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Sustainable Farming 2020 (pages 20-21)

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## Taking Farming to Net Zero

*George Harvey*

Farming stands out as one of the most important contributors to climate change. The U.S. Environmental Protection Agency lists it as contributing 10% of greenhouse gas (GHG) emissions as of 2020, but this does not tell the whole story (https://bit.ly/31eSEzv). The European Commission lists the five most consequential causes of rising GHG emissions as burning fuel, cutting down forests, livestock farming, nitrogen-based fertilizers, and fluorinated gases. (https://bit.ly/3ldtcTd) Please note that two of these are specific to agriculture, and one of the other three is largely related to agriculture.

Other sources show greater emissions working the land. A story that appeared in *Forbes* last December, "Why Agriculture's Greenhouse Gas Emissions Are Almost Always Underestimated," says that farming and land use may contribute as much as 20% of all GHG emissions (https://bit.ly/34seGka). And an article that appeared in *Nature*, "One-third of our greenhouse gas emissions come from agriculture," has a title that says exactly what it means (https://go.nature.com/3gcFqri).

*Solectrac electric tractor. Image: Solectrac.*

The reasons for the differences lie partly in how emissions are calculated. For example, one of the really significant causes of emissions has to do with the soil and how it is handled. Plants draw down carbon dioxide from the atmosphere. Much of what they turn it into is put underground, in the roots. So plants are potentially great allies. But some calculations have ignored the fact that tilling the soil can cause a complex set of changes that release the carbon back into the atmosphere, destroying the great advantage the plants can provide.

Clearly, farming can

*Cont'd on p.20*

## Major League Baseball Players for the Planet

*Jessie Haas*


*Brent Suter, MLB player for the* Milwaukee Brewers, *speaks out as an athlete's voice for StrikeOutWaste. Image: big12fantastics.com*

Brent Suter, pitcher for the Milwaukee Brewers, recently endorsed the Energy Innovation and Carbon Dividend Act which is working its way through the U.S. House of Representatives. Fellow endorsers include many names that will be familiar to New England readers, including former Vermont governor Howard Dean and biathlete Susan Dunklee. Over seven hundred businesses, 116 faith groups, 118 local governments, 187 nonprofits, and six tribal entities also support the legislation. The bill has 82 cosponsors including Adam Schiff, Chellie Pingree, Barbara Lee, Seth Moulton, and Karen Bass, all Democrats. (There is one Republican cosponsor, Francis Rooney of Florida.) Representatives of all northeast states except Vermont are cosponsors.

In brief, the bill Energy Innovation Act puts a small fee on fossil fuels, which will increase over time. This is intended to drive down their use. The money gathered by the carbon fee will be returned to American people; the law is designed to be revenue-neutral. In order to protect American jobs and industry, imported goods will pay what's called a 'border carbon adjustment,' and American companies will receive a refund. According to the website energyinnovationact.org, "This policy preserves effective current regulations, like auto mileage standards, but pauses the EPA authority to regulate the CO2 and equivalent emissions covered by the fee for the first 10 years after the policy is enacted. If emission targets are not being met after 10

*Cont'd on p.38*

## Fossil Fuels Declining As Renewables Rise

*George Harvey*

*The San Juan generating station is closing down. At its peak, it had a capacity of 1,848 MW. (Wikipedia)*

Every month or so, the Federal Energy Regulatory Commission (FERC) publishes its estimates of short-term changes in the energy markets. Among its data is a table showing its expectations of probable infrastructure additions and retirements, organized by technology.

FERC's projections of probable additions include no new coal-burning power plants over the next three years, but 20,696 megawatts (MW) of capacity to be retired. While 23,415 MW of natural gas plants are expected to come online, 5,935 MW are expected to retire. FERC projects 4 MW of additional oil-burning additions, but 3,986 MW of oil-fired capacity to be retired. Altogether, this means that FERC is projecting a reduction of 7,198 MW of net generating capacity powered by fossil fuels over three years.

The picture is a bit different for renewable energy. Probable additions of wind power come to 26,798 MW, with retirements of 239 MW. Probable additions of solar power are 26,154 MW, with no retirements. FERC projects 2,063 MW of hydropower probably added, against retirements of 7 MW. For other renewable energy (geothermal,

*Cont'd on p.3*

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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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***Our mission is to create Energy Awareness, Understanding and Independence – Socially Responsible Living.***

*Solar Power works! … anywhere under the sun!*

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

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# We Remember Bhima Nitta as a Passionate Part of the Solution

The *Green Energy Times* team notes with sorrow the passing of Bhima Nitta, founder and owner of Power-Guru Solar Electric Systems on August 6th, 2020. Bhima was 54 years old.

Bhima was passionate about being a part of the solution to global climate change.

His lifetime of work focused on clean energy was more than a job for Bhima, and it led him to the founding of Power Guru. Bhima believed that the only acceptable answer to the existential threat of climate change was to be part of the solution, and through his work at Power Guru he was directly helping people find solutions to their energy needs through renewable solar power, and indirectly helping Vermont meet its energy goal and ultimately helping the planet. Since his founding of Power Guru in 2008, Bhima's company has installed over 200 solar power systems, and completed a community solar power farm that provides power to over 50 people and businesses.

Never far from his passion for developing renewable energy through his business, was his equal dedication to education about solar power, energy efficiency, and how a community could lower our carbon footprint and help save our planet. Bhima volunteered his time to participate in community forums, programs, and informational sessions to educate the public on how they can participate in the "green revolution". Most recently this past January, Bhima was instrumental in conceiving, producing, and participating in the CAT TV show *Green Energy Opportunities*, which featured a panel discussion with the recently created Town of Bennington Energy Committee, a representative of Efficiency Vermont, and Bhima.

Bhima's business acumen was readily apparent in the effective way he ran his business, but perhaps surprising to some would be how much time he and his staff spent working with people on ways to lower their energy needs. Rather than simply try to sell more solar panels, Bhima and his team always began with an energy audit where they would try to LOWER the number of panels needed by suggesting other ways of saving power. For Bhima, the ultimate goal was never his short-term profit, but rather the long-term goal of serving the needs of our community and planet.

If ever there was a time when the world needed people like Bhima, that time is now. The choice he made to dedicate his life's work to green energy and saving the planet are a testament to the kind of person Bhima was.

Power-Guru Solar Electric Systems will be continuing operation normally during this time, servicing existing clients, selling and installing new systems, and finishing development of the Bennington Community Solar Farm. Learn more about Power Guru at power-guru.com.

*Green Energy Times* sends our deep-felt condolences to his family and all who work at Power-Guru. His depth of knowledge is a huge loss to the world. We will miss him but are happy to hear that his company is carrying on his legacy. Watch for just how far they are going to keep his legacy alive in our November 2020 edition of *Green Energy Times*.

Green Energy Times' *coverage of Power Guru and links:*

- April 15, 2014: "Getting to Know Your Solar Installers: Power-Guru". Go to: www.greenenergytimes.org/2014/04/15/solar-installers/.
- December 15, 2014: "100 kW Power Guru Installation". Go to:www.greenenergytimes.org/2014/12/15/100-kw-installation/.
- April 21, 2017: "Southshire Community Solar". Go to: http://www.greenenergytimes.org/2017/04/21/southshire-community-solar/.
- March 18, 2018: "Even Greener Recycling at TAM Waste and Recycling". Go to: www.greenenergytimes.org/2019/03/18/tam-waste-and-recycling/. ♻



**Concentration of CO2 in the Atmosphere**

**411.57**
***parts per million (ppm)***
***September 1, 2020***

***Learn more at www.co2.earth.***

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# BUTTONUP 2020 GOES VIRTUAL

This year upended life for just about all of us, and for many Vermonters, it's been really tough. With all the uncertainty we face, why bring weatherization up on your list of things to make happen in 2020? Well, it's even more important now that we're all spending more time at home.

**Safety**: A professional weatherization contractor will help you ensure the right amount of fresh air is moving through your home to keep you healthy, without losing all that cold or heat you're paying for. This work can reduce mold and respiratory illness, keeping your family safer.

**Money:** Winter used to be the only season we needed to spend money on to stay comfortable. But more of us are installing AC to make it through the longer heat waves we're facing. Anytime you're spending money to heat or cool your home (or time at the wood pile), weatherization is a great investment. The average Vermonter saves $500 a year and stops those annoying drafts, which might be worth doing if "date night" is always at home for the foreseeable future.

**Security:** Cheaper utility bills are always nice…but they're suddenly critical when you lose a job, as so many Vermonters did this year. Weatherization gives Vermonters financial flexibility, which can mean a lot during a crisis. And it's also a key step in preventing future crises. We can't meet our state climate goals without significant weatherization projects in almost all of our buildings. Progress here is necessary to reduce the future weather, economic, and yes, pandemic disasters that a warmer climate could bring.

For Button Up 2020, expert advice will be offered through online events, virtual home energy visits, and resources on the website. And Efficiency Vermont is going a step further to help you help your neighbor. Efficiency Vermont has joined with the Vermont Community Foundation to build the Button Up Vermont Fund, paying for weatherization projects for low income Vermonters. It's an opportunity to help your neighbors and double your impact with matching contributions from Button Up sponsors.

To learn more call 888-921-5990 or go to buttonupvermont.org. ♻

# 10th Annual Drive Electric Week

## September 26 – October 4, 2020

*Brianna Brand*

Driving habits certainly look much different than normal as adults and children alike transition to virtual work and school environments that leave the trusty family automobile in the driveway more often than not. Most long for the days when the disruption of daily life due to the COVID-19 pandemic are nothing more than a hazy memory. But during this unprecedented time, many are looking for ways to rebuild our world stronger than ever, and electrified transportation is near the top of the list of priorities.

Usually at this time of year, residents across the Northeast look forward to electric vehicle (EV) ride-and-drive events through National Drive Electric Week. While the pandemic has shuttered in-person events, Clean Energy NH's Drive Electric NH initiative is shifting Drive Electric Week to a virtual format, offering a series of top-notch webinars that delve deep into the latest EV topics.

From September 26-October 4, residents, businesses, and municipalities across the Granite State and beyond are invited to participate in a series of webinars on electrified transportation. On Monday, September 29 at 7:00p.m., hear insights and tips from EV owners including how and where they charge their cars, EV technology, and how they combat range anxiety. This is as close to behind-the-wheel as possible this year!

Another webinar on Tuesday September 28 at 1:00p.m. will discuss the impacts of the pandemic on the national shift towards electric transportation, featuring insights from local EV dealers showcasing Toyota, Hyundai, Ford, and Chevrolet models. Learn about future EV models, modified release dates, and more!

Don't miss the Thursday October 1 webinar at 1:00p.m., which will cover the crucially important topic of EV charging and the modern utility grid, including advances in vehicle-grid technology by the Founder & CEO of Fermata Energy, David Slutzky, a former White House and EPA Senior Policy Advisor.

To view the full line-up of webinars and to register, visit https://www.driveelectricnh.org/drive-electric-week. For virtual events in other regions, visit https://driveelectricweek.org/.

*Brianna Brand in the Senior Program Director for Clean Energy NH and manages the organization's Drive Electric NH initiative.* ♻

*2019 Charge Forward EV Relay, hosted by Drive Electric NH. Image: Drive Electric NH and Kate & Keith Photography.*

# 'Building Communities' Grants Available through Vermont BGS Department

The FY21 Building Communities Grants through the Vermont Department of Building and General Services (BGS) is now available for applications. The Building Communities Grant Program consists of the Recreational Facilities Grant Program, the Regional Economic Development Grant Program, and the Human Services and Educational Facilities Grant Programs. These grants are intended for construction and capital improvements to support and strengthen Vermont towns and regions.

Applicants including municipalities, nonprofit agencies, and regional economic development organizations, are all encouraged to apply for these opportunities to fund construction, infrastructure support, and needed projects.

Although the award of the grants is competitive, the application process has been designed to be simple and straightforward. Grant applicants will be awarded funding as determined by a special committee comprised of private citizens, legislative branch members, and executive branch administrative staff appointed by the Governor. Grants will be awarded in the fall of 2020.

