home in three ways, first with one MX23 Mitsubishi heat pump duckless splits with two head units that keep the house at an even temperature of 68 to 70 degrees F. Second, we put in hot water radiant floor heat, for when the temperature drops below zero, using a propane-fired Weil-McClain energy-efficient boiler which supplies two HTP SuperStor insulated hot water tanks, one 120-gallon [tank] for radiant heating and 60 gallons for domestic

hot water. Third we designed the home to maximize passive solar with large double-glazed tilt-and-turn windows that allow plenty of light for heating and cooling in our home. All this combined with the ICF material has made our home very comfortable and highly energy efficient.

"The energy efficiency of our home is more than we expected achieving a HERs index rating of -22."

We at Green Energy Times give our sincere congratulations to all.

Links: Unity Homes, unityhomes.com; Matt O'Clair, <http://bit.ly/Matt-Oclair>; Domus Custom Builders, domusbuilt.com; NHSaves competition, <http://bit.ly/NHSaves-competition>. ♻️



Left are interior images of the home. Above: the mechanics. Photos from Elizabeth Peterson.

Ground Zero: Net-zero Building

Cont'd from p. 25

When Brian Crowl started Crowl Construction, he didn't intend on building net-zero homes. However, after attending several seminars and conventions such as those put on by the Northeast Sustainable Energy Association (NESEA), he decided that he would begin weaving elements of what he had learned about sustainable and zero-energy building into all of his projects in order to make the absolute best version of each home.

Crowl Construction, partnered with TruexCullins Architecture + Interior Design, broke ground on the Eisinger NZE home on November 18th, 2015. The goal was to build a completely self-sustaining, single-family home that could survive the harsh winters of the Adirondacks without relying on any outside energy. To do so, the team focused a lot on carefully insulating each aspect of the home, using four-inch-thick insulating foam on the exterior of the concrete, installed with both weatherproof flash tape and spray foam for long lasting durability. Once the basic insulation was set in place, building picked up pace, much like a normal house. Says Crowl, "At each step along the way we had to stop and rethink our methods...some of this is really typical construction technique, it's all basic stuff, and then we have other elements that we're figuring out on the fly."

Since this was the first attempt made by Crowl Construction to create a completely net-zero building, communication with the architects was key. One big point of concern was the reliance on adhesives to hold all of the flashing and outer insulation together. So, after much back and forth, it was decided that they would also invest in house wrap that would go under the siding to hold it all together. However, there was also the issue of moisture collection and venting under the siding, so after much thought they used Core-A-Vent strips applied to firing strips attached to the side of the house that created drainage for any trapped moisture. Crowl stressed the importance of the back and forth with the architects that led to this innovative combination of sustainable building elements showcased in the Keene house.

Once these aspects had been hammered out, the rest of the house went up fairly smoothly. The most important detail of most net-zero houses is that they are sealed tightly to preserve energy. To test this, Crowl performed a series of blower-door tests, a simple measurement of how much air filters out of your house. The common rule is that your home should have a blower

Cont'd on p.33



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LED IT SHINE, LED IT SHINE

George Harvey

Green Energy Times has had a number of articles on light emitting diodes (LEDs). LEDs can be used for lighting in homes and businesses, for street lights, for flashlights, for vehicle headlights, and more; and in every instance we have seen, they have important advantages. In August of 2018, G.E.T. ran an article, "Cool Ways LEDs are Helping the Planet" on their generally superior lighting for specialized circumstances ranging from architectural highlighting to museum displays. An article in April of the same year, was "Product Preview: LEDdynamics™ Gro-Lights," which examined their use for indoor gardening.

We live in a time when things change very quickly. For example, costs for photovoltaic (PV) modules have been declining so fast that any information on their prices that is as old as a year should be regarded as very possibly obsolete. It happens that the technologies of LEDs and PVs are very similar, so an improvement for manufacture for one of them could be reflected in an improvement for the other.

Ian Pahl, the renewable energy specialist at Sol-Air since 2006, serving the regions surrounding Lake Sunapee and Kearsarge, New Hampshire,

recently sent us a summary of updates he thought we should pass on to our readers. They include some observations that we believe are definitely worth taking into account.

Pahl started by saying something we knew already: The energy consumption of LEDs, relative to the amount of power they consume, is very low, and that means people can save a lot of money by installing them. But he went on. It is not so well known, but important to consider, that LEDs outlast just about any other kind of light people would use. An incandescent light might have to be replaced 25 times in the lifetime of an LED, and that means big cost savings. And it is not just the cost of the lights that is important, it can also be the cost

of physically making the switch which can be significant when tall ladders or lifts have to be called into service.

Pahl also points out something that is actually pretty obvious, once you think about it, but could slip by a person easily. Calculations of the sizes of solar arrays to provide power to specific sites always should take demand into account. By installing LEDs, that demand can be decreased considerably, and this would reduce the size and cost of the solar array. It is important, for that reason, that the first step in designing many solar arrays should be to upgrade lighting systems first. In some cases, the size of the solar array could be reduced by as much as 40%, and that reduction is reflected by a reduction in cost.



LED bulb with Edison base.
Image: Artoria2e5, Wikimedia Commons.

Peter Salvitti of Efficient LED Lighting Systems, with which Sol-Air partners, also had suggestions Pahl passed on to us. He has been quoting linear fixtures that go into warehouse spaces lasting up to 160,000 hours. He also pointed out that the technology is constantly improving, with prices being reduced and new products coming online.

