Issue 59 • January- March 2020

★ Sustainability Challenges for XC Ski Centers - p.39 ★

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SWEET SOLAR
At Sidelands Sugarbush

George Harvey

Dan Crocker is the owner of Sidelands Sugarbush, a maple sugar business in Putney, Vermont. Recently, the business had a fairly sizable solar array installed by Southern Vermont Solar (SVS). The story behind this goes a fair distance back in time, however, and some readers might like to learn about it.

Crocker was the Bellows Falls High School ski coach, and that is how he met Simon Piluski, who now is co-owner of SVS with his wife, Victoria Roberts. Back when Piluski was a teenager learning to ski and negotiate his way through life's complexities, Crocker happened to be putting in a system of sap tubes at his sugarbush. Because he liked Piluski, Crocker offered him some work, and this laid the foundation for a supportive friendship that has lasted for years.

Piluski ended up doing well in high school and went on to Marlboro College, from which he graduated with honors with a Bachelor of Science. Throughout the

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Sidelands Sugarbush solar array in Putney, Vermont. Photo courtesy of Southern Vermont Solar.

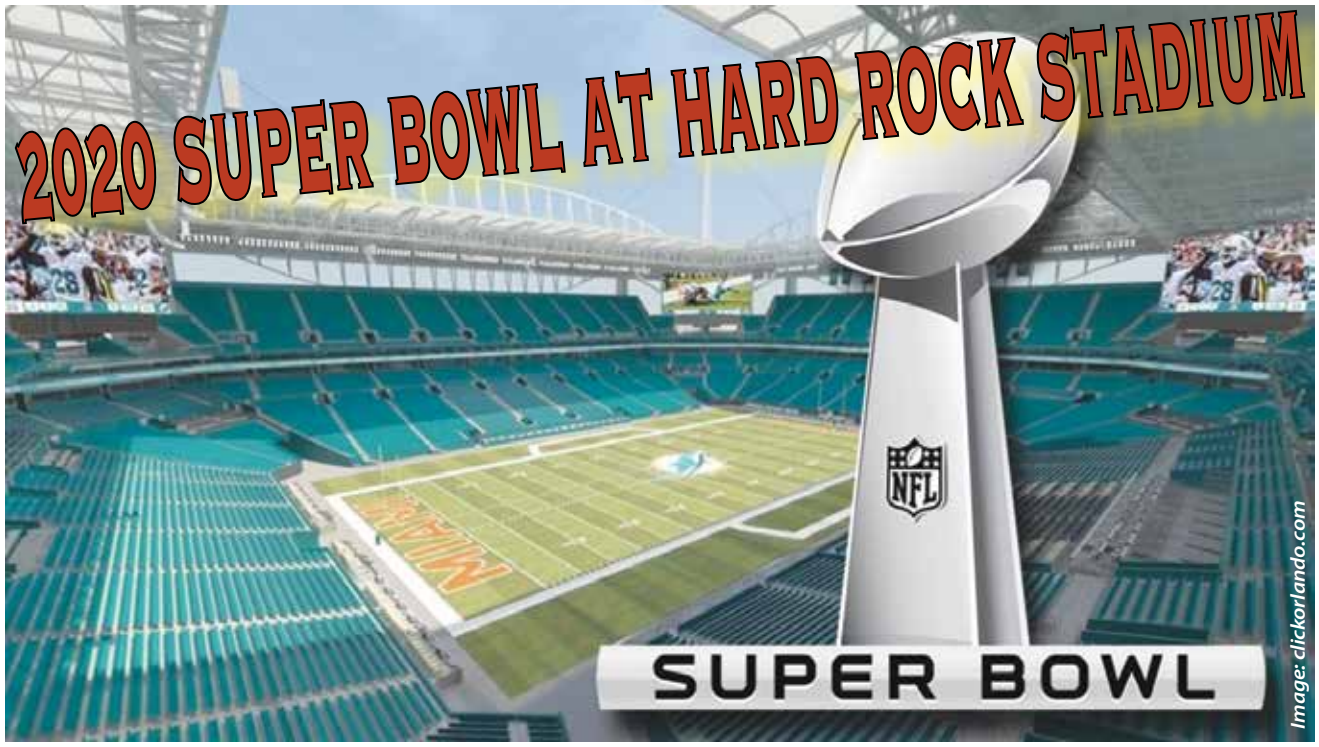

Image: clickorlando.com

Greg Whitchurch

This year's Super Bowl will be held at Hard Rock Stadium, Miami, Florida. But due to rising sea levels over the next 50 to 75 years, that stadium might eventually only be available for water sports (bit.do/stadiums-sea-level).

Ironically, part of the reason for this is due to the nature of the events held therein -- namely, the attendees' widespread use of single-use plastics (bottles, straws, bags, plates, flatware, containers, etc.). That particular stream of waste is still growing throughout the world and is on track to contribute as much as 13% of the world's atmospheric carbon by 2050.

Hard Rock Stadium alone has been going through about 2,800,000 plastic items annually. Our own personal thirst for throw-away plastic cups, cutlery, bags and such has now led to the new Shell ethane cracker being built in Pennsylvania, as well as the new ExxonMobil refinery now being built in Texas. Each of these facilities will emit millions of tons of additional CO2 into our atmosphere -- almost the equivalent of adding 800,000 more gas cars to our roads. The fracking (which we accept though it poisons our groundwater and contributes to earthquakes); the wasteful transportation of crude oil (the emissions from which cause additional early cancers and contribute to the millions of extra cases of childhood asthma caused by our gas-burning vehicles each year (bit.do/ice-childhood-asthma)); the methane-releasing refining process (methane is 80 times more "warming" than CO2); the production of the single-use plastics themselves (noted above); and the subsequent dumping of the waste somewhere or other (don't ask, don't tell) taken together are only one part of our lethal legacy to our children.

Cont'd on p.32

It's Tax Time! Cash In On Your Credits for Solar!

Chaz Blackmore

Our tax code provides many potential tax benefits for investments in renewable energy systems, whether you are investing for the first time or expanding an existing system. If you can overcome the many hurdles imposed by our tax laws and utilize the tax benefits, the rates of return on the investments are usually impressive, good for the planet and your bottom line.

This article identifies the key tax issues that should be addressed before you commit to the investment. However, beware the tax laws can get complicated quickly, with many minefields to navigate. This is a high-level summary only, intended to help start the discussion with your tax advisor to make sure all the bases are covered.

The tax laws are constantly changing. Often a particular tax provision will expire, only to be reinstated retroactively. In my 30-plus years of practice, I've

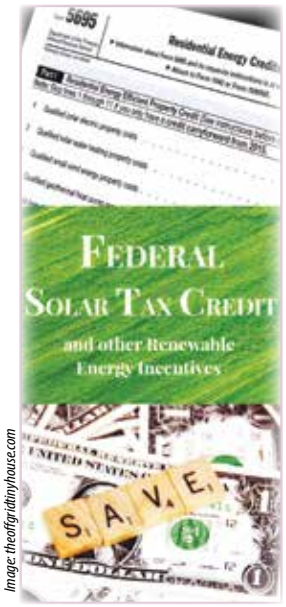

Image: theoffgridtinyhouse.com

watched the renewable energy tax laws ebb and flow with the changing political and ideological winds in Washington. There have always been significant tax benefits available for the fossil fuel industries, but recently the tide has been shifting toward renewables. The Treasury Grant "§1603" program in the late 2000's, which provided cash instead of tax credits, generated significant interest in these investments. We assisted many farms in my home state of Vermont to qualify for and obtain the grants for "cow power" methane digesters. After the §1603 program expired, the interest shifted primarily to solar energy, although we have also worked with clients investing in hydro, wind and biomass projects.

The tax laws differ for each type of renewable energy, and it would be impossible to summarize those differences in a

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

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****G.E.T.'s Carbon Footprint Disclosure:*** *Green Energy Times* is printed locally on recycled paper. The printing process uses eco-friendly water-based inks. There are not any totally green printers in the area that we are aware of, so it would mean trucking them MUCH farther to have *G.E.T.* published in a totally green manner, thus increasing carbon emissions, as a consequence. We chose to move from printing that used soy based inks because the soy is only used for the colors - not black, which is the most prominent color.... *G.E.T's* distribution emissions are also kept to a minimum, as well. With the wonderful help that we g.e.t. within many communities, it keeps our carbon footprint a lower. Hopefully our footprint is offset because we are 100% solar powered! Because all of our employees work from home, our carbon footprint is kept to a minimum. We grow most of our food organically and live as sustainably as possible. We DO walk our talk! ***Peace!***

Tips to Reduce Your Carbon Footprint Every Day

G.E.T. *staff*

The *Green Energy Times* team wants to share some ideas with you on what you can do now to help the planet and reduce your carbon footprint. We hope you learn some new ideas that you can adapt to your everyday lives. More ideas will be shared in the coming issues throughout the year. *Send your tips to us at info@greenenergytimes.org.*

- Don't leave chargers plugged in. Connect electronic devices to power strips and turn off the strips at the end of the day or when leaving for any length of time. This includes, phones, televisions, as well as any rechargeable tools we seem to require to live today. They waste energy when left plugged in. Unplug that power charger box when your device is charged.
- Be quick when opening refrigerator doors. When the door is left open, it is pulling in heat from the room requiring the motor to run more to cool back down.
- Use rechargeable batteries. Recycle them at the end of their life.
- Stop using toxin-loaded dryer sheets. Use white vinegar as a softener.
- Don't put food waste in your garbage. It is a big source of methane in the landfill. Methane is a horrible greenhouse gas! Compost your food waste or take it to a location that accepts it to compost.
- Never use single-use plastic water bottles. Use a reusable water bottle.
- Avoid buying single-serving packages with excessive individualized packaging.
- Avoid buying items sold in boxes, blister-packs, and clam-shell packaging.
- Buy in bulk and divide contents into smaller containers. Store in reusable and resealable airtight containers.
- Never accept plastic bags and use canvas, mesh or cloth bags.
- Donate used cooking oil for recycling into biofuel. Never pour it down a drain or put it in the compost.
- Do not eat or drink from paper or plastic plates and cups. Ban all Styrofoam products and never accept them from a restaurant for your leftovers. Keep re-usable containers in your car for leftovers.

Our final tip for this edition of *G.E.T.* is from Greg Whitchurch: stop thinking that what you do about the climate crisis is less important than any other person, group, company, political party, or country. Change at any level is always dependent upon an individual. Be one of them. Do what you can, as soon as you can. ♻

Carbon Cashback Coalition in NH Offers Hope

George Harvey

We live in distressing times. It is bad enough that there are over a hundred wildfires in Australia, and one of them is a good deal bigger than Delaware, but climate change is clearly hitting the United States, with droughts, floods, and wildfires of our own. Climate activists have been trying to address the problem, but some people in government seem bent on making it worse for the short-term benefits of their friends.

In New Hampshire, the Carbon Cashback Coalition is offering us some hope, as it has a realistic chance of making changes in that state's dependence on fossil fuels. The approach is unique, because it makes fairness for all the top priority.

Nearly 100% of scientists say we are in trouble with climate change. (A MSNBC survey was only able to find four out of nearly 70,000 recently published climate and weather scientists who disagreed.) We have also heard economists say that the most effective and fair way to reduce carbon emissions would be to make the emitters pay. But there is one big problem with that approach. It has always been taken to mean we need a tax, and people do not like taxes.

The Carbon Cashback Coalition's approach is really simple. What it entails is that a price is added to all fossil fuels, but 100% of that price is distributed evenly to state residents. It can hardly be called a tax. It is really more like a small payment for a state lottery that always pays off for everyone equally.

The implication is an increase of one cent for each pound of CO_2 that burning a fuel will release. That implies an increase for the price of gasoline of about 18¢ per gallon – an increase of 1¢ per mile for some gas-guzzlers. That cost could be considerably lower than what people might pay for a single, unwise political assassination in the Middle East.

It's important that the amount of money gathered in would be equal to the amount sent back to residents. Those people who are the most wasteful would pay the most. Those people who are at low income would benefit the most, in terms of a percentage of their income. Representative Ken Wells of Andover told us that he believes the majority of people, about 60%, would come out ahead financially. For people who are very short of cash, Wells said there is an amendment to the bill that would allow them to be paid monthly.

The New Hampshire H.B.735 would implement carbon cashback, with 100% of the increased fuel costs going back to residents. Those pushing for the bill are looking for supporters who can educate local people, get signatures for petitions, and do other advocacy work.

We should be absolutely clear on this. The people who will pay most are the people who emit the most CO_2. But everyone would get a check each year, distributing equally everything taken in.

Wells suggested a website for those who are interested in learning more: carboncashback.org. ♻

Concentration of CO2 in the Atmosphere

413.45
parts per million (ppm)
January 12, 2020

Learn more at www.co2.earth.

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Homefront Climate News: Direct from Alaska

George Harvey

We have been aware for a long time of problems brought on by climate change in Alaska. Buildings have tilted as permafrost supporting them gave way. Heat waves like nothing in history have brought on wildfires. Exploitation of natural resources threatens traditional fisheries.

Metlakatla, Alaska. Photo by Joey Mendolia, Alaska Public Media.

Florence Carnahan is a *Green Energy Times* reader who lived for years in Alaska. With friends and family there, she has maintained ties, including subscriptions to media. She has shared links to online news that she thought others might find interesting. I think they will; I found them fascinating.

The city of Akhioks, which sits at the southern end of Kodiak Island, has a population of 71. It is not tied to the island's power grid, and has been dependent on diesel power. It is an old system that typically fails about twice per week, often for many hours, and the electricity costs 80¢ per kilowatt hour (kWh) (http://bit.ly/GET-AK-1).

The North Slope is the northernmost part of the State, and includes all the Arctic shore. It is not a place where people are accustomed to growing vegetables. A one-pound cabbage can cost $10. A local woman has been developing vegetable agriculture using "tall tunnels," a term used for hoop-style greenhouses (http://bit.ly/GET-AK-2).

Kongiginak is a city of about 439 people near the Bering Sea. It is installing a lithium-ion battery, which will make it possible to run over half its electric and heating needs from wind energy. Other communities are doing similar things with both wind and solar power (http://bit.ly/GET-AK-3).

The city of Ambler, with a population of 258, is in north-western Alaska, about 45 miles north of the Arctic Circle. Its approach to cutting down dependence on diesel oil is to install cold-climate heat pumps, powered by solar PV systems. If that sounds like it is bit much for a place that cold, where the sun doesn't shine in the depths of winter, take this into account: It is cold in the summer, too. The heat pumps will be of value just about whenever the sun shines (http://bit.ly/GET-AK-4).

Alaska has had serious climate change problems. One of these is a combination of high temperatures and drought that has led to fires. Another is that it is raining where the permafrost is melting, leading to more rapid and destructive changes. In some places, it is even raining in the winter. The University of Alaska has a research project to look into these problems (http://bit.ly/GET-AK-5).

Metlakatla, with a population of about 2,500, is in the southernmost part of the Alaska Panhandle. It got about 80 to 90 inches of rain this year. While that may seem like a lot, it isn't. The average for the area is about 110 inches, so even with that much rain, the area is in a drought. The salmon are not running normally, which has effects on the economy. Hydroelectric power is threatened. And the local drinking water, which has historically been of wonderful quality, has had to be conserved (http://bit.ly/GET-AK-6).

The Swan Lake Fire. Photo by Kale Casey, Alaska Division of Forestry.

For those who want to see more, Carnahan suggests circletocircle.blog, which has a category for Alaska, where you can keep up to date. Recent entries include a time-lapse sequence showing sunrise to sunset, in three hours and forty minutes reduced to a minute and a quarter, in which the sun, at noon, is barely above the horizon. Another recent post has to do with cancellation of cod fishing for 2020 because of low stocks, which can be blamed on an ocean system, called "the blob," with temperatures that are higher than normal. And there is much more to satisfy the curiosity. The Alaska category can be visited at circletocircle.blog/category/alaska. ♻

THE SUN DAY CAMPAIGN NEWS

FERC Report Shows Renewables on Track to Lead in New Generating Capacity for 2019

✓ Renewables Neck-and-Neck with Gas as Wind-Generated Electricity Grows 33% and Solar by 22%

Ken Bossong

According to a review by the SUN DAY Campaign of data recently released by both the Federal Energy Regulatory Commission (FERC) and the U.S. Energy Information Administration (EIA) for the first ten months of 2019, the mix of renewable energy sources (i.e., biomass, geothermal, hydropower, solar, wind) is on track to place first in the race for new U.S. electrical generating capacity added in 2019.

FERC's latest monthly "Energy Infrastructure Update" report (with data through October 31, 2019) reveals that natural gas holds a diminishing lead for 2019 with 49.67% of all new generating capacity compared to 48.45% for the mix of renewables (i.e., wind - 28.55%, solar - 18.59%, hydropower - 0.83%, biomass - 0.41%, geothermal - 0.06%). The balance of new capacity added includes nuclear power (0.99%), oil (0.49%), coal (0.39%), and "other" (0.01%).

Notwithstanding a strong start earlier this year, gas' rapidly shrinking lead seems likely to disappear completely once the full 12-months of data are tabulated. In October, gas added just one megawatt (MW) of new capacity while the mix of renewables added 721 MW. New renewables capacity, mostly wind and solar, also exceeded that of gas in July, August, and September.

Moreover, EIA recently reported that it "expects that an additional 7.2 GW of (new wind) capacity will come online in December 2019" alone [1] - a one-month expansion roughly equal to the total of new gas capacity (7.8 GW) brought online in the ten months since the beginning of the year. EIA also foresees another 14.3 GW of wind capacity coming online in 2020.

The forecast growth in new wind capacity during the remainder of 2019 is reinforced by EIA's latest "Electric Power Monthly" report (with data through October 31, 2019) which shows that wind-generated electricity in the month of October 2019 was 32.80% higher than a year earlier while year-to-date (YTD), wind produced 9.21% more electricity than during the same 10-month period in 2018.

Likewise, solar-generated electricity in October 2019 was 21.65% higher than in October 2018 while YTD, solar's electrical output was 14.59% higher than for the same time-frame a year earlier. Small-scale solar photovoltaics (e.g., rooftop solar systems) alone grew by 19.22% YTD. Compared to all other energy sources, solar-generated electricity has enjoyed the fastest growth rate thus far in 2019 - that for natural

Cont'd on p.7

New Electric Car Incentive Updates

David Roberts

Incentives remain an important motivator for many electric car buyers today. While plugging in can save thousands of dollars in fuel and maintenance over the life of the vehicle, many consumers still see higher purchase prices as a significant issue.

The Federal tax credit for plug-in electric vehicles (EVs) offers up to $7,500 to buyers but begins to sunset as individual automakers reach 200,000 U.S. EV sales. While there was hope that Congress would extend the availability of this program, it appears this did not happen in 2019. Tesla and General Motors passed the sales cap many months ago, triggering the 12-month phase out which ended for Tesla on December 31, 2019 and will be complete for General Motors on March 31, 2020. Nissan is the next in line to reach 200,000 sales – likely not to happen until sometime in 2021 or beyond at their current rate of EV sales.

Many states have stepped up to offer incentive programs that further reduce up-front costs for EV buyers and lessees, although funding limitations have constrained several northeast state EV incentive programs in the past few years, including the end and then re-launch of the Massachusetts program. On a more positive note, the State of Vermont launched a new EV incentive program on December 16, 2019 for low- and moderate-income households purchasing EV models with a base price under $40,000. Lower income households qualifying for home weatherization assistance are eligible for significantly higher incentives of up to $5,000.

The table provides summary information and links to details on financial incentives offered by states in the *Green Energy Times* distribution area.

States and municipalities may also offer non-monetary incentives, such as carpool lane access, reduced inspection fees, parking benefits and more.

Many electric utilities are also supporting EV adoption through purchase incentives and programs offering lower electric rates, discounted charging equipment, and other incentives to ensure the greatest benefits for their customers by shifting charging to off-peak hours. Check with your local provider to learn more about any current offers.

In relation to state incentive programs, there is potential for the multistate Transportation & Climate Initiative (TCI) to offer additional options to support transportation efficiency and electrification programs. TCI states recently shared details of a proposed program through a Draft Memorandum of Understanding now available for public review and comment. If the proposal advances, participating states will place a regional cap on transportation carbon emissions and will be able to leverage the proceeds of carbon allowance auctions to invest in programs and activities that reduce transportation emissions. This could include providing more sustainable funding for EV incentive programs moving forward. Additional details are available at https://www.transportationandclimate.org/.

TCI funding or development of other sources may require several years to implement, so if you are considering purchasing or leasing an electric car, your best option may be to take advantage of any current opportunities.

David Roberts is the Drive Electric Vermont coordinator. He has driven all-electric vehicles for the past seven years and says if you have to drive, drive electric. ♻

STATE	ELECTRIC CAR INCENTIVE	WEBSITE
Connecticut	Up to $1,500 at auto dealers	www.ct.gov/deep/CHEAPR
Maine	Up to $2,000 at participating dealers	www.efficiencymaine.com/ev/eligible-vehicles
Massachusetts	Up to $2,500 rebate	www.mor-ev.org
New Hampshire	No state incentives available	www.granitestatecleancities.nh.gov
New York	Up to $2,000 at participating dealers	www.nyserda.ny.gov/All-Programs/Programs/Drive-Clean-Rebate
Vermont	Up to $5,000 incentive available	www.driveelectricvt.com/why-go-electric/purchase-incentives

Electric Cars:
Are They Better for Your Pocket and the Climate Right NOW?

Jayd Alvarez

I read a blog post from Connecticut Fund for the Environment President Curt Johnson, and he reaffirmed what I already expected: my next car will likely be an all-electric vehicle (EV). I currently drive a Toyota Prius hybrid, because in 2013, the price to purchase and to operate an EV did not work out. I chose the Prius hybrid instead, which has very reliably achieved 50 mpg over the last six years.

As an engineer who admittedly knows nothing about cars, I feel information out there on EVs is either slightly biased (i.e., published by EV manufacturers) or not supported enough by the math to convince me. So, I set out to create a blog post that was unbiased and transparent. I liked one from Tom Murphy (https://dothemath.ucsd.edu/mpg-EVs), an associate professor of physics at the University of California, San Diego. Here, I'm adapting it to be a bit more user-friendly and applicable to your current or local situation.

I just wanted to know two simple things (and admit to ignoring a long list of other factors that influence the type of car most people will choose to drive).

Number 1: At what gas price is an EV cheaper to drive per mile?

Number 2: While EV tailpipe emissions are zero, what about the emissions from the power plant supplying the electricity for my car? I know my next car will be electric, but is the local grid clean enough so that it's better for the environment when I switch?

When I began writing this article, I had no idea what the answers would be.