**Hurry to apply! The deadline is Tuesday, September 15, 2020**.

Descriptions and application criteria for all three of these grant programs are available on the Department of Buildings and General Services website: www.bgs.vermont.gov/commissioner/building-communities-grants. ♻

## Fossil Fuels Declining – *Cont'd from p.1*

wasted heat, and biomass), 433 MW are expected as probable additions and 102 MW as expected retirements. All told, FERC projects the net change in renewable capacity to be 55,100 MW.

This may seem surprising, especially considering that current policies of the Trump Administration favor fossil fuels and all FERC commissioners are Trump appointees. Nevertheless, it seems to confirm changes we have been seeing reported, and they come constantly.

To illustrate this, here are ten headlines that I saw over the seven day period of July 28 to August 3:

July 28 – Era of Subsidy-Free Offshore Wind Turbines Has Arrived, Researchers Say – RenewEconomy

July 29 – Solar-for-Coal Energy Swaps Could Facilitate Utilities' Renewables Transition, Analysis Shows – Morning Consult – (There is no need for natural gas as a "bridge fuel" in many places.)

July 30 – Record EV Sales in Europe – CleanTechnica – (Electric vehicles sales are increasing, even as fuel vehicles sales are off badly.)

July 30 – Renewables Set to Replace Coal-Fired San Juan Generating Station – New Mexico Political Report

July 30 – Texas Utility CPS Energy Kicks Off Search for More Than 1 GW of Clean Resources – Greentech Media

August 1 – Oil Giants Post Historic Losses as Covid-19 Obliterates Demand – Huffington Post

August 2 – Deutsche Bank to Discontinue Lending to Coal Miners – EconoTimes

August 3 – OPEC Struggles to Manage 'Permanent Demand Destruction' – CleanTechnica

August 3 – More Coal Power Generation Closed Than Opened Around the World This Year, Research Finds – The Guardian

August 3 – NextEra Energy Sees Hydrogen as a Zero Emissions Alternative to Natural Gas – CleanTechnica

This was not a particularly extraordinary week. I put the list together for this article on August 3, choosing the then-most recent week's news to illustrate my point. And the point is that renewable energy sources are pushing fossil fuels out the door.

One important note is that the old idea of using natural gas as a "bridge fuel" seems no longer to be attractive. This is especially worth examining because the cost of natural gas is now at a low – low enough that many companies extracting it are going bankrupt – and yet, customers are not really moving to it.

Another powerful move in recent months is that utilities, power generators, and oil companies all seem to be excited to adopt hydrogen as a fuel. While there is a "dirty" type of hydrogen, which is derived from methane, adoption of hydrogen is often paired with electrolysis driven by green energy. Again, this is a move away from fossil fuels.

The adoption of renewable energy to replace the coal-burning was mandated by a unanimous decision by the New Mexico Public Regulation Commission. Natural gas is not needed for the change, and it is not wanted.

Renewable energy has a number of attributes that make it superior to fossil fuels. To start with, it is less expensive. It can be produced locally, in most places giving extra benefit to the local economy. Properly set up, it is more reliable than the old thermal plants it is replacing. It is not subject to the whims of the market, major parts of which are unapologetically controlled by the OPEC cartel.

Major drivers of intentional moves away from fossil fuels are the environment and human health. In an age of Covid-19, it is worth noting that Americans die from air pollution faster than they do from the pandemic. But also, the damage we are doing to the environment is by itself sufficient reason to put an end to our use of fossil fuels. We are not changing fast enough to address those issues fully. Not yet.

Nevertheless, the change is happening, with new evidence of a profound shift to renewable fuels every day. Watching this reminds me of a Sonny and Cher song, "The Beat Goes On." ♻

# Drive Electric Vermont Electric Vehicles in the Wintertime

*David Roberts*

Many recent car buyers are discovering the benefits of getting plug-in electric vehicles (EV), including:

- They have great performance and are fun to drive;
- They are cleaner than gasoline options - even factoring in upstream emissions of electric generation; and
- Federal, state, and utility incentives can bring purchase prices down significantly. Over the life of a vehicle, they can save thousands through lower fuel and maintenance costs.

We're enthusiastic EV advocates at Drive Electric Vermont, but it is important to understand how cold temperatures may reduce battery range to make an informed purchase. Below are some tips on picking the right EV model, model options and operating practices to maximize cold-weather performance.

*The Ford Fusion performs well on a snowy road in Vermont. Courtesy photo.*

## Winter Range EV Purchase Considerations

Cold weather reduces efficiency of all vehicle types, not just EVs. According to FuelEconomy.gov, conventional gasoline vehicles typically have a 20% reduction in fuel economy at 20° F. However, it is often more noticeable with an EV and is especially concerning for all-electric vehicle drivers who need to know they have enough range to reach their travel destinations.

Keeping the inside of the vehicle warm in winter is usually the biggest drain on EV range, especially when ambient temperatures plunge below 15° F. Lithium ion batteries used in EVs also do not perform as well in cold temperatures, which can lead to further range reductions.

The team at fleet analytics company, Geotab, analyzed thousands of EVs in varying conditions and developed detailed data on expected EV range reductions in cold conditions. Their general findings are that at -4° F, drivers of an average EV might see about half of the manufacturer's estimated range. However, this varied significantly depending on the model, and how it is stored and operated. Their online EV temperature tool allows users to check the potential cold-weather performance of specific models.

Getting through the winter in your EV begins with purchasing the right vehicle for your needs. Most new all-electric models offer more than 200 miles of "official" range, so even with winter reductions, many drivers will rarely be inconvenienced by these issues. On the other hand, older used EV models may offer less than 100 miles of official range which can present significant challenges if drivers aren't aware of winter reductions when purchasing.

If you have a long commute or are a winter road tripper, we recommend longer range all-electric models or plug-in hybrids that can run on gasoline for extended range. For long distance travelers wanting to go all-electric, Tesla's proprietary fast charging network and navigation systems greatly simplify route planning. States and automakers are building out more non-Tesla fast charging along key routes, but Tesla has a significant lead in this effort.

We also highly recommend purchasing EVs equipped with cold weather options offered by many automakers, including heated seats and steering wheels. These are much more efficient than running cabin heating systems. Some EV models may also have battery heaters that help keep the battery pack at optimal temperatures. Several automakers offer more efficient heat pump heating systems that can significantly improve cabin heating efficiency down to about 15° F. The list below details model-specific cold-weather options for many current 2019 or 2020 model year vehicles.

- Audi e-tron includes a heat pump as standard equipment, but also offers a cold-weather package with heated rear seats and a higher-powered system for preheating while still plugged in.
- BMW i3 has an optional heat pump on the all-electric model.
- Chevrolet Bolt uses a resistance heating system - a heat pump option is not available. The base LT trim has an optional "Comfort and Convenience" package that includes heated front seats and steering wheel. The Premier trim includes heated steering wheel, front and rear seats as standard.
- Hyundai Ioniq Electric includes a heat pump on the higher "Limited" trim level. The base SE model does not have one. Hyundai Kona does not currently offer a heat pump for USA models, although one does come as standard equipment in Canadian models.
- Jaguar I-Pace includes a heat pump as standard equipment. A cold weather package is also available with a heated windshield and steering wheel.
- Kia Niro EV includes a heat pump in the Cold Weather Package, which also includes a heated steering wheel and battery heater.
- Mini Cooper SE all-electric includes a heat pump as standard equipment on all models.
- Nissan LEAF comes in S, SV and SL trims and the more efficient "hybrid heater system" is not available on the S, is optional on the SV (included in the all-weather package), and only standard on the top-of-the line SL Plus.
- Subaru Crosstrek Hybrid plug-in hybrid includes a heat pump system according to the owner's manual.
- Tesla Model Y is the only Tesla currently offered with a heat pump, although other models include systems that recover waste heat from electronics to improve the efficiency of heating systems.
- Toyota Prius Prime and RAV4 Prime plug-in hybrids come standard with heat pump systems.
- Volkswagen e-Golf includes a heat pump on the higher SEL trim level. The baseline trim SE model does not have one.
- Volvo all-electric models will likely include heat pumps. Existing PHEV models may not offer them. Dealers should have additional information on heating system options.

Models not included on this list are unlikely to offer heat pumps, but we recommend checking automaker resources to confirm.

## Traction and Clearance

If you live in a snowbelt or regularly travel on rough roads, you may want to consider an EV model with higher ground clearance or all-wheel drive. You can filter Drive Electric Vermont's vehicle comparison tool (https://www.driveelectricvt.com/why-go-electric/compare-vehicles) to show what's currently available.

EV batteries are often placed along the underside of the vehicle. This extra weight helps keep your wheels on the road, especially if you have winter tires installed. Studies have shown winter tires are the single most important investment you can make for safe winter driving in any vehicle, and EVs are no exception. Winter tires tend to be less efficient than all-season or summer tires, but in most cases, they will not have a major impact on range.

Most EVs available today have front wheel drive, which is fine for most winter driving conditions in the northeast when accompanied by winter tires and modern traction control systems. A growing number of EVs have all-wheel drive (AWD), including models from Toyota, Tesla ("dual motor"), Mitsubishi, Subaru, Audi, BMW, Mini and Volvo all offer models with AWD. Many more options are due to arrive in the next few years.

A few EV models have rear wheel drive (RWD) systems, which may be less predictable in winter road conditions. Many owners have reported traction-control systems and winter tires make RWD acceptable in northeast conditions. We recommend researching specific models prior to a purchase to ensure they will work for your needs.

Aerodynamic body parts help EVs maximize their range, but they do sometimes include trim pieces which reduce the ground clearance of the vehicle. Some EV models have adjustable suspension systems that allow drivers to increase ride height at the press of a button. Another option is putting in a "lift kit" that boosts the standard suspension further off the ground. If you regularly drive in deep, snowy conditions you can inquire with your dealer or manufacturer as there may be other options to provide more clearance.

## Charging in Winter

EVs can charge on Level 1 charging (plugging into a standard 120V home outlet), which typically takes overnight or longer to charge. Faster Level 2 (240V) charging is also available. Some EVs include DC fast charging capability which can provide an 80% charge in 30-60 minutes under normal conditions. All three types of charging may require more time in cold winter conditions, but this is especially true of DC fast charging.

If you have a garage or carport for your EV that will help keep the battery a bit warmer. Some EVs have battery heaters that turn on in the coldest temperatures (e.g. below 0° F) to prevent permanent battery damage, so it is often prudent to leave your EV plugged in overnight when polar air visits your neighborhood – especially if your vehicle is parked outside. Check with your EV dealer or owner's manual for more information on whether this is a consideration for your vehicle.

If you have an all-electric vehicle, upgrading to a Level 2 charger will speed your charging and can also boost your ability to preheat while still plugged in to save range.

For DC fast charging in winter, some EVs may have preconditioning systems that warm up the battery when you approach a fast charging stop. For example, if you are on a trip including a stop at one of their Supercharger DC fast chargers, be sure to use the built-in vehicle navigation system as it will automatically precondition the battery prior to a Supercharging session.

## Driving Tips

Fortunately, there are some things EV drivers can do to restore some of the range lost in colder winter conditions. Best practices include:

- Preheating – getting the vehicle cabin up to temperature while still plugged in means more energy is available for range. This can often be controlled with smartphone apps or key fobs and generally works best on higher powered Level 2 chargers. Preheating can also make it much easier to remove snow and ice from your vehicle before leaving home.
- Departure Time Scheduling - Many EV models will allow you to schedule a departure time that will finish a charging session just before you need to go. This is a great way to get the battery warmed up a bit from charging and, for some models, it will include preheating.
- Heated Surfaces – Using heated seats and steering wheels if your vehicle has these is usually much more efficient than operating the cabin heat, even if you have a heat pump installed. Some drivers will use a lap blanket or continue wearing jackets to avoid operating heat for longer distance travels.
- Tire Pressure – Cold temps increase the density of air, which commonly leads to lower tire pressures. You can find the recommended tire pressure on a sticker located on the driver's door jamb. Check pressure and add air regularly to increase winter efficiency.
- Driving Speed – reducing travel speed is one of the most effective ways to boost range in any condition as air resistance increases significantly with speed. Slowing down 5-10 mph can provide an additional 10-20% or more of range, depending on the model and conditions.
- Eco-Driving – Some vehicles have "eco" or economy modes that reduce power to the motors and do other things to increase efficiency. Also, following basic eco-driving principles (accelerating slowly, braking slowly, letting off on the accelerator as you crest a hill, and anticipating stoplights and slowing down) will help maximize the use of regenerative braking systems that put energy back in the battery instead of wasting it with mechanical brakes. You should also remove any heavy objects, roof racks, snow and ice, etc. from the vehicle when possible to increase efficiency.