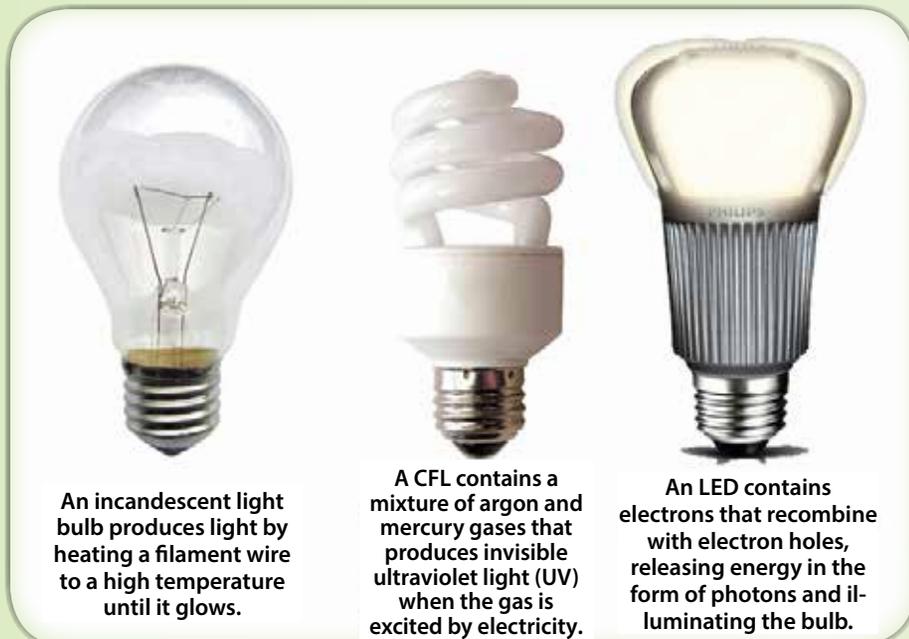
At one warehouse project, after incentives, the LEDs were so much more efficient than the previous lighting system that a customer cost of \$6,400 produced annual savings of \$3,990. This means the estimated payback period was 1.6 years, for a return on investment of over 62%.

In some cases, LED lights are not only more efficient, in terms of energy used, but they are also brighter. Pahl told us, "Another project at Henniker Farm and Country Store shined so bright, some of their crew said they didn't even have to keep all the lights on!"

Salvitti observed, "The real question is why aren't more businesses making the switch? The key factor here is because we all get comfortable with our day-to-day lives, and lighting is typically always an afterthought." 

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An incandescent light bulb produces light by heating a filament wire to a high temperature until it glows.

A CFL contains a mixture of argon and mercury gases that produces invisible ultraviolet light (UV) when the gas is excited by electricity.

An LED contains electrons that recombine with electron holes, releasing energy in the form of photons and illuminating the bulb.

Image: parquessustentaveis.blogspot.com

While shopping at a local retail store, I noticed that incandescent light bulbs were still for sale, and I watched customers picking them up to compare their purchase cost to that of LED bulbs. I wondered if they understood that the LED bulbs might cost a few cents more to purchase, but their lifetime time costs would be much lower.

As of January 2014, a law took effect that requires general use light bulbs to be at least 30% more efficient than the incandescent light bulbs in use at that time. In 2020, this law will require bulbs to be 60 to 70% more efficient. In response, incandescent manufacturers met the law's requirements by creating a 43-watt halogen-incandescent bulb that produces only slightly less light than its 60-watt predecessor. However,

a 60-watt equivalent LED only uses nine watts, and it will use less energy and last much longer than even a yet-more-vastly-improved incandescent bulb that meets the 2020 regulatory standard. Thus, despite the recently increased efficiency of incandescent bulbs, it is still well worth it, financially, to purchase the LEDs. Although the purchase prices are close, the operational costs are vastly different. A LED will provide 80% of its energy use as light and 20% as heat. A halogen-incandescent bulb provides the opposite, 20% light and 80% heat. Additionally, LEDs will last 10,000-20,000 hours versus only 3,600 for the halogen-incandescents.

Over time, the differences in efficiency lead to shocking differences in cost. In fact, if your 43-watt halogen-incandescent light bulb is on for four hours per day, you

will burn through \$75 more electricity over a nine-year period than if you had decided to switch to an LED. As a halogen-incandescent bulb only lasts around 2 ½ years, you will also be buying many more bulbs over the life of the single LED bulb. If the added cost of these bulbs is added to their higher operating costs, the total added cost is around \$82. Penny wise but dollar foolish is an aptly applied saying!

Multiply savings of up to \$9 per year by the number of light bulbs in your house! One Ammonoosuc Regional Energy Team (ARET) member added up the light bulbs in his house and came up with 100. He estimated that the average light was on for close to an hour per day, so that annual savings of \$200 would be achieved following a complete conversion from incandescent bulbs to LEDs.

A 2015 Residential Energy Consumption Survey conducted by the U.S. Energy Information Administration indicates that most people understand the savings pos-

sible by replacing incandescent bulbs with LEDs or CFLs (compact fluorescent lights). CFLs are much more efficient than incandescent bulbs, but not quite as efficient as the more recently available LEDs. The study indicated that only 11% of households had all incandescent lights, 18% had no incandescent lights, and 71% had at least some LEDs or CFLs. These figures indicate to me that everyone was doing as I was doing. When incandescent bulbs burned out some years ago, we replaced them with CFLs. Now, years later, when the CFLs burn out, we are replacing them with LED bulbs.

Then, one day I wondered what it was costing me to keep those CFLs around. Perhaps it would make sense to replace them all right away. So, I did the math. CFLs are similar in cost and expected life to LEDs; 72% of their energy consumption goes towards light, and they will last around

Cont'd on p.34



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Dover, NH School Achieves Solar Milestone

Array to Save Taxpayers Over \$4 Million

ReVision Energy has completed the installation of the largest rooftop solar array in the company's history. The project at the Dover High School and Career Technical Center includes 2,581 solar panels, increasing the state's solar capacity by 1.5% and saving Dover taxpayers more than \$4 million long-term at no upfront cost. The project was unanimously approved by the Dover City Council last year. The ribbon-cutting to celebrate the completion of the project was on September 19th.



Starting the school year off right! Dover High School's new 2,851-panel, 912kW rooftop solar array will keep 1,111,262 pounds of carbon out of the atmosphere every year. Photo ReVision Energy.