1. What Costs More Per Mile to Drive? Gas or Electric?

The math is straightforward. Let's assume the car you drive achieves 50 mpg and you drive it 10,000 miles per year.

10,000 miles/50 miles per gallon (mpg) = 200 gallons of gas. Multiply total gallons by the local gas price (let's say, $2.50 here in CT) and your annual cost to drive is $500. (Yes, this completely ignores the purchase and maintenance costs. The calculator at https://www.befrugal.com/calculatordoes a better job of that. More information can be found at https://www.cars.com/buyNow.)

Electric cars aren't rated in mpg, and I don't like the MPGe ratings I have seen, and like Mr. Murphy, I prefer the kWh/100-mile approach.

Quite a few EVs are reported to get 100 miles of range for about 27kWh of electricity, and we'll round that up to 30kWh to account for ~10% charge inefficiency. For comparison, 30kWh is the same amount of electricity needed to power thirty 100-Watt incandescent light bulbs for 10 hours (not that you still have any of those). For the sake of this article, we'll assume the average driver will get that range from their EV for that charge.

10,000 miles/100 miles per 30 kWh = 3,000 kWh. Multiply by local electricity price (let's say, $0.15 per kilowatt hour) and your annual cost to drive an EV is $450 ($50 less per year than my Prius).

So, depending on your current car's mpg, local gas and electricity prices, the math for an EV could work out for you. The table on p.6, based on your current mpg from the far-left column and your average electric rate in the top row, shows you the highest gas price you should pay before a typical EV will save you money. For example, in CT, once gas went above $2.25/gallon, I was spending more on gas in my 50 mpg hybrid than if I drove an EV and paid $0.15/kWh to charge it. For my CT colleagues driving a newer model Prius and getting 70 mpg, an EV won't save them money until gas goes above $3.15/gallon. With current average gas prices at about $2.50, most of us will save money by switching, so I highlighted in green all the scenarios where if you are paying $2.50/gallon, an EV will save you money, and in red where it won't.

2. Is My Local Electric Grid Clean Enough?

For me personally, here in CT, it costs me less to charge and drive an electric car than to buy gas for my 50-mpg hybrid. Also, it seems like I might be at the right price point for buying an EV, if local rebates and tax credits reduce the purchase price to within that of a gas hybrid, as indicated by Mr. Johnson.

But, is driving an EV really saving the planet, if I shift my tailpipe emissions to a local power plant? Luckily, according to the EPA, in my region and most others, the answer is YES! The average pounds of CO_2 produced per gallon of gas burned is 20 (I did not do the math for diesel engines and bio-diesels). So, again, assuming the same 10,000 miles per year driven in the examples above, the second column in the table shows how many pounds of carbon dioxide (CO_2) are produced annually by the gas engines (lbs. of CO_2 is a common metric for greenhouse gas emissions, even though there are other greenhouse gases, such as sulfur dioxide and nitrogen oxide).

For a hybrid getting 70 mpg, 2,857 lbs. of CO_2 are produced annually to drive 10,000 miles. This goes up to 13,333 lbs. for a truck or SUV getting just 15 mpg.

For comparison, in the table on p.6, I report average emissions for EVs travelling the same 10,000 miles, for a few eGrid regions. I show one state in each region for context and sorted them from lowest to highest, from left to right, with the national average in the middle. I used green to show where gas engines, even hybrids, are emitting more CO_2 than the average emissions from power plants in that region providing the electricity to charge an EV to drive the same distance.

In CT, my hybrid is producing 4,000 lbs. of CO_2 *Cont'd on p.6*

SMART COMMUTING IN NH & VT

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

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

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

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

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

IN NEW HAMPSHIRE

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

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

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

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

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

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

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

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

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

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

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

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

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

IN VERMONT

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

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

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

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

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

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

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

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

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

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

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

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

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

GOOD NEWS FOR NH EV SHOPPERS!

Randy Bryan

Nissan LEAF at charging point. Image: Wikimedia

Happy New Year to all, especially electric vehicle (EV) lovers! The year 2020 will start the breakthrough years for EVs in NH and around the country. New EVs from multiple manufacturers are being introduced and sold. Compliance cars made only for CAL-ZEV mandate states are slowly being replaced with EVs available nationwide.

Tesla has dominated EV sales so far with its impressive EVs, especially the Model 3 now made in high volume. The 'crossover' Model Y will start shipping in 2020 and is aimed right at the heart of the U.S. car marketplace. The success of Tesla seems to have scared the big legacy manufacturers into making EVs in earnest. New EVs will come from Ford with an Escape plug-in hybrid vehicle (PHV) in the second quarter. A new Mustang crossover EV and a Volkswagen ID-4 EV crossover may both arrive by the fourth quarter. Hyundai and Kia are starting to produce their popular EV crossover cars in larger numbers, and Toyota and Honda offer even better plug-in hybrids. Nissan is improving its LEAFs, GM continues to improve the Bolt and BMW will both improve the i3 and introduce a new Mini EV soon. Many more companies and cars are joining the EV wave, too. EV sales growth should be about 20% yearly. Just as important is the ever-growing used-EV marketplace where cars coming off leases and from natural turnover are finding a brisk market that is sustaining high valuations.

In 2020, NH drivers will still have to get many of their EVs from MA or VT, but more and more will be available here over time. Tesla should continue to dominate EV sales, and their vehicle range and charger network seems sufficient for growing sales in nearly all states. Of course, non-Tesla EV drivers will have more car choices, but still have to deal with sparse coverage of chargers. This scarcity should start to change later in the year, however, as the Volkswagen (VW) settlement money gets spent on the installation of fast chargers around the state.

The State of NH has identified six major corridors (seven roads) to receive fast and slow chargers. Vendors will propose solutions to the State in January 2020, with vendor selections in March. We could see the first new chargers (4 sites) installed by the end of 2020, and the rest by mid-2021. The state has also reserved some VW settlement money for possible future allocation (maybe well-placed Level 2 chargers).

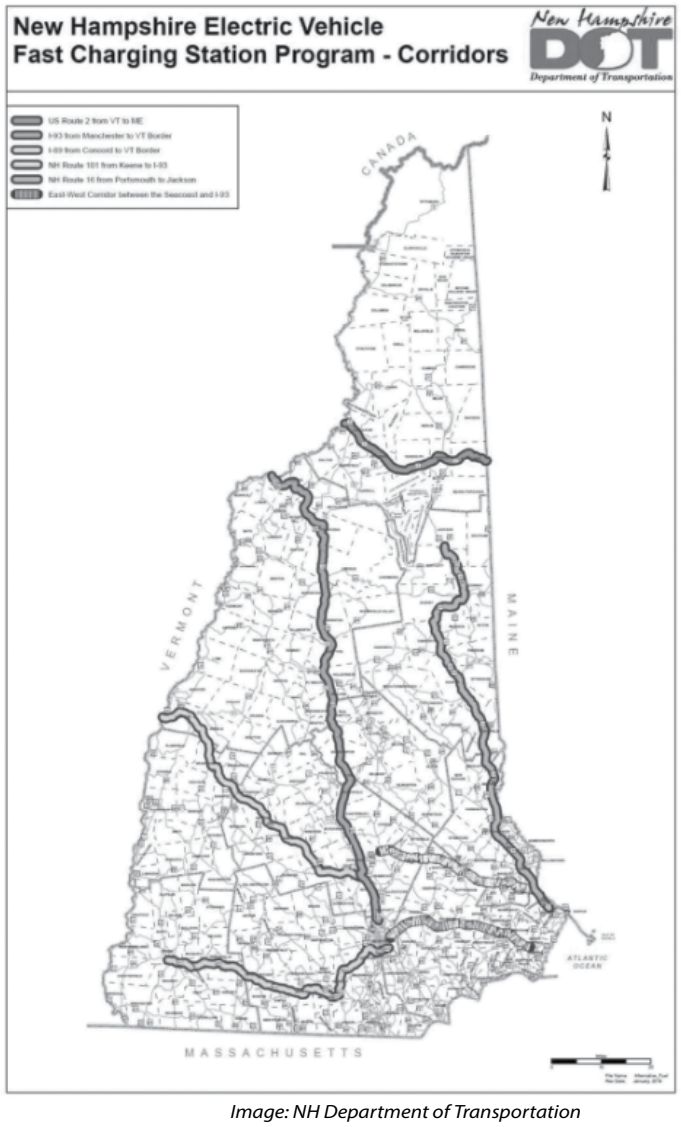


Image: NH Department of Transportation

All this charger activity means good news for NH residents and tourist business owners. A hearty congratulations to all in the NH government and involved persons and companies for getting the VW money put to good use.

Have a safe and Happy New Year!

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. ♻

EV's Now? – *Cont'd from p.4*

Current Supplier:			
Generation Services Charge	155 kWh X $.062500	$	9.69
Total Generation Services Charges		$	**9.69**
Transmission per kwh on-peak	0 kWh X $.115960	$	0.00
Transmission per kwh off-peak	155 kWh X $.000000	$	0.00
Distribution Basic Service		$	12.84
Distribution per kwh on-peak	0 kWh X $.074452	$	0.00
Distribution per kwh off-peak	155 kWh X $.074452	$	11.54
Combined Public Benefits Charge	155 kWh X $.009256	$	1.43
Non-Bypassable FMCC per kwh on-peak	0 kWh X $.042032	$	0.00
Non-Bypassable FMCC per kwh off-peak	155 kWh X $.000000	$	0.00
Decoupling Adjustment	155 kWh X $.001749	$	0.27
Total Delivery Charges		$	**26.08**
Total New Charges		$	**35.77**

to go 10,000 miles, whereas the average emissions to generate and distribute the electricity an EV needs (in CT) is only 1,520 lbs. of CO2. (Since some of these regions are really large, if you want to get state-specific values as I did, go to Table 3 of this report and multiply the CO2 numbers in the second column (which are reported as pounds per thousand kWh by 3.05 which accounts for a line loss of 5%).

Even the regions with the highest carbon emission rates for electricity generation (Long Island, Wisconsin) produce less CO2 to charge your EV as compared to non-hybrid gas engines.

Note: The CO2 emissions from eGrid regions represent averages – so the actual value could be higher or lower, depending on the source of the electricity (e.g., gas, coal, wind, solar) at the time you are charging your car.

While I didn't touch on issues with batteries, driving range, lack of EV chargers, a car's "embodied" carbon (emissions associated with everything from manufacture to disposal), and a whole list of other related topics, I sincerely hope that the math has shed some light on this subject for you.

If you are ready to go shopping for an EV, check out https://www.energy.gov/eere/EVcredits for the federal tax credits and other local incentives that may be available. But don't wait too long. The Federal Tax Credit phases out once the manufacturer sells 200,000 EVs, and Tesla and GM have already reached that milestone.

Jayd Alvarez is a Marketing Coordinator for Steven Winter Associates, Inc. ♻

Tesla. Image: digitaltrends.com

THE SUN DAY CAMPAIGN NEWS

Cont'd from p.3

gas, for example, was just 6.71%. Nuclear power grew by a mere 0.08% while coal-generated electricity plunged by 14.46%.

For the first ten months of 2019, the mix of renewables accounted for 18.18% of the nation's electrical generation, compared to 17.57% during the same time period a year earlier. Renewable energy sources were also 21.95% of total available installed generating capacity, up from 20.76% a year earlier. [2]

Solar capacity alone is now 3.37% of the nation's total compared to 2.93% a year ago [3] while that of wind has expanded from 7.72% to 8.50%. In addition, wind now enjoys a clear lead over hydropower in both its share of capacity (8.50% vs. 8.43%) and actual generation (247,182 thousand MWh vs. 230,815 thousand MWh).

"If I were to predict the final numbers for the year based on the data and trends to date," noted Ken Bossong, Executive Director of the SUN DAY Campaign, "I think it is highly probable that renewables, dominated by wind and solar, will comfortably take the lead for new capacity added in 2019 and then continue to expand their lead in 2020 and beyond."

Footnotes and sources will be posted with this article on the Green Energy Times' *website: greenenergytimes.org.* ♻

ELECTRIC BUS PILOT PROGRAM IN VT

Electric buses may be coming to a school or transit center near you! Late last year, Barre Unified Union School District, Champlain Valley School District, Franklin West Supervisory Union, and Marble Valley Regional Transit District were all chosen by the Department of Environmental Conservation to be part of the new Electric Bus Program. The program aims to demonstrate the viability of the technology as a reliable and cost-effective option for school districts and transit agencies. This project is funded by Vermont's $18.7 million share of the Volkswagen Settlement Mitigation Trust.

While fuel savings and reduced maintenance costs can make an e-bus cheaper over the full life of the vehicle, proving the case for making that steep investment, both for individual schools and more broadly at the statewide level, is a core goal of the pilot. Jennifer Wallace-Brodeur, director of transportation efficiency at the Vermont Energy Investment Corporation, the consulting group selected to administer the program, will help determine if the program achieves its goals. Additionally, the buses can help save money in ways that diesel buses could not. During the summer, when solar generation is the highest, schools could be paid by utilities for the excess solar, especially during peak times, to subsidize the costs of the buses. ♻

We Have Met the Future and It is Now

Green Energy Times Staff

Nickel Ride ride-sharing cars. Photo courtesy of Nickel Ride.

It has been five years since *Green Energy Times'* daily blog posted its first mention of Tony Seba. The reference was to a CleanTechnica review of Seba's book, *Clean Disruption of Energy and Transportation* (http://bit.ly/CT-disruption). In it, he argued that the transition to clean energy would be not only disruptive, but so sudden it would be over by the year 2030.

It now seems that Seba's forecasts are starting to come true.

In May, CleanTechnica ran another article, "Nickel Ride Finds EVs Are So Affordable … They Can Give Rides For Free"[sic] (http://bit.ly/CT-nickel-ride). Nickel Ride is a car-sharing service that can be called with a cell-phone application in any of several Florida cities.

Experienced in running the business for some time, the folks at Nickel Ride started using electric vehicles (EVs) in their service. What they found was the EVs are so inexpensive to run, that they can give their customers free rides and still make money. So that is what they are doing.

Paying for the EVs, employee driver time, charging, insurance, maintenance, registration, etc., Nickel Ride found that all costs could be covered, with room for a profit, by income from advertising.

Welcome to the future. ♻

Community Solar in the Connecticut River Valley

George Harvey

Norwich Solar Technologies (NST) has continued to move ahead with its community solar installations in Vermont. Some of that has been done with the help of its Community Impact Investor Group, which is made up of local impact investors, who like to see their investments go beyond just earning profits to help their communities with positive local impacts.

Ribbon Cutting at Thetford, VT Community Solar. Photos courtesy of Steve Snyder, Norwich Solar Technologies.

NST has been cultivating local impact investing as a way to get solar power to people and organizations that could not otherwise afford it. In doing so, it is developing an organization of experienced investors. Some beneficiaries are local people, ordinary citizens, but the benefits also flow to non-profit organizations, local governments, and schools.

In November 2019, NST had ribbon cuttings for two arrays. One of these was on November 15, for the Newbury Scotch Hollow array, and the other, on November 23, was for a mixed-use array in Thetford.

The Newbury Scotch Hollow array is a ground-mounted system with 648 solar modules of 345 watts each, for a DC total capacity of 223.56 kilowatts (kW). The power goes through three CPS 50-kW AC 3-Phase Inverters with AlsoEnergy monitoring.

This array was built on the site of a former town sand pit. This is what is called "preferred siting," because the land would be of very little value for other purposes.

The Town of Newbury and the Newbury Elementary School both benefit from the solar array, because it will decrease their energy costs under net metering through discounts on energy credits. Throughout the term of the 25-year agreement, the school will take about 50% of the net-metering credits, and these are expected to save it about $3,000 per year. The town will save less, because it will only take 15% of the credits, but it will have the added benefit of $1,300 per year of tax and lease revenue. There was no up-front cost to the town or school.

Another major beneficiary of the project is Upper Valley Haven. Please see the article on page 9 of this issue.

A number of people spoke at the ribbon cutting. Among them were NST president Joel Stettenheim, Upper Valley Haven Executive Director Michael Redmond, and community impact investors Allan Wieman and Jo Shute.

One person who spoke was Vermont State Representative Sarah Copeland-Hanzas. When we contacted her, she told us, "Often, when we pass bills in Montpelier, we wait years to see a direct positive impact. This solar project, right in our backyard, benefits the Town of Newbury, Newbury Elementary School and the Upper Valley Haven, providing clean, renewable electricity for years to come. And it's made possible by a bill that was signed into law in 2019." She was referring to Act 81, which she sponsored, and which raised the capacity limit for schools from 500 kW to 1,000 kW. She gave particular credit to a high school intern, Ginger Knight, who went to the state house every week advocating for the bill's passage.

The second ribbon cutting was for Thetford Community Solar (TCS) for their 150 kW-AC community solar array. The array was installed by NTC and Wolfe Energy. This array is 100% community owned, with benefits going to shareholders along with two non-profits, Thetford Library Federation and the Thetford Water Co-op. TCS is a member-owned company. Having built the community solar array, it will continue to operate it with all Renewable Energy Credits to be retired by Green Mountain Power. The solar photovoltaic (PV) system is expected to generate about 270,000 kilowatt hours per year.

The TCS project was conducted with care to make best use of local contractors and equipment suppliers in Vermont and New Hampshire subcontractors and equipment suppliers, fostering local economic activity and capacity development.

The project members have purchased shares, each of which represents three PV modules. Shareholders receive about 85% of the credits generated on their utility bills, with the remaining 15% credited to the non-profits. The project is fully subscribed.

Norwich Solar Technology's web site is norwichsolar.com.

Wolfe Energy's web site is wolfeenergy.com. ♻

Newbury Scotch Hollow Community Solar. Inset: Sarah Copeland Hanzas; Newbury School; Newbury Town Hall; bottom: Upper Valley Haven.

Upper Valley Haven: a Ray of Sunshine

George Harvey

LEED-certified Hixon Adult Shelter at the Upper Valley Haven. Photos courtesy of UV Haven.

This summer, the Upper Valley Haven (the Haven), a non-profit organization in White River Junction, VT that provides food, shelter, and hope for people addressing the challenges of poverty, was able to realize a 25% reduction in its electricity bills when a solar array located in Scotch Hollow, Newbury, Vermont came on line. Over the 25-year lifetime of this project, the Haven is projected to save over $170,000 in expenses which it will be able to direct to its services.

This project is the latest in a series that the Haven has taken on to be a sustainability organization. Though there's no official definition, sustainability organizations demonstrate the inclusion of social and environmental concerns in business operations. Both for-profit and non-profit organizations can adopt sustainability practices.

It is just about forty years since the Haven came into being. It was founded in 1980 by clergy and parishioners of two Episcopal churches in Vermont, St. Paul's in White River Junction and St. James' in Woodstock. They had noticed that a run-down farmhouse had gone up for sale. There were poor families with children in the area who lacked shelter, and the old house was purchased and set up to provide for their needs.

The history of the Haven is full of expansion projects, but this was definitely not growth for just its own sake. Every few years, another need arose with a new challenge. As more churches and people became affiliated with it, it also became clear that local needs went beyond shelter, so the Haven started providing food and clothing in 1983. Services connecting people to jobs and even providing some education were soon added. Economic downturns, especially the one in 2008, put further demands on the Haven. It started providing shelter for those without children, expanding to a second building.

The Haven has achieved energy usage savings and achieved high building performance in new construction projects at its Hartford Avenue campus. The Byrne Community Building, which opened in 2004 prior to widespread usage of LEED (Leadership in Energy and Environmental Design), received an Energy Star award for efficiency in systems design. The Hixon Adult Shelter (2009) was built with a LEED plan in mind from the beginning; and a basic LEED level was achieved. The Haven has continued to add improvements to both buildings, most recently a dozen programmable thermostats to regulate temperatures and also warn building management staff remotely of any dangerous heat or cold conditions. LED lighting has been installed on exterior walkways for safety. Internal lighting systems will be upgraded to LED later this year, which will improve lighting quality and reduce operating expenses.

The Haven puts a lot of attention on food. It has teaching gardens that provide it with fresh food, herbs, vegetables, and fruit. It also distributes canned food, baked goods, and more. Its food waste goes to

Cont'd on p.28

Upper Valley Haven Executive Director, Michael Redmond, at the Scotch Hollow Newbury Solar Field built by Norwich Solar.

IT'S RENEWABLE ENERGY TAX-CREDIT TIME!

Cont'd from p.1

short article, so the comments below focus on solar electrical production, although the concepts and issues are relevant for other types of renewable energy investments as well.

Federal Tax Credits: The U.S. income tax laws provide a significant tax credit for a certain percentage of qualifying costs – 30% in 2019, phasing down to 26% in 2020, 22% in 2021, and in 2022 and beyond the credit drops to 10% for businesses and 0% for residential. The tax laws also impose limitations on how much of the Federal income tax liability can be offset by tax credits, so you must take those limitations into consideration in your planning.

Business vs. Residential: Solar energy assets used for either business or residential purposes have the same Federal 30% (2019) tax credit, however the credits are allowed under different Code sections with different sets of rules, so be careful to follow the correct Code section and its related regulations and rulings. Some of the key differences are (1) only business assets can be depreciated, (2) carrybacks of excess (unused) tax credits, (3) state income tax results, and (4) tax bases.

Qualifying Costs: The costs qualifying for the tax credit are generally those costs incurred for equipment that uses solar energy to generate electricity, as well as any equipment that is integral to that process, and components that are functionally interdependent. Certain assets do not qualify, such as land, inventory, buildings, transmission equipment, and non-integral equipment. It is not always clear whether certain costs are qualifying or non-qualifying, so it is critical that you explore these nuances.

State Taxes: Every state has its own set of tax laws, so you have to consider 50 different sets of rules. Often state income tax laws follow the Federal rules closely, which can make the analysis less complicated. Each state offers unique incentives for renewable energy, and the tax benefits can take many forms, such as deductions, credits, grants and exemptions. Vermont has a generous state-level income tax credit, equal to 24% of the Federal business tax credit allowed, as well as property tax exemptions.

Placed-in Service: The tax credits, as well as depreciation expense for business assets, are allowed and reported in the year the asset is "placed in service", which is the tax code terminology for the moment when the asset is ready and able to perform its intended function. For solar arrays, this is generally the time when the array is "energized" (producing electricity), or when the local utility tests and approves the array for electricity transmission into the grid. The placed-in-service issue can be particularly important in determining the proper year for reporting the tax benefits for assets constructed close to the end of the year.

Passive Activities: The tax code imposes many limitations on the ability of taxpayers to deduct business losses and credits. Taxpayers usually don't have problems with the basis and at-risk limitations in a typical solar investment, but the passive activity limitations are more difficult to overcome and tend to be where we do most of our tax planning with clients investing in renewable energy projects. The passive activity rules are too complicated to attempt to summarize here, so make sure you consider those issues with your tax advisor.