Most EV owners find these practices become second nature, and they enjoy running their EVs year-round. That said, if you are in a single-car household and don't relish the thought of more planning for road trips in winter, you may be happier with a plug-in hybrid EV model that can run on gasoline when needed.

Automakers and battery designers are working on new battery chemistries that promise more range and less impacts from colder temperatures, so hopefully these issues will continue to diminish as these technologies are integrated into future EVs.

*Additional resources are available on* GET's *posting of this article.*

*David Roberts is the Drive Electric Vermont coordinator. He has driven all-electric vehicles for the past 8 years and says if you have to drive, drive electric.* ♻

# 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**

**COMMUNITY VOLUNTEER TRANSPORTATION COMPANY (CVTC)** - serving 34 towns in the Monadnock Region, providing "no fee" transportation for people with limiting circumstances. 877-428-2882 x5. **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**

# Cars as an Energy Appliance: Tesla as Lead Actor

*Randy Bryan*

*Tesla EV being charged by a Powerwall battery. Image: Tesla*

Cars based on gasoline and diesel technology have been refined for over a hundred years, and their design and costs are projected to stay level or trend up. But, on the side, there is growing acceptance of global warming issues that combustion cars only make worse.

Electric vehicles (EVs) are considered a revolutionary technology even though cars designed to run on an electric motor, and the use of batteries are concepts that pre-date combustion engines. Now that global warming issues make combustion cars a too-costly luxury, clean electric technology with ever-expanding innovations in electronic components and battery improvement (largely ignored for a hundred years, compliments of the oil and car industries) are now coming faster than predicted. This means better cars that cost less, have lower fuel and maintenance costs (one-half to one third of combustion cars) and, now, it may be possible for EV owners to generate revenue when the car is idle.

Tesla is setting the standard to which all car makers are now being compared. Little Tesla. Consider: 1. Tesla is now making a profit on their electric cars, where all the other car makers, still manufacturing EVs to meet mandated quotas, remain years away from profiting on their EVs. 2. Tesla has funded their own fast charger network around the country and the world, whereas other car makers sit on the fence, waiting for someone else to build this infrastructure. VW Settlement money is a help, but not enough. 3. Tesla cars are now demonstrating that the lower operating costs (fuel and maintenance) for an electric car can deliver better payback to commercial customers even with the higher initial cost of the car. 4. Most significant, Tesla is developing their PowerPak, Powerwall and car batteries as a giant energy buffer to help the utilities better handle power fluctuations. With the US-FERC order 841 (distributed energy storage mandate) being affirmed in Federal court there will be a lot more distributed energy storage coming to our grids, and soon. Tesla is positioned, through their testing in Australia, Vermont and soon in England to share revenue captured in this way with their Tesla car and Powerwall customers

None of the current car companies can offer such benefits to their customers. Imagine buying an electric car at the same price as the equivalent combustion model, with half the fuel and maintenance costs, and in addition, getting paid by the electric utility company when your car battery is idle. Think what this does to the market for new and used combustion cars. Fundamental changes to transportation economics are coming faster than most car manufacturers planned. Look at the current percentage of EVs sold by Tesla versus all other conventional auto makers, and you begin to see how Tesla's technology lead could play out. Look for Tesla to continue growing, and more partnerships and mergers among the existing manufacturers.

How does this affect New Hampshire? Well, thanks to FERC 841, the NH Public Utilities Commission has to come up with a more open distributed storage plan, and NH companies could participate. Various car companies will introduce more Vehicle to Grid (V2G) capacity, and we can look for more market awareness of using the car for temporary energy - as an energy appliance. These are not next-month predictions, or maybe not even next year. But, looking at the two- to five -year period time frame the effect will be quite noticeable.

Will NH benefit from these changes? Yes, certainly, as every consumer will from better technology. But, will NH prosper by developing and offering new solutions for this new world? And maybe exporting these solutions? But, only if NH adopts policies that encourage early adoption of the technologies so new solutions can be envisioned, made, and sold from here. The replacement of combustion energy with clean electric energy will be among the largest and widest markets in the world this century. Will NH produce solutions, or just consume? We'll see.

*Randy Bryan is one of the co-founders of Drive Electric NH. Bryan has been an advocate for electric cars since 2006. His company, PlugOut Power [formerly ConVerdant Vehicles], has converted vehicles to plug-in hybrids and currently develops and sells inverters that turn electrified cars into emergency generators.* ♻

# VERMONT BIKE & BREW

## A REAL 'VERMONT EXPERIENCE' IN THE UPPER VALLEY

*G.E.T. Staff*

*Vermont Bike & Brew owner, Jonas Cole, enjoys a brew during a tour.*

"When out-of-state visitors come in search of a 'Vermont experience' they're chasing the best maple syrup, maple creemes, small-batch craft beer, locally roasted coffee, and fresh produce. And they want to enjoy it all with a Green Mountain backdrop." That's how Jonas Cole, owner and founder of Vermont Bike & Brew, a new Thetford, VT-based electric bike rental, sales, and tour company thinks. Cole was born in Vermont and knows which elements are essential in creating an authentic Vermont experience. "Many of these visitors don't know they can avoid the many tourists in places like Burlington and Stowe. We have all the ingredients for an outstanding Vermont adventure right here in the Upper Valley."

The Upper Valley, which is situated around Hanover, NH and includes about 30 towns on both sides of the Connecticut River, is Cole's back yard. One of the silver linings of the COVID-19 pandemic, he explains, is that Upper Valley residents are signing up for the tours as well. Lifetime residents are discovering small businesses and back roads they never knew are right around the corner from their own home.

Vermont Bike & Brew tours are customized for every group. Locally roasted coffee from Abracadabra Coffee (Woodstock, VT) and cold pints from Jasper Murdock's Alehouse (Norwich, VT) are classic stops. But don't simply find these places on your own; Cole sends you on the scenic route with the maple creemee finale. One Bike & Brew customer remarked, "We had a true tour of Vermont from the farms and scenic landscapes to the ice cream."

*Touring on bikes. Photos courtesy of Vermont Bike & Brew.*

For many, steep hills have been a barrier to exploring New England on a bicycle, but the pedal-assisted electric motor has changed the situation. Now people are commuting on electric bikes and ditching their cars whenever they can. As one Vermont Bike & Brew customer wrote, "We simply could not have done the almost 40-mile, extremely hilly ride with regular bikes. You still get a good work-out, but the hills are delightful rather than daunting!" The moment you start to pedal, the motor gives you a boost, and you can see how fun, practical, and environmentally-friendly they are. All over the world e-bikes are gaining popularity. Europeans have been riding e-bikes for years, whereas Americans are just catching on. Because e-bikes allow people of different ages and abilities to ride together at a similar pace, Cole refers to them as "the great equalizer."

After graduating from the University of Puget Sound, Cole spent eight years taking youth on wilderness expeditions in the American Southwest. He spent summers leading international trips with Overland Summers, and, between trips, he always found a way to return to Vermont. This guiding experience gave him the background needed to understand what groups are looking for on a bike ride. Last year Cole moved back to the Upper Valley full-time and is running Vermont Bike & Brew from the garage at the house he grew up in.

Because the business operates out of his home, Cole is able to deliver bikes to the beginning of a tour route or anywhere a guest wants to ride. The weight of an e-bike is significant and loading it onto a rack can be a challenge, but he removes that challenge by delivering the bikes so guests can focus on the joy of riding. When a customer buys a bike from Vermont Bike & Brew, Cole delivers the bike fully assembled, charged, and warrantied by the manufacturer. Vermont Bike & Brew is an authorized dealer of Haibike and iZip electric bikes and will be adding Diamondback electric bikes next year.

Cole sees Vermont Bike & Brew as an opportunity he can leverage to benefit the local economy. His partner businesses are included on self-guided tour routes that guests can download on their phones. "When a guest visits one of my partner businesses," he explains, "I feel like they are completing a cycle. These businesses have been sources of sustenance, libation, and entertainment in the Upper Valley for years and this is my way of saying thanks and showing my support." Partner businesses include breweries, farm stands, cafes, scoop shops, B&Bs, and more. And what would a summer bike ride be without jumping in at a local swimming hole?

For reservations or to learn more about Vermont Bike & Brew call 802.274.2277 or visit www.VtBikeAndBrew.com. ♻

### E-BIKE LOVE

More people are finding their way back to biking thanks to the Upper Valley e-Bike Library project.

E-bikes profoundly expand the range, carrying capacity (children and cargo), hill-climbing ease, and comfort of biking. Dave Cohen, director of V-Bike, says at least 15 people who tried one of the electric bikes on loan through the program have contacted him about where to buy one.

The Upper Valley e-Bike Library moves to Hartland and Windsor in September, 2020. Find out how you can try an e-bike at http://bit.ly/Vitalbike or call 802.291.9100! ♻

*A real 'Vermont Experience' touring on bikes in the Upper Valley. Photos courtesy of Vermont Bike & Brew.*

# Enabling Provisions To Reduce Carbon Emissions from Freight

*Therese Langer, ACEEE Senior Fellow, Transportation*

Freight transport is responsible for a large and increasing share of U.S. greenhouse gas emissions. Despite great strides in truck efficiency and the potential to transition to electric trucks in many applications, vehicle improvements are not enough to deliver a sustainable freight sector. We need a freight network that is itself more efficient, with streamlined truck routing and loading, as well as greater use of trains and ships.

A new ACEEE (American Council for an Energy-Efficient Economy) report examines how state-level freight planning can advance efficient freight networks and shows how federal transportation law—which Congress is working to update right now—could help. In fact, Congress's pending reauthorization of federal transportation programs may be the best opportunity for several years to help the freight sector chart a new course.

The U.S. House passed a transportation bill this month as part of a broader infrastructure bill. The bill included several helpful provisions for reducing greenhouse gas emissions, though it missed some opportunities to enable emissions reductions from the freight sector. The Senate's transportation bill has only moved through committee, and it largely fails to tackle freight planning.

The last two federal transportation bills, MAP-21 and FAST Act, delivered much-needed funding opportunities for freight projects, but fell short of articulating a coherent national freight policy, especially with respect to freight's impacts on the climate. This has consequences at the state level. While states must have approved freight plans in place to be eligible for federal funding, the plans are not currently required to show how states will reduce freight sector emissions.

These days, many states are setting their own climate goals, and an efficient freight system will be important to meeting those goals. But for the most part, state climate efforts appear not to extend to freight planning.

ACEEE reviewed state freight plans to understand whether and how, in the absence of clear federal direction, states sought to ensure that their freight projects and policies would improve efficiency and reduce emissions. For example, we looked for explicit improvement targets as well as indirect approaches such as building a modally balanced freight system (essential given the high emissions per ton-mile of trucking), or using mobile computing and real-time data to minimize underutilized capacity in the system.

We took a deeper dive into the plans of a few states we suspected, for a variety of reasons, might be well advanced in freight planning. California emerged as the clear leader in our review, with a comprehensive draft freight plan that sets a goal of a 20% reduction in the carbon intensity of goods movement by 2030. Other states' plans had features that could help to advance freight sustainability: Minnesota's project planning is highly multimodal, while Nevada's plan clearly defines a set of freight performance metrics and targets. However, only California could be said to have a strategy for emissions reduction. Without such a strategy, states will squander gains from cleaner trucks on offsetting increasing truck miles and may struggle to turn freight sector emissions downward.

Getting a better freight plan in place should be on the agenda of any state working toward climate goals. Fortunately, the efficiency improvements that are key to greenhouse gas reduction will also produce a freight system that better supports economic activity.

**Federal guidance needed**

State and regional governments drive freight policy and planning, with information and views from freight industry and community stakeholders. But a well-defined national freight policy is essential as well, especially when it comes to sustainability and the environment. As a major funder of freight projects, the federal government must ensure that the national interest is served with those dollars.