The solar array has a useful lifespan of 40 years and will generate over 1,000 megawatt-hours of electricity each year, offsetting roughly 40% of the school's electric load. The solar power generated by the array is equivalent to offsetting 558 tons of carbon pollution each year or the annual electricity use of 88 homes or the carbon sequestered by 600 acres of forests.

The 912-kilowatt array was financed through a Power Purchase Agreement (PPA) which enables the city to purchase electricity at below-market rates and includes a purchase option that becomes available in year 10 of the agreement. Exercising the purchase option would enable the city to acquire the array at a significant discount and produce free

solar energy for decades to come.

Investor partner Kenyon Energy owns the school array and will sell the electricity to the city at a negotiated rate. PPAs enable nonprofits, municipalities, and schools that are precluded from accessing available solar incentives to transition to clean energy at no upfront cost. The PPA gives the city the ability to leverage the economic benefits of solar power while affording the investor partner the opportunity to make community investments that align with its core values of creating positive change in the world.

Ongoing maintenance and operations of the project will be managed by Bay4 Energy, one of the country's leading solar

service companies providing a comprehensive suite of energy and asset performance management services.

The Renewable Energy Credits (RECs) generated by the array will be sold by Kenyon Energy into environmental compliance markets for the term of the PPA. RECs are market-based mechanisms that represent

the environmental benefits of solar power generation. A REC is produced when an array generates one megawatt-hour of solar electricity.

ReVision Energy's agreement with the City of Dover includes an educational initiative aimed at teaching students how solar energy works and exposing students to the various functions involved in the engineering, electrical, and marketing aspects of the project.

According to Dover Energy Commission member Zachary Koehler, "This project has the potential to ignite the imaginations of current and future students. I am hopeful that this array will intrigue students to learn more about this technology and

entice them to utilize the educational possibilities they have at Dover High School and the Career Technical Center."

Koehler added, "This has the potential to stimulate a passion for engineering and development of this technology in their future endeavors, be it in furthering education or career opportunities. When this happens, our students can be the ones who bring our community, our state, and our country closer to the clean energy future that we so desperately need."

The City of Dover also partnered with ReVision Energy on the installation of rooftop solar arrays at the Children's Museum of New Hampshire and adjacent Dover Indoor Pool. ReVision Energy donated 103 solar panels for the installation, part of a 318-panel solar array at the museum and pool which share a common electricity meter. The rooftop projects installed on the museum and indoor pool are owned by ReVision Solar Impact Partners (RSIPs).

Under the terms of the RSIP program, impact investors provide capital to build solar projects. Investors earn a modest rate of return through payments made for solar generation, tax incentives, and other project benefits while solar installers benefit from a steady pipeline of work. The entity entering into the agreement receives a reduced electric bill. ReVision Energy continues to seek out impact partners for future projects. Learn more at revisionenergy.com/solar-impact. ♻️

Ground Zero: Net-zero Building

Cont'd from p. 31

door number less than the square footage of said home. In this case, it was significantly lower, with the final test reading just .26 ACH (air changes/hour), meaning the air filtering out was almost none. Satisfied with this result, they then installed an HRV filter, which provides fresh air and exhausts pollutants from the home. They also installed a three-ton air source heat pump that provides all the heating and cooling for the entire house, and finally a 13-kW solar panel system on the roof of the house and garage. The solar panels themselves provide 100% of the on-site energy demand and are designed specifically to accommodate the house's solar gain and shading.

It may not look like anything other than a beautiful family home nestled in the woods, but the Eisinger house is a modern marvel, a testament to the future of sustainable building and living.

Jenna Batchelder is a 21-year-old climate change activist and passionate clean-energy supporter. She is excited to be writing for Green Energy Times and encourages all young adults to become more involved in activism. ♻️

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Global Immunity through Community Resilience

Cont'd from p. 2

focus on carbon emission reductions to maintain equilibrium, resilience intentionally expands the conversation into broader strategies that promote both a thriving populace and regenerative ecosystems. Just as a sensible and effective approach to health should be integrative in order to address all systems in our bodies, a "both/and" approach to global wellbeing should combine multiple perspectives for maximum benefit.

We cannot ignore that our choices and lifestyles, as individuals and as communities, factor heavily into the disease that we are experiencing on a personal and a global scale. We can continue to treat the disasters and emergencies that arise but, unless we dig down and focus on finding the cause and a cure, we are going to keep having the same expensive and heart-wrenching problems again and again. Prevention is almost always cheaper than emergent treatment, and it takes longer to recover from a major illness (or disaster) than it does from a minor one.

No two communities are alike, so the path to resilience will be different for each. We can nurture social cohesion, support greater equity, and engage our neighbors in the solutions. We can design redundancies and diversity into



our energy supplies and food systems. We can conserve resources, financial and otherwise, to save money and reduce waste. And, as we develop innovative, responsible, and future-minded policies we increase the overall health and happiness of our communities and help lessen the impact of shocks to

those systems and increase our ability to respond.

Health-enhancing strategies implemented at an organizational and regional scale lead to personal wellbeing, social justice, economic stability, and ecological balance. As we become more aware of the integration between our mind and body, and ourselves and the planet, we can mindfully leverage those connections for our own wellbeing, as well as the greater good. In addition to giving us more energy to enjoy our lives, the development of individual and community resilience, might actually be able to save it someday.

Jennifer White is the director of sustainability and innovation at Colby-Sawyer College where she collaborates with stakeholders to implement policies, initiatives, and curricula that promote sustainability and resilience on campus and within the greater community. ♻️



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ELMORE ROOTS' PERMACULTURE KNOW-HOW

Rock Stars

David Fried

What gives plants the strength to grow through so many obstacles?

What gives people the strength to go on day after day doing their work in the world?