Financial Analysis: The potential investor will want to determine if the investment makes sense economically, usually in the form of cash flow analysis that calculates the internal rate of return (IRR). The IRR on solar investments is generally high, particularly if the tax benefits are available, and are less speculative than most other investments, because the electrical production and tax benefits are fairly predictable and stable.

I hope you found this overview of the key tax issues to consider when analyzing an investment in renewable energy helpful. Renewable energy tax planning tends to be a specialty niche area for CPAs, and not all are familiar with the nuances, so please consult with a qualified tax advisor before investing.

Chaz Blackmore is a partner at Bilodeau Wells & Co. in Essex Junction, Vermont. He is a CPA in practice for over 30 years, including stints with Ernst & Young in Boston and Fortune-500 high-tech companies in California. He lives with his wife, two children, and way too many pets, in Charlotte, Vermont. ♻

LIQUID AIR ENERGY STORAGE IN VT

George Harvey

Two energy companies announced that they will co-develop a highly unusual energy-storage project in Vermont. It will be the first commercial cryogenic energy-storage system in the United States. It will use air that has been cooled to the point of being liquid to store energy.

Cryogenic energy storage system. Image: Highview Power.

A cryogenic system is similar to a steam engine that recycles its steam. Both systems require energy to make them work, and both produce energy. In a steam system, energy is used to boil water, and condensation requires only cooling off in a heat exchanger, releasing heat to the atmosphere. In the liquid air system, energy is used to compress the air, which causes it to liquefy, and the boiling is done by

Cont'd on p.18

Battery Storage Choices Grow with Fortress Power

Chris Sparadeo

In the past, flooded lead-acid (FLA) batteries have been the first choice for those living off-grid. Although they have historically been the backbone of remote electrification, these batteries come with tradeoffs. Off-gassing, equalization charge, hydrometer readings are concepts that off-grid homeowners have come to grudgingly accept as part of the love-hate relationship with their battery banks.

In recent years, there have been major advances in battery-storage technology that have revolutionized the way power is stored and accessed. We now have a multitude of new chemistries, from salt water to numerous new lithium variations. Storing energy is becoming safer and easier as the revolution is ongoing.

One battery chemistry, lithium iron phosphate ($LiFePO_4$), has emerged as a shining star. These batteries have a 100% depth-of-discharge capability, no noxious off-gassing, and a long lifespan. They offer an extremely stable battery chemistry not susceptible to thermal runaway. They often come with robust manufacturer warranties. Also, unlike FLA batteries, $LiFePO_4$ batteries will likely supply rated storage capacity, regardless of how fast the power is drawn from them.

With $LiFePO_4$, there are plenty of choices when it comes to size, style, price, and options.

A manufacturer based in Pennsylvania, Fortress Power, and its 48-volt offering, the eVault 18.5kWh, present a perfect combination of performance and price. Each cabinet supplies a massive 18.5 kWh

Fortress Power eVault 18.5 installation. Courtesy photo.

of usable energy storage and up to twelve units can be combined for a total of 222 kWh. The batteries have fast charging and discharging abilities, reducing the time it takes to charge. Fortress Power, with its integrated bussing system, has also solved the issue of inter-cell resistance, which can lead to reduced life span and performance.

The eVault's most eye-catching feature is its digital display touch screen interface that provides data on the battery's state of charge (SOC), along with charging and discharging statistics. This display is very important, as those who have used FLAs will appreciate. With typical lead-acid batteries, the user reads the voltage from a charge controller or inverter to understand the SOC. Unfortunately, FLA batteries and their voltage-based readings are imprecise at best, and even advanced battery-monitoring devices eventually fall out of calibration, leaving a user with an inaccurate understanding of the battery bank's actual SOC.

FLA voltage readings can vary widely during normal operation, from often 44 to 52V at resting states.

$LiFePO_4$ chemistry is such that usable SOC typically exists in between 52 and 54V. This means at 53 volts, a battery bank might very well be at 80% SOC, but at 51.5 volts somewhere around 10%. This is a tight window of voltage, and the SOC of a LiFePO4 battery is not only established from voltage, but also determined by charging and discharging current. The eVault's highly sophisticated battery-monitoring unit and integrated display screen give a precise reading of SOC, whereas screenless LiFePO4 batteries relying on voltage-based readings may not be as accurate.

Today, we are clearly in a new age for energy storage. Whether it be an off-grid, grid-tied battery backup, or an uninterruptable power source (UPS) system, the 18.5 kWh eVault offers reliable storage at an accessible cost, comparable to other makers' batteries. It has a 10 year/6,000 cycle warranty, three years more than most of its competitors.

Homeowner Joe Hester Ingram has had experience with the Fortress eVault battery. He recommends it, saying, "I have been using off-grid solar to power our home in Wolcott, Vermont since the late 1970's. I had been using the standard deep-cycle lead-acid type batteries in my system. They have always been a challenge to manage all these years, with the need to monitor fluid levels and state of charge, with their life in service always being fewer years than I had always hoped for, with declining capacity as they aged. In October 2019, Catamount Solar replaced my system with new panels, controls, and batteries. The battery cabinet is the Fortress eVault 18.5. I have been extremely pleased with their performance, the freedom from monitoring and maintenance, and especially the LCD screen displaying state of charge information available at a glance on the front of the cabinet. The ten-year warranty adds promise to my new confidence going forward." Ingram re-used the old system for a cabin on his property.

Gail Boyajian of Strafford, Vermont said of her new eVault, "Its compact footprint, the fact that it's sealed so that there's no issue of off-gassing and its energy density compared with the lead acid batteries it has replaced, make it a vastly superior storage system."

Learn more about Fortress Power batteries at fortresspower.com or at (877) 497 6937.

Chris Sparadeo is a NABCEP Certified Professional PV Installer and is a member-owner of Catamount Solar as their off-grid specialist. Chris has been working in battery-based, off-grid solutions for nearly a decade. Feel free to send him an email with your questions at c2@catamountsolar.com. ♻

Living Off Solar Credits

Alpen Phenix

Log home build by author provides enough solar energy and solar gain to live off during the summer and bank credits for winter use. Courtesy photos.

In 1978, the Public Service Company of New Hampshire (PSNH) was charging customers for the construction of the Seabrook Nuclear Plant. I lived thirty miles from the plant and was very much opposed to its construction and imposition of costs on consumers. I put anti-nuke and pro-solar stickers on all my checks to PSNH. Two years later I decided to move 85 miles north to Tamworth, N.H. to get away from the plant before it went on line. I built myself a two story, 24'x32' log home on some family land. In an effort to be as self-sufficient as possible, I added double insulation to the roof and put in large south facing windows to maximize passive solar gain. I heated with a wood stove and small propane heater in the basement. I cut three cords of wood off my property every year to keep warm, for 30 years!

Three years ago, I decided I needed a new plan to save my aging body and also to become more environmentally responsible. I contracted with Frase Electric of Sandwich, N.H. to install nineteen solar panels on my roof. It was a big decision, but one of the best I have ever made. My electric bill dropped from $40/month to basically zero, having to pay only delivery charges of $11.41/month. A whole new world of energy opportunity had opened up for me. I replaced my gas hot water heater with an electric one, having it installed with a power switch conveniently located, so I could control my usage. I quit using my propane heater. I purchased a couple of oil-filled electric radiators for night time heat upstairs, and put a small hot water tank on top of my new, more efficient wood stove. The tank was tied into my electric hot water heater. Through thermodynamics this provides tepid water for hand washing in the winter saving me from turning on the electric hot water heater. When I need to do dishes or take a shower, I turn it on for 15 or 20 minutes, and I am all set. Since I now generate my own electricity, I take longer, much more enjoyable showers, too.

They say a penny saved is a penny earned. This also applies to kilowatt hours as well. During the summer months, my panels generate the power I need for heat in winter. Through net metering, I currently have 3553kWh in the bank. On October 15th, I reached a high of 4,128kWh thanks to a sunny summer and outside solar showers. Let me explain. When I built my house in 1985, I planned to put a thirty-gallon solar hot water tank in my roof under a skylight, but never did. The tank sat unused for many years until last year. I installed it on a rack outside and hooked it up to my outside faucet and added a hose and shower head to the outlet end of the tank. I then mounted the head on a pole so I could take solar-heated showers. On a typical summer day, the tank would give me enough hot water for a three to four-minute shower, thus, saving me valuable electricity I would need for winter heat. My electric oil-filled radiators are nice and quiet and use about 20kWh per night, and I only use them at night, or possibly if I am away for the day. The house is always about 65-68º. In the winter, the roof panels generate about 15kWh per sunny day which almost equals my radiator usage currently. At the end of last winter, on March 16, 2019, I still had 1350kWh in the bank, so I could have used my radiators more and will do so this winter as it gets colder.

A thirty-gallon water tank sitting in the sun on a summer day provides enough water for a quick shower, saving solar energy for winter use.

So, I was told back in the beginning that it would not be possible to heat my house with my solar panels. Well, I am not convinced that is the case. I still am burning wood to stay warm, and I did buy a new, more efficient stove but having electric radiators and a good supply of electricity in the bank has made winter a lot less stressful money wise and heat wise. I say yes you CAN heat your house using solar panels.

Solar is the only way to go if you have the exposure or can hook into a group array. I see so many residential and commercial buildings with great solar exposure but no panels. What are they thinking? To me it is a no brainer. The environmental and financial benefits are indisputable. As I said, putting up solar panels was one of the best decisions I ever made. And now I see an electric car in my future, which was unthinkable before.

Alan Phenix is a self-employed craftsman and public television videographer living in Tamworth, NH. Alan is a volunteer distributor of G.E.T. *in the Mt. Washington Valley for the past four years.* ♻

The Mount Washington Valley Hosts an Adult Day Center in Center Conway, NH

Roger Lohr

So many people who are aging and dealing with varying levels of memory loss sit at home alone with the television all day long. The adult day care center's time has come, and a facility has been created to provide senior-care services in a home-like setting where the beneficiaries can enjoy stimulation and socialization. The Mt. Washington Valley Adult Day Center (ADC) in Center Conway, NH provides geriatric care for those living with dementia, Alzheimer's disease, and those living with other chronic health conditions.

Above: MWV Adult Day Center with 150 kWh ground-mount solar array; left: MWV Adult Day Center. Courtesy photos.

The 14,000 square foot facility with trained staff can service about seventy adults per day (open 7:30 AM – 5:00 PM), and it is integral that the building and operation be a holistic factor for servicing the guests. Adult day programs are an essential source of support for caregivers and their loved ones—providing reliable respite care, therapeutic and health services, fun activities and positive social interactions.

The ADC facility is owned by the Betty C. Ketchum Foundation. Norman Cloutier, Trustee of the Foundation, was responsible for including high efficiency and sustainability into the construction of the building and operations to increase the guests' comfort and to save on expenses. A ground-mounted, 400-module, 150 kWh solar array offsets 100% of the ADC's electricity use for lighting and other operational needs. The solar installation was done by ReVision Energy out of Portland, ME, which is an employee-owned Certified B Corporation. The "B" stands for "Benefit" Corporation and certification by the non-profit B Lab denotes that a business has committed itself to a defined set of non-traditional business practices that benefit employees, customers and the broader community by creating a positive impact on society and the environment.

The 100% LED lights in the guest area of the ADC are "tunable" to mimic the natural sun spectrum. The lighting is programmed to scientifically support the occupants' circadian rhythms, and it is differentiated from the early morning lighting, to mid day and then later in the day back to early morning.

The ADC building construction used double-insulation with five-inch panels and an additional three inches of foam spray to make the facility draft free, even though it has many windows. It was also built and situated to take advantage of light during the day, and there is in-floor radiant heating, which is comfortable for guests on a cold, winter day.

The landscaped "therapy garden" features plantings, walking paths, kinetic sculptures and water fountains. This restful therapeutic outdoor setting was created by a wildlife biologist, and it delivers a sensory experience for guests with different colored flowers that are aromatic and timed to blossom throughout the growing season.

The center has two electric vehicles (KIA Niro PHEV SUV sedans) for transportation. These three-passenger vehicles are used to pick up guests, and they are easier for guests to get in and out of while avoiding the need for gasoline and sending a message about the environment. The vehicles are also used to pick up daily meals.

The ADC trained staff and operations are provided by MaineHealth and the Memorial Hospital, and programs are customized for individual guests. The activities provided are designed to build on the person's remaining strengths and compensate for deficits. The activities range from art, music, dance, cooking, reminiscence, as well as intergenerational and community interactions. ADC offers support for caregivers, community outreach and assistance with resources.

Personalized programs are developed from standardized assessments. Services could include nursing care, medication administration, help with cognitive impairment or depression, assistance with activities of daily living (grooming, bathing, etc.) and so on.

There is a basic charge at ADC for a five-hour day and other services such as transportation, hair styling, and nail care or an extended day are available for an additional cost. Payment for services at the ADC can be via Medicaid, the VA long-term care insurance or private pay. The Mt. Washington Valley Adult Day Center was made possible through a unique collaboration between Memorial Elder Health Services and the Betty C. Ketchum Foundation. For more information, visit www.mwvadultdaycenter.org

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

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 program is ending. Details at www.rerc-vt.org or call (877) 888-7372.

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

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

Pellet Sap Evaporators:

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

Other Utilities Heating Offers

- Members of Washington Electric Co-op (WEC) can get a $1000 rebate on approved pellet boilers and $500 for pellet furnaces. This can be combined with the CEDF and EVT incentives for a total of $7000; $250 for qualifying pellet or wood stove installed by a qualified installer. This can be added to stove offers from CEDF and EVT.
- 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.

EVT has started a new program giving away free energy efficient products and appliances (including wood and pellet stoves) to income eligible customers. https://www.efficiencyvermont.com/free-products

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 with an Efficiency Excellence Network contractor: 50% off eligible project costs, up to $2,000. Moderate income Vermonters get up to $4,000 back.
- Air sealing and insulating your attic and/or basement with a contractor of your choice: up to $500; Moderate income Vermonters get up to $1,000 back.
- DIY: $100 back for completing eligible projects, like weatherizing windows and doors, and sealing air leaks in your attic and basement.

Appliances (must be ENERGY STAR)

- Dehumidifiers $25 - $40 rebate
- Clothes Dryers - $400 rebate
- Appliance recycling: $50 + free pickup of secondary refrigerators/freezers

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;
  - Moderate-income Vermonters are also eligible for bonus rebates up to $500 for heat pumps and heat pump water heaters.
- 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 program is ending/ **Efficiency Vermont** offers a $650 rebate for a new pellet or cord wood stove, with a $100 adder if they turn something in.

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
- Sense Home Energy Monitor: $199
- Discount Pool Pumps – up to $500 back on select ENERGY STAR models
- Home Energy Loan – low-interest loans of up to $35,000 for home weatherization and heating improvements.

ELECTRIC VEHICLES: Vermonters with household income of $92,000 are eligible for any new EV priced $40,000 or less. More than 20 PEV models are eligible with $1,500 incentives for plug-in hybrid electric vehicles and $2,500 incentives for all-electric vehicles. Larger incentives of $4,000 for plug-in hybrid electric vehicles and $5,000 for all-electric vehicles are available for individuals whose households qualify for Vermont's Weatherization Program. Incentive may be used in combination with PEV incentives offered by the state's electric utilities through the Renewable Energy Standard Tier 3 and federal tax credits. https://revermont.nationbuilder.com/EV-incentives.

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.htmls

Commercial Solar Rebate Program

> ***Note: C&I solar incentives rebate program is currently closed to new applications.***

Incentive levels for PV systems are as follows:

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

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

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

PACE

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

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

- Note: program is currently closed to new applications,

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

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 lighting products purchased through participating NH retailers. More information at: 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.
- Mass Solar Loan: 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 wa er 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

- Visit: https://mor-ev.org/
- ***Please note that all the the Massachusetts incentive information is not up to date and may have changed. Please refer to the links for each category to find the current information that is available. It is ever changing!***

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NYSERDA

New York solar incentive and rebate information: 169 programs and incentives at: http://dsireusa.org (enter your zipcode). More programs and services from NYSERDA: For current NYSERDA solar, ground source and air source heat pumps, EV residential and commercial incentives and more visit: *https://www.nyserda.ny.gov/nyPutEnergyToWork/Energy-Program-and-Incentives.*

Heat Pumps

$1000 per ton NYSERDA incentive. NYSEG/RG&E rebate program up to $1050. More info at http://bit.ly/NYSEG-Rebates.

EV Incentive from National Grid

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

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

Home Energy Waste

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

RENEWABLE ENERGY/NY-SUN

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

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

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

Residential and Small Business

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

Commercial and Industrial

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

Commercial Energy Storage

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

Community Solar

- http://bit.ly/NY-sun-Community

Commercial/Industrial PV Installer

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

Residential/Small Commercial Solar PV Installer

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

Financing Options

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

Clean Power Estimator

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

Geothermal

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

Electric car

- buyers in New York State can now get a rebate of up to $2,000 on qualifying EV models from participating dealers. See https://on.ny.gov/2Rd14zL
- Charge Ready NY: $4,000/installed Level 2 electric vehicle (EV) charging stations for public, workplace, and multi-unit dwelling stations. http://bit.ly/ChargeReadyNY.

Utility sponsored incentives & tips:

http://bit.ly/utility_sponsored_incentives

Clean Energy on Farms

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

National Grid

- National Grid savings for customers, http://bit.ly/Thanks-For-Saving-Energy
- *For more utility rebates google the utility name and search for rebates.*

UP-TO-DATE INCENTIVE INFO CAN BE FOUND AT:

WWW.DSIREUSA.ORG

Reader OP-ED:

"GREEN-WASHING" GAS

Vermont Gas Systems leads the way

H. Clattenberg

A November 14th press release from Vermont Gas Systems (VGS) trumpeted a bold new initiative: "VGS Targets Elimination of Greenhouse Gas Emissions by 2050". It sounds revolutionary and wonderful. The poser, though, is how can VGS eliminate greenhouse gas emissions from its product, which is essentially pure methane (CH4)? Methane in itself is a greenhouse gas, and when burned, carbon dioxide (CO2) - another greenhouse gas - is produced. According to the laws of chemistry, CH4 + 2(O2) = CO2 + 2(H2O). No artful business plan can alter the equation. Production, storage, shipment and burning of methane emits greenhouse gasses, whether through "fugitive" methane that escapes into the atmosphere prior to combustion, or through the generation of carbon dioxide at the gas jet. So how exactly is VGS going to eliminate greenhouse gas emissions? (This appears to be the premise, although the word "targets" in the press release headline suggests a measure of non-commitment). The answer features a novel trademarked commodity called "RENEWABLE NATURAL GAS".

What is Renewable Natural Gas?

Renewable Natural Gas (RNG) is captured from waste in landfills, wastewater treatment plants, farms, food processing by-products and the like. The source material ("feedstock") is collected into the tank of an anaerobic biodigester, where it gets broken down by methods that favor the production of methane. The bio-digester yields "biogas", a mixture containing roughly 2/3 methane and 1/3 carbon dioxide and traces of gaseous sulfur and nitrogen compounds. The fermentation within a biodigester will also produce a low-odor solid or semi-solid residue that can be used as animal bedding or fiberboard or fertilizer, depending on the design of the installation. It is important to understand that the biogas generated directly from fermentation of bio-waste is not considered "Renewable Natural Gas", until and unless it has been enriched to consist of nearly pure (90%) methane. This isn't a necessary extra step, small farm biodigester set-ups in developing countries, for example, use the mixed biogas, as is, to produce heat and electricity. The souped-up product, "Renewable Natural Gas" simply contains more methane. The methane in RNG is still methane, chemically indistinguishable from the methane that was in the original biogas, and chemically indistinguishable from the methane in fossil-derived natural gas. The difference between RNG and biogas is that Renewable Natural Gas meets purity standards that allow it to be offered for sale to natural gas markets worldwide.

Let's count the beans:

To appreciate the hollow promise Renewable Natural Gas offers for mitigating the climate crisis, it is useful to consider the environmental consequences of using biogas without the extra purification needed to produce RNG. Responsibly-generated, locally consumed biogas can have benefits as a fuel source, as for example, in situations where farm waste would otherwise be allowed to decompose in a heap and contaminate air and water. However, even when farm waste is used to generate biogas without further processing, greenhouse gas reduction is not a guaranteed result. What puts biogas in the plus column relative to regular natural gas is the fact that methane gas generated from waste contains carbon molecules that are already at large in the biosphere, cycling between the soil, trees, atmosphere, crops, chicken poop, etc. Fossil-derived natural gas, in contrast, is mined from carbon that was put into deep storage around the Mesozoic era. When fossil carbon sources burn, essentially new atmospheric greenhouse gas is introduced. A close and comprehensive calculation is required to establish that the use of biogas will successfully curtail atmospheric greenhouse gasses, because the combustion of the already-circulating carbon in biogas as opposed to previously-unavailable carbon in fossil fuels is the only gain that can be realized in the substitution. And, while the environmental costs of storage, shipping and burning methane have not changed, there are further considerations as well. An anaerobic biodigester must be tight so that it does not leak gas, and never over-charged with bio waste, or methane will have to be vented to relieve excess pressure. To minimize the fuel consumed in the course of generating biogas, feedstock for the biodigester must be from a nearby source and likewise the product biogas should be transported only a short distance to the end-user. Other inputs to the calculation can further erode environmental advantages. If feedstock is sourced from dedicated crops instead of from true waste, or if the biodegradable waste was diverted from a preferable fate as compost (which tends to sequester carbon in the soil, rather than releasing it into the atmosphere) the scale again tips the wrong way.

Perhaps the most effective way to undermine potential gains from the use of biogas is go the next step and process biogas into Renewable Natural Gas. This is because industrial methods for separating and purifying RNG from biogas all consume energy. More energy still is required to compress RNG and transport it to distant markets. This quickly becomes a zero-sum game: the energy in biogas is useable, but the gratuitous energy input required to bump biogas to a higher grade of fuel eradicates the already marginal payback and serves only to make money. Perhaps the most insidious impact of Renewable Natural Gas is that it provides a specious justification for yet more pipeline infrastructure (as VGS readily mentions in its current report to the Public Utility Commission). VGS urges us to believe that Renewable Natural Gas can help lower greenhouse gas emissions. Not true. Whereas there is some possibility that an anaerobic biodigester coupled with equipment that burns the biogas directly to co-generate heat and electricity for a farm and some neighbors might not make matters

Cont'd on p.31

Efficiency Vermont's EEN Contractor Spotlight: Integrated Solar Applications

Interview with Katrina Wilson, Vice President of Operations and Sales

Green Energy Times Staff

Katrina Wilson, Integrated Solar Applications

Efficiency Vermont has a program that anyone looking for serious work on a building should know about. It is the Efficiency Exellence Network (EEN) program. Professionals associated with it are required to keep updated on the latest technology in their fields. Its manager, Allison Fode, answered some questions for us.