The House infrastructure bill takes a step in that direction by specifying that reduction in greenhouse gas emissions and local pollution is a goal of national freight policy. It also raises the cap on the amount of funding that can go to non-highway freight projects and provides funding for freight projects emphasizing "operational, technological, and mode shift strategies," which should help. These provisions should make their way into the final bill.

But beyond those provisions, the bill should require state freight plans to define and advance sustainability goals, and it should provide tools to help states deliver. A performance measure for freight carbon dioxide emissions would be a good start. Just assembling the information needed to set a baseline and target would help states get a handle on the often-elusive data required to understand the impacts of goods movement. Other planning requirements, from mode-share targets to data-sharing protocols, would also help. These steps to improve freight system efficiency should be added to the transportation bill as it makes its way through Congress. ♻



# Using Your EV or PHEV as Backup Power

*Barb and Greg Whitchurch*

Some of you may remember an amazing inverter kit from a New Hampshire company called Converdant, which consisted of a 2,500- or 5,000-watt inverter for the Prius. We bought the 2,500-watt version, which allowed us to use our Prius as a generator for offsite power and for powering our house when the grid was down. Of course, the car engine would only run when the big "traction" battery got low, and then it would recharge the battery while still running the attached loads and then shut off again automatically.

*Old version of Converdant's Prius inverter in the trunk of the Whitchurch's Prius. Courtesy photo.*

But then the company owner retired and stopped offering the product. However, he's now coming back at www.PlugoutPower.com/ with a new, improved product, which can tap into hybrids or pure EVs.

This is great news for homeowners, builders and others who want to use their vehicles for 120-volt to 240-volt AC applications, such as power tools, outdoor concerts, home backup, camping, etc. Whereas a couple of Tesla power walls could get you around 20 kWh of home backup, the typical EV has a battery two to three times that size, and when necessary after days of use, can be driven to a charger to be recharged.

Randy Bryan, the owner of Plugout Power, manufactured the earlier version for six years, and while the new product is not out yet, we look forward to getting ours. Early reservations are possible, and we've already reserved two (one for our Kia Niro EV, and one for our daughter's Nissan Leaf). Stay tuned and we'll let you know how they work out!

*Barb and Greg Whitchurch, having moved on from gas mobiles and hybrids, power their Nissan LEAF and Kia Niro EV with solar PV from their roof at their passive house in Middlesex, VT.* ♻

# TinySolar Vermont: Small, Affordable Solar

*George Harvey*

Sometimes things work exactly as I think they should, and yet I feel a sense of astonishment that they do. This is one of those times.

Right now, I am typing away on the article you see before you, using a computer that is powered directly from a USB port on the side of a 20-watt solar photovoltaic (PV) panel. All of the electricity for the computer, its monitor, and the dongles that connect it to its wireless keyboard and wifi, is supplied by that panel. And everything is going along without any problem. More amazingly, perhaps, is that the entire solar PV system is highly portable and costs only $85.50.

Truth be told, it was an unfair test. I could have plugged in a cell phone or two, and possibly a battery to be charged, and still have run that computer without a problem. The computer system, a Raspberry Pi 1 Model B, with its seven-inch monitor and the dongles, draws only a trifle more than four watts, leaving a lot of power for the panel to apply to other things. Assuming the local Wi-Fi works properly I could use the computer to check the news, surf the internet, or talk to a far-off relative on Skype.

We have come to a new age for solar power, as well as of tiny, highly useful systems. And to some degree, we in Vermont can thank Joe Yoder, the owner of TinySolar Vermont, for an amazingly small but truly significant proof of that.



*Charging a computer directly to a USB port.*

Yoder became interested in solar power early on, but as he got to an age when he felt it might not be best to go up on roofs to install systems, he decided to consider a different business model for solar power. He started TinySolar Vermont in 2014 with a stated goal of designing and selling "very small, very affordable solar electric systems and related materials.

The TinySolar Vermont website, tinysolarvermont.com, is a place to go to buy small solar systems. The PV systems range in size from 20 watts to 150 watts. While the one I have been using has no battery, the others include them.

I should mention that the specifications on these systems are not written in stone. Yoder said that the biggest problem with building such systems is sourcing the small components, and they become unavailable really easily. His approach is not one of mass producing a product, so having a single source for all products is not the issue it would be in a bigger business. And TinySolar Vermont is a place where a custom design is not a difficult problem.

*Larger TinySolar Vermont systems include solar panel, charge controller, battery and inverter. Images courtesy of TinySolar Vermont.*

The system I got consists of a 20-watt panel mounted in a frame, with wiring on the back leading to a 12-volt cigarette lighter receptacle. Into this is plugged a separate device with a standard USB port. Larger systems include batteries, which are usually sealed or flooded lead-acid types.

You might ask why anyone would want a 20-watt system. There are lots of reasons to have a system like this. These systems are light enough to carry, and that means, for many people, light enough to use when you go camping. Or when you want to type an article in the back yard on a hot day in July. (And by the way, to be truthful, I have moved back indoors because it is just too hot to work outside today.)

Some of the reasons to have a system like this are rather surprising. Yoder talked about one person who had a series of automotive batteries in vehicles that go dead when unused for months at a time. A single small panel was able to keep a battery continually topped off.

In another case, he came across one person who had a large storage system that was charged by a single panel. The system was used to supply electricity to a retreat that was only used for one or two days on weekends. It had all week to be charged.

One woman lived off-grid for many years, without any hope of getting any electricity because there were only a few places at her home that got any sunshine, and none of them got it very long. She was able to move a small, portable panel among morning, mid-day, and afternoon charging stations easily.

There are other potential uses for very small PVs. For example, batteries lose cranking power in low temperatures, so small PV can also be useful to keep a battery that starts a standby generator from getting too cold in the winter.

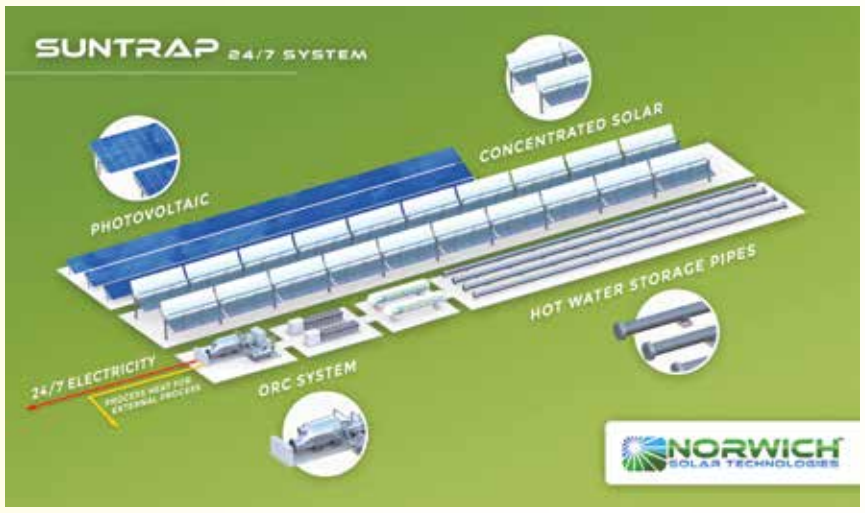
Altogether, I have been through four power outages that lasted upwards of a week. From those experiences, I can say with absolute certainty that a tiny amount of electricity is a whole lot better than none at all. I think that everyone should have a small PV system like those available from TinySolar Vermont, just for emergencies.

Again, the TinySolar Vermont website is tinysolarvermont.com. ♻

# Local Solar Co. Developing Unique Approach to Generate Electricity

*George Harvey*

The U.S. Department of Energy (DOE) supports some innovative technologies through the Small Business Innovation Research and Small Business Technology Transfer program. Of special interest here is a grant given to Norwich Solar Technologies (NST) for its unique approach to concentrating solar thermal power for generating electricity on a continuous basis, 24 hours per day.




*Norwich Solar Technologies' SunTrap™ concentrating solar system. Images courtesy of NST.*

*Green Energy Times* has run numerous articles about the innovative technologies from NST. Most of them have been about solar photovoltaic (PV) systems in the New England area. Here, however, we are dealing with a different technology, which has been under development for some time.

Many people are familiar with concentrating solar power. We might think of the 392-megawatt (MW) Ivanpah plant, in California, with its 173,500 heliostats, following the sun to focus light on three big towers that glow brightly when the sun is shining. Or we could recall the 354-MW Solar Energy Generating System's (SEGS) trough collectors, which use somewhat different technology to accomplish the same end. The first of these systems uses molten salt to transfer energy, and the later uses special synthetic oil, which is heated to about 750°F.

Both of these systems are sited in deserts in California. Both produce power reliably, but it is considerably more expensive than baseload power. And both of the plants are huge.

NST is developing a concentrating solar system, dubbed SunTrap™, with intended capability to produce electricity on a 24-7 basis, with the hope that its electricity will be much less expensive, at a much smaller scale, with much smaller investment, and in wider areas of the country than the deserts of the Southwest.

The NST SunTrap™ system under development uses pressurized water as the medium for transferring and storing energy. Because it is pressurized, it can be used at much higher temperatures than the water in a tea kettle. It is heated in solar troughs, like the SEGS system, and similar temperature to SEGS I and II.

Now comes the novel part of the system, the reason for getting the grant. Storing and using this very hot water at very low cost is a key enabler for the NST/SunTrap system. Challenges include dynamically separating the hot and cold sides of the pressurized water during operation in order to achieve the lowest possible costs for bulk energy storage.

Water in the troughs can be heated very hot without boiling, because it is under pressure. At such high temperature, it can be used to heat a liquid to boiling, to drive a turbine. This is done in a Rankine system, which means that the liquid is in a closed system, so the gas that turns the turbine is all captured and condensed back to liquid for reuse. In the case of the NST system, the liquid is organic, which means that its temperature range is different from that of boiling water, and so pressurized water can be hot enough to drive the system.

"This grant is specifically related to the pressurized water's thermal storage." Troy McBride, NST's chief technology officer, told us. "Our goal is the lowest cost electricity we can generate. The novel part, which requires research funding is the storage. We just completed the nine-month proof of concept grant. Now we will build a full-scale system with the Cleco Alternative Energy Center of the University of Louisiana, Lafayette."

The SunTrap™ system NST is building will include the concentrating solar collector, heat storage, and organic Rankine generator. It will be a hybrid-generating station with a matching PV array to produce daytime power, allowing a greater portion of heat collected to go into storage.

Under the schedule for the research in Louisiana, the project is to be completed within two years after the contract is signed. Within that time, the engineering and preparations for a respectably large project would have to be finished, the project built, and several months of testing completed, to show how a full-scale system will work.

*Top: Troy McBride, Chief Technology Officer of NST; Jonathan Lynch, VP of Research & Development*

"Our target customers are commercial, industrial, and municipal operations, universities, schools, and hospitals, in the sunbelt," McBride said. He said the smallest systems are about 1 MW and would be big enough to supply the equivalent of 200 homes for economies of scale.

We will watch this with anticipation. ♻

# W.S. Badger Flips the Switch to 100% Solar Energy in NH

***1,384 solar panels bring award-winning sunscreen manufacturer closer to its 2030 goal of Net-Zero***

With a flip of the switch, W.S. Badger, an award-winning manufacturer of organic personal care products and a certified B Corporation, will transition to 100% solar power for all of its operations. On Monday, August 17, at 10 am, Badger welcomed several distinguished guests, including Executive Councilor Andru Volinsky, State Senator Jay Kahn, and representatives of New Hampshire's Congressional delegation, to a ribbon-cutting ceremony at its headquarters in Gilsum, New Hampshire.

*The 486.7kW rooftop solar array at W.S. Badger is expected to generate approximately 600,000 kWh of clean electricity per year which will cover 100% of Badger's electrical needs. Photo courtesy W.S. Badger.*

The 486.7-kilowatt array, which consists of 1,384 solar panels installed by ReVision Energy, will produce zero carbon emissions. As one of the largest rooftop and ground-mount photovoltaic arrays in the region, it is expected to generate approximately 600,000 kilowatt-hours of clean solar electricity per year, the equivalent of taking 61 cars off the road, planting 338 acres of trees, or removing over 590,805 pounds of carbon from the atmosphere.