I have been noticing the strength of plants lately. By the ocean, I saw some *rosa rugosa* (beach rose) looking healthy as it was flowering and growing right up through a pile of rocks. There is a grape vine that year after year comes in through the window of my office and grows across my desk. As I write this, a Virginia creeper has somehow entered my house through a wall and is holding its "head" up on our porch, near our summer dining table. These plants breathe life into our world and



A Virginia creeper growing through the wall into the author's sunporch. Image: David Fried.

show us an example of plant optimism. They don't give up. They don't talk politics. They keep doing what they are supposed to do. They are answering their inner call. To be green. To be the best they can. To be fruitful and multiply. This is why I grow plants. And this is why I like to hang around with people who see beauty and wonder in the world around us.

People think I am a great grower of plants and trees. They see a lot of fruit and nuts on our trees and think I have mastered the secrets of growing. The reason I can grow and harvest so much fruit and nuts is because these plants want to grow!

It is effortless. You plant a fruit tree or a nut tree and water it a bit at first. Keep the lawnmower away but give it the edge over the surrounding grass. The trees' roots go down into the earth and find the resources they



A rose grows in the rocks. Image: Navah Fried.

need right there. Our biggest job is not to hurt them.

Plants are amazing. People are amazing. We survive.

My mother got up every day in her high eighties and painted and wrote poetry. She donated to every organization that wrote to her. She was helping the world to be better, brighter, with more music



and kindness, to her last day.

Plants do this also. When the sun touches them in the morning, they are ready. Putting forth flowers and fruit and shade and interesting shapes on our street and in our fields. They take in CO₂ and give us oxygen while they are at it. When they die, they give everything back to the earth from where they sprouted. As the famous perennial tree crop enthusiast John W. Hershey once said, "Plant 'til you are planted!"

When we plant flowers and shrubs and trees, we are standing up for everything that is good in the world. We have hope for the place. Each plant is our partner in believing in our world and in each other.

David Fried started Elmore Roots Fruit Tree Nursery forty years ago. He also plays guitar and writes songs, including an elderberry rap song. ♻️



Larry Plesent

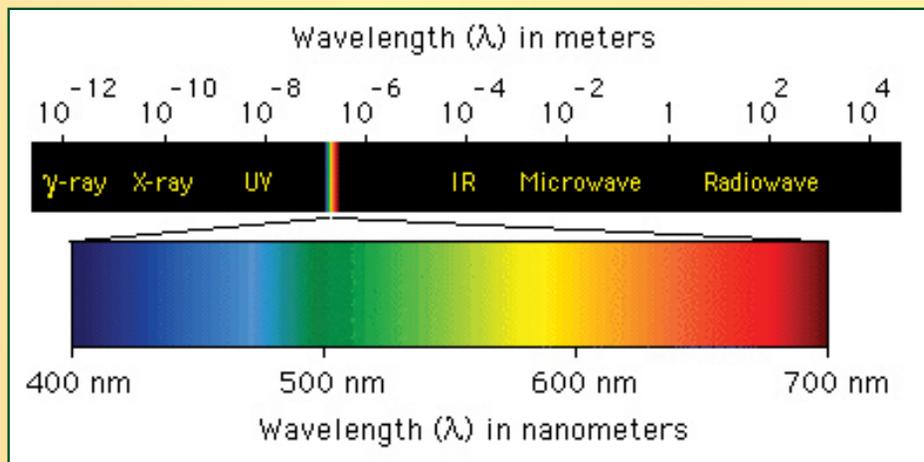
This issue's "Ingredient of the Month" focuses on light and specifically the blue-white light that is wavelength 483 nanometers; just before the UV (ultra violet) range.

Several disturbing reports have come out in the past year about old 483, including one from the University of Toledo illustrating the mechanism of retinal eye damage from bright blue-white LEDs. Here scientists clearly proved that blue-white light in the presence of retinal (a natural chemical produced by and present in the eye) caused physical and permanent changes to the structure of specific sensors in the back of eye.¹

Even more disturbing is this 2018 study on pigmented mice. Here is an excerpt: "Exposure to (continuous) blue LED light for three days induced retinal damage... induced white spots on the retina, and... this led to a secondary degeneration of the photoreceptors. Exposure of pigmented mice to three consecutive days of blue LED light will cause retinal pigment epithelium and photoreceptor damage. The damage led to an accumulation of macrophages (scavenger bacteria often found near infections) and drusen (yellow or white

Ingredient of the Month

Making Light of It



deposits) around the outer segments of the photoreceptors...²

Blue-white light is a natural part of sunlight, and we evolved to live with it. The exciting thing here is that we now know which exact wavelength that is responsible for the truth every child on the planet knows, "Don't stare at the sun or you will (risk) going blind."

Counter strong blue-white light exposure by wearing blue wavelength blocking sunglasses (yellow lenses are one way). Read the tag on the glasses, the brochure or the online brand website to find out for sure. This becomes more important with increased exposure. You can also filter your screens with plastic light filtering schemes or by keeping your blue light filter on all the time on your hand held. Change out bright white LEDs for "softer, cooler" yellower spectrum lighting. This last suggestion was especially

tough for me as I LIKE a bright white light so I can see what the heck I am doing! However, I did unscrew four out of six LED bright white bulbs in my office and got a special screen for my work computer. I keep the blue blocker on my phone turned permanently "on" and

turned down the brightness on the LED screen of the entertainment center. Lastly, I changed out my (very) cheap sunglasses for \$35 amber colored blue-wave blocking sunglasses and kind of like the new look.

Light, like water, is completely natural. And, like water, too much of it may be harmful to your health. Trust me, staying

healthy should NOT be painful.

This is the Soapman reminding you that whenever you are not paying attention to you is probably going downhill. Or like soap, down the drain. Scientists call that entropy, but we will save that one for another month. Have a blessed day.

¹ Ratnayake, K et al (2018) Blue light excited retinal intercepts cellular signaling. *Scientific Reports* 8:10207 DOI:10.1038/s41598-018-28254-8 20.