What is your area of expertise?

As designers and installers of solar and heat pump systems, our expertise is getting to know our customers and their homes, while we discuss their needs and desires in detail.

We have extensive training and certifications in calculating heating and cooling loads, as well as designing and installing solar photovoltaic (PV) systems and heat pumps (air-to-water, water-to-water, or air-to-air).

Also, we have installed a number of off- and on-grid battery storage systems, including flooded lead acid, AGM, and lithium-ion. We are certified installers of the Sonnen, LG Chem, and SimpliPhi home energy storage systems.

What projects do people try to do themselves that really should be done professionally?

We recommend having a trained and certified professional for each step of the way in bringing your home to net zero. Tightening up a home too much without the correct equipment to test the airflow can lead to injurious health consequences.

Installing solar and heat pumps requires precautions for safety. Making a mistake designing, wiring and installing either a PV system or a heat pump can lead to serious consequences.

If you could only choose one type of project to reduce your carbon footprint, what would it be and why?

If we could only choose one type of project to reduce a household carbon footprint, we would choose weatherization to bring the household heating and cooling load down as far as possible within its financial means.

This will not only save on energy consumption, lowering the carbon footprint but will enable a reduction in the size the renewable energy system needed to power, heat, or cool a home.

What is it in your field of specialty that is most valuable (related to energy efficiency) that our readers ought to know about?

We believe our valued specialty is our knowledge of and passion for the net-zero home, and what it takes to get to net zero with limited financial means.

Our business model has been "net zero" since 2008. This concept is incorporating both in energy efficiency and renewable energy systems. For example, we can match a cold climate heat pump system with PVs to lower a home's carbon footprint to as close to zero as possible within a budget.

Why should people use an Efficiency Excellence Network (EEN) contractor over another contractor?

Customers should use EEN contractors over other contractors because of the standards that Efficiency Vermont holds their members to with regard to customer satisfaction, continuing education and certifications.

What are the best ways to finance projects (or what incentives are available) for residential or commercial projects?

The best way to finance home projects is through home equity loans. If you are not in a position to take advantage of a home equity loan, Efficiency Vermont has the Home Energy Loan. This loan is facilitated through the Vermont State Employees Credit Union (VSECU), Opportunities Credit Union and NeighborWorks of Western Vermont. You can find more information at https://www.efficiencyvermont.com/services/financing/homes/home-energy-loan. Efficiency Vermont in partnership with VSECU also offers a Business Energy Loan for businesses, non-profit organizations, municipalities, farms, and owners of rental housing needing to finance energy-efficiency projects. See https://www.vsecu.com/financial/business-loans/clean-energy-loan for more information.

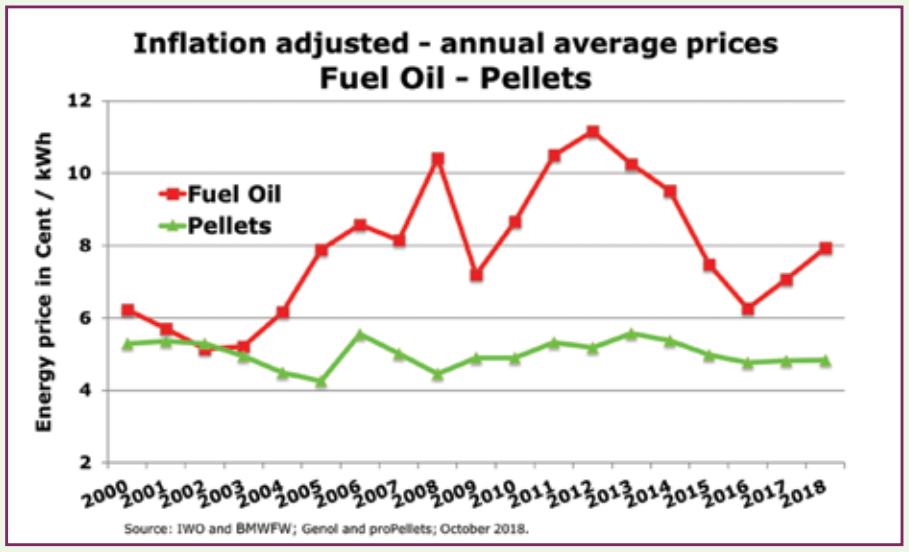
For solar PV systems, there is a federal tax credit of 26% of the project cost for 2020. Incentives for heat pumps can be found in the Incentives section on pages 14 and 15 in Green Energy Times. In addition, eligible rural small businesses and agricultural producers can apply for renewable energy grants and loans through the USDA (known as the REAP program). These grants provide up to 25% of total project costs and loan guarantees on loans up to 75% of total project costs. The details of the REAP program can be found at http://bit.ly/REAP-loan. ♻

Replacing Your Boiler? Consider Pellets!

J.S. Fitzpatrick

I have a pellet boiler in my basement that heats my house. Not a pellet stove, but an electronic, touch screen, digital-brain modern boiler that is run by thermostats, just the same as a gas or oil-fired unit.

I'm planning on this boiler keeping me warm and cozy for two or three decades at least, and I won't be burning fossil fuels to do it. Really, everyone ought to avoid replacing or installing any fossil fuel heaters. If you are looking at replacing your oil or gas fired boiler anytime soon, replace it with something electric run by solar if you can. If not, figure something else out. For me, wood pellets were a pretty good solution.



A modern pellet system is quite a bit more costly to install than a fossil fuel system. But I was willing to take a big gulp and do it for two reasons.

The first reason was more about not burning fossil fuels than about the advantages of pellets. I just couldn't stand the idea of buying fossil fuel to heat my house for another 20 or 30 years. Something like this little sign should be printed on every oil and gas bill:

SURGEON GENERAL'S WARNING: Global warming is real and the burning of fossil fuels is bad!

We must minimize their use!

The second reason was that I have a high degree of confidence that I will indeed save money in the long run. Since you are talking about something that lasts for decades, the costs over time are pretty hard to predict. Pellet prices are quite stable. Oil and gas prices are notoriously volatile (see chart below). It's quite clear that heating with pellets saves money, but just how much it saves depends on the up and down prices of the fossil fuel market. The cost savings are over the long haul. Plus, right now New Hampshire will reimburse 40% of the cost of most residential systems (see website links at the end of the article).

Burning anything adds carbon dioxide to the atmosphere but eliminating the burning of stuff to heat an old farmhouse in the north country isn't a realistic scenario for many situations, certainly not mine. I would have loved to go real green and put in an air-source mini split heat pump run by solar panels, but it wasn't practical. But I could eliminate the burning of fossil fuels. I know that my house is heated with a fuel originating in Maine or New Hampshire and is part of an ongoing carbon cycle.

While we are talking realistic, I also think that it's pretty much too late to avoid climate trouble. Our ability to take action has just been too slow. But I also think that doing something is better than sitting still, especially if it is a move away from fossil fuel use. And even though I'm pessimistic, it is still theoretically possible to avoid a lot of future climate trouble.

Anyway, I replaced the oil boiler with the pellet boiler and it's been fine. The old farmhouse's oil system already had cast iron baseboard radiators. They are great. The system has two heating zones and makes our hot water. The fuel truck comes and blows in a couple of tons of pellets a couple of times a heating season, and the guy comes to service it once a year. Sound familiar? It probably does, because that is pretty much the typical routine. That's what you expect from a heating system -- turn up the thermostat and it gets warmer. All in all, it's pretty carefree.

And my pellet boiler has neighbors! I have visited residential pellet boilers in Littleton, Bethlehem, Sugar Hill and Franconia. They are also in a number of schools, apartment buildings, businesses and public buildings right in the towns where we live. You probably already know places with one. So, before you replace or install a fossil fuel boiler, ask around. Your neighbors who use pellets like using them.

But for me, more important, it's one answer to the most important question: How can we stop burning fossil fuels?

Current NH state PUC rebate information can be found at puc.nh.gov.

Step by step online calculators to compare pellet costs to your current or proposed fossil fuel system can be found at http://woodenergyproject.com/ or https://www.biomassthermal.org/resource-center/.

J.S. Fitzpatrick, "Fitz" is a retired teacher who devotes a good deal of his energy trying to reduce our dependence on fossil fuels. He serves on two local energy committees in norther New Hampshire. ♻

Liquid Air Energy Storage in VT – *Cont'd from p.10*

drawing heat from the atmosphere in a heat exchanger.

Liquid air is held in highly insulated tanks, at a temperature of -196°C (-320°F). At this temperature, it boils very slowly, and the boiling removes heat. In a very efficient cryogenic system, very little of the liquid is lost to keep the rest cold.

Compressing the air takes a fair amount of energy, but boiling liquid air releases energy in the same sort of way boiling water does. The liquid air expands by a factor of 700, as it becomes a gas, and that can drive a turbine.

Much of the theory behind cryogenics has been known since the 19th century. Of course, turning theory into reality is often not terribly easy. Highview Power, a British company that is partnering with Encore Renewable Energy (ERE) for the Vermont storage project, has been pursuing the business of cryogenic energy-storage since 2005. After laboratory work and patent development, it produced a 350-kilowatt pilot project in the UK. Next, with support from the British government, it built a larger project of 5 megawatts (MW). Last October, it built a 50-MW project that could provide 250 megawatt-hours (MWh) of electricity. The project to be built in northern Vermont is of similar power capacity, 50 MW, but with more energy storage, at 400 MWh.

We should note that these projects are both technologically uncomplicated and rather small compared with lithium-ion batteries of similar power capacity, so they do not need much land. They have the same advantage over pumped storage, with the added benefit that they do not have much potential effect on wildlife. Highview Power says they are not expensive. They are very clean and can be powered without any need for fossil fuels.

The decision to build the plant in Vermont solves a problem that exists in the northern part of the state with an old and limited electric transmission system. As the system goes through regular use, with changes in supply and demand of electric power, local power lines can be asked to deliver more electric power than they were designed to conduct. In such a case, one or more tricks have to be employed to reduce the load. In a worst case, the supply may have to be cut off. The flip side of this is that if too much local power is produced, whether from a wind farm or net-metered solar panels on rooftops, that power has to be curtailed; even if it can be produced, it will not make it to the grid. By putting storage into a place with a limited power grid, it becomes possible to deal with both excess power and excess demand locally. Using the battery means that electricity that would otherwise be lost can be saved for use when it is needed.

Another advantage to local storage is that it provides emergency power support in situations where the grid would otherwise fail altogether. The cryogenic system in northern Vermont could wind up being important, as more extreme weather comes with climate change.

Highview Power's website is www.highviewpower.com. ERE's website is encorerenewableenergy.com. ♻

THE MANY CO-BENEFITS OF A GOOD CLIMATE SOLUTION

John Gage

The cheapest and quickest way to reduce climate pollution is to put a price on it and let efficient market forces unleash the investment, innovation, and transition to clean energy required. We can protect household budgets during the transition, protect US businesses from free-polluting foreign competition, and strongly encourage all other countries to follow our lead, with a simple three-part solution:

1. Carbon Fee: Charge fossil fuel producers and importers a carbon fee based on the climate pollution generated from their products, starting at $15 per ton of CO2e and increasing it by $10 more each year;

2. Dividend: Return all the money collected back to all households each month equally - one share per adult and a half-share per child - to recoup each of us for damages from the pollution; and

3. Border Carbon Adjustments: Put a corresponding carbon fee on energy-intensive imports from countries that don't match our carbon price and remove the fee from our exports to keep the US globally competitive.

The Energy Innovation and Carbon Dividend Act of 2019 (HR 763) does all that, and the effects are powerful.

Fossil fuel producers will pass their steadily increasing costs down to businesses, incentivizing them to invest in, develop, and use non-polluting energy solutions. Businesses will pass their temporarily higher energy costs down to consumers, and compete to reduce those costs. Consumers cannot pass down their higher costs, but their purchasing power is protected by the dividend. Producers and consumers will make more fully-informed choices and clean energy options will rapidly become less expensive than polluting ones through economies of scale.

Independent studies from Columbia University, Regional Economic Modeling Inc., and the US Treasury have identified many benefits from this climate solution:

It's Effective: Carbon emissions will be reduced by 40% by 2030 and 90% by 2050. This will hold warming below 2˚C this century when other countries follow our lead.

It's Bipartisan: Over seventy members of Congress - from both parties - are cosponsors.

It's Good for People: Two-thirds of all households will break even or receive more in their dividend than they spend due to higher prices from the fee. See how you'll do here: energyinnovationact.org/carbon-dividend-calculator/.

It Cleans the Air and Water: Sulfur dioxide and mercury emissions from the power sector will decline by more than 95 percent and emissions of oxides of nitrogen decline by about 75% by 2030 relative to a current policy scenario. This will yield significant health benefits.

It Helps the Poor: The lowest 10% of households by income will get an average of 9% more income by year five simply because they have smaller-than-average carbon footprints.

This benefit is available to *Cont'd on p.19*

INVESTING FOR IMPACT AND FINANCIAL SUCCESS

Harry Moran, CFP®, AIF®

With the wide availability of mutual fund and exchange traded fund (ETF) impact investing vehicles, it's become relatively easy for an individual investor to get started. There's also an abundance of solid information available online through resources such as USSIF, Green America, As You Sow, and FossilFuelFreeFunds.org. This represents tremendous progress in this area since I started working with socially and environmentally conscious investors over 30 years ago. It's become quite clear that investors don't have to sacrifice returns, if they will follow the same foundational investment principles that traditional investors use. The following guidelines should be helpful for sustainable, responsible, impact (SRI) investors as they navigate this process.

Start with your goals. Without clearly defined goals, it's impossible to define success, or to be able to lay out a prudent plan to get there.

Determine your time horizon and be prepared to have different time frames for different goals (e.g. college funding, buying a house, retirement).

Make sure you have a handle on your risk tolerance. Many people feel the urge to be more aggressive when the stock market is doing well. No one likes to feel that they're leaving money on the table in an environment where it seems that everyone is raking in big profits. Investors' emotions can shift quickly though between greed and fear, and market downturns can put people in panic mode. One surefire way to reduce the likelihood of your long-term success is investing overly aggressively and then selling into a market downturn, and thereby turning paper losses into real losses. Once out of the market, it can also be extremely difficult to know when to get back in.

Uncertainty is one of the biggest drivers of market volatility, and election years are always fraught with uncertainty. If you have cash that you're thinking about investing, consider strategies like dollar cost averaging which can help reduce risk. By systematically investing equal amounts of money at regular intervals, you can take advantage of price fluctuations by automatically buying more shares when prices are down, and fewer when prices are up. Over time, this reduces your average share cost and often leads to better outcomes. Similarly, consider directing the dividends or interest from bonds or other income-oriented vehicles to automatically purchase shares in more volatile equity investments. Of course, dollar cost averaging doesn't guarantee success.

Use market declines to rebalance your portfolio. If you're targeting a 60% stock weighting and a market drop reduces the stock portion to 50%, take advantage of that by moving some money from other, lesser performing categories. This goes against our instinct to invest more in what's doing well, and less in what's been going down, but portfolio rebalancing is another time-tested way to use volatility to your advantage and increase the odds of long-term success.

SRI investors need to pay attention to other issues as well. It's critical to maintain a diversified portfolio and to avoid putting too much in highly volatile sectors such as renewable companies. While these investments are exciting and are one of the pieces of the puzzle in addressing the climate crisis, they can exhibit dizzying price swings.

Understand that adding extensive environmental or social screens can materially reduce diversification and affect risk and returns in sometimes unpredictable ways. In our experience, aggressive screening has significantly increased risk and volatility. To address the needs of investors with multiple areas of concern, we employ a state of the art process that "reoptimizes" the investments remaining after the screens have been implemented. This system has helped us maintain proper balance and diversification, and significantly increase the likelihood of a positive financial outcome.

Another trap for impact investors is to get seduced by a "green-sounding" investment product that turns out to own several companies that they find objectionable. Look at the stated goals and strategy of the investment, and also at the top holdings in the portfolio. Be aware of how they define positive impact and sustainability, and make sure that definition aligns with your own.

Consider working with an investment professional who specializes in this space. Some individuals have the time, energy, and temperament to be successful "do it yourselfers", but many people benefit from guidance from an independent, objective, experienced professional. Beware of financial advisors who try to dissuade you from pursuing this kind of investing by saying that you'll sacrifice returns. A growing number of academic studies, and many years of experience working with screened portfolios strongly suggest this isn't the case. Also, be aware of advisors who say they don't specialize in this but they can do it. When advisors and investors in this space do their homework, they are much more likely to be successful. With all the challenges we face, impact investing continues to be a transformational force for change as we use our investment dollars for the common good.

Harry Moran, CFP, AIF, owner/founder of Sustainable Wealth Advisors (SustainableWealthAdvisors.com), helps socially conscious investors define and achieve their highest goals by aligning their money with their values. Contact him at 518-450-1755 or hmoran@prginc.net. Advisory services offered through Portfolio Resources Advisor Group, Inc. Home Office: 800 Brickell Ave., Suite 903, Miami, FL 33131. (305) 372-0299. ♻

CLIMATE SOLUTION – *Cont'd from p.18*

everyone simply based on their carbon footprint.

It Creates Jobs: 2.1 million new jobs (net) will be created in ten years from the extra spending enabled by low-income households.

It Protects Businesses: The border carbon adjustment will protect US businesses and jobs by putting the cost of pollution into the price of imports and taking it out of exports in trade with countries that haven't yet matched our carbon price.

It Has Global Reach: Forty-six other countries are already using or implementing carbon pricing to reduce their carbon emissions, but most of their prices are too low according to US, IMF, and World Bank economists. The border carbon adjustment provision will strongly incentivize all other countries to match our carbon price, driving global emissions down as required for our safety.

We have an opportunity to reap the economic and job benefits of leading the next big global transition, rapidly reduce pollution, and make great strides towards ensuring a safe climate for our children and life on Earth. To do so, we must unleash the full power of an efficient energy market by putting a sufficient price on climate pollution. This will supercharge the green economy.

The Energy Innovation Act solution has sound science and economics behind it and offers many co-benefits, but Congress cannot do this without our help. Status quo-profiting businesses and politicians supported by them have actively worked against effective policy changes for decades. They got the benefits; we got the pollution and are paying for it. If we want change, we must create the political will for it ourselves. By speaking up together for our common interests we can make our democracy work for all of us. Please learn more about it and add your support now. Citizens can write Congress: cclusa.org/energy-innovation-act/. Businesses, organizations, and elected leaders can endorse the bill: energyinnovationact.org/endorse/. Thank you!

John Gage is Citizen's Climate Lobby's New Hampshire State Coordinator. ♻

Affordable Leaky Window Solutions

Tin Mountain Energy Team Wants to Help Warm Up Your Windows

Russ Lanoie

The Mount Washington Valley's Tin Mountain Energy Team, originally formed to help local residents install solar hot water systems following the PAREI model (Plymouth Area Renewable Energy Initiative) is joining with the WindowDressers of Rockland, Maine to produce and install low-cost, double-layer interior inserts through community workshops. The Energy Team recognizes that one of the most effective ways to reduce building energy consumption is to stop the heat loss through and around windows, especially those in older homes that may still have single pane windows, even if they have aluminum storm windows, which in many cases do little to stop air infiltration.

A Window Quilt® installed above a set of double windows. Photo courtesy of Window Quilt®.

WindowDressers is a volunteer-driven, non-profit organization dedicated to helping Maine residents reduce heating costs, fossil fuel consumption, and CO2 emissions by lowering the amount of heat loss through windows. Each insulating window insert is made of a custom-made pine frame wrapped in two layers of tightly-sealed, clear polyolefin film and finished with a compressible foam gasket. The foam allows enough give for the inserts to be slid easily into place in the fall and removed in the spring, while holding firmly enough to provide a tight, friction-based seal that stops drafts and adds two more insulating air spaces between the home and the window. The inserts are installed inside of your existing window jamb with no fasteners required.

This fall, several Tin Mountain Energy Team members participated in the multi-step process of measuring and constructing the actual inserts under the guidance of veteran WindowDressers volunteers. Team members attended a measuring workshop to learn the way to accurately obtain window dimensions which are recorded into a custom database and sent off to Rockland, Maine for the production of the pine frames. These unassembled frames are then sent to several community workshop locations throughout Maine and upcoming locations in Vermont where volunteers assemble the frames, wrap the two layers of plastic film and add the foam edges, again under the guidance of seasoned volunteers.

Two workshop volunteers apply the plastic film on an insert destined for their own home. Insert recipients are encouraged to participate in the workshop if at all possible. Courtesy photos.

Because most of the work is being done by volunteers, including the end users who are encouraged to participate whenever possible, the cost of the inserts is well below the cost of commercially available products. Since its inception, WindowDressers insulating window inserts have saved an estimated 880,000 gallons of heating fuel and over $2.2 million at today's fuel prices. In 2018 alone, over 1,000 volunteers worked together to build 7,597 inserts at 33 community workshops across Maine. In 2018, 34% of these inserts went for free to low-income households.

Among the first buildings to receive WindowDressers inserts in New Hampshire is the Gibson Center for Senior Citizens, an old building in North Conway, NH with many leaky windows, some of which face the northwest wind that blows across the Valley. Gibson Program Coordinator, Jill Reynolds, found that the first day after the inserts were installed she no longer needed an afghan to keep warm, because her office "was like a sauna."

For more information on WindowDressers insulating window inserts visit https://windowdressers.org/.

At the same time the Tin Mountain Energy Team is planning on hosting WindowDressers workshops, two team members are bringing commercially produced Window Quilts® back to the Valley. One of the senior members who had a very active Window

Cont'd on p.21

Affordable Leaky Window Solutions – *Cont'd from p. 20*

Quilt® dealership in the 1980's is helping a newer member establish her own dealership. Window Quilts® are very different from window inserts in that they are moveable in the same manner as a shade and provide privacy as well as a vapor barrier, added insulation and a tight seal. Window Quilts® are manufactured in Brattleboro, VT and have been installed in many public buildings and homes, and owners still comment on how well they work even decades after they were installed. Like WindowDressers inserts, they are custom-measured for each window but remain in place year round and can also be used to keep out summer heat.

Although WindowDressers inserts and Window Quilts® provide very different approaches, they each provide effective solutions for reducing heat loss through windows. In certain cases they can even be used together for very leaky windows. For more information, visit windowquilt.com.