"Clean, renewable energy is the future, and our future begins now. Switching to solar has been a long-held dream. This amazing array is a daily reminder of Badger's commitment to reducing its carbon footprint," said Rebecca Hamilton, Co-CEO of W.S. Badger Company. "It's also a smart financial decision, especially in these uncertain times, as entering into a solar power purchase agreement (PPA) meant no capital outlay on our part to make it happen. This is a model that businesses can and should seriously consider. We're grateful to ReVision Energy and its impact investors, our partners, the community, customers, and employees for it a reality."

The project is made possible through a PPA under ReVision Energy Solar Impact Partners, with no upfront cost to Badger. Under the PPA, the impact investor Blue Haven Solar, with the assistance of lending partners NH Community Loan Fund and NH Charitable Foundation, will own and operate the solar array for a minimum of five years to take advantage of available tax incentives. Badger will purchase solar-generated electricity at a negotiated rate below the cost of traditional grid electricity. After five years, the Company will have the option to buy the system at a significant discount and continue generating free solar power for decades.

This project is estimated to save Badger $1.6 million over the 25-year warranty period and $3.8 million over the 40-year lifespan of the system. Not only will the array provide significant cost savings for powering its 23,000 square-foot-facility, but it will also allow the Company to support the community by sending some of the energy produced to its neighbors—a win-win for all.

"As an employee-owned solar company and fellow B Corporation, ReVision Energy is thrilled to partner with Badger as they become one of the first 100% solar-powered manufacturers in the region," said Dan Weeks, ReVision's Director of Market Development. "Our solar installers have been using Badger balms for years because they work and because the company behind them is a model of social and environmental responsibility. To know that these balms, along with Badger's many other healing products, are now being made with power from the sun is good news all around."

During periods of peak power demand in the spring and summer months, the system will provide up to 100% of the power required for Badger's manufacturing facility in Gilsum. This will help reduce demand on the local power grid and provide the facility with a reliable energy source. And when the system generates more power than Badger may need at any point in time, such as on weekends, that excess is exported back to the grid to benefit local customers. A metering system tracks the flow of power and applies discounted net metering credits for power sent to the grid.

Hamilton went on to say, "When it comes to reducing the impact of how we consume and use energy, this is a major milestone for Badger. We've always had a forward-thinking approach to sourcing, formulating, and packaging our products. Everything we do, we strive for green. Now we can proudly state that our beautiful post and beam facility and the products we make on-site are powered by the sun." ♻






# Solarize Hanover Continues Amidst Pandemic

*Yolanda Baumgartner*

Solarize Hanover has launched its 2020 campaign with a toolkit of online events in place of their usual in-person open house gatherings. This is year two of Sustainable Hanover's three-year campaign to double the number of residential solar systems in town. Community-wide, Hanover residents, the Town and Dartmouth College have installed more than three megawatts of solar capacity which would generate sufficient electricity on average to power 570 homes.

*Waters' residence in Hanover, NH with both rooftop and ground-mounted tracker systems. Image: Kim Quirk.*

As expected, the campaign is experiencing a slower response rate than in prior years because of the enormous uncertainties created by the pandemic. As of mid-August, sign-ups averaged one per day, fewer than half the number from the 2019 campaign. But Sustainable Hanover Co-Chair Marjorie Rogalski notes, "People are still concerned about our climate future, and we're happy to be here for those who are able to do something about it."

The campaign team decided to forego raffles and prizes for incentives that help those facing economic hardship during the pandemic. For every site or community solar evaluation completed, Sustainable Hanover is donating a meal to the LISTEN Community Meals Program. For every completed installation, the Solar Hanover partners will donate a portion of the sale to the solar fund for Hanover's affordable senior housing apartments on Summer Street.

New for 2020, Solarize Hanover is offering community solar as an option for those who cannot install rooftop or ground-mounted systems where they live. Norwich Solar Technologies developed the community solar option based on a new rule allowing on-bill credits for group net metering. This project is located in Charlestown, NH.

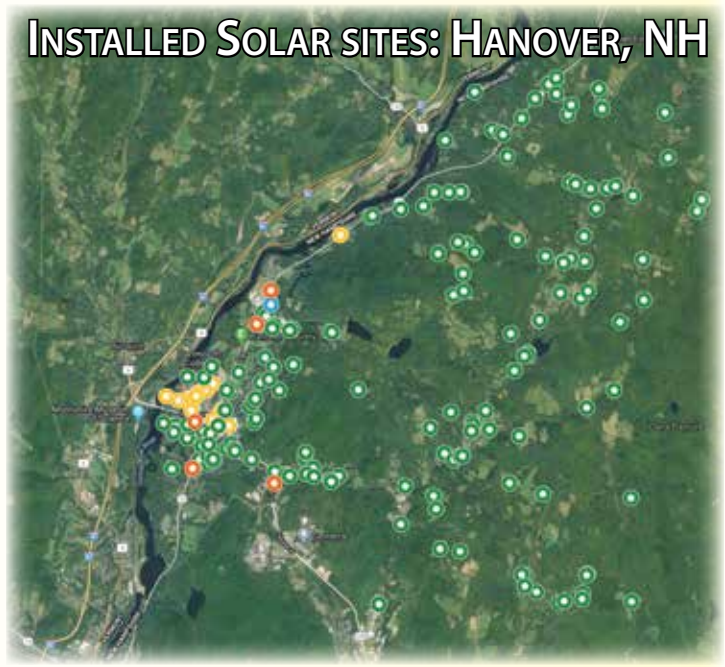
The other installer partners are ReVision Energy for rooftop and fixed ground-mounted systems, and Solaflect Energy for sun-tracking ground-mounted models.

Solarize Hanover is reaching out online with a Virtual Open House (https://www.hanovernh.org/2020_open_house.pdf) which presents videos with local solar owners speaking candidly about their solar experience. Cost savings, system reliability ("no drama"), fighting climate change, protecting the environment, and setting an example for the next generation are some of the themes they express. Solarize has also created a Google Earth map (https://www.google.com/maps/HanoverNH-Solarize) for users to see where 180 solar systems are located, quietly producing electricity throughout the Hanover community.

Solarize Hanover also hosted a webinar headlined by Dartmouth climate scientist Erich Osterberg. Professor Osterberg's research includes compelling data on the impact of climate change on our bi-state region. Town Manager Julia Griffin described the solar systems the Town has installed for its facilities and those currently in development to achieve 100% solar-generated electricity for Town operations by 2021. The recording from this August 26 webinar is posted at www.hanovernh.org/solarize.

Solarize 2020 will remain open through September. Hanover residents are invited to sign up at www.hanovernh.org/solarize to see if 2020 is their year to go solar. Both on-site systems and community solar shares completed in 2020 are eligible for the 26% Federal tax credit. The credit is scheduled to drop to 22% in 2021. Financing is available through general equity loans or through a custom solar loan such as those from Mascoma Bank which is tailored to work with the tax credit timing.

*Yolanda Baumgartner is a co-chair for the Sustainable Hanover program.* ♻




*Google Map of the current solar installed in Hanover, as they work towards their 100% renewable goal. [Green: residential; yellow: Dartmouth College; orange: Town; and blue: school]*

# EXTRA-ORDINARY SOLAR

## Solar Pioneer: An Interview with Steven Strong

*George Harvey*

It isn't very often that one gets a chance to talk with the people who started an important movement. I found the opportunity to interview Steven Strong, founder of Solar Design Associates (SDA), a memorable experience.

***Steven, you founded SDA in the mid-1970s. What got you started so early?***

I got interested in electricity early. My father was an electrician, and he took me to work with him. At eight years old, I was helping him rough wire homes. In high school, I took as many shop courses as I could, as they were the most interesting. This included four years of electronics as well as engineering drawing courses back when all engineering drawings were created on a drafting table. I then chose a college engineering program with a co-op work program that put 'book learning' into practice.

This provided me with a marketable skill set early on, and I landed a 'to-die-for' job as a junior engineer on the power systems engineering team supporting the Alaskan pipeline. We were responsible for powering the remote gate-valve equipment stations: essentially two-story-high, automated faucet valves that can isolate sections of the pipeline in the event of sabotage or a seismic event. There were 52 stations, each requiring stand-alone power systems.

The pipeline experience paid very well, and I learned a lot. However, going to the end of the earth to extract the last drop of fossil fuel wasn't really where I wanted to be. I read about advances in photovoltaics (PV) and the vision of a renewable energy future became very compelling. I returned to Massachusetts with a bit of money and a lot of enthusiasm, started SDA, and enrolled in architecture school.

*U.S. Mission to the United Nations, Geneva – America's first solar-powered embassy.*

*Discovery Center's Giant Solar Cube. Images courtesy of Steven Strong.*

***How did you get started? What were your early projects?***

I started with solar thermal and stand-alone PV applications while also designing ultra-efficient residences with passive and active solar.

In 1977, SDA was asked to design a large-scale solar thermal system to supply domestic hot water to a 286-unit housing complex. The project developer was also keen on trying PV so we fielded one of the first grid-tied PV systems beyond the fence of a government lab to power the solar thermal pumps and controls. Since there were no guidelines on interfacing PV with the grid, I suggested that we reach out to the local utility for guidance. The project developer was not interested. After confirming the installation was complete, he threw the switch starting up the system. Afterward, he shared this: "Steven, something you should learn early in your career: It's much easier to ask forgiveness than to ask permission."

When the ribbon-cutting event came, the developers invited the usual dignitaries, the Mayor, Governor, Senator Kennedy, as well as executives from the utility. All speakers, including the utility representatives, went on about how innovative the project was. The utility folks made no mention about grid-tying the PV.

Shortly thereafter, the U.S. DOE was looking to field the first occupied solar residence fully powered by PV. SDA was retained to design the highly efficient house, integrate the solar systems and work with a builder to construct it. The Carlisle House – as it became known, received worldwide attention. It differed from earlier 'behind the fence' demonstrations as it was to be built on a private parcel and sold to a family after initial monitoring.

Boston Edison, the utility that served eastern Massachusetts, noticed all the interest the Carlisle house received and, in 1983, reached out to us to design and build another solar-powered residence. The "Impact 2000 House," as it became known, was to be representative of how we would be living 20 years hence. In addition to a roof-integrated PV and solar thermal, features included passive solar gain, super insulation, internal thermal mass, air sealing, high-R glazing, ground-coupled heating and cooling and earth sheltering. It became the subject of a national TV series on PBS. Subsequently, Rodale Press invited me to write the book: "The Solar Electric House."

New England Electric, the utility that served central MA, had seen all the notice the Impact 2000 House received and reached out in 1985 asking SDA to help them field the first solar-powered neighborhood. Their research engineers were interested in studying the impact of multiple small generation sources on their distribution network and selected Gardner, MA for the project. In addition to an entire neighborhood of rooftop PV, the initiative also included solar for the city hall, library, community college, a furniture retailer and the local Burger King. The 'Gardner Project' was well-publicized drawing interest, and tourists, from all over the world.

As we completed Gardner, the Sacramento Municipal Utility District (SMUD) was persuaded by citizen opposition to shut down their nuclear power plant – a clone of the infamous Three-Mile Island disaster. The citizens' campaign promoted solar power as an alternative. In response, SMUD asked SDA to provide technical support in developing their solar program that included everything from residential rooftop to commercial, industrial, and utility-scale applications. After the SMUD solar effort got underway, multiple utilities asked us to help them to incorporate solar into their plans – including LADWP, TVA, NY Power Authority, Austin City Electric, Seattle City Light, So Cal Edison, San Diego G&E, and PG&E – among others.

*First solar-powered neighborhood, Gardner, Massachusetts in 1985.*

***That's quite a start. You were responsible for a number of other solar firsts. Could you tell us about some of those?***

With my interest in architecture, we focused on the integration of solar in buildings. We were responsible for the design of the first solar-powered Olympics. That was the 1996 Atlanta Summer Games. When complete, the system was the largest solar rooftop in the world.

Other notable firsts followed, including:

- 1st energy-positive academic facility (Oberlin College, Environmental Studies Center) - 2001,
- 1st solar- and wind-powered campus (MA Maritime) - 2006,
- 1st Major League Stadium to go solar (SF Giants' AT&T Park) - 2007,
- 1st Network TV studio to go solar (PBS) - 2008,
- 1st zero-net energy college academic laboratory (UMass system) - 2010, and
- 1st energy-positive multi-story office building (Bullitt Center, Seattle) - 2013.