² Nakamura M, Yako T, Kuse Y, Inoue Y, Nishinaka A, Nakamura S, Shimazawa M, Hara H. *Exp Eye Res.* 2018 Dec;177:1-11. doi: 10.1016/j.exer.2018.07.022. Epub 2018 Jul 21.

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

LIGHTBULBS - \$82

Cont'd from p. 32

10,000 hours. However, the CFL uses fifteen watts versus nine watts for the LED. A CFL light that is on for five hours a day will use more than 27 kWh of electricity (5 hours per day x 365 days per year x 15 watts = 27.4 kWh) and cost \$4.65 annually, assuming electricity costs 18 cents per kilowatt-hour. A nine-watt LED would cost only \$2.79 and the savings of \$1.86 per year would be more than the cost of an LED bulb. Thus, it is not only worthwhile to replace incandescent bulbs with LEDs, it is also worthwhile to replace CFLs.

Suppose a household replaces five 60-watt incandescent bulbs that are on for one hour per day, ten CFL bulbs that are on for three hours per day, and ten CFLs that are on five hours per day. It will cost approximately \$38 to purchase the 25 bulbs, but they will save nearly \$50 per year or \$600 over the life of those bulbs. This modest investment would provide a return far greater than best annual returns from the stock market.

On a larger scale, if NH's more than 500,000 homes made similar upgrades to LEDs, they would together save about \$24 million per year, which would lead to an annual increase in economic activity of \$40 million as these saved dollars turned over from one NH business to another.

Mark Koprowski lives in Bethlehem, NH. He is a member of the board of the all-volunteer, non-profit Ammonoosuc Regional Energy Team (ARET), which encourages and supports economically and environmentally sensible energy practices in the Ammonoosuc Region of Northern New Hampshire. For more information about ARET and local energy solutions, go to www.ammenergy.org. ♻️

RECLAIMING URINE AS FERTILIZER

Julia Cavicchi

The Rich Earth Institute is reclaiming urine as a precious resource. From their base in Brattleboro, Vermont, they have developed a novel approach to pee, diverting it out of the waste stream and returning it to the environment as fertilizer. Through the power of pee, they are developing solutions for both farms and water systems.

Urine diversion provides a sustainable source of fertilizer for local farms while also saving water and preventing downstream pollution. It captures the vital nutrients held in urine before they are lost down the drain. Rather than polluting waters elsewhere, nitrogen and phosphorous can be saved for use as a fertilizer.

Synthetic fertilizers are part of a broken nutrient system where large amounts of greenhouse gases are required to produce nitrogen, and phosphorous is a limited planetary resource. The potential for urine to replace synthetic fertilizers thus has wide-reaching implications beyond the local water systems involved.

Simply nourishing crops with urine was once a common practice; urine was framed as a waste product only in relatively recent history. Confiscated by public infrastructures, it seemingly disappears without a trace. The Rich Earth Institute is working to address the myth that waste vanishes around the U-bend.

Rather than flushing waste away, they are developing a novel approach to reclaiming the value of urine. Diverting urine from the waste stream offers a way

for each of us to re-embed ourselves within our local ecologies. Through urine diversion, we find our own bodily functions intimately connected to both water quality and farm production. Urine-diverting toilets not only save urine as fertilizer but also reduce the amount of water that is wasted in flushing it away.

"Pee-cycling" can be done at home, following World Health Organization guidelines. Pee can be collected in stand-alone jugs or through a retro-fit to your toilet, with plastic inserts to divert the pee. It's best to dilute your urine with water before applying it to plants. See the WHO guidelines for exact details to ensure safety and best practice: https://www.who.int/water_sanitation_health/wastewater/urineguidelines.pdf

Urine diversion is one accessible solution to a planetary problem, scaling from individual households to whole communities and beyond. The Rich Earth Institute has developed the nation's first community-scale urine diversion program. In Vermont's Connecticut River watershed, the Urine Nutrient Reclamation Program addresses both local sanitation challenges and regional ecological concerns.

The project brings the community



A divided bowl toilet for use with urine diversion and the collection program; inset: Application at a local farm. Images courtesy of Rich Earth Institute.

together in unexpected ways. From the individual donors, to the farmers who apply the fertilizer, to the engineers and designers, it takes a village to make this process flow smoothly. Since the project's inception in 2012, the community has collectively saved over 30,000 gallons of urine from entering the waste stream.

This project is made possible through funding from both the National Science Foundation and the National Fish and Wildlife Federation, and other private foundations and small donors. In addition

to the community project, the Institute is conducting research in partnership with the University of Michigan to develop innovative methods for urine diversion and scalability strategies.

Other communities can replicate what the Rich Earth Institute has made possible in the Connecticut River watershed. The Institute is eager to gain momentum for other community-scale urine diversion programs. For those communities interested in learning more, the Institute has developed a urine-diversion guide which

is available online at richearthinstitute.org/urine-diversion-guide/.

In the midst of the inter-connected planetary crises of climate change, nutrient cycles, and water contamination, urine diversion shows how alternative futures are possible. "Pee-cycling" helps us to understand the entanglements between bodies of water and our own watery bodies, and re-embeds us within the nutrient cycle. This holistic approach to revaluing waste will be key to building resilience into communities in uncertain times to come.

Julia Cavicchi is an ECO-AmeriCorps member serving with the Rich Earth Institute in Brattleboro, Vermont. www.richearthinstitute.org.

FARMS, HARVEST AND CLIMATE CHANGE *Cont'd from p. 1*

Climate Hub, recently led a team which produced the New England Adaptation Study for Vegetable and Fruit Growers, which examines how Northeast farmers are adapting to extreme weather.

Seventy-two percent of vegetable and fruit farmers surveyed have made adaptations in response to heavy precipitation; 66% have made adaptations in response to drought. And many of their adaptations actually address the root of the problem.