Russ Lanoie is a long-time solar proponent in NH's White Mountains and operated his Alternative Systems business in the 70's - 80's selling solar hot water systems, composting toilets and Window Quilts®. He lives in a passive solar home which has had Daystar solar hot water for forty years and 11kW of PVs on his barn since 2015. RuralHomeTech.com. ♻

A workshop coordinator at right shows a Tin Mountain Energy Team volunteer how to apply the double sided tape that will hold the plastic film in place to the edges of an insert frame. Well-designed jigs and fixtures help make this and other processes simple and accurate. Photos: Russ Lanoie.

Another workshop volunteer runs the insert under the heat gun to tighten up the plastic film before the final step of adding the sealing foam edges.

A Growing Interest in Window Inserts in Vermont

Green Energy Times staff

Recent window insert workshops. Photos courtesy of Bob Walker.

Volunteer groups in Vermont have begun to adopt a community-workshop approach to the problem of drafty windows and high heating bills. Custom-fitted inserts, that can be equally suitable for old casements or new replacement windows, are produced by executing an elegantly simple production scheme developed by a Maine non-profit called WindowDressers. Made-to-measure frames are fabricated by volunteers from locally-sourced pine and covered on both sides with transparent plastic film. The double-sealed inserts provide an effective and attractive cold-air barrier that is held in place by a compressible foam gasket. Because the inserts are friction-fit to the inside of a window, they install quickly without hardware and can be easily slipped out and re-used over multiple seasons. Annual savings on heating costs, though affected by the original condition of the window and the type of fuel involved roughly averages $27 per window, meaning that a homeowner or renter can recover the cost of their inserts in 1-2 years.

WindowDressers was sparked by the weatherization challenges of a Rockland, Maine church. In the course of solving the problem of heat loss through the sanctuary windows, the two founders (an engineer and the president of the church) ended up refining an operation that needed only a simple set of readily mastered skills, some well-designed jigs, and a communal, energetic corps of volunteers. The WindowDresser solution caught fire throughout Maine, and to date, groups assisted by the non-profit have manufactured over 35,000 inserts, conserving over a million gallons of heating fuel. Because of the volunteer labor involved, insert costs are kept low and between 25% and 30% of interior storm windows can be donated to low-income households.

The Glover Energy Committee first brought WindowDressers to Vermont, hosting a pilot workshop last January that fitted 26 homes with inserts. Now workshops have been scheduled for 2020 in six towns throughout the state: Bristol, Charlotte, Montpelier, Thetford,

Cont'd on p.28

HeatSmart Campaigns in New York and Massachusetts

Georgena Terry, CESA
Research Associate

Note: This is the third in a series on community-based strategies for increasing the adoption of residential renewable heating and cooling technologies. For more information on community-based strategies and renewable heating and cooling technologies, please see the September 2019 and November 2019 issues of G.E.T. and read the Clean Energy States Alliance's full report and case studies.

HeatSmart campaigns promote the use of renewable heating and cooling technologies in their communities. In some areas, state energy offices support these campaigns through funding and other resources. This article discusses two of those states.

New York State and Massachusetts each have passed legislation addressing the reduction of greenhouse gas (GHG) emissions. Massachusetts' Global Warming Solutions Act mandates an 80% reduction in GHG from 1990 GHG levels by 2050. Similarly, New York State's Climate Leadership and Community Protection Act requires an 85% reduction in GHG from 1990 GHG levels by 2050.

To help reach these targets, both states have enacted community-focused programs that address emissions reductions from the heating sector. New York's Clean Heating and Cooling Community Campaign (CHCC) and Massachusetts' HeatSmart Mass program seek to increase the use of clean heating and cooling technologies in multiple communities. Eligible technologies include air source heat pumps, ground-source heat pumps, solar heating (and cooling in New York), and low-emission biomass heating. Both programs are based on the proven Solarize model, which pioneered community campaigns and group purchasing for solar photovoltaics. Funding for the programs comes from charges on customer electric bills.

Communities who wish to participate in these initiatives are solicited through a request for proposals (RFP) that describes the program, outlines the community eligibility requirements, and details the roles and responsibilities of the state and the community.

The New York State Energy Research and Development Authority (NYSERDA) launched its first round of the CHCC in November 2017, seeking proposals from organizations to administer the community campaigns. The first round resulted in eight campaigns: Sustainable Homes Rochester, HeatSmart Central New York, HeatSmart Orange, HeatSmart Otsego, HeatSmart

Southern Tier, HeatSmart Tompkins, HeatSmart Ulster-Sullivan, and HeatSmart Westchester. After the second round, five more organizations across the state were awarded funding for campaigns. These are HeatSmart Utica, HeatSmart Capital Region, Putnam, Brooklyn, and Green the Bronx.

NYSERDA provides the selected communities with financial support for multi-year campaigns to select qualified installers and negotiate a reduced price for homeowners. This includes recruiting teams to provide technical assistance for community campaigns. The teams help with the installer selection process through the development of an RFP template and also assist in marketing and outreach efforts.


HeatSmart Tompkins Program Director Jonathon Comstock discusses how a heat pump works in Tompkins, NY. Photo: Karim Beers.

Because the lessons learned are key to the program's sustainability and future success, teams conduct debriefings, an analysis of the successes and failures of a campaign, and remit quarterly enrollment data and metrics to NYSERDA.

NYSERDA uses an artificial intelligence tool that gathers data from public records to target potential high-value customers who would benefit from clean heating and cooling. NYSERDA provides the CHCC program's participating installers with access to this data for up to two years.

The Massachusetts Clean Energy Center (MassCEC) provides a marketing budget between $5,000 and $13,000 to each municipality participating in HeatSmart Mass. The budgeted amount depends on how many clean heating and cooling technologies are promoted, the median household income of the municipality, and the size of the municipality. MassCEC issues an RFP for installers and provides a technical consultant to support participating communities.


Courtesy image: NY Heat Smart

Currently, there are HeatSmart Mass programs in Great Barrington, Bolton/Harvard, Hudson/Stow, Carlisle/Concord/Lincoln, Arlington/Winchester, Belmont, Marshfield, and Nantucket.

HeatSmart Mass also promotes no-cost home energy assessments by MassSAVE, an organization providing programs and services funded by electric and natural gas utilities. Through its Three-Year Energy Efficiency Plan, it provides financial awards of $5,000 to $25,000 to communities who achieve energy-saving goals. MassCEC works with HeatSmart Mass communities to find the best ways for the two programs to work together to benefit participating communities.

Recognizing that there may be clean energy opportunities not contemplated in its RFP, MassCEC considers unique programs, such as partnerships with local financial institutions that offer loans to those purchasing clean energy technologies. NYSERDA acknowledges and offers additional awards to communities with strategies for developing the local clean heating and cooling workforce. It also encourages communities to propose strategies for increasing the participation of low-to-moderate income households.

As of the summer 2019, the original eight NYSERDA campaigns created 1061 leads, which resulted in 118 contracts. In Massachusetts, 1185 unique leads from HeatSmart Mass resulted in 173 contracts. Both organizations are continuing to refine their programs based on lessons learned to achieve lower GHG emissions. ♻

Rockingham Roasters Gets a Free Lunch

From Saxtons River Solar Electric

George Harvey

Saxtons River Solar Electric (SRSE) installs heat pumps, in addition to solar photovoltaics (PVs). Some people might ask why a solar installer would do that. After all, the technologies are completely different. The answer, however, is actually pretty simple.

"Heat pumps are the perfect companion to solar power. It really is a match made in heaven," said Eric Shenholm, the co-owner of SRSE. "Solar and refrigerants come about as close as you can get to a free lunch in physics."

Rockingham Roasters. Photos courtesy of Saxtons River Solar Electric.

The marginal cost of electricity from PVs is pretty close to zero. That is a fancy way of saying that it costs nearly nothing to use PVs, once the investment is paid down. And the marginal cost of running a heat pump is based mostly on the cost of electricity, which, as supplied by PVs, can also be pretty close to zero. Together, they can produce pretty good heat that is as nearly free as one can get. And that explains why SRSE and some other installers work with heat pumps.

In the start of his work life, Shenholm was actually heading in the direction of a career in refrigeration. He earned a license to work in refrigeration from the state of New York. Though he never actually used that license in those early days, the background turned out to be very handy as he got into the solar PV business. Heat pumps, which are used to heat or cool buildings, use precisely the same technology as refrigerators.

Shenholm recently told us about a special installation he had done in Bellows Falls. People driving north through downtown will note the building inside a major fork in the road, between Rockingham Street, which goes level to the left, and Canal Street, which goes downhill to the right.

It is a building of some historic interest, though it had seen better days. Shenholm said, "On a scale of benign neglect from one to ten, I'd say this building was at about nine." It was purchased by Jennifer Gurley, owner of Rockingham Roasters, with the idea that with some fixing up it could be home to her business. She just had to rescue it first.

Shenholm said that the benign neglect included flooring over rot and painting by just putting fresh paint over old paint. So, Gurley understood that the building had to be redone by taking everything down to the frame. This gave her the opportunity not just to do cosmetic work, but to bring fresh vigor into the structure. New wiring, new heating, good air sealing, and good insulation were all part of the plan.

The building's second and third floors, designed to be living quarters, could be insulated, sealed and heated in a pretty normal manner. However, the intended cafe on the ground floor, where people will enjoy drinking superior fair-trade coffee, presented special heating problems due to the large amount of glass in two walls.

Shenholm always uses Fujitsu heat pumps because of their ability to deal with low temperatures. Those heating his own home have performed well even at the lowest outside temperature experienced since installation of -14° F. The top two floors at Rockingham Roasters will be heated with a single heat pump rated at 36,000 BTU, with four indoor heating heads. The cafe area will be heated with two units of 24,000 each, which will amply compensate for the amount of glass in the walls.

Jennifer Gurley guides her business, Rockingham Roasters, on "a simple principle: to produce quality without waste." The coffee beans are all organic, primarily fair trade, and roasted using electricity from hydropower. Packaging is compostable. The company is what she calls "low-brow on the branding and packaging." And she said she is working to make the business an employee-owned company.

Interior of area where the cafe will be. The old beams are beautiful.

Saxtons River Solar Electric's web site is saxtonsriversolar.com.

The Rockingham Roasters website is rockinghamroasters.coffee. ♻

Exterior condenser heat pumps.

LEWIS CREEK COTTAGE: NET-ZERO ENERGY WITH A VIEW

Barbara Whitchurch

All images courtesy Ryan Bent Photography

The Lewis Creek Cottage is a net-zero-energy home designed by Rolf Kielman (AIA, Leed AP) for *TruexCullins Architecture + Interior Design*. It was designed for his daughter, her husband and their new baby boy. Kielman told me that the family was fully on board with net zero right from the start: "My son-in-law insisted that the house be conditioned without the use of carbon fuels." Also, the orientation and placement of the house on the site was chosen for both passive and active (PV panels) solar gain. Situated on the northern edge of a hay meadow, with a view south to the Green Mountains, the house adjoins 65 acres of preserved land that is part of local efforts to improve the Lewis Creek Watershed. The primary living and gathering spaces are oriented toward the southern view and sun. Windows and glass doors provide ample natural light, beautiful views across the fields, and easy access to the outdoors. The white interior walls and natural wood floors impart a very modern feel.

The builder for this project was Jeremy O'Neil. According to architect Kielman, O'Neil has a long history of energy-efficient construction, and they have worked together before. Don Schroeder, another long-time colleague of Kielman, supplied and installed the solar array and did all the electrical wiring for the house. The 15kW solar array, with battery backup, provides auxiliary power when required. (Their utility, GMP, supports homeowner electrical backup grid load sharing (bit.do/gmp-home-nrg). This is an owner-installed Tesla storage system with two 13 kWh batteries.

A cold climate air-source heat pump system by Mitsubishi provides heating and cooling, as well as hot water. The windows are by Logic from Pinnacle Window Solutions of Maine (bit.do/logic-windows), good value Euro-type windows with an R value of 7. Air quality is controlled by a Lifebreath 205 Max HRV heat recovery system.

The efficient thermal envelope includes four inches of sub-slab insulation, R-42 walls and R-70 roof. The blower door test yielded a 0.5 ACH@50P. Other energy-saving features include low-flush toilets and Energy Star appliances. The exterior siding, cementitious Hardy Board, was chosen for ease of maintenance.

All of these details contribute to a low-upkeep, beautiful home with annual utility costs that are close to zero.

Rolf Kielman began his career designing solar-powered homes in the Philadelphia area during the energy crisis of the mid-seventies. He has been involved in environmentally conscious projects at VT Law School as well as South Farm Homes, a community of net-zero homes in Hinesburg, VT. He is a principal designer with *TruexCullins Architecture + Interior Design* of Burlington, VT. Learn about more of their high-performance projects at https://truexcullins.com.

Barbara Whitchurch is a freelance writer and a member of Passive House Vermont. She is the co-owner of a Passive House, a Nissan Leaf, a Kia Niro, and a St. Bernard. ♻

AEROBARRIER™ – CASE STUDY #4:

LOWER LEVEL OF BRICK CHURCH, CA 1869

Nate Gusakov

This is the fourth article in this series, highlighting our experiences installing AeroBarrier around New England. Here's a quick refresher on the technology.

AeroBarrier is a patented building envelope sealing technology that simultaneously measures and seals building envelope air leaks. In a nutshell, the system involves pressurizing the building (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 aerosolized, water-based acrylic sealant. 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 are sealed. When we reach our leakage target, we turn off the machine, clear the air with a few fans and 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.

The lower level of this former Methodist church is being used for offices. Air leakage was reduced by 87% using AeroBarrier. Courtesy photo.

In this article we share our experiences air-sealing the lower level of the new home of Paragon Digital, a digital marketing firm in Keene, NH. Originally built in 1869, the building was a Methodist church and remains a striking landmark.

This phase of the project involves partial renovation of the lower level of the church (approximately 3800 sq. ft.). The space will be used for offices, so the required ventilation (per ASHRAE 62.1 standards) is only 350 CFM (~0.62 ACH50). After discussions with the owner, we established an air-leakage target of 1 ACH50 (~670 CFM). Previous to our arrival, dense-pack cellulose insulation was added to the floor below and ceiling above and care was taken to ensure as complete a separation as possible between the lower level and the cathedral space above. (In order for AeroBarrier installation to be efficient and cost-effective, there must be no gaps larger than ½-inch across in the building envelope to be sealed). Knowing this beforehand, the owner was able to pay attention to the detailing as the new space was defined.

After covering the hardwood floor with red rosin paper (it is made of 100% recycled paper—it's a great easy-down, easy-up floor protection) and protecting the few fixtures and appliances that remained in the space, we installed a blower door and depressurized the lower level while checking for large leaks with our theatrical fog machine. This guided diagnosis revealed a couple of large leakage pathways. One was through an interior wall separating the space from a mechanical shed (somewhat unexpected), and one through the ceiling into the space under the altar above, where it had been much harder to install the cellulose insulation (as predicted by the owner). We were able to address the mechanical shed wall manually; the space under the altar between floors was for AeroBarrier to deal with.

Close-up of what the AeroBarrier sealant looks like at the leak point.

The lower-level building envelope measured 7.94 ACH50 (5478 CFM50) when we started installing AeroBarrier, and a little less than four hours later we achieved our target. Final testing measured the air-leakage at 709 CFM50 (1.03 ACH50). We had achieved an 87% reduction in air leakage, and the owner was ready to continue with the renovations the next 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 installations throughout New England and upstate New York. ♻

AUSTRALIA IS IN TROUBLE. SO ARE WE.

Green Energy Times *Staff*

Australia has a wildfire season every year. The worst of the bushfires occur in the summer months, late December through late March, in the southern hemisphere. On the first day of the Australian summer, it was already a record fire season. Wildfires covered an area about equal to the size of Vermont in a country a little smaller than the 48 contiguous United States. Now, only about a quarter of the way through the fire season, it is far, far worse. As of January 11, the burned area was 41,000 square miles, equivalent to two thirds the area of New England.

Wildfires currently burn in all six states. There were about 130 bushfires in New South Wales on January 9, fifty of which were uncontained. By January 10, fires in New South Wales and Victoria had merged into a "megafire" covering 1.5 million acres. Smoke from the Australian bushfires caused gray skies and dark horizons 7,000 miles away in Brazil. Animals all over Australia have been suffering. The World Wildlife Fund reports that an estimated 1.25 billion animals have been killed. The loss of human property and life is also significant; an interim count stands at 28 lives and over 2,000 homes. Australians in affected areas are being told to evacuate as soon as they receive notification, because by the time roads are cut by fires, helicopters are hindered by smoke and cannot always get people out. Those who are trapped can do little more than hunker down and wait for the fire to pass

Weather caused by fire. Source: EPA Australia.

The Australian wildfires have been creating their own weather. Smoke plumes generate towering pyrocumulonimbus clouds which are associated with dry lightning, a condition which can spark new blazes, as well as with strong down drafts, which can carry live embers from existing fires for miles.

This brings us to the question: Can similarly devastating fires happen here? It is certainly possible. California is subject to the amplification of drought and heat conditions caused by climate change, just as are Australian states. Our leaders are equally able to duck responsibility when challenged with the responsibility of responding to the climate crisis. Australia's prime minister has taken the position that because fires come every year, the 2020 fire season is nothing to be alarmed about. He vacationed in Hawaii in December just as the record-breaking fire season was ramping up. Confronted by angry citizens upon his return, he belatedly promised money and 3,000 armed forces personnel to fight the fires. This was far too little, far too late. In a similar mode, Donald Trump has steadfastly resisted acknowledging the scope and calamity of climate change, rolling back environmental protections and promoting the fossil fuel industry in the face of super storms, drought and wildfires in this country.

One Australian farmer, Peter Andrews, illustrates a positive reaction to the abandonment of responsibility by his leadership. He has developed what he calls "natural sequence farming," which raises the water table and decreases the effects of droughts that afflict his area. Examples of resiliency are also seen here, as in California, where one vineyard was able to survive when those around it were consumed by wildfires, because its solar-powered microgrid and satellite communications enabled irrigation to continue for days after the staff evacuated. Watch for more about this in the next edition of *Green Energy Times.* ♻

HOW DARE YOU!!!

John Bos

Greta Thunberg: Time Magazine's *2019 'Person of the Year'. Wikimedia Commons.*

With global emissions reaching record levels and showing no sign of peaking, UN Secretary-General António Guterres called national leaders to come to New York last September 23 for a Climate Action Summit. Guterres's goal was to highlight concrete promises by presidents, prime ministers and corporate executives to wean the global economy from fossil fuels to avoid the worst effects of global warming.

The historic Youth Climate Summit, the first UN climate summit for young people, took place as part of a weekend of events leading up to the UN Climate Action Summit. It provided a platform for young leaders to showcase their solutions and meaningfully engage with Summit decision-makers. The Youth Climate Summit brought together young activists, innovators, entrepreneurs, and change-makers who are committed to addressing the global climate emergency. It was action-oriented, intergenerational, and inclusive, with equal representation of young leaders from all walks of life.

The contrast between the slow pace of action and the urgency of the problem in the Climate Action Summit was underscored by Swedish climate activist, 16-year-old Greta Thunberg, who excoriated world leaders for their business-as-usual approach. "The eyes of all future generations are upon you," she said, her voice quavering with rage. "If you choose to fail us, I say we will never forgive you."

Despite protests in the streets, China made no new promises to take stronger climate action. The United States, having vowed to pull out of the Paris Agreement, the pact among nations to jointly fight climate change, said nothing at all. And a host of countries made only incremental promises.

There were, however, some concrete measures. By the end of the day, 65 countries had announced efforts to achieve net-zero emissions by 2050, several asset fund managers said they would aim to get to a net-zero portfolio of investments by the same year, and dozens of businesses said they would aim to abide by the Paris Agreement targets.

Perhaps the most prominent person in the next generation is Thunberg who had first became known for her activism in August 2018 when, at age 15, she began spending her school days outside the Swedish parliament to call for stronger action on global warming by holding up a sign reading (in Swedish), "School strike for the climate." Soon, other students engaged in similar protests in their own communities. Together, they organized a school climate strike movement under the name Fridays for Future.

After Thunberg addressed the UN Climate Change Conference last year, student strikes took place every week somewhere in the world. In 2019, coordinated multi-city protests involved over two million students. Thunberg is the youngest person to be named Person of the Year on the cover of Time magazine. She has been disparaged by both Presidents Trump and Putin which should tell you something about the power of her messages.

Diagnosed with autism, Thunberg had fallen into a deep depression by age eleven. There were a number of factors, "some," writes Naomi Klein in her new, must-read book, On Fire; The (Burning) Case for a Green New Deal, related to being different in a school system that expects all kids to be pretty much the same. "Many people on the autism spectrum," Klein says, "are also less prone to imitating the social behaviors of the people around them – they often don't even notice them – and instead tend to forge their own unique path. In a way, she is asking those of us whose mental wiring is more typical – less prone to extraordinary focus and more capable of living with moral contradictions – to be more like her."

The New York Times called the now 16-year-old Thunberg's visit to the U.S. "a barnstorming tour for our time: She had demanded of world leaders at the UN, 'You all come to us young people for hope. How dare you?' She had marched alongside millions in the Global Climate Strike. She had rallied with thousands of fellow students in places like Iowa City. She had stood with Native American activists at Standing Rock."

Two and a half months after she arrived by boat in New York Harbor, she set sail for her return home across the Atlantic Ocean in a 48-foot catamaran, La Vagabonde, which as outfitted with solar panels and hydro-generators had a minimal carbon footprint. She hoped to get back to Europe in time for the Madrid Climate Change Conference, COP25, intended to bring the world together to consider ways to strengthen the implementation of the Paris Agreement.

In Madrid, the global climate talks lurched to an end with finger-pointing, accusations of failure and fresh doubts about the world's collective resolve to slow the warming of the planet - at a moment when scientists say time is running out for people to avert steadily worsening climate disasters. The delegates from nearly 200 nations had wrestled for more than 40 hours past their planned deadline, making the COP25 the longest in the 25-year history of the climate talks.

I could go on but space requires me to cut to the chase. I invite *G.E.T.* readers, urge them, to listen to Thunberg's "How Dare You!" presentation to the UN Climate Change Conference. She captures in her passionate voice, how all of us must embrace the reality of our climate crisis. Her message is visually enhanced in the video by Mei Li, an extraordinary animator and illustrator who is one of the highly talented people who comprise the New York-based ADLubow, LLC advertising agency. They are the creative force behind a distinguished roster social change and public good clients. Please go to this web link and hear for yourself A Voice in the Wilderness: Greta Thunberg. You will find that what so many of us are feeling, but unable to express, is given voice by Thunberg www.adlubow.com/climate-for-change/.