***I understand you were involved with some other truly unique projects. What are some of those?***

- There were the "Electric Sunflowers," an early dual-axis tracker field, custom-designed for Robin Williams for his place in Napa, CA in the mid-90's.
- The nation-wide rollout of BP's solar powered gas stations from coast-to-coast, including early electric vehicle charging ports - 2001.
- The giant Solar Cube for the Discovery Center in Santa Ana, CA - 2002.
- A building-integrated "solar skin" for the U.S. Mission to the United Nations in Geneva - America's first solar powered embassy - 2004.
- Powering the King Abdullah University of Science and Technology in Saudi Arabia with solar, the first university planned from the ground up to be fully powered by solar - 2012.

***Looking back on your career, what other highlights stand out?***

President Carter invited me to the celebratory ribbon cutting of the first solar system on the White House. I was very discouraged when it was removed by the next administration and promised myself, I'd work to get solar back on the White House. It took me two decades to secure the window of opportunity. In the end, we installed three solar systems – all in one week while the residents were away on summer holiday. We roof-integrated one of the systems making it difficult to remove.

Cont'd on p.13

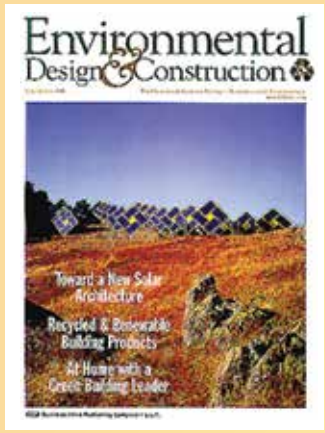
*Cont'd from p.12*

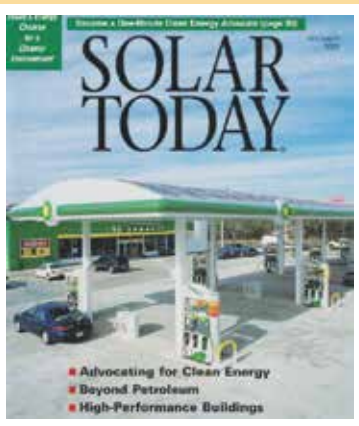
Another high point was being appointed by the Clinton administration to serve as the U.S. representative to the International Energy Agency's Expert Working Group on Solar – an appointment I held for seven years.

I was surprised and honored to be named "An Environmental Hero of the Planet" by TIME magazine.

And another was receiving the Abbot Award from the American Solar Energy Society and, subsequently, being made a Fellow of ASES.

Looking back to our humble beginnings, I'm pleased that SDA has been able to complete work in Europe, Asia, the Middle East, Africa, Latin America, the Caribbean, Canada and across the U.S. from Maine to Hawaii.




*Lt: "Electric sunflowers" - an early field of dual-axis trackers custom-designed and built for Robin Williams by Solar Design Associates; Rt: BPs solar-powered gas stations.*

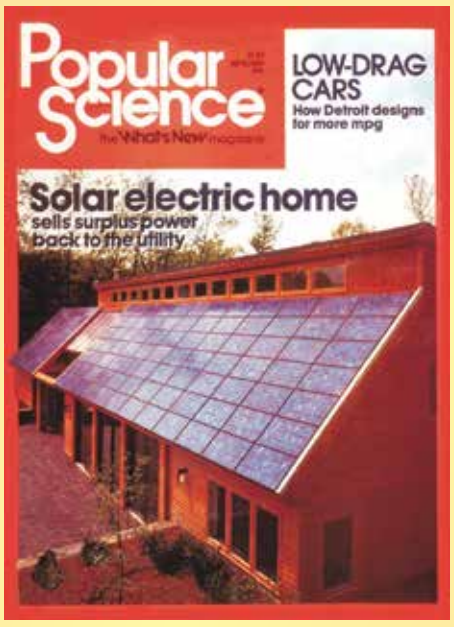
### *What do you see for the future of solar power?*

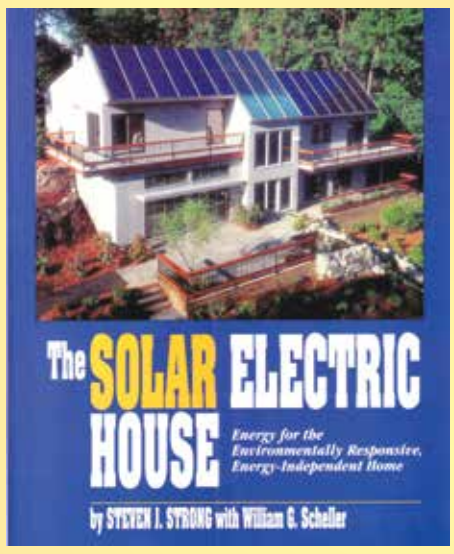
The industry is rapidly expanding integration of energy storage with solar and wind. The advent of cost-effective storage is changing everything!

Much of our work incorporates storage. One of our early projects was a solar+storage plus generator hybrid system for a barrier island off the coast of Belize in 1994. Another was a solar/wind+storage hybrid that powers a private island in the Caribbean in 2006. We powered Cuttyhunk Island off the south coast of MA with a solar+storage plus generator hybrid system. [See GET's article, "Cuttyhunk Island's Microgrid," in June 2018, https://bit.ly/3h9zalu.] We're currently powering another Caribbean island as well as fielding two industrial micro-grids of 10 MWh each – one in Oregon and the other in Mexico.

We're always looking to push the envelope. Another exciting current project is a solar plus storage micro-grid to power another island off the New England coast. The island's been supplied by an under-sea cable nearly 40 years old that's had issues and could fail at any time. We'll couple this micro-grid with a novel new storage technology employing super capacitors in lieu of traditional battery technology. Their micro-grid will cost far less than a new cable and their island will be self-reliant.

When I started SDA, I hoped to see the day when renewables would become the lowest-cost option making a strong and compelling case for a clean energy future. The rapid ascension of storage has now made utility-scale renewables more attractive than all modes of conventional generation including gas plants. In areas with abundant renewable resources, the total capital and operating expenses of new utility-scale renewables is now lower than simply keeping fully depreciated coal plants open. In many applications, storage alone is even deferring or eliminating the need for new generation. Further cost reductions along with continued technical improvements in both renewable generation and energy storage are making renewables the best choice in the majority of utility-scale applications. ♻





*Top:* Popular Science *cover featuring the Carlilse House; Center: The Impact 2000 house is featured on the cover of Strong's book,* The Solar Electric House*; Bottom: The Bullitt Center, the first energy-positive multi-story office building.*

# Municipal Solar Madison, NH

*This article is adapted from Tom Eastman's article that appeared in the Conway, NH) Daily Sun in July, 2020*

*Ribbon-cutting ceremony (July 20, 2020) was held for the municipal solar in Madison, NH. From the left are members of the Madison energy committee along with selectmen Ray's O'Brien's wife, Brenda, and Brittany Angelo of ReVision Energy. Image: Tom Eastman.*

The alternative energy vision and community legacy of late Madison resident, Ray O'Brien, shined bright at dedication ceremonies on a hot and sunny Monday morning on the town of Madison's new "Ray's Array" solar electric system behind the town-owned Burke Ballfield.

Noreen Downs, of the Madison Advisory Energy Committee, chaired Monday morning's dedication held behind the town garage, town hall, town fire department, town maintenance garage and library. All the buildings are being supplied power from the 63-kilowatt, 180-photovoltaic panel solar array, installed by ReVision Energy and which will produce more than 80,000 kilowatt-hours of solar electricity each year.

"Back in 2013, Ray O'Brien and I were part of the Citizens for Energy Efficient Communities. We asked selectmen if they would be interested in having some analysis done on town buildings for energy efficiencies. We went before the town legislative body in 2014 and they approved the establishment of the energy committee. Ray O'Brien was the chair. At the end of 2014, we put together quite a list of timeline projects and half of them have been completed," said Downs.

At the end of 2018, the committee decided to look further into solar and did analyses of the energy efficiencies of Madison Elementary School and town buildings. The school was mired at the time in other projects concerning maintenance, however, and was not in a position to embrace the solar project; but, the committee put out a request for proposals focusing on town buildings.

Voters at a town meeting last year approved a warrant article that authorized selectmen to enter into a lease agreement with a third-party investor for renting a piece of town property for the purpose of the installation of a ground-mounted solar array. The area chosen required no tree removal or grading. It was perfectly suited for solar application.

Downs said the Energy Advisory Committee will track the progress of this project in hopes that one day a similar project can be recommended for the elementary school, adding that the project is expected to save on the overall cost of electricity for years to come while providing a positive impact on the environment.

"What you see here today is the result of that effort. It took us about a year and a half for the paperwork which was finished in 2019, fortunately before the pandemic. The installation was completed a few weeks ago and actually turned on July 2. It is producing quite a bit of power which can be followed on a website. It is doing a fabulous job," said Downs.

Downs was joined by the Energy Committee co-chair, Russ Dowd, former general manager of Pine Tree Power of Madison, a wood-to-energy plant. He also praised the vision of O'Brien in wanting to lead Madison's alternative energy efforts, noting that as a teacher and community leader, O'Brien's legacy was to plant seeds — the fruits of which townspeople are celebrating today with the new array.

"For me, this project

*Cont'd on p.38*

# FEDERAL

## FEDERAL INVESTMENT TAX CREDIT

• The federal investment tax credit (ITC) for most technologies, including solar, wind, heat pumps, and fuel cells, is 26% 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 energy independence
• Promote resource conservation, public health, and the environment
• Diversify markets for agricultural, forestry products and agricultural waste materials
• Create jobs and enhance economic development in rural America
• For more information go to www.rurdev.usda.gov/BCP_Biorefinery

# REGIONAL

## NEW ENGLAND GRASSROOTS ENVIRONMENTAL FUND

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

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

# VERMONT

## CLEAN ENERGY DEVELOPMENT FUND

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

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

• Retails sales of "Advanced Wood Boilers" are exempt from Vermont's 6% sales tax. http://tax.vt.gov/exemptions,
• Residential Bulk Pellet Bins. Up to $3,000 rebate. Details at www.rerc-vt. org or call (877) 888-7372.
• **More into at at 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

**In Rutland & Bennington 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 Efficiency Vermont 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 Efficiency Vermont.

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

• Stowe Electric Customers can get a $150 rebate with the purchase of a pellet stove.

## VT TAX CREDITS

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

### Tier III programs

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

## EFFICIENCY VERMONT

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

### Lighting

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

### Weatherization

• Comprehensive air sealing and insulation projects with an Efficiency Excellence Network contractor: 50% off eligible project costs, up to $2,000. Moderate income Vermonters get 75% off up to $5,500.

• 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 - $200-$400 rebate

### Heating/Cooling/Water Heating

• Central wood pellet boilers and furnaces: $6,000 rebate (in partnership with CEDF)

• Advanced pellet or cord wood stove: $650 discount at participating retailers, plus $100 for proper removal/disposal of old stove

• Heat Pumps:
  • Air-to-Water System: $1,000/ton rebate
  • Centrally-Ducted System: $800/ton rebate
  • Ductless Heating & Cooling System: $200-$300 discount at participating distributors
  • Heat pump water heaters: discounts up to $300-$600 discount 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 Most Efficient models.

• Smart thermostats: up to $100 back for select ENERGY STAR models.

• Electric utility rebates may also be available.

### Residential New Construction

• Enroll to receive a home energy rating, expert technical assistance, and incentives – Efficiency Vermont Certified™ projects receive up to $4,000 cash back

• Washington Electric Coop and Vermont Gas Systems customers may also receive additional incentives

### Commercial and Institutional

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

### Other Opportunities To Save

• Advanced Power Strips – special pricing starting at $6.95,

• Pool Pumps – up to $600 back on select ENERGY STAR models

• Home Energy Loan – finance up to $40,000 in energy-related home improvements with interest rates starting at 0%. First 6 months of loan payments covered for a limited time (up to $900). Restrictions apply.