A good share of the excess carbon currently in the atmosphere came from soil in the first place. Practices like keeping soil covered, keeping living roots in the ground, and reducing tillage build carbon back underground where it belongs. That in turn helps farmers. Carbon-storing techniques create well-structured soil that can absorb more water, hold it longer, and release it when conditions dry. Seventy-four percent of New England farmers surveyed were building soil health and using cover crops as a response to heavy rains. Other popular responses include using crop



Flooding from extreme weather conditions related to climate change can cause devastation on crops like this corn field. Image: news.stanford.edu.

rotation, green manures, and no-till farming. The study notes, "Growers reported changing crops and diversifying crops, and expressed interest in species and cultivars

that are more tolerant of extreme weather conditions and excess moisture. Crops that are native, moisture tolerant, and even "suitable for heavy rains" are increasingly considered by growers because these plants could thrive through challenging climate conditions. Some farmers noted that they have reduced crops that "expose bare ground for too long, such as potatoes," and added crops that consume a lot of water."

Other growers are shifting to hoop houses to grow some of their crops, or using plastic mulch, which reduces the amount of water infiltrating into the soil. Plastic comes with its own set of problems; however, it may be a necessary transitional tool.

Farmers are also paying close attention to the movement of water on their land, controlling, catching, and containing it,

installing rain barrels and ponds, and putting in irrigation systems. None of these are new techniques, but it's new to need them in the Northeast.

Livestock farmers have also adapted by pasturing only animals that can walk away from high water in the flood plain. Poultry and young animals are grazed on higher ground.

All this is happening whether or not an individual farmer accepts climate science and in the absence of legal mandates. It's an objective fact that there's too much rain lately, that farmers can get on sod faster than they can bare ground, that a crop you don't have to plant every year is less exposed to the vagaries of weather, and that fewer inputs of tractor fuel,

agricultural chemicals, and farmer time lead to a better life and the possibility of profit. And that's all good news for the planet.

Links:

Natural Resources Conservation Service: <https://www.nrcs.usda.gov/natl-home>
USDA Climate Hub <https://www.climatehubs.usda.gov/>

UVM Adaptation Survey <https://www.uvm.edu/ag-adapt/>

UVM Extension's Center for Sustainable Agriculture: <https://www.uvm.edu/ext-sust-ag>

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

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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.encyvt.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.nyse.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...

Community Outreach Strategies to Drive Renewable Heating

Cont'd from p. 23

However, Massachusetts' campaigns have seen a 58% increase in adoption in comparison to the years without HeatSmart campaigns.

There are several important take-aways that communities should keep in mind when planning HeatSmart campaigns:

1. Since homes differ widely, it is difficult to reduce costs dramatically for heating technologies. Many heating projects must be individually designed for each home.
2. Installers tend to stay local and are not well equipped to scale-up in response to increased demand.
3. Education and outreach are key.
4. Customers rely on vetted installers for high-quality installations.
5. Transparent pricing is an important aspect of the program.

For a more in-depth analysis on HeatSmart campaigns, download the Clean Energy States Alliance's recent report, Community Campaigns for Renewable Heating and Cooling Technologies, Four Case Studies: <https://www.cesa.org/assets/2019-Files/Community-Campaigns-Renewable-Heating-Cooling.pdf>.

Look for our next two stories in this series in G.E.T.'s November issue, which will feature case studies from recent HeatSmart campaigns.

Val Stori is Project Director for Clean Energy States Alliance. ♻️

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Marine Ecosystems' Population Decline

EarthTalk®, From the Editors of E - The Environmental Magazine

Environmental advocates do spend a lot of time harping about threats to our oceans, but sadly for all of us the facts bear out the concern. According to the World Wildlife Fund (WWF), population numbers for the majority of marine wildlife species have declined by half since 1970, with many species down as much as 75 percent. Furthermore, a third of all fish stocks are overfished and one in four species of cartilaginous fish (sharks, rays and skates) are living on the brink of extinction. "Driving all these trends are human actions: from overfishing and resource depletion, to coastal development and pollution, to the greenhouse gas emissions causing ocean acidification and warming," said WWF's Senior VP for Oceans Brad Ack.

Another recent study by University of British Columbia researchers corroborates WWF's findings, concluding that the biomass of predatory fish in the world's oceans has declined by some two-thirds over the last 100 years, and the decline is accelerating, with 54 per-



The oceans certainly aren't as crowded as they used to be. We have depleted stocks of large marine predators through overfishing. Pollution and climate change have been destructive, as well. Photo by Tom Fisk, Pexels.

cent of it occurring in the last 40 years. No doubt these changes are happening partly as a result of overfishing. According to the United Nation's Food & Agriculture Organization (FAO), nearly 90 percent of the world's marine fish stocks are either fully exploited, overexploited, or depleted. Efforts to rein in the industry in the U.S. and elsewhere have led to more sustainable practices, but bad actors still ply

deep sea waters with destructive trawlers and other gear which not only collect more fish than is sustainable but also inadvertently kill many other marine wildlife in the process.

There is some hope. Early results of efforts to essentially rope off certain parts of the ocean as "marine protected areas" (MPAs) to let marine wildlife recover are showing promise. A Center for Biological Diversity analysis of 31 marine wildlife populations found that habitat and other protections afforded them under the Endangered Species Act helped them rebound significantly, with three-quarters of endangered marine mammal and

sea turtle species increasing population sizes accordingly. "The Endangered Species Act not only saved whales, sea turtles, sea otters and manatees from extinction, it dramatically increased their population numbers, putting them solidly on the road to full recovery," said the Center for Biological Diversity's Shaye Wolf. "Humans often destroy marine ecosystems, but our study

shows that with strong laws and careful stewardship, we can also restore them, causing wildlife numbers to surge."

Another way to stop or slow the over-exploitation of marine resources would be to end the approximately \$20 billion in yearly subsidies for harmful fisheries that encourage destructive practices. The World Trade Organization has pledged to set new targets by mid-2019 that would require member nations to reroute any such subsidies toward investments in sustainable fisheries, aquaculture and coastal community development to reduce pressure on fish stocks. But even if such a drastic restructuring of the fisheries economy takes place, environmental leaders worry it may be too little too late.