John Bos is a contributing writer to Green Energy Times. *He has written about his growing concerns about our endangered environment for the past ten years. Your comments and questions are invited at john01370@gmail.com.* ♻

TIME TO RE-IMAGINE CAPITALISM

Dr. Alan K. Betts

There are many areas where rapid change is needed to confront and deal with climate change and ecosystem degradation. But our societies mostly refuse to face and discuss these issues. Some of this is nostalgia for the past. We dream of the days in the 1950s and 60s when the consumer economy grew rapidly, forgetting that this was made possible because the US kept the price of oil below $3 a barrel, until first OPEC rebelled in 1973 and then Iran in 1979. It is more comforting to ignore the unknown future rushing towards us than face change.

Our global capitalist system grew rich on cheap oil and the freedom to exploit the Earth and the poor. By dumping the greenhouse gases into the atmosphere, and many waste-streams into the oceans, industries never had to budget for the downstream costs. Now the webs of deceit and corruption driven by wealth and ancient doctrines try to bury the truth of the disasters ahead for our children and all life on Earth.

Instead of nostalgia for business-as-usual, which made a few very rich, our communities need imagination to create a sustainable future for the Earth and our children. We need stability not growth. The democratic cooperative society that we dream of, but wealth, power and greed oppose.

Meanwhile the ongoing corruption in Washington has distracted the American people from the real world-climate and extinction crises ahead. While we shopped on Black Friday, two million youth around the world again went on strike for the climate. Greta Thunberg spent ten weeks in the United States this fall. She had been planning to travel overland to Chile for the next round of U.N. climate talks. However, unrest there forced the COP25 climate conference to move from Santiago to Madrid in Spain.

I watched Greta's two-week journey back across the Atlantic to Lisbon, Portugal on the 45ft catamaran La Vagabonde, with its amazing and inspiring crew. They averaged 8 knots across a stormy Atlantic, while avoiding tropical storm Sebastien to their east. So Greta attended meetings in Lisbon and Madrid.

The UN Emissions Gap Report 2019 is bleak, saying, "Countries collectively failed to stop the growth in global GHG emissions, meaning that deeper and faster cuts are now required."

Our central government crumbles into irrelevance on the global arena. Did our leaders read the August 7th IPCC Special Report on land degradation, sustainable land management and food security, or the September 25th Special Report on the Ocean and Cryosphere (ice)?

Did they hear the November 6th "Warning of a Climate Emergency" by 11250 scientists across the world? I doubt it, as they prefer false information sweetened with cash.

The implosion in Washington threatens our democracy and our future. 'We the People' need to get together in our communities to imagine and create a way forward, both locally and at state levels. We have to ensure that businesses are responsible for all their waste-streams, and accept responsibility for the future of the Earth and our children.

Activist Thunberg channels youth fury to U N climate summit. Courtesy image.

We have to ensure that the oil companies, who still pocket $100 billion in profits each year from the destruction of the Earth, are held responsible for deliberately funding deception for the past thirty years. Their own scientists mapped out the long-term impact of climate change in the late 1970s, but management suppressed these reports.

We have to reject the archaic aspect of capitalism that corporations are only obligated to their shareholders, but are not responsible if their actions mean the destruction of the life-support systems of the Earth. This is clearly absurd, knowing what lies ahead for our children, while billions are being spent on trying to preserve the status quo. We have to expose the cruelty of this sophisticated extortion scheme, and collectively and imaginatively drive social change. It will not come if we sit back, wait and hope. Instead give thanks to the Earth for all that we have been given, and plan a better economic and social future for our communities.

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

GREENBACKS TO BACK GREENING!

Bean-counting toward sustainable living

J.D. Kaplan

This year, *G.E.T.* motivated an attempt, on my part, to study and summarize two very important reports released by the Intergovernmental Panel on Climate Change (IPCC). The IPCC is a group of scientists from everywhere, and they organize through the UN. Participants number in the thousands.

After being familiarized with these efforts among the world's scientists to quantify, model and predict climate change, it is rather awkward to see efforts to negotiate a path forward so handily sunken by the dead weight of a few backward leaders. These negotiations at the COP 25 event in Madrid were years in the making and were held upon the premises reached by collective efforts toward scientific consensus that is unmatched in scale. Two weeks passed there, and we didn't get the global trade scheme for emissions all involved had worked toward.

As stated in the Wall Street Journal (WSJ) (https://on.wsj.com/37MQmYK), "Despite the setback to a global carbon market, an existing framework suffices for national and regional initiatives, say climate experts. The EU already has the world's biggest emissions trading system, covering energy-heavy industrial plants. This month, the EU and Switzerland linked their carbon markets, signaling a way forward for other countries."

The priorities on display by the Brazilian leadership under President Jair Bolsonaro and by delegates under Mr. Trump are at variance with the business community's demands and attitude.

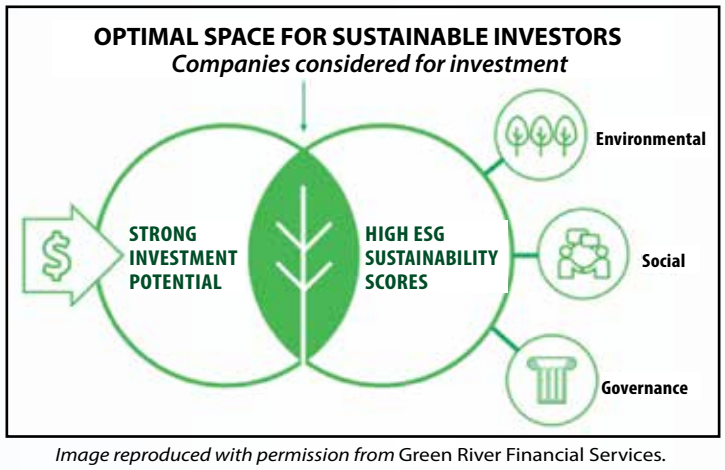


Image reproduced with permission from Green River Financial Services.

These contrarians want nothing to do with the climate at all, it would seem, but they're off kilter even from the viewpoint of the investment crowd. Finance folks need to know what to do with their money based on the best information available. Thus, the developments afforded by COP25 collapsing includes some good news. Woe is the elected official who dares to run afoul of American finance!

The WSJ business press goes on, "The turning point for business came in 2015, with the United Nations Climate Change Conference in Paris. More than 190 nations met to agree on a plan to tackle the problem of greenhouse-gas emissions, crystallizing the anxieties of governments and environmental activists the world over.

That has meant coming up with strategies to reduce carbon and improve transparency about their environmental practices—and it has meant opportunity, as companies find ways to monetize consumers' rising demand for climate-friendly products." (https://on.wsj.com/2Fxc8nq)

Monetizing things––just what America does best. This time, though, it's you and your money that keep saying carbon ought to be reduced. In response, the business cloud has been seriously thinking for several years now about how to channel money into CO2 reductions that are actual, real, verifiable and repeatable. Carbon footprints and offsets all jibe with this directive. The base metric is the carbon dioxide equivalent, expressed as CDE, CO2e, or CO2eq. It essentially means to count all greenhouse gases by how many carbon-dioxide molecules they might match up to in a heating contest.

I share the sentiments among skeptics who analyze these happenings and see activity that is maturing very late and which remains a very small share of business and capital commitment. To date, the will of consumers to commit funds voluntarily to support carbon offsetting is also tiny. Mistrust probably holds that one back, and Messrs. Trump and Bolsonaro aren't exactly reading the tea leaves. The show they put on will come to an end, eventually, but I would invite readers to read the extensively well-detailed documentation supporting the decisions of fund managers over trillions of dollars that are now concerned with what they call "ESG" (see graphic). This is investment and fund management with a fiduciary duty to support environmental, social, and governance goals set by those providing the money. They vary enormously, but the snail's crawl forward on this one isn't likely to go away.

My first foray into the formal carbon-project-concerned literature began with verra.org and with the Verified Carbon Standard (VCS). Therein, you find hundreds of documents that carefully frame greenhouse gas-reduction projects by type so as to let people calculate their likely efficacy. It is an evolved system that probably will never be perfect, but I found nothing therein to indicate parallels to the outright disinterest in a sustainable future that was delivered in Madrid this year. It is serious, and it deserves your attention. Climate change antagonists do not.

J. D. Kaplan is a certified remote pilot and a former member of the I.T. crowd. He is a reader in the areas of bioelectromagnetics and cryptocurrency. For G.E.T. readers, Mr. Kaplan intends to profile blockchain activity within the energy sector. He lives and works at or above sea level near Boston, MA. ♻

Upper Valley Haven, a Ray of Sunshine

Cont'd from p.9

local farms where it can be used to feed pigs.

The impacts of natural events are often seen more clearly at the Haven than most other places. Hurricane Irene is just one example. It created its own havoc in the area, putting large numbers of people suddenly into need. This means that there is a sudden growth in the Haven's work load, multiplying it.

The impetus for the connection to solar power came from community impact investors Allan Wieman and Jo Shute from Norwich. They had previously led the effort to install solar power at the Unitarian Universalist Congregation of the Upper Valley ("UUCUV") in Norwich, Vermont, and they stepped in to lead the Upper Valley Haven project. Allan and Jo worked with Norwich Solar Technologies for development, design, engineering, construction and power purchase agreement with Green Mountain Power.

Another member of UUCUV, Dr. David Nierenberg, also serves on The Haven's board. Dr. Nierenberg knew about the UUCUV project and suggested to Wieman and Shute that the Haven would be a good candidate for a net-metering agreement (NMA). NMAs are often used to bring discounted power to nonprofits unable to take advantage of the tax credits and accelerated depreciation associated with renewable energy projects.

Wieman and Shute agreed with this suggestion and after meetings with The Haven's executive director and an approval of the project by the Board of Directors, the partnership was formed.

Allan and Jo were excited to work with The Haven. "We knew about The Haven because of its close relationship with UUCUV, and we wanted to support its work. The net-metering agreement provides a way to simultaneously contribute to the Upper Valley Haven and reduce carbon emissions."

The Haven's solar array was built this year in Scotch Hollow, Newbury, Vermont in a former sand pit. It has a capacity of 225.56 kilowatts (kW) of DC, which becomes 150 kW of AC power. It is expected to produce 27,000 kilowatt-hours of electricity per year. The Haven is not the only beneficiary, with the town of Newbury and the Newbury Elementary school also signing the net-metering agreement.

"We are a very efficient and effective organization. Ninety-four cents of every dollar we raise goes to program services. In addition, ninety-three percent of our revenues derive from charitable contributions," said Executive Director Michael Redmond. "When an opportunity came up to save on our electric bill and do something good for the world and the state, it was a natural win on many levels." ♻

Many thanks to our sponsor:

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Upper Valley Haven

Interest in Window Inserts

Cont'd from p.21

Strafford and again, Glover. As of this writing, the first series of five Thetford/Strafford workshops have successfully concluded.

Preparing for the workshop after first engaging with WindowDressers is a yearlong endeavor. Customers are signed up and each window measured, volunteers are recruited for roles such as shift manager, lunch provider, transport crew or workshop staffer, and additional funds are often raised. In the case of the Thetford/Strafford workshop, residents of these towns, the Mascoma Bank and New England Grassroots Environment Fund donated money to help subsidize inserts for income-qualified recipients who might otherwise miss the opportunity to make their homes more comfortable and lower their contribution to climate change.

Residents of other Vermont towns showed strong interest at the Win-

dowDressers booth during this years' VECAN conference, so it seems likely that participation will only grow in the 2020-2021 season.

Any towns interested in getting involved should contact WindowDressers' executive director, Laura Seaton, at 207-230-9902 or director@windowdressers.org.

Jack Sumberg is a contact for WindowDressers in Vermont. He can be reached at jack.sumberg@gmail.com or at 802 525-4277. ♻

Do-It-Yourself Energy Upgrades: Basements

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

David Keefe

Foam insulation on walls and poly vapor barrier on floor. Photo courtesy Dave Keefe.

Most of us don't think much about our basements, especially if we have one that isn't particularly pleasant. But the basement is part of the house, and what goes on there affects our fuel bill and how comfortable we feel upstairs.

Even if you don't deliberately heat your basement, you are probably at least partially heating it. Your heating and hot water equipment and a bunch of ducts or pipes are down there. It usually doesn't make sense to put insulation in the basement ceiling. It's almost always better to put it on the basement walls. The only major exception to this is when the basement has no equipment or heating distribution in it, there's no danger of freezing pipes, and you don't care how cold it gets down there.

You shouldn't insulate a basement that is wet. It's very important to do anything you can to resolve any water issues before you insulate. How to do that is beyond the scope of this article, but if you have a wet basement, fix the water problem first.

In terms of performance, it's best to insulate on the outside of the foundation walls, but in most existing homes that's difficult because of the digging that would be required and the stuff (porch, deck, driveway, steps) in the way. We'll assume for the purposes of this article that you are insulating the basement walls on the inside.

You should avoid fibrous insulations (cellulose, fiberglass) below the first floor unless all moisture is carefully managed, and there is an effective air barrier layer on the inside of the insulation. If you want to avoid moisture issues, use a foam insulation (spray or board) and install it to be airtight, so the basement air can't get outside of it. This holds true for the main basement walls and the rim (or band) joist.

The rim (or band) joist refers to the perimeter of the first-floor deck framing in modern stud-frame construction. It's immediately on top of the foundation wall and is usually 8-12 inches high. At this location, there is typically only about two inches of wood between the basement and outside. The best way for a homeowner to insulate this is with blocks of foil-faced foam, glued in place with construction adhesive, and sealed around using a caulking gun or foam gun. Professionals usually use spray foam here because it's quicker.

The basement walls are also usually best done with foam. For concrete block or poured concrete, you can use the same foil-faced foam glued to the wall. With rough stone foundations you are limited to spray foam, which requires specialized equipment and training.

The Vermont energy code doesn't require that you insulate your existing basement walls, but it does say that if you choose to, you need to do at least R-15. This is about 2 ¼ to 3 inches of foam, depending on the product.

Building codes require foam insulation to be covered by a fire protection layer. There's an exception for the band joist, but all other areas must be covered. This is often ½" drywall, which is approved for this purpose. Other options include an intumescent paint (good choice for spray foam), and at least one board foam (sold under the trade name "Thermax") that has a factory-applied aluminum layer that meets the protection requirements.

Don't forget the bulkhead door, if you have one. If the only door is the steel bulkhead cover itself, you need to frame out the opening in the basement wall and install a door. An inexpensive insulated steel pre-hung door (36", no window) works fine. If you have a rough door of planks or plywood, you can replace it or install a layer of rigid foam to the outside surface and weather strip it, so it doesn't leak much air.

Next time we'll talk about attics.

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. ♻

Understanding the Blower Door Test

Michael Canavan

I received a call from a homeowner saying they had a blower door test done to find out how well their house was sealed against drafts. They were looking for any places that air could be leaking in or out of the house.

They described the house as a two-story colonial built in 2004. It was assembled on site from four prefabricated units, two for each floor, on a concrete foundation. It had all the windows and building wrap on the exterior when it arrived on site, the roof system and vinyl siding were installed on site after the sections were assembled.

The homeowner had a blower door test on their house but was not sure how to interpret the results of the test. The report indicated an AHC50 of 8. As it was October, cooler air was being sucked into the house, so during testing the technician used an infrared (IR) camera to look for cold spots. He also had a smoke-generating pen looking for locations of air infiltrating drafts, outlets, switches, pipes, and vents.

First, the blower door test uses a calibrated fan to blow air making a pressure difference between the inside and outside of the house that forces air through all the holes in the building envelope. The fewer the holes the less air you need to change the pressure.

Now, what does ACH50 mean? It is simply the number of times the air will change over in an hour, in a house with an air pressure of 50 pascals applied to all sides of it. What is "50 pascals?" It is air pressure equal to a 20mph wind on your house which is the standard set by the International Energy Conservation Code (IECC). The IECC developed this kind of measurement, so that all houses are tested using the same procedures. They set a requirement in 2009 that houses should be built to at most an ACH50 of 7. This was revised in 2012 to an ACH50 of 5 or 3 depending upon which climate zone you're in. Vermont, New Hampshire, New York, Massachusetts, and Maine are an ACH50-of-3 climate zone. This standard was aimed at improving air barrier systems for buildings, which means fewer home air changes and lower heating and cooling costs. It is succeeding, as builders are now more educated in how to seal a building better than just a few years ago.

Air infiltration at outlet. Blue is colder area indicating air coming from outside. Courtesy photos.

Hot air leaking at foundation wall. Yellow shows heat coming from inside.

Back to the question, for the house with an ACH50 of 8 this means the air in your house is completely replaced eight times in one hour when the wind is blowing at 20mph. That means you're using more energy for heating and cooling than you should. With the test report, you should receive pictures of areas where warm air is escaping the house. Some of these spots are easy to seal. For example, you can retain more heat by adding outlet foam sealers on the inside of the cover plate, insulation on the bathroom exhaust vents, and new weather stripping on doors and windows.

When you finish doing all the items recommended in the report, you may save over 10% on your heating and cooling costs. If your house is older and leakier, you can potentially save up to 35% of your heating cost. On a heating bill of $3800 that's $1330! — a good deal! Perhaps more important, your home will be more comfortable when it is warmer with no drafts due to the reduced air infiltration potential. Your heating equipment will have a longer lifetime due to reduced loads. You can look forward to being in your cozy, warm house this winter as the blizzards rage outside this year.

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

Recycling Glass into Aggregate: Glavel

George Harvey

Glavel is a company based in Burlington, VT, who sells foam-glass aggregate. Some people might look at it and ask what good it is. Others will be delighted with its possibilities.

Science is full of surprises. For example, in some ways, glass is stronger than steel. While it is true that you can use steel to smash glass, because glass is brittle, it is also true that most types of steel are not as hard as most types of glass.

Glavel foam glass aggregate is a super-light insulating gravel. Courtesy photos.

The unusual properties of glass, including its hardness, make glass useful in some ways that are also surprising, and some of these are important for recycling.

Today, when glass is recycled, it is often put into a machine, which immediately smashes it. The bottles are not returned to a bottling plant for reuse, as they were in the past. Instead, they are just broken up into fragments, which are mixed. They are not separated by color or other properties. And that means that they cannot be used for many of the things we think of when we think of glass.

That is where the inherent strength of glass comes in. Though it might not make an attractive wine bottle and would be pretty useless for windows, the wreckage of old glass still has its core value of hardness, and good minds have found a use for that.

It is possible to heat the broken glass pieces to the point that they melt while introducing materials that will cause the mix to foam. When the glass solidifies, as it emerges from the kiln that melted it, it breaks apart into lumps. It looks rather like some sort of volcanic rock. It is very light, but importantly, it retains some of the strength of the glass. The gas bubbles in the glass are sealed off completely, which means that they will not allow water, for example, to penetrate, but they also make the glass into a really good insulator. It is inert, it is not toxic, it is extremely light, and it has a surprisingly high compressive strength. These are characteristics that make it valuable.

So, what would you do with a material that is essentially super-light insulating gravel? Well, one thing you can do is use it as super-light insulating gravel. I'll put this another way – this is really neat stuff!

These days, when a building is built, the slab or basement floor is usually insulated from whatever is below it. This can be done by putting down a layer of gravel, carefully packing and leveling it, and then covering it with insulating material such as foam board. With Glavel foam-glass aggregate, we have the alternative of putting down the gravel and insulator in a single step, because they are combined.

Rob Conboy, the CEO of Glavel, gave us a rundown, comparing foam glass aggregate with the combination of gravel and foam insulation. The R-value of both is similar. The thickness is similar. The strength is similar. And the cost is in the same ball park with foam glass aggregate a little more expensive, though it is easy to see reasons why its cost would go down, but the competition's costs would not.

Right now, the Glavel product is imported from Europe. Conboy told us that it will soon be made in the United States, which will give it a cost advantage. It will be made in an electric kiln, powered by electricity from 100% renewable resources. Also, he is moving to tweak the formulation, in the hope that it will have somewhat better insulating value.

The end result is that we have a new system that is just as good as the old in terms of performance and cost but is far superior for the environment. Glavel foam-glass aggregate will be using a problematic resource, recycled glass, that might otherwise go to a landfill, and it can be produced with renewable energy.

And by the way, Glavel foam glass aggregate has other uses. Because it is so light, it can be used as substrate for green roofs. It can be used for road construction, for embankments, to insulate pipelines, and in other places where its insulating qualities, light weight, and good drainage are valuable. Learn more at glavel.com. ♻

Clean Energy NH Champion of the Year

Clean Tech Business of the Year Awardees Recognized at Annual Member Holiday Dinner

Clean Energy NH, the Granite State's leading clean energy advocate and educator, held its third annual Member Holiday Dinner on December 11 and announced the winners of its annual awards.

The event was held at the law offices of member firm Sheehan Phinney in Manchester and welcomed members from the state's most distinguished clean technology companies ranging from renewable energy generation, engineering, consulting, energy efficiency, legal, financial, and beyond. Over sixty members gathered at the sold-out dinner to network and recap the state's challenges and successes in 2019.

The highlight of the event was the award ceremony, during which the nominees and winners were announced.

The Clean Energy Champion of the Year Award was established in 2017. The award is presented annually to a Clean Energy NH member who has gone above-and-beyond in support and engagement with the organization and demonstrates leadership in the transition to a clean energy future. Nominees included Chris Skoglund of the NH Department of Environmental Services, Julia Griffin, Manager of the Town of Hanover, Lebanon City Councilor Clifton Below, and the winner, Tony Giunta of The Nobis Group and Mayor of the City of Franklin. For over 20 years, Tony Giunta has made renewable energy a priority. Throughout his career Tony has been a tireless advocate for vital state-level clean energy policies, including the expansion of the net metering cap.

Clean Energy Champion Award Winner, Tony Giunta (center), poses with Clean Energy NH Staff (from left to right): Henry Herndon, Executive Director Madeleine Mineau, Brianna Brand, and Michael Behrmann. Photo courtesy of Clean Energy NH.

"I'm very grateful and honored to receive this prestigious award from such a distinguished dedicated organization," said Giunta. "My continuing drive to move New Hampshire toward a clean energy future has been a multi-team effort of which my co-workers at The Nobis Group and staff at Clean Energy NH have played a significant role. Again, my sincerest thanks to Clean Energy NH for this humbling recognition."

The Clean Tech Business of the Year Award, also established in 2017, is presented annually to a Clean Energy NH business demonstrating excellence in the clean tech industry sector and support of Clean Energy NH's mission through engagement with the organization and commitment to their work. Nominees for the award included GDS Associates with offices in Manchester, Froling Energy of Peterborough, and Barrington Power of Barrington, and the winner, Affinity LED Lighting of Dover, NH. Affinity LED Lighting has helped 40 NH cities and towns save money by converting to LED streetlights, and employs veterans at their Dover, NH office.