# 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

Effective March 6, 2020, incentives are limited to 25% of the total project cost or $10,000 if less than the AC incentive payment otherwise calculated, whichever is less. The Program is available to non-residential structures with a commercial electric meter located in New Hampshire.

Incentive levels for PV systems are as follows:

• $0.20/watt (lower of AC and DC) for new solar electric facilities.
• Expansions to existing solar systems are not eligible.
• Incentive levels for solar thermal systems are as follows:
• $0.12/rated or modeled kBtu/yr for new solar thermal facilities fifteen collectors in size or fewer; $0.07/rated or modeled kBtu/yr 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: 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 $0.20 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

• Program is currently closed: $1500 - $1900 per system based on annual system output

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

• 40% of the heating appliance(s) and installation cost, up to a maximum of $65,000. An additional 30% up to a maximum $5,000 is available for thermal storage.

Systems must be 2.5 million BTU or less

### Residential Wood Pellet Boiler/Furnace

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

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

### LOCAL INCENTIVES

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

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

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

**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.

**NHEC's ENERGY STAR Heat Pump incentive structure for 2020 is as follows:**

**Heating and Cooling -** (Must meet or exceed the minimum efficiency requirements - SEER 18/EER 12.5/HSPF 10 ) $500 per ton

**Geothermal -** (Must meet or exceed the minimum efficiency requirements - EER 16/3 COP ) $500 per ton

**Cooling only -** (Must meet or exceed the minimum efficiency requirements - SEER 15/EER 12.5/ ) $70 per ton

**Wi-Fi thermostats -** (Must be installed with a heat pump also receiving an incentive ) $100 rebate per T-stat

**Weatherization Bonus –** (Available for members participating in the Home Performance with ENERGY STAR Program ) $250 per ton

**Whole House Bonus –** (Available for qualified heat pump applications that offset 80% or more of the total heat load. Two years of fuel use history is required ) $250 per ton

**ENERGY STAR Heat Pump Water Heater –** (Must meet or exceed 2.3 energy factor ) $750 rebate on 50 gallon or greater

**Loan Buy down –** NHEC provides interest subsides through participating banks and credit unions for the installation of qualified heat pump installations. Must get pre-qualified. Loans up to $15,000 after rebate.

### NH Home Performance with ENERGY STAR

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

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

### NH ENERGY STAR Homes

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

### NHSaves Residential ENERGY STAR ® certified Products Program

- Mail-in/online rebates are available toward the purchase of the following ENERGY STAR® certified products: Clothes Washers, Clothes Dryers, Room Air Conditioners, Room Air Purifiers, Refrigerators, Dehumidifiers, and Pool Pumps. For current rebate information and forms go to www.NHSaves.com/appliances.
- Refrigerator/freezer recycling is available – unit must be in working condition (10 – 30 cubic feet in size), program includes free pickup and $30 rebate. For program requirements and scheduling information go to www.NHSaves.com/recycle.
- Instant rebates available on certain ENERGY STAR® certified LED light bulbs purchased through participating NH retailers, and instant or mail-in rebates available on ENERGY STAR® certified light fixtures (varies by retailer, see store associate or rebate form for details). Infor: NHSaves.com/lighting.
- Rebates are available to residential electric customers of the four NHSaves utilities.

### NHSAVES Online Store

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

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

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

### NHSaves: nhsaves.com

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

- Rebates of up to $500/ton on Air Source and Geothermal Heat Pumps. Rebates of $500 - $750 on Heat Pump Water Heaters. Rebates of $100 on WiFi Thermostats
- Program details and application at www.NHSaves.com/heating cooling

### Other NH Electric Utility Programs

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

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

### Business Programs

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

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

### NH Weatherization Assistance Income-Eligible Programs

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

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

## MASSACHUSETTS

### Commonwealth Solar Hot Water (SHW) Programs

- Visit http://www.masscec.com/shw

### MassSave Heat Loan SHW

Through this loan program, customers may borrow at 0% interest the costs of a Solar Domestic Hot Water and/or Thermal Heating system. Apply through receiving the MassSave Energy Audit. .

### Energy Efficiency

- 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 at http://www.masssolarloan.com/.
- Renewable Thermal Infrastructure Grant Program: www.mass.gov/funding

### MA SMART INCENTIVE

This info may have been updated. Check website. 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

This info may have been updated. Ck website. 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

This info may have been updated. Ck website.

- 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

This info may have been updated. Ck websit3: https://mor-ev.org/

## NEW YORK

### RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NYSERDA

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

NYSERDA currently has a $1,500 per ton incentive on geothermal for residential systems.

Visit NYSERDA's new website. It is user-friendly and a one-stop learn-all site: https://www.nyserda.ny.gov/ny/PutEnergyToWork/Energy-Program-and-Incentives/

### 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

### Heat Pumps

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

# Shelburne, NH's New Energy Committee Sets Bar High for Energy Projects

*Emily Roscoe*

The Town of Shelburne's new energy committee is busy leading the way forward on clean energy projects. The northern New Hampshire town has a population of about 350 people. Two of those residents, Ray Danforth and Michael Prange, formed the Shelburne Energy Committee last year and are setting a high bar for what energy committees can accomplish for their communities.

*A 15-kilowatt solar array was installed on the Shelburne town hall. The solar array offsets all of the electricity consumed annually by the town hall. Courtesy photo.*

Danforth and Prange, working closely with the Shelburne Select Board and the Budget Committee, are responsible for recent projects both in improving municipal building energy efficiency and in developing a renewable energy project.

Previous energy upgrades helped set the stage for these successful projects. Earlier in 2019, the Select Board approved an LED lighting project recommended by Danforth and Prange, working in partnership with Melissa Elander, a North Country Energy Circuit Rider with Clean Energy NH. Clean Energy NH staff provide technical assistance to towns and schools in implementing energy upgrades in Coös County. With Eversource (the electric utility) covering 34% of the cost of the $4,300 project lighting upgrade, the resulting electricity savings will reduce the town's electric bill by over $1,000 each year, and are expected to pay for the project in four years.

The energy efficiency and LED lighting upgrades at the Town Hall and fire station paved the way for the next project: a 15-kilowatt solar array mounted on the roof of the Town Hall. The solar array offsets all of the electricity consumed annually by the Town Hall. These projects will save the town money starting in year one.

Prange, who has a background in computer coding, designed a financial model for the solar array to understand the savings over time. The 25-year forecast of electricity expenses projects that the town will save over $700 in the first year and over $4,000 in year 25.

Prange's analysis drew upon his background and used data from Danforth's existing solar array to confidently project the value of the electricity generated by the solar project into the future. The analysis looked at both the value of net-metered electricity, or extra power exported to the utility distribution gird, and the value of electricity used to power the Town Hall. Prange's "monte carlo" model takes the risk of forecasting uncertainty into account by projecting a range of possible outcomes.

The Energy Committee drafted a warrant article to install a solar array on the roof of the Town Hall to offset 100% of the building's energy use. An important aspect of the warrant article gave the Select Board flexibility to obtain financing and approve the system only if it made financial sense for the town.

A big part of the work of the Energy Committee involved educating town residents in preparation for the town meeting vote in March 2020. Danforth, who has a long history as an engaged citizen of Shelburne and the Coös County community, developed informational leaflets which he distributed at the town transfer station. He also hosted educational meetings in his home. On Town Meeting Day, the vote in favor of the solar project was nearly unanimous. As a result of the public outreach conducted by the Energy Committee, residents who were initially hesitant about the project ended up being the residents speaking up at town meetings in favor of the project, answering questions, and voicing support.

Once the financial analysis made clear that solar was a good deal for the town, the Select Board worked with a local bank to obtain a loan at less than 3% interest. Given current low interest rates, a 15-year loan can be paid with the savings that would otherwise have gone to Eversource to pay for electricity. This generates positive savings starting in year one. Structuring the project this way means that the project is a revenue source rather than an additional expense to the town.

The 15.372 kW AC PV system was installed in July by 603 Solar out of Stratham, NH. The LED lighting projects were completed by Energy Management Consultants, Inc. Ray and Michael reflect that an important part of their success was keeping the town residents, committees, and especially the Select Board informed and engaged throughout the process.

*Emily Roscoe works for Clean Energy NH as the North Country Weatherize Coordinator for Coös County.* ♻



# RELiON Battery Joins 1% for the Planet

## 1% of annual sales to be donated to environmental causes

On July 30, 2020, RELiON Battery announced that they have become a member of the international non-profit organization, 1% for the Planet, (http://bit.ly/1pct4planet) pledging to donate 1% of annual sales to fund eco-friendly, earth-conscious causes and organizations around the globe.

"We are thrilled to be a member and support a forward-thinking organization like 1% for the Planet. This partnership is a natural fit for our core values. We, along with our customers, live and breathe adventure and relish the opportunities that our planet provides. Our tagline, Challenge Your Limits, reflects our philosophy to push yourself to greatness. So, it's only logical to give back and support organizations making a real difference," said RELiON CEO Paul Hecimovich.

Members of 1% for the Planet contribute one percent of annual sales directly to any of the approved nonprofit environmental organizations in the network. Nonprofits are approved based on referrals, track record and environmental focus. Thousands of nonprofits worldwide are currently approved.

"Currently, only 3% of total philanthropy goes to the environment and, only 5% of that comes from businesses. The planet needs bigger support than this, and our growing network of member businesses is doing its valuable part to increase giving and support on the ground outcomes. We're excited to welcome RELiON Battery to our global movement of over 2,700 businesses," said Kate Williams, CEO of 1% for the Planet.

RELiON's membership with 1% for the Planet is only the start of a long-term mission for positive environmental impact. RELiON calls this quest "Limitless Blue" – blue battery, blue sky, blue ocean – because action has no limits.

"Limitless Blue is about reducing our impact on the planet and using our business for a force of good moving forward. We face a long list of environmental challenges around the world. It is in all of our interests to work towards creating a healthier planet and we believe business has a responsibility to give back," explained Hecimovich.

RELiON's lithium iron phosphate batteries offer several advantages over other technologies in terms of resource consumption and safety, and have great potential to help reduce carbon emissions when used in wind and solar power systems. Most important, LiFePO4 batteries are inherently stable and non-combustible, and free from dangerous and messy outgassing, fumes and leaks.

"RELiON customers enjoy being in nature, living off-the-grid, fishing, sailing and much more. We feel that given the environmental friendliness of lithium batteries, it is our duty to do better as a business, making our batteries as sustainable as possible for our customers whom enjoy being outdoors," added Hecimovich.

To learn more about RELiON Battery, visit relionbattery.com. ♻

# VT-based 'The Peck Company' is in the News Again

*George Harvey*

The Peck Company formerly Peck Electric) has been of special interest here at *Green Energy Times (GET)* for a long while. It has been one of our supporters, but it has also been the source of some fairly impressive news. For instance, *GET* reported "Peck Electric: In the News Again" in May of 2019 (https://bit.ly/3hzbkjm).


*Jeff Peck rings the opening bell on the day The Peck Company (S. Burlington, VT) went public. Photo: The NASDAQ Stock Market.*

Peck Electric was founded as a family-run business in 1972. For almost fifty years, it has prospered, growing from a small company servicing the area around South Burlington, Vermont, to having an important presence well beyond the local region. As a leading installer of commercial solar photovoltaic systems, it grew to the point where it was listed on the NASDAQ exchange under the symbol, "PECK," in 2019. That same year, *General Contractors Magazine* named Peck Electric "The Best Residential Contractor" in Vermont.

The Peck Company has grown to have wide geographic importance. Impressively, it was rated by *Solar Power World* as number 59 in the nation for the total amount of solar capacity installed in 2019 (https://bit.ly/3b259lj).

Now, The Peck Company is back in the news again. It has entered into an agreement under which it will acquire Sunworks, Inc. Under the terms of the agreement, shareholders of Sunworks will receive stock in The Peck Company Holdings, Inc.

The combination of the two companies makes a good deal of sense. Where Peck is based in Vermont, Sunworks is based in California. Combined, they have a coast-to-coast presence. Peck is known for leadership in commercial solar engineering, procurement, and construction; and Sunworks has expertise in agricultural, commercial, and industrial applications, along with public works and residential installations. This gives the combined company a broad base of expertise.