Contacts: "A century of fish biomass decline in the ocean," www.int-res.com/fish-decline; "Marine mammals and sea turtles listed under the U.S. Endangered Species Act are recovering," journals.plos.org/sea-mammals-turtles; FAO, www.fao.org/fisheries/en/.

EarthTalk® is produced by Roddy Scheer & Doug Moss for the 501(c)3 nonprofit EarthTalk. Send questions to: question@earthtalk.org

A Step In the Right Direction *Cont'd from p. 1*

coastal environments. Together, BIONIC and Sperry's other mission partner, Water-keeper Alliance, have, to date, recovered the equivalent of 4.2 million plastic bottles from marine environments, using an average of five upcycled plastic bottles for each pair of Sperry BIONIC® shoes.

Learn more at sperry.com/en/bionic.

Rothys



Rothys' collection of stylish flats are environmentally-friendly and durable. Image: plugin-magazine.com.

Rothys is a women's shoe company built on sustainability. By using upcycled plastic bottles to create the knitting for their shoes, as well as vegan, recyclable, carbon-free rubber for the soles, Rothys' collection of stylish flats are ecological and durable. In fact, Rothys' products are so durable, they can even be machine washed, allowing their owners to maximize their lifespan and continue enjoying clean, sheik shoes for miles and miles. In addition to this, Rothys' shoes are shipped in 100% recyclable biodegradable shoe boxes that are made from 85% post-consumer recycled material and are durable enough to be shipped by themselves, as to prevent box-in-a-box shipping.

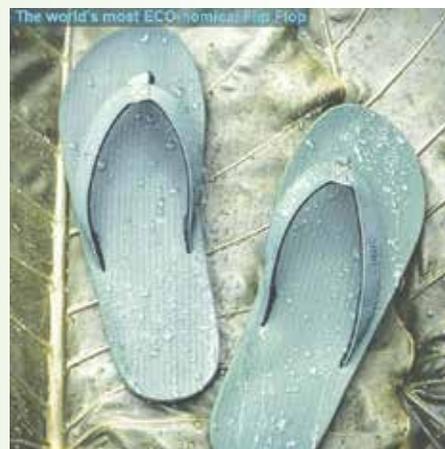
Learn more at rothys.com/sustainability.

SAOLA



SAOLA shoe collections are manufactured from recycled plastic bottles and environmentally-friendly materials. Image: www.saolashoes.com.

Named after one of the rarest and most endangered species in the world, SAOLA is as passionate about finding new ways to implement eco-construction techniques in their shoe development as they are wildlife conservation. SAOLA's collections of men's and women's everyday shoes are built from recycled plastic bottles as well as several other innovative, environmentally-friendly



Indosole uses discarded tires to produce its footwear collection. Image: indosole.com.

materials. By partnering with Bloom Foam, SAOLA has been removing harmful algae from lakes and rivers and using it as a main ingredient in their shoes' soles. SAOLA then uses cork, a highly renewable material, to finish their soles with extra comfort and odor-resistance. On top of this, 1% of all SAOLA shoes sold will support volunteer efforts to supply sustainable water systems to wildlife communities in Africa.

Learn more at saolashoes.com.

INDOSOLE

Certified B Corporation Indosole is working to reduce the build-up of another imperious man-made substance in our natural environment: tires. Similar to plastic, tires are practically indestructible when it comes to decomposition, so discarded tires have been collecting and damaging waterways and other habitats around the world for a century. The team at Indosole intercepts old tires before they are thrown away and cuts them by hand into soles of various shapes and sizes. These soles are then attached to the upper halves of the shoes, which are woven from various natural materials like grass, banana leaves and organic canvas.

Indosole is best known for their ESSNTLS line of flip flops and slide-on sandals, however, they also sell a variety of other flats as well. For more information, visit indosole.com.

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



Sperry's BIONIC® Collection creates shoes using yarn spun from plastic recycled from marine and coastal environments. Image: www.sperry.com/en/bionic.

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Recycling Furniture: Why and How

Abby Overton

Home furnishings make up about 6% of what goes into landfills in the U.S. Americans threw away 48% more furniture and furnishings in 2015 than in 2000. We send 9.7 million tons of furniture to landfills each year! Let's stop doing that! As a rule of thumb, your best bet for used furniture is to repair if possible, donate if available, give it away or sell for further use, and trash as bulk waste as a last resort.¹

Check with your local Habitat for Humanity ReStores, which are reuse stores operated by local Habitat for Humanity organizations. They accept donations and sell home improvement items to the public at a fraction of the retail price. Many ReStores will come to you and pick up your gently used furnishings – it's easy and convenient!

Find more places to donate used furniture at sites like the Furniture Bank Association of North America (FBANA) and the Mattress Recycling Council. Through FBANA, you can locate your nearest furniture bank. Furniture banks provide furniture to those in need at little or no cost. Many will pick up gently used furniture straight from your house. You can also look for Goodwill or Salvation Army locations. If these options don't appeal to you, homeless shelters, battered women's shelters and thrift stores



are often looking for furniture donations. Contact them and see if you have something they could use. In some cases, you might have to haul your old furniture to a drop-off location just to donate it. But that's not always true. Sometimes, you can arrange to have it picked up. Many donations can be deducted from your taxes.²

You can also give or sell used furniture to someone who will continue to use it. There are many classified websites out there (such as Craigslist) with people looking to buy. Tap into your network of social media contacts. Trade networks (like Freecycle) are worth investigating, too. Instead of selling an item, trade it for something you need. This is a fun and easy way to participate in the circular economy!²

If the piece is in no condition to be used by anyone, consider repurposing or

upcycling it. Search "upcycled furniture ideas" and you will find nearly twenty million hits. You can (re)build something wonderful that saves you the money of buying another piece.