Also at the event, Clean Energy NH recognized Ted Vansant of New England Commercial Solar Services, with a special Distinguished Leadership and Service Award. Vansant served as Board Chair for two 3-year terms and is stepping down at the end of 2019, handing the Chair position to fellow Board member Charlie Niebling of Innovative Natural Resources Solutions.

"I have been honored to serve as Clean Energy NH's Board Chair to witness the organization's growth and expansion over the past several years. With the magnitude of the issues that clean energy addresses only rising in significance, Clean Energy NH is well-poised to make a lasting impact for a stronger NH economy and healthier future for our citizens, and I look forward to remaining involved and supportive of this important work," said Vansant. ♻

"Green-washing"

Cont'd from p. 16

worse, Renewable Natural Gas merely paves the way for "building out" an obsolete infrastructure that will keep us burning fossil fuels for decades to come.

Magical, Mythical Attributes?

VGS aims, by 2030, to provide 20% of the gas consumed by its customers as RNG. As of mid 2019, VGS had enrolled all of 54 customers in its RNG plan. These residential and commercial customers voluntarily pay a premium for Renewable Natural Gas. The customers do not actually receive Renewable Natural Gas from VGS, what the company provides is "attributes". The physical Renewable Natural Gas associated with the attributes is introduced into the pipeline at the Canadian border. Sourced from Quebec and Idaho (yup, Idaho, via Canada) the gas goes out equally to all VGS consumers. And how much RNG is coursing through VGS pipelines at present? According to VGS' latest report to the Public Utilities Commission of Vermont, Renewable Natural Gas constitutes one twentieth of 1%. of the total gas supplied to its customers. The idea that there is such a program on the road to reducing greenhouse gas emissions is questionable. Where will VGS get RNG for a 400-fold increase in ten years? Should Vermonters anticipate a future of permanent dependence on foreign cow patties?

Some final food for thought: Vermont's only gas company is 100% owned by private Canadian corporations. Among these, Enbridge, with its notorious environmental track record, has heaped 40% of the VGS pie on its own plate. Is this a reasonable state of affairs as we navigate a climate crisis?

Footnote references available with posting of article on the GET *website.*

This article was submitted to Green Energy Times *as an op-ed.* ♻

Brattleboro and Bellows Falls, VT Middle Schools

Save 45% in Fuel Costs with Renewable Heating and New Biomass Boiler Systems

Jim Van Valkenburgh

The Green Street School is located in Brattleboro, VT. Image: greenstreetschoolvt.com

A project to upgrade the heating system at Green Street School (GSS) in Brattleboro, VT has been a tremendous success in comfort, annual energy use and cost savings. The school was built in 1924 with a coal-fired steam heating system. Later it was converted to burning oil—recently over 17,500 gallons a year. In the summer of 2016, Froling Energy removed the old steam boilers and replaced them with two new high-efficiency boilers: one burning dry wood chips and the other propane gas. At the same time, all the old cast-iron steam radiators throughout the building were removed and replaced with modern hot water radiant panel convectors.

Stunning results from the last two winters show a 35% reduction in heat energy consumption and annual fuel cost savings of 45%.

"The heating improvements at GSS have been amazing for our entire school community!" explained Principal Mark Speno. "Prior to our upgrades, we had a building with drastic temperature changes from room to room. It was common to have (electric) space heaters running in some rooms while others had windows open to try and cool down."

A new building energy control system was also installed. "Now we have a beautiful, consistent school climate," says Principal Speno. "This has led to a much happier building. Students, staff and parents can expect to be comfortable when they come to school. This energy project has had an incredibly positive impact on our school culture and has helped lead to a safer and healthier school. On behalf of the entire GSS community, I am incredibly grateful for the opportunity to participate in this dynamic energy-efficiency project."

GSS is the smallest building in the region to be heated by semi-dry chips, a relatively new biomass fuel that has cost and efficiency advantages. The new boilers and 15-ton capacity dry chip storage silo all fit into the old boiler room and coal bin areas. A Froling T4-150 dry chip boiler is assisted by a Viessmann propane-fueled boiler.

"We're excited to support semi-dry chip installations as they are easily adapted into the local forest economy and fuel-supply market," said Program Manager Marion Major of The Windham Wood Heat Initiative, who provided a significant grant for the project. "We are pleased to be a part of the upgrade to Green Street School's antique steam heating system to install a fully automated wood heating system fueled by semi-dry chips." The goals of their program are to heat local buildings more efficiently, renewably and "to support the local economy through the transition from fossil fuels to renewable sources. GSS encapsulates this perfectly."

"Including students in the conversation through education is a powerful tool," Marion continued. "My hope is to incorporate the system into the curriculum, so the students can learn about the positive local impact, the science of wood heat, and that they have opted out of oil."

The project was designed by Chris Hebb of Dynamic Integrations LLC and fully executed by Froling Energy of Peterborough, NH under contract to Windham Southeast Supervisory Union.

One year later, a semi-dry wood chip boiler installation was installed at Bellows Falls Middle School. This was partially funded by The Windham Wood Heat Initiative. However, there were some distinct differences at Bellows Falls Middle School which is part of Windham Northeast Supervisory Union. Marion Major explained, "The previously installed system had a faulty (wood pellet) boiler which never performed up to standard. Replacing this with a reliable system sent a clear message to the community that this was a sound technology to invest in."

Bellows Falls Middle School, located in VT, upgraded their heating system to a Froling T4-150. The new boiler replaced their faulty, old, wood-pellet boiler that did not meet their needs. Photos courtesy Froling Energy.

(Top) The old coal furnace (possibly part of the original heating system) at the Green Street School in Brattleboro, Vermont; (middle) the new Froling T4-150 boiler; (bottom) one of the new panel radiator/convectors in the art classroom.

The boiler is the same model as that installed at GSS, a Froling T4-150 with a maximum output of 512,000 BTU/hour. The winning bid, by Froling Energy, converted the existing wood-pellet silo and material handling system to work with dry wood chips which reduces future biomass fuel costs by 35%. The new boiler in Bellows Falls, VT started operation in January 2019, so this will be its first full winter of operation. Results look to be quite positive.

"The Windham Wood Heat program prioritized the swap out with substantial financial incentives to support the school board's decision to continue with wood heat," reported Ms. Major. "The project was an important step in building local buy-in for automated wood heat systems."

Jim Van Valkenburgh is VP Sales & Marketing for Froling Energy. *He can be reached at 603-924-1001 x2. For more information on* Froling Energy *go to FrolingEnergy.com.* ♻

2020 SUPER BOWL – *Cont'd from p.1*

As "just one" of the more than 4,700 sports stadiums in the world, Hard Rock Stadium could claim that they can't make a real difference, even within that small cohort of sister institutions, let alone within the far broader scope of polluters. Just as we might say that our individual contributions can't make a difference, so too do large corporations point to even larger entities to excuse their inaction. It makes just as much sense for us to claim impotence as for ExxonMobil to point out (correctly) that their own pollution is insignificant compared to that of all the people who won't give up their gas mobiles, gas stoves, single-use plastics, air travel and industrial beef. (All of which, by the way, ExxonMobil helps to make possible.)

However, Hard Rock Stadium has made a U-turn that serves as an example to others (from restaurants, to event parks, to stores, to our own homes). Tom Garfinkel, executive at Hard Rock Stadium and the Miami Dolphins, had an epiphany while watching a program on plastic pollution (bit.do/hrs-sup) and has taken action that has resulted in a reduction of their use of single-use plastics by 99.4%! (This writer's mind boggles at the idea of reducing single-use plastics at a sports stadium by even 50%.) The stadium had already switched to LED lighting, no plastic straws, and waterless urinals, among other measures (bit.do/hrs-ecology).

Be that as it may, sea level rise is already exceeding most of the more pessimistic scientific predictions of the past. While it has long been thought that South Florida might avoid catastrophic flooding for another 100 years or so, that is no longer the case -- and Hard Rock Stadium is less than 10 feet above current sea level. Although we've all known about the threats and consequences of climate change for the past decade, we've done scarcely anything about it. The turn-back deadlines are now piling in upon us quickly, and the window of opportunity to avoid real catastrophic changes is now measured in months (bit.do/cc-18mos).

This all might not sound like such a big deal to us in and of itself (although it certainly is for those who must live in it), and it does seem a long way off (to those of us who won't likely be around to experience much of it). But try to imagine your great-grandparents deciding to continue a way of life that they knew guaranteed us failed crops, frequent devastating storms and floods, potable water scarcity, new diseases and infestations, many more cancers, breathing problems starting in childhood, the need to migrate to less-extreme climates, and the lot.

Mr. Garfinkel has made a significant statement here. At some personal and professional risk, he's leveraged his position to put a halt to something that he knows is already harming others -- and will continue to worsen far into the future. Doing something to fight climate change is often simply not doing something that we know makes it worse. Do what you can, as soon as you can.

Greg will be watching SB LIV at his dad's passive house: bit.do/vgbnphc. ♻

SWEET SOLAR AT SIDELANDS SUGARBUSH

Cont'd from p. 1

time, he kept working with Crocker. As he did so, Piluski became an electrician, and the two of them helped out a lot of Vermont sugarers move to high-efficiency pump controllers. Electrical work, in turn, led Piluski to solar photovoltaics (PVs) which became a passion.

Sidelands Sugarbush solar array in Putney, VT. Photo: Southern Vermont Solar.

Even then, Crocker was examining energy and ecological issues of his sugaring business. His inclination was to have a minimum negative impact on the environment and to improve it, if he could. His operation was big. He had 23,000 taps. He relied on vacuum pumps to collect sap from the trees, but these used large amounts of electricity. The evaporator was heated with oil. Reverse osmosis to reduce water content used a lot of electricity. These were all issues that had to be addressed.

Over ten years ago, Crocker switched to vegetable oil to avoid petroleum products. This has not been as easy as one might expect. Under European Union environmental rules, vegetable oil became highly desirable, and large amounts of it started to be shipped from the United States to Europe. The price went up to the point that it was no longer economical to use. Crocker saw he had to reduce dependence on oil as much as possible, and he began a serious study of sustainability, looking at just about any possible avenue for improvement.

Meanwhile, Piluski was getting a real education on solar development. He was certified for solar work by the North American Board of Certified Energy Practitioners (NABCEP). He built an off-grid home for his new family. He started a small electric and solar business. He soon became a Lead Designer for Soveren Solar, one of the most interesting companies in Vermont's PV sector, with highly innovative practices. Piluski stayed with Soveren Solar for years.

Crocker, meanwhile, had come to see that he really needed to rely on his own, home-produced energy. With a sugarbush as large as the one he had, he could have used wood heavily, as much was being cut in maintaining his trees. But he could not see himself devoting the time it would take to process that much wood, and he could not see hiring people to do it either.

The time came, some years ago, when Crocker and Piluski talked about a solar system, but the price was not yet right. Of course, prices for solar systems were constantly dropping.

In 2017, Piluski and Roberts, decided to open their own solar business, Southern Vermont Solar. This was just about the time that Peter Thurell decided Soveren Solar would close because of the Trump trade tariffs. And that was the state of things when Crocker decided once again to look into solar power. This time, the price was right.

The PV system that Southern Vermont Solar developed for Sidelands Sugarbush has a capacity of 48.3 kilowatts. It should be no surprise that there were delays getting it all together, but they were overcome and the actual work of installing the system began in November of 2018, it was completed in December, and the system was turned on in January of 2019. Since that time, it has been providing electricity for Crocker's business and two households.

That is not the end of the story. Crocker put in an air-to-water heat pump from Arctic Heat Pumps, which can provide water at the right temperature for radiant heat, even when it is well below zero outside. He also replaced the pumps he was using to draw sap with a screw pump that uses one third of the energy. He has set his sights on net-zero energy usage.

Crocker made one observation about renewable energy and business. "I don't know why operations are not renewable," he said. "They're crazy not to be – it is a no-brainer."

Sidelands Sugarbush is at 163 Burnett Rd, Westminster, VT. The number is 802-387-6606.

Southern Vermont Solar's website is svtsolar.com. The number is (802) 387-0088). ♻

Revisiting Sustainable-Sugaring Operations

George Harvey

Five years have gone by since the *Green Energy Times'* article "Sustainable Sugaring" appeared (http://bit.ly/GET-sugaring). We felt it was time to reconnect with some of the people we interviewed and see how they are doing, especially regarding their sustainability efforts.

Silloway Maple's 17.5-kW rooftop solar on their sugar house. Image: Green Energy Times, *2/2014.*

Silloway Maple – Randolph Center, VT

When we contacted Paul Lambert to find out how renewable power was doing at Silloway Maple, he told us, "We are extremely pleased with our sugarhouse solar installation. This year (2019), we had the same solar company, Integrity Energy, install a system on one of our barns."

Silloway Maple's main other business is dairy. The farm has 65 Holstein cattle which are raised to produce organic milk. Dairy farming uses a lot of electricity, much of it for cleaning, and the barn has 140 solar panels for a total of 42 kW. They were installed by Integrity Energy of East Bethel, Vermont, the same company that installed the earlier 17.5 kW system that was featured in the 2014 article mentioned above.

Lambert told us the original system paid for itself in about four and a half years, somewhat faster than anticipated. He said, "This is a good savings. I am impressed by it. A Rural USDA (REEP) grant paid for 25% of the system. We also got tax credits." Both of the systems are grid-tied, and both supply electricity for household use for family members.

The Silloway Maple sugaring operation has 16,000 trees tapped. While electricity provides much of the energy for the farm, including power for pumps for drawing sap and reverse osmosis, the boiling still uses firewood. "We use blown-down wood for that," Lambert said.

Efficiency Vermont has been a great source for Lambert, both on the farm and in his home, to reduce energy waste. He has sealed and insulated buildings and is using the wood from the forest for fuel.

Here, as elsewhere, the effects of climate change are noticeable. Maintaining sap lines is more difficult, and the hillside soil is suffering the effects of warmer weather.

Some of Silloway Maple's products are used by bakeries, restaurants, and hotels, but most are sold locally at farmers' markets in Vermont. You can also purchase products right at the sugar house. All year you can call Silloway Maple at 802-272-6249 for a free tour and samples. The web site is sillowaymaple.com.

Sugaring at the North Family Maple Farm.

North Family Farm – Canterbury, NH

The North Family Farm website has a motto that is worth repeating: "From the trees, wind and sun,

Cont'd on p.36

Elmore Roots' Permaculture Know-How

Good Viburnums

David Fried

Walking up the dirt road in Johnson, Vermont the other day, I came across glowing red berries in clusters all over the stems of a large bush. I tasted some. Wow. Sour, but good. Would be very fine in a cranberry sauce. Yes folks, this is the American highbush cranberry, "viburnum trilobum." The true American highbush cranberry bush is taller and woodier than the lowbush bush trailing cranberry we eat at Thanksgiving and not related except in common name and flavor.

American highbush cranberry in Johnson, VT. Photo courtesy David Fried

Why do so many of the so-called highbush cranberry bushes have fruit that tastes awful, but this one has fruit that tastes delicious? The culprit is the European highbush cranberry bush, "viburnum opulus." My friend and mentor, Bill Mackentley, tells me that it seems a lot of plants being sold as viburnum trilobum have crossed with the European highbush. The European highbush cranberry fruit is bitter and no one would want to eat it off the bush. One of his goals and mine is to find an original American highbush cranberry and propagate some good ones and get them out again to the people. Maybe today I have located an original.

Besides being tasty and useful in sauces and jams, its fruit tastes like it is packed with vitamins and antioxidants. In the winter, the multitudes of red shining berries seen against the white snow is a real artist's masterpiece. Songbirds leave them alone for a while, but, after they have polished off all the sweeter crabapples, they zoom in for these. So do I.

Seen any pelicans in Vermont lately? I have! On the ends of a bush or small tree called the wild raisin viburnum. "Viburnum lentago" is easy to grow and not very fussy about its location. It grows perfectly well at our farm in sun or shade, in dry or very moist locations. Its buds in winter remind me of pelicans ready to take off. In spring they open to large white florets which over the summer become fruit. When blue-black, you can take one or two and suck on them for a snack. They are not juicy but have a very pleasant pumpkin pie spice flavor, with a flat watermelon seed-like pit inside. In autumn, these bushes glow reddish-purple as their leaves turn rainbow colors. Though some years a viburnum beetle skeletonizes the leaves of the highbush cranberry and other viburnums, I never see them on the wild raisin. Both of these viburnums grow about 6-10 feet tall. The more they are enjoying their spot, the fuller and taller they get.

Besides being beautiful and producing tasty fruit, these bushes have good vibes. They don't ask for much. They are simple beings. They don't grow too large or shade out many others. They settle in wherever they are invited. They feed us. They feed songbirds and chipmunks. When we go to sleep, you can hear them softly strumming a guitar (you have to listen very closely). I think they sing of a place far away where pelicans fly in and out of ocean waves and catch fish. Sometimes they sing of cranberry bogs that reach out for miles around so there is nothing else. Being taller and woodier, they are treated like celebrities there.

When you taste these fruits on a summer night and close your eyes, you may just hear the Beach Boys singing (from 1966): "good, good, good, good vibrations." Or was it good viburnums?

David Fried is a writer, grower of plants, and teller of tales. ♻

Larry Plesent

Ingredient of the Month

Feeling your Oats – Avena sativa, the Unexpected Superfood

When I think of superfoods (ingredients that are especially high in vitamins, minerals and other botanical goodies), I think of exotic red berries from Brazil or peanut-like legumes that grow on vines in the rainforests of Peru. Trust me. Oatmeal is not what most of us imagine when we think about superfoods!

And yet, the lowly oat, formerly relegated to be the food of choice for one's horse, is now recognized as a valuable food and cosmetic ingredient. That's right, plain ole ordinary low-cost oats are amazing for your health both inside and out.

Large glumes of Avena sativa *plant enveloping 2-4 glabrous and mostly awn less florets characterizes the spikelet of cultivated oats. Image: Matt Lavin/Flickr.*

The key is a water-soluble carbohydrate fiber called beta-glucans which make up about 4% of your breakfast mush. Turns out that 4% is enough to make a significant contribution to your overall health.

That's right! Oat beta-glucans are very healthful and anti-inflammatory, whether you eat them or wash with them.

Inside, oats are a good source of iron, zinc, magnesium and phosphorus. Think bones, teeth, blood and immune system. They provide good overall nutrition but are low in calories. Oats are a good source of antioxidant polyphenols that may help to lower blood pressure and reduce inflammation in stressed out Americans.Beta-glucans' fibers are anti-inflammatory to your arteries, as well as helping to modulate insulin production, lower overall cholesterol levels and helping LDL (the "bad cholesterol") to keep from reacting with free radicals and causing even more trouble for your arteries.

Eating oatmeal regularly (once or twice a day) helps your gut "biome" to remain healthy and balanced. A healthy gut IS a healthy immune system, so the benefits here cannot be overstated.

Oats fill you up without adding a lot of calories; important for those of us battling with the sugar- and fat- heavy American diet. Even more surprising, oats encourage the production of the so-called satiety response which tells your brain that the belly is full, and it's time to stop eating.

Two cups of oatmeal in a hot bath as part of a regimen will help to soothe the symptoms of eczema and psoriasis, reactive rashes and poison plant contact. First, be sure to thoroughly wash off toxic plant oils (think poison ivy, oak, sumac, parsnip and carrot) with castile liquid soap. A half and half mixture of tea tree and peppermint castile soap works especially well. Work it in from several directions and in a circle, and then rinse it off with warm water. Repeat two to three times and again when the itches return; up to four treatments may be required. Afterwards take a long soak in oatmeal to soothe everything out. Vermont Soap makes a product called "Plant Itch Fast Relief" which is specifically made for this. Use as directed for best results.

A bowl of oatmeal. Photo: TheCulinaryGeek, http://bit.ly/2tWGSM0

Oatmeal can be eaten sweet with real maple syrup and fruit or savory with tamari soy sauce and nutritional yeast. I'm not super crazy about oatmeal, since I pretty much lived on it during the starving hippie teenage years. But I still try to eat oats every day. My favorite source is a large oatmeal raisin cookie from Sandy's Books and Bakery in Rochester, Vermont. A cookie a day keeps the doctor away!

Remember, it's the habits we make in life that to a large extent determine our medical outcomes. Make it a habit to make oats a part of your life and enjoy the benefits of this amazing superfood for just pennies a day.

Larry Plesent is a writer, philosopher and natural products formulator living and working in the Green Mountains of Central Vermont. Read more at www.vermontsoap.com/category/blog/ ♻

Reforestation Versus Biomass

George Harvey

Hapgood Pond Recreation Area of the Green Mountain National Forest. USDA photo.

Through reforestation, we can draw down atmospheric carbon dioxide (CO_2). We can also use wood from the forests to heat our homes. The question is, can we do both of these things at the same time?

One of my favorite events of the year is the VECAN conference. This year, we saw some extraordinary people give some really great presentations. One of those was "The Role of Vermont's Forests in Climate Action – Heating and Sequestering," presented by Jamey Fidel, Vermont Natural Resources Council; Emma Hanson, Department of Forests, Parks and Recreation; Adam Sherman, Biomass Energy Research Center; and Bill Keeton, University of Vermont.

The question of forests and biofuel is not something that can be settled by armchair speculation; it needs studying, testing, and careful calculation. According to the presenters at VECAN, however, through sustainable forestry practice and use of clean stove technology, Vermonters can get about 35% of their heat from the state's forests, without compromising their ability to sequester CO_2.

The issues are complex, partly because of the many uses we have for forest products. High quality wood is used for fine carpentry, lumber for construction, and lower quality wood for making paper. Our maple industry is based in forests, and though fruit orchards are considerably less wild, they also should be considered as part of the overall question. There is low quality wood left over from all of these, and forest falls add to the amount.

Another consideration is that trees in the forests do not sequester CO_2 forever; eventually they die. Given the issue of climate change, that might happen sooner rather than later for most species. The Vermont Agency of Natural Resources produced a series of papers on climate change about ten years ago, and their conclusions were that most types of trees in our forests are vulnerable to invasive species. Two species of wooly adelgids will attack firs and hemlocks. A virus targets pines. Maples are being attacked by fungus. We have emerald ash borers coming for our ash trees. Most other trees have similar issues. In the end, it may be that only our oaks and hickories are safe.

Clearly, careful forestry, based on planning that considers the problems, is required. And if there is infected dead wood in the forests, it has to be removed.

We might consider, if forest waste is not burned, what will become of it? And how is that different from burning it? While termites are not on lists of invasive species in Vermont, with increasing temperatures from climate change, they are getting more active. I bring this up because when wood rots, it is often decomposed by fungus, with chemical reactions giving off CO_2, just as though the wood had been burned. If the wood is eaten by termites instead, a fair amount of methane is produced, which is many more times as powerful as a greenhouse gas than CO_2. Allowing a tree to decompose naturally may be worse than burning it, though we might do well to return the minerals in the ash to the land.

This brings us to the question of pollution from burning wood. Dirty wood-burning appliances can cause pollution, but energy-efficient ones can be quite clean. Very often, the difference can be seen clearly by everyone in the neighborhood. A clean wood fire should not produce any smoke.

The VECAN presenters made another issue clear. Though the use of wood for heating is a comparatively straightforward matter, in terms of pollution and efficiency, using wood for generating electricity is more problematic. All combustion systems need to meet EPA standards, but the wood fuel for generating electricity often comes, in huge quantities, from forests a long way off. This tends to lead to poor forestry practice, and the required transportation adds to the carbon footprint. Care must be taken anywhere wood is used as fuel.

There are other reasons to be careful to use wood from local sources. Not only does transporting wood over long distances add to the climate costs, wood that has been brought in from a distance can bring invasive species with it.

One other point is that there was a time in the late 19th century when only 20% of Vermont's forests remained. Today, with forest reforestation, 80% of Vermont is woodland. While that restoration was taking place, Vermonters continued to cut wood for fuel, and the restoration proceeded anyway. ♻

RESOURCES

350-Vermont: General group that coordinates a variety of statewide actions.
To join this group go to: **http://350vermont.org**
American Council for an Energy-Efficient Economy: Consumer guide to home energy savings - **aceee.org/consumer**
American Solar Energy Society (ASES): www.ases.org
Backwoods Solar: Specialty: solar, off-grid - **www.backwoodssolar.com**
Buildings Energy Data Book: buildingsdatabook.eren.doe.gov
Carbon Tax: carbontax.org
Clean Power Estimator: www.consumerenergycenter.org/renewables/estimator
CO2.Earth: See emissions harms, scientific advice, and pathways to follow. www.co2.earth
Consumer Guide to Home Energy Savings, Heating, Appliances, Refrigerator Guide, Building Envelope, Driving: http://aceee.org/consumer
Dept. Public Svc. (CEDF): publicservice.VT.gov/energy/ee_cleanenergyfund.html
Dsireusa.com: www.dsireusa.com Renewables & Efficiency. Find state, local, utility, & federal incentives for renewable energy & energy efficiency.
Efficiency VT: This is a must-go-to site for immeasurable amounts of info. **www.efficiencyVT.com**
Energy Efficiency & R/E Clearinghouse (EREC): **eetd.lbl.gov/newsletter/CBS_NL/nl6/Sources.html**
Energy Efficiency & Renewable Energy Clearinghouse (EREC): eetd.lbl.gov
Energy Guide: Unbiased advice about today's energy choices. Find ways to save, lower your bills & help the earth's environment - **www.energyguide.com**
Energy Star Federal Tax Credits: www.energystar.gov/tax credits.
Federal Energy Regulatory Commission (FERC): www.ferc.gov
Federal Energy Regulatory Commission(FERC): www.ferc.gov
Find Solar: www.findsolar.com
Fossil Fuel Freedom: Group working to make Vermont's energy plan 100% free of fossil fuels:
To join this group go to: **groups.google.com/group/fossil-fuel-freedom-**
Greywater Info: www.oasisdesign.net/greywater
Home Energy Saver: Interactive site to help you identify & calculate energy savings opportunities in your home. A lot of great information! - **hes.lbl.gov**
Home Power Magazine: www.homepower.com
IREC/ Interstate Renewable Energy Council: RE educational info. **www.irecusa.org**
NABCEP/ North American Board of Certified Energy Practitioners: This organization that tests & certifies PV system installers. Individuals are Certified, companies are not. **www.nabcep.org**
NESEA/ Northeast Sustainable Energy Assoc.: www.nesea.org
National Association of Energy Service Co. (NAESCO): www.naesco.org
National Renewable Energy Laboratory (NREL): www.nrel.gov
National Solar Institute: www.nationalsolarinstitute.com
NeighborWorks® Alliance of Vermont: Low-cost energy loans - **www.vthomeownership.org**
New Hampshire Sustainable Energy Assoc. NHSEA Focused on N.E. US, for consumers & industry- RE & clean building info, events. **www.nhsea.org**
New York Solar Energy Industries Association/NYSEIA www.nyseia.org
New York Solar Energy Society (NYSES): www. nyses.org
NFRC independent rating & labeling system for the windows, doors, skylights **www.nfrc.org**/
NH Office of Energy and Planning: www.nh.gov/oep/programs/energy/RenewableEnergyIncentives.htm
Renewable Energy World: www.renewableenergyworld.com
Renewable Energy Vermont: www.revermont.org
SEIA/ Solar Energy Industries Association: The SEIA Tax Manual to answer your solar related tax questions. **www.seia.org**
SmartPower: www.smartpower.org
Solar Components: www.solar-components.com
Solar Jobs: Listed by city, state, and district, **SolarStates.org**
Solar Living Source Book: realgoods.com/solar-living-sourcebook
Solar Power Rocks: Impressive data and info ,including per state. www.solarpowerrocks.com/
Solar Store of Greenfield, MA Stock & install a wide variety of solar & environmentally friendly technologies. **SolarStoreofGreenfield.com**
Tax Incentives Assistance Project (TIAP): www.energytaxincentives.org
The Energy Grid: www.pvwatts.org
The Office of Energy Efficiency & Renewable Energy (EERE): develops & deploys efficient & clean energy technologies that meet our nation's energy needs - **www.eere.energy.gov**
Track the Stimulus Money: www.recovery.gov/Pages/home.aspx
Vermont Energy and Climate Action Network (VECAN): works to start and support town energy committees as a powerful, people-powered response to realizing a clean energy future. www.vecan.net.
Vermont Tar Sands Action: Group working to stop the XL Pipeline and any other developments stemming from the Alberta Tar Sands. To join this group go to: **groups.google.com/group/vt-tar-sands-action**
VPIRG: understand the clean energy resources available to VT - **www.vpirg.org/cleanenergyguide**
VT Energy Investment Corporation (VEIC): nonprofit organization that issues home energy ratings for new & existing homes. 800-639-6069 - **www.veic.org**
Weatherization, Energy Star & Refrigerator Guide: www.waptac.org
www.susdesign.com Online info for solar benefit with house design: overhangs, sun angle & path…

Sustainable-Sugaring Operations

Cont'd from p. 33

crafted by hand for you." In addition to being certified organic, North Family Farm is renewably powered with a 10-kilowatt (kW) wind turbine, a 7-kW solar array, both net-metered.

Tim Meeh, one of the owners, told us the wind turbine, which has been running for 28 years, gets regular maintenance but has been very productive. Asked about the solar, Meeh said, "The solar just keeps on working, and I'm glad we did it." Apart from repairs that have had to be done to an inverter, the whole electrical system seems to have been both trouble-free and financially rewarding.

Demand for electricity is now much greater than it once was. With sap lines instead of buckets, and reverse osmosis doing much of the concentration, sugaring operations use much less energy than they used to, and most of it is powered by the wind and sun at North Family Farm. Now, even taking products to market is powered by the farm's own renewable energy, which charges its Chevy Bolt.

Meeh said there is clear evidence of climate change on the farm. "Winters are not as cold as they used to be," he said. "This makes it trickier to pull logs and make syrup. People are starting to tap in December and make syrup whenever the temperature is above freezing. But polar vortexes produce cold weather, and you have to find the right time to tap."

North Family Farm will put on maple candy making demonstrations and have products on sale at the Canterbury Maple Festival at Canterbury Shaker Village on March 21 and 22. Their web site is northfamilyfarm.com. ♻

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Where Is(n't) the Beef?

Tackling the ever-evolving world of meat-based burger alternatives

Marc Kaye

Long gone are the days when finding an alternative burger for vegetarians or vegans was a distant wish. Today, there are more options than ever, and I'm here to help you make a decision and get started on your journey to meat-free, burger-loving.

I took on the task the critical work of ranking four marketed meat alternatives: The Pure Farmland Plant-based Burger, dr. Praeger's California Veggie Burger, the Beyond Burger and Wholesome Pantry's Black Bean Chipotle Veggie Burger.

Many meat-alternative burgers are on the market. Courtesy photo.

Let's start with the Pure Farmland Plant-based Burger Patty. With an impressive 14g of protein (soy-based), this burger presented with a peppery, sausage-like taste. Having a salmon-like coloration and appearance, it is perfectly acceptable as a breakfast-meat alternative, perhaps more so than as a burger substitute. The grainy texture and overall consistency would make this a wise choice for use as a crumble in an egg burrito, omelet or even a vegetarian chili, rather than a straight burger. Much like breakfast meats (or breakfast, in general), I was left with a bit of an after taste.

Dr. Praeger's California Veggie Burgers are a healthful alternative for sure, with only 120 calories per serving and a popular choice for those who prefer a more traditional vegetable burger without the taste or texture of traditional beef. As for mimicking meat, this patty was as similar to a beef patty as a middle-aged father is to his teenage daughter - not even close. The seemingly unpreventable and inevitable mushiness of this burger isn't going to fool anyone. That being said, if you are a fan of vegetables and enjoy the confluence of flavors that they present, this is a great, healthy alternative. Warning - just like Bonnie Tyler, every now and then, it falls apart.

Now, I moved onto the infamous Beyond Burger, who's public relations agent has been working overtime this year. Recalling the famous commercial of the 90s where Fabio proclaimed "I can't believe it's not butter!", one might upgrade this advertisement for the 21st century and have Beyoncé proclaim, "I can't believe it's not beef!" because it sure is close. Though protein burgers are traditionally not as healthful as pure vegetable-based burgers, this still packs a respectable 20g of plant-based protein per serving.

Finally, I tried Wholesome Pantry Black Bean Chipotle Veggie Burgers, which are branded for ShopRite food stores and are similar to other brands that may be found in other grocery chains. With 58% less fat than ground beef, this patty had a nice natural flavor but not one that could be mistaken for meat. Unlike the Praeger's burger, it seemed to hold together better and appeared more as a spotted, pork roll slice - which is generally not something that garners a lot of excitement- than its competition.

So, if you are looking for the taste, texture and experience of beef but without any of the guilt or excess fat, the Beyond Burger is the way to go.

If you recoil at even the idea of mimicking beef and want a good, delicious vegetable burger, Wholesome Pantry is a good value and with many varieties gives you the opportunity to enjoy a burger that won't fall apart after the second bite.

Meatless alternatives can be found in more and more places based on the tastes and preferences of more and more people -- and that's a good thing! Now, I just have to figure out a way to make French fries from carrots that taste as if they came from Shake Shack.

Happy, healthy, meat-free eating!

Marc Kaye is a writer, singer, songwriter, stand-up comedian and marketer who gets a lot of his material and life lessons from raising two teenagers. He is President of Eliro (www.eliro.us) that helps organizations create content, messages, communications and training that have lasting impact through the use of compelling storytelling and the power of humor. You can reach Marc at marc@eliro.us. ♻

Vermont Brewshed® Alliance is Launched

Clean water for good health, environment and beer

Jessie Haas

Beer. Did you ever sit there staring at a pint, wondering what's in it? People love to talk about hops and barley, but, fundamentally, beer is water, over 90% water. And without good water, you can't make good beer.

That's the basic insight behind the Vermont Brewshed® Alliance. True, water is one of the necessities of life, and it had better be clean or our health will suffer. But face it, many of us greet a pint of beer with a lot more enthusiasm than we do a big glass of cool, clear water. That makes beer afficionados, and the brewers and pubs who cater to them, a natural constituency for clean water in this day and age.

Our pioneer ancestors, on the other hand, drank beer because they didn't have clean water. Having sited the well next to the manure pile and the outhouse, they found that drinking water often made them sick, and milk could carry tuberculosis. They preserved their food by smoking and salting and worked hard on their farms, generating a prodigious thirst. Brewing beer, by happy accident, involved boiling the water, creating a beverage they could drink without immediate illness.

We moderns come at it from a different direction, wanting clean, pure water as a base ingredient. That makes brewers very aware of their water sources. In Vermont, those include rivers, streams, springs and aquifers, all of which face unique threats. The Vermont Natural Resources Council (VNRC) has been working on these issues since 1967 and has recently adopted a model pioneered in Washington State called the Brewshed® Alliance to raise awareness of water quality, and money to help provide it. (The word 'brewshed' is trademarked by Washington Wild, a nonprofit that protects and restores wild waters and woodlands in Washington.) States that have already signed on with the Brewshed® Alliance include Washington, Oregon, Maine, and Texas, and now Vermont.

Five founding members, all breweries in the northwest corner of Vermont, have joined the VNRC effort: Alchemist Beer, Halyard Brewing (makers of ginger beer), Lawson's Finest Liquids, Magic Hat Brewing Company, and Zero Gravity Craft Brewing. Soft launches have occurred at Lawson's and Magic Hat; the latter held a special event on Giving Tuesday, donating $1 per pour to VNRC clean-water initiatives. More events are planned in the spring, and VNRC is actively recruiting members around the state.

According to Colin Keegan of VNRC, the Brewshed® initiative has been greeted with enthusiasm by the brewers. The focus on awareness, education, and fundraising, is structured around fun and beer. Brewshed® Alliance activities include events, hikes, and opportunities to support clean water by hoisting a cold brew.

Keegan said, "The response in Washington and Oregon (the original Brewshed® Alliance states) has been overwhelming." The events and the money raised, have grown over time.

VNRC is working on planning a statewide event sometime in the spring. "We don't want to reinvent the wheel," Keegan says. There are many beer festivals already, so VNRC is looking to find other fun and educational ways to reach people. Currently, the initiative is beer-focused. VNRC has no plans to reach out to distillers and wine-makers, "but that could change," said Keegan.

So, keep your eyes peeled for an event near you, a chance to gaze deep into that amber liquid and honor the water in there by protecting all its sources. Learn more at https://vnrc.org/brewshed/.

Jessie Haas has written 40 books, mainly for children, and has lived in an off-grid cabin in Vermont. ♻

Is this Recyclable? Tips to Recycle Right in Vermont

Cassandra Hemenway

We've all done it. There's a thing we're not sure of – a lightbulb, a plastic bag, maybe a Styrofoam tray– and we throw it in the recycling bin because we REALLY want it to be recyclable, even though deep in our hearts, we know it isn't.

Contamination is the biggest problem in the recycling industry, and the number one reason why markets have dipped. Some recycling systems in the U.S. have even shut down, because they cannot find an economically viable way to deal with contamination and sell the materials for recycling. Contamination, in other words, renders recyclables valueless, particularly to foreign markets such as China.

Recyclables on the conveyor belt with a worker sorting them at the Williston, VT Materials Recovery Facility. Photo courtesy of Cassandra Hemenway.

Vermont recyclers have been sending materials mostly to domestic markets for a long time, so, although we feel the economic crunch, our materials ARE getting recycled, for now. While the U.S. catches up with the new recycling reality, more domestic recyclers are coming on line. But whether our materials go to a domestic or an international market, they still need to be sorted correctly, so we can supply a reliably clean, contamination-free, stream to manufacturers down the line.

You can contribute to a clean recycling stream by following these tips:

1. Memorize Vermont's "Statewide Six" mandated recyclables. If it's not on this list, keep it out of your blue bin:

- glass (all colors)
- rigid plastics (these are hard plastics like yogurt cups or "blister pack" plastic packaging, as opposed to "film" plastics like plastic bags)
- Corrugated Cardboard (not waxed)
- Paper (including glossy, newspaper, magazines, office paper, envelopes, boxboard)
- Steel (food-grade cans like tuna or baked bean cans)
- Aluminum (cans, pie pans, even aluminum foil if clean and dry and balled up to the size of a tennis ball or larger).

2. Know the process. If you understand where your recyclables go, it's easier to understand how to manage materials and why certain "rules" exist. Vermont's recyclables are mostly managed as "single sort" materials; everything goes in one bin. After you drop off your materials at a transfer station, or they get picked up by your hauler, they get transported to the nearest Materials Recovery Facility (MRF), where humans and high-tech machines sort the materials into the six categories, bale them, and ship them to market.

3. Follow the rules: Both human beings and complex machinery sort your materials once they reach the MRF. A few simple rules make the whole system work:

a. **Rinse food containers.** No need to sterilize, but any container that has had food in it should be empty and rinsed. If you don't want to pick it up and inspect it yourself, then imagine how the person at the recycling center feels.

b. Know the 2 x 2 rule. Anything smaller than 2" x 2" or larger than 2' x 2' cannot go into your blue bin. Small items fall between the cracks at the MRF, and the larger items are too large for efficient sorting on the conveyor belt. (Exception: Caps can go on plastic bottles once they are empty and dry.)

c. No Tanglers. Tanglers are things like plastic bags, textiles and hoses that tangle up machinery at the MRF. Tanglers can cause the MRF to shut down for an hour or more. Imagine the loss of time and money involved in shutting down a factory for a full hour every day!

d. Symbol schmymbol. Just because it has the chasing arrow symbol does not mean it is recyclable in our region. Think of frozen food bags or Styrofoam – neither of which is recyclable in Vermont, but both of which feature a recycling symbol.

e. Consider the economics. Recycling is an industry. Blue bin recyclables are the raw materials that eventually get remanufactured into new products. It works because the value of the raw materials exceeds the cost of hauling, sorting, baling and hauling again. If recycling didn't work economically, we wouldn't be able to do it (which explains why some U.S. municipalities have had to temporarily shut down residential recycling until markets improve). Contribute to making recycling work by buying recycled materials made from post-consumer recycled content.

4. Opt out. Recycling is great. It's better than dumping our (often toxic, whether we realize it or not) materials into the landfill. But it is not the best solution environmentally. The best solution is to buy less, use less, and reuse what you have. A full 30 percent of landfilled materials in Vermont are single-use disposables that cannot be recycled. As a first step, consider giving up anything disposable in favor of something reusable; or buy second hand and avoid packaging.

Finally, keep in mind that Vermont has sixteen solid waste management entities covering most of the state. The folks who work at these organizations are knowledgeable, and particularly well-versed in your local systems. Find your solid waste management entity at https://dec.vermont.gov/waste-management/solid/local-districts. For other states, please contact your local solid waste entities. If you are not sure who that is, start with calling City Hall or your Town Clerk's office.

Cassandra Hemenway is the Outreach Manager at the Central Vermont Solid Waste Management District. ♻

Baled cardboard at the Materials Recovery Facility owned by Chittenden Solid Waste District (CVSWMD) in Williston, VT. Photo courtesy of CVSWMD.

Sustainability and Challenges for XC Ski Centers

Roger Lohr

Cross country skiing and snowshoeing are some of the most "sustainable" recreational activities requiring skiers or snowshoers to use their own power and techniques to move over the snow. But when these sports are offered commercially, the trails are groomed, the snow is machine-made (at some ski areas), and as a business operation providing skiers and snowshoers with easy access to the outdoors, there is a different equation regarding sustainability.

Craftsbury Outdoor Center's rooftop solar and diesel groomer. All photos courtesy of COC.

Craftsbury Outdoor Center (COC) in Vermont is a cross-country ski area operation that surpasses many competitors in the area of sustainable practices. The COC mission statement includes using and teaching sustainable practices and protecting and managing the surrounding land, lake and trails.

Electricity is net metered with 32kW on an array of solar trackers and 3,000 square feet. of panels on the roof, supplying the Activity Center with close to 70kW. In 2018, a new 37kW solar PV array was installed on the maintenance shed providing energy to the new dining hall. These solar panels provide a substantial portion of COC's electricity, and solar thermal also provides summertime domestic hot water, which is supplemented with heat pumps.

COC has incorporated massive amounts of insulation into all of the new buildings, and many of the wood products used in the building construction are locally sourced. The insulated roof of the Activity Center is at R72 and the walls are R46. The dining hall and kitchen area was expanded and retrofitted. The new kitchen uses a closed-loop, ground-sourced heat pump system to heat hot tap water, radiator water, and cool the walk-in fridge. Much of the baking was switched from propane to electricity, and the new significantly larger building saved 4000 gallons of propane in its first year as a result.

Improvements were also made on the off-campus athlete and staff houses installing two heat pump water heaters, three insulated and sealed basements, an insulated attic, wood pellet furnace and wood pellet boiler, and 80 window inserts. Additionally, two heat pumps were installed in two of the waterfront cottages.

The locker rooms feature composting toilets, as well as low-flow water fixtures, timed showers, and hand-dryers to minimize paper towel waste. They also are warmed with a heat pump and used locally-sourced wood for paneling and recycled steel beams for support in the construction. High efficiency wood gasifying boilers provide all of the heating and domestic hot water demands during the cooler months. They are tied into the 10 million BTUs of thermal storage in the form of 20,000 gallons of water. This storage system allows them to cogenerate with the snowmaking generator, providing electricity for the pumps and guns, and catching waste heat off the engine.

An electric vehicle (EV) charger was installed and there are preferred EV parking spot designations. Signage helps to inform COC guests about sustainable efforts being undertaken.

COC grows much of their veggies and herbs, and they source as much food from local Vermont farms as possible. Meals are altered every month to adapt the menu to the food that is in season. Additionally, they participate in the meatless Monday movement, which is a campaign to reduce meat consumption for environmental reasons.

Tracking progress on efforts since 2009, the detailed data of energy expenses on all fuels has been converted to estimated CO2 emissions. This data will instruct future projects to strive to reduce the overall footprint. Some of the findings have shown that CO2 emissions from fossil fuels rose from 2009-2013, primarily due to expansion, before they switched some of the energy systems. From 2013-2017 there was a decrease in emissions as new heating systems and buildings became more efficient. But realities such as a long, cold winter and having lots of snow will impact emissions according to Hannah Dreissigacker, the COC sustainability coordinator. Hannah stated, "It turns out that when all of the ski trails are open for almost the entire winter, it takes a lot of diesel fuel to groom them all increasing the level of emissions!"

According to sources in Vermont, in 2003, the entire state land had 115.9 days with a minimum of one inch of snow cover that reduced to 22.5 days by 2013. COC is dealing with this by creating a gigantic snow mound produced by the most efficient snowmaking equipment. The mound is stored and protected during the warm summer months and then uncovered in the fall to be transported from the mound to the trails. This guarantees the operation will be open and programming can commence as scheduled rather than being as susceptible to the whims of climate change. The concept is being analyzed at the University of Vermont in terms of financial and energy justification. The battle against global warming continues on all fronts at Craftsbury Outdoor Center.

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

Craftsbury Outdoor Center: (top) entranceway; (middle) the new super-insulated, energy-efficient dining facility; (bottom) Froling *pellet boilers in a well-sealed and insulated basement for renewable heating along with many other creative ways to lower their emissions at COC.*