If there just isn't any appealing way to reuse your furniture, check with your community to see if it provides bulk waste collection. Most cities offer bulk waste pick-up for large items like

furniture, appliances or electronics, but you'll likely need to schedule a collection.¹

No matter what it is, there are probably ways to reuse it instead of sending it to a landfill. The Sustainable Furnishings Council is here to help! Visit <https://sustainable-furnishings.org/>.

Links:

¹Earth911.com; ²recyclecoach.com

Abby Overton is the Communications Manager for Sustainable Furnishings Council.

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



Climate Strike

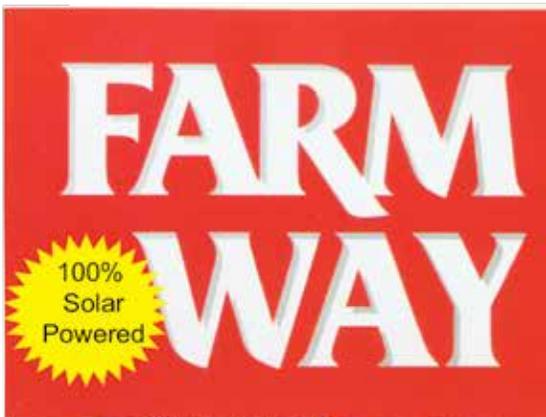
SEPTEMBER 20, 2019

These are extraordinary times. A sixteen-year-old Swedish girl is a world leader. And millions of people, old and young, have joined to follow her. *Green Energy Times* will have more to say about this in our next issue and our website.



Top: Greta Thunberg, odds-on favorite to win the Nobel Peace Prize in 2019. Photo: Anders Hellberg, Wikimedia Commons, <http://bit.ly/2kZshex>. Bottom: A Richmond Middle School student at the strike held in Hanover, NH to Norwich, VT. Photo by N. R. Mallery, Green Energy Times.

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Appalachian Gap Distillery Gets It Right *Cont'd from p. 1*



Tasting room interior. Note the white oak barrel-vaulted ceiling and white oak bar with cast-in-place concrete counter.

ingredients. Co-founder Lars Hubbard said, "We buy as much of our grains — corn, rye, and wheat — as locally as is possible, with the intent that a full 100% be grown and harvested within 25 miles of the distillery. (We are close to 90% local on these grains). Barley does not grow well in the Champlain Valley, though we are seeking Vermont-grown sources for that grain. Apples used in our apple brandy are from New England; maple syrup used in our Papilio spirit is from a local producer; agave for our Papilio spirit is from Jalisco, Mexico but is 100% organic. Our 100% organic kombucha spirit is also produced locally."

Appalachian Gap operates out of the former Breadloaf Construction Company building at 88 Mainelli Road in Middlebury, VT, which they gutted upon purchase seven years ago. Local architect Richard Robson did the official floor plans for the first build out, and Vermont Integrated Architecture for the second. "They essentially documented what I had planned out," says Hubbard, who is a software designer and architectural consultant. He acted as the general contractor for both builds. "We insulated, in both cases, with spray foam in the walls, around R-32, and dense-pack cellulose in the ceilings (averaging 18 inches thick, so around R-64 overall)." New windows are Marvin thermopane with a low-e coating and existing windows in the building were also double-glazed.

Hubbard said, "The six-collector tracking solar array was installed by AllEarth Solar in 2013. Each collector is an Allsun Series 24, each with twenty-four solar panels capable of generating 54,000 kWh per year. In the past 12 months (9/1/18 through 8/31/19), we generated 52937 kWh. We slightly over-ran that, using a total of 55440 kWh. We recently upgraded some of our equipment in the distillery, and I expect that number to drop. Our usage in the month of August 2019 was almost 15% less than August of 2018." When there is excess, the credits have been given to employees.

Appalachian Gap uses separated-combustion Hot Dawg space heaters where necessary; only outside air is pulled in for the heaters. This is more healthful and safer for workers. For air conditioning in office areas, Hubbard required units with minimum SEER of 18.

Appalachian Gap uses minimum 80% efficiency gas units for steam production for its stills and plans to use only renewable natural gas (methane produced by organic material in farms and landfills) from Vermont Gas once all installation is complete.

Hubbard said, "Liquid waste and waste grains are currently hauled to South Burlington to the PurposeEnergy biodigester. We used to have local farms pick them up but have opted to go this route in anticipation of the new (biogas) facility which will be built in Middlebury." PurposeEnergy is currently gathering permits and approv-

als for the biodigester to be constructed in the same industrial park as AppGap; the digester will use waste from local companies like Appalachian Gap, including Otter Creek Brewing and Agri-Mark/Cabot, to dispose of waste in compliance with Vermont law while creating energy.

According to Hubbard, Appalachian Gap uses only non-polluting cleansers and detergents. Waste water is captured, pH tested, BoD(biochemical oxygen demand) tested, and monitored for release to the town sewer system. The distillery

pays quarterly for the BoD content of its waste stream and has reduced the overall BoD released to the town by over 75% as a result of changing its waste handling to the PurposeEnergy solution. (PurposeEnergy is a company based in Salem, NH, that custom-configures biodigester systems for food and beverage producers.)

When asked about the solar and sustainability, founder Lars Hubbard said, "We're just trying to do the right thing." The right thing for the environmentally-concerned appreciator of fine spirits would be to get down to the tasting room between 1 p.m. and 5 p.m. and do some sampling and then take a bottle or two home to toast the spirit of ecological concern embodied by Appalachian Gap.

Learn more at appalachiangap.com.

Links: Purpose Energy at purposeenergy.com, and vanguardrenewables.com.

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

Distilling tends to have a large ecological footprint, which we do our best to counterbalance. All of our electricity is produced by our solar array; our waste grains and waste liquid are hauled to a biodigester to create clean energy; our building is super-insulated; we make everything ourselves, instead of trucking it in and repackaging it; and we buy as much as we can locally.

We believe its the least we can do.

So, raise a glass of one of our spirits, and feel good about it. It's not just well made, it's responsibly made.

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