While the new Peck Company will be greater than it had been, serving a national market with increased abilities, it will do this with a great savings in costs. Speaking of mergers and acquisitions, people make reference to synergies. Cost synergies make it possible for the combined company to avoid expenditures that would have been duplicated. In the case of the Peck Company and Sunworks, the avoided costs come to about $6 million per year.

Jeffrey Peck, Chairman of the Board and Chief Executive Officer of Peck, commented, "This is a transformational combination, leveraging the respective strengths of the two organizations and creating a national leader in the fast-growing and resilient solar energy industry. It provides Peck expansion, scale, an enhanced financial profile and a stronger platform from which we can continue to build more solar projects. Our integration with Sunworks will extend our presence to the west coast and broaden our offerings to agriculture and public works. The transaction solidifies our three-pronged growth strategy that we announced a year ago when we listed on Nasdaq through a SPAC merger. Since we have been public, we (1) delivered organic growth of revenue from $16 million to $28 million in the

*Cont'd on p.38*

## *Congratulations to the* Top Solar Contractors in our Region

*George Harvey*

Every year, *Solar Power World (SPW)*, one of the top web sites and print publications for news relating to the solar power industry, publishes a list of the top contractors in the United States (https://bit.ly/3b259lj). The list is based on the number of kilowatts (DC) the contractors installed in this country. The list is very large – this year there are 407 companies listed, but it is drawn from data on over 10,000 companies, which are spread across all fifty states.

Looking at the list, we can see contractors in all of the states within *Green Energy Times'* primary readership area. There are companies based in Maine, Massachusetts, New York, and Vermont. While no company is listed as based in New Hampshire, there is at least one company, ReVision Energy, which has multiple offices there.

The SPW list is impressively long. It is also multidimensional, because it can be viewed in numerous ways. We hope to touch on this in greater depth in the next issue.

In the meantime, Renewable Energy Vermont (REV) has simplified the task of sorting this out by producing a list of its own members that are mentioned by SPW. It has extracted out of the SPW data a list of its own member companies it has represented in it. We might mention that while REV members all do business in Vermont, not all REV members are based in the state.

The REV list is divided into two parts. The first lists the top solar contractors in Vermont, providing their ranks both for the state and nationally. This list is ordered by rank in Vermont.

- Peck Company – South Burlington, Vermont – #1 Vermont; #59 nationally
- Green Lantern Solar – Waterbury, Vermont – #2 Vermont; #102 nationally
- Norwich Solar Technologies – Norwich, Vermont – #3 Vermont; #118 nationally
- Aegis Renewable Energy – Waitsfield, Vermont – #4 Vermont; #190 nationally
- ReVision Energy – Enfield, New Hampshire, and South Portland, Maine – #7 Vermont; #88 nationally

With changes in solar power technology, *SPW* has had to add more data, creating other lists as needed. One of these focuses on the solar plus storage market in a manner similar to the treatment of solar contractors (https://bit.ly/2EvGtpG). There are 137 companies in SPW's list of installers of solar plus storage. And again, REV has given us a list of its contractors that appear on that list.

- Green Lantern – #8 nationally
- ReVision – #20 nationally

We offer our congratulations to all these companies. We also wish to thenk Renewable Energy Vermont and the state of Vermont itself for being the home of such inspiring companies.

And while we are at it, congratulations to our friends at Apex Solar, which appears as #194 on the *SPW* list of top solar contractors in the U.S. Apex Solar is based in Queensbury, New York and not on the REV lists. ♻

# We Worry About the Wrong Things

*Joanne Coons*

It was a special day. I got to go to Boston to attend the NESEA Green Building Conference in March 2017, with two of my favorite people and husband. The bonus was they just purchased a Tesla S and we drove out together in it. Before returning back to the Albany capital region, we stopped at a restaurant on the Boston waterfront and more good luck was with us as we snagged a table overlooking the harbor. During dinner we suddenly saw many police boats, fire boats, and coast guard boats enter the harbor. I had never seen anything like it. Was it a drill? Was there a problem? It certainly was unsettling to see such a response so close to where we were. And then, like a giant mountain range, appeared the biggest ship I ever saw. It rose above and silhouetted our horizontal viewscape. It was a delivery of liquefied natural gas. This event was one of the most ominous and scary memories I have, and I will not forget it. The "what if" question is even scarier.

We had just been to Halifax, Nova Scotia the year before and learned about the 1917 boat explosion that killed 2000 and injured 9000 which connected Boston and Halifax in a special way. The Boston Red Cross responded immediately to assist the injured and, to this day, Halifax provides Boston with a Christmas tree as a sign of appreciation. It is beyond me why anyone would site something so dangerous in such a highly populated and important place. I feel almost as much fear when a gas tanker passes me on a highway or a "bomb train" goes by on the railroad.

I feel strongly that we need to electrify everything, heating, cooling, cooking, and get away from fossil fuels. They aren't good for the health of our planet which includes us. The sun delivers free, non-combustible energy which is both healthy and safe. It's a truism that the sun doesn't shine at night, by tamping down our night energy usage and supplementing with other renewables, we can supply what we need. We have adjusted our lives and schedules during Covid-19; we can adjust our energy usage to accommodate our supply.

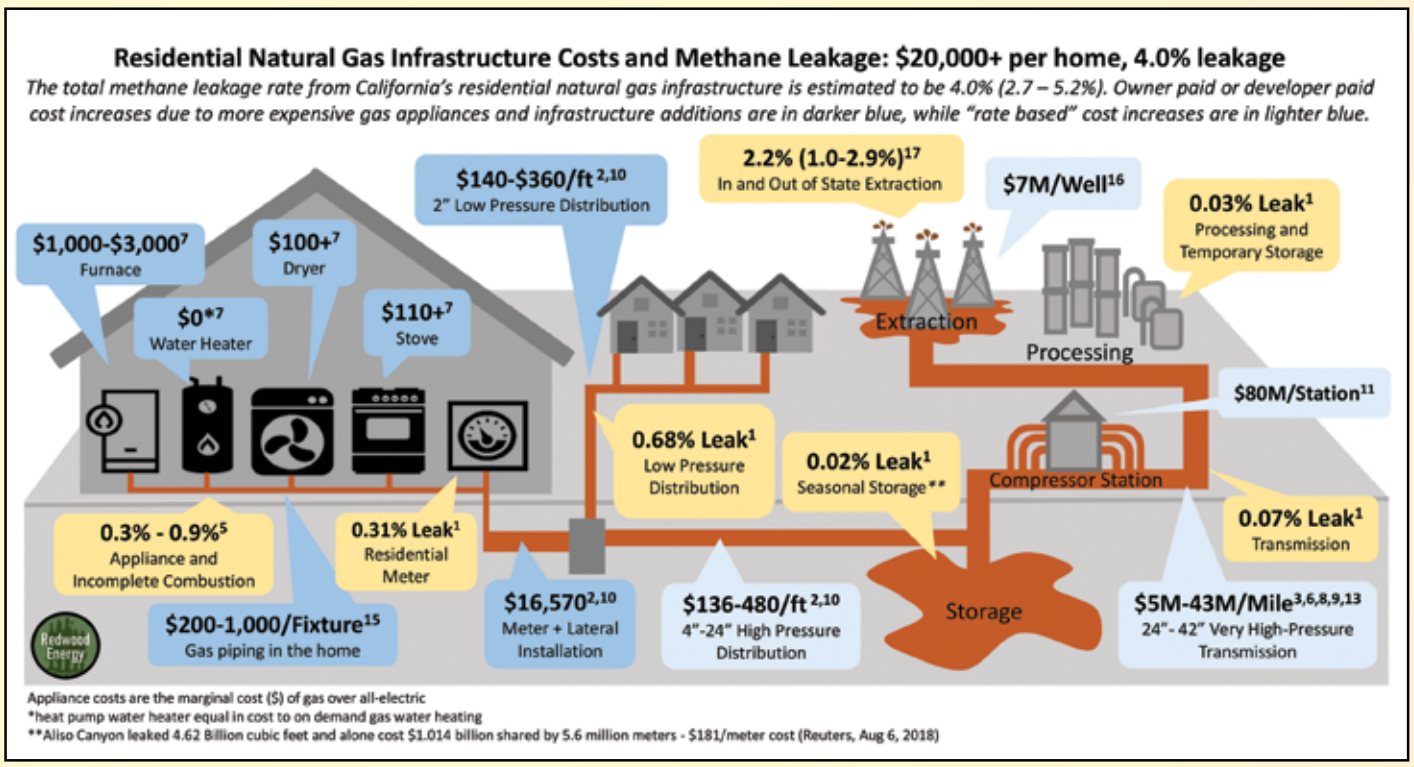

*The LNG Tanker Berge Boston . Inset: a close-up of Coast Guard Seaman Darcy McGrail mans an M-240-B machine gun during a security escort of the liquid natural gas tanker Berge Boston in Boston Harbor in January. A congressional study questions how prepared the government is to handle a terrorist attack on an LNG facility. Images: Luke Pinneo, U.S. Coast Guard.*

Dr Richard Perez, SUNY Albany professor has researched solar energy all of his career and has developed a road map for a safe, clean energy future. He spells out his solution in a 26-minute YouTube video http://bit.ly/Perez-video. Or you can read his research paper at http://bit.ly/Perez-paper

Let us pause and reflect on how our actions can have unintended consequences. What we choose to do today might solve an immediate problem, but it could create bigger ones down the road.

*Some resources that describe the dangers of LNG transport: http://bit.ly/LNG-danger-1 ; http://bit.ly/LNG-danger-2*

*Joanne Coons is an adjunct professor at Hudson Valley Community College, TEC-SMART facility teaching PV Theory and Design. She is a member of NYSES (New York Solar Energy Society), NY GEO, HeatSmart Capital Region and the Town of Clifton Park GREEN Committee.* ♻




# Gas Pipelines in New Hampshire: 'Another One Gone and Another One Bites the Dust'

*George Harvey*

Whether it is court decisions, potential customers fading from view, or just mysterious decision making, companies developing natural gas pipelines have been giving up on them. A pipeline in Lebanon, New Hampshire, gave up on developing it and let permits lapse, without much explanation. The Granite State pipeline, which would have replaced older infrastructure, was also abandoned after its developer found it would lose a large customer and the upgrade was not needed.

Natural gas pipelines are often under high pressure, and they often spring leaks. Wikipedia has a couple of good articles explaining this, one is its article, "Gas explosion," where the reader can find an impressive list of major explosions (bit.ly/WP-gas-explosions).

*House destroyed by a gas explosion in the Merrimack Valley, 2018. This was one of 40 buildings damaged or destroyed by explosions or fires resulting from a pressure surge. Photo: National Transportation Safety Board.*

Leaks are far more common than most people understand. In 2012, a study locating leaks by use of sensors on all the streets in Boston found 3,300 leaks in that city. When the Conservation Law Foundation duplicated the study to verify the result, it found that there were 4,000 leaks (https://bit.ly/WP-gas-leak-studies).

We should make one thing clear. Whether it is for heating, cooking, or transportation, natural gas is neither more effective nor less expensive than electricity. It has no major advantages except to feed obsolescent equipment. It is a horrible contributor to climate change. And it is unsafe.

We at *Green Energy Times* believe we do not need natural gas. We believe, in fact, its use should be stopped. We urge all readers to scrutinize the positions of all in office and vote in November for people who have taken strong environmental stands that include positions ending new pipelines. We could note that the Sierra Club, the Sunrise Movement, and Bernie Sanders have endorsed Andru Volinsky, who is a candidate in the New Hampshire Democratic gubernatorial primary race for the upcoming election, which takes place on September 8, 2020. In some cases, they explicitly cite Volinsky's position against new pipelines. ♻

# CLIMBING OUT OF THE CRISIS: A NET-ZERO ECONOMY

*George Harvey*

The German Institute for Economic Research, usually called the DIW Berlin from its name in German, is a non-profit economic research institution funded by the country's federal government. In early July, it published a report, "European Green Deal: Using Ambitious Climate Targets and Renewable Energy to Climb Out of the Economic Crisis," which argues that the changeover to renewables had to move much faster than it is to achieve a net-zero economy in Europe by 2050.


*Wind Lift I, a jack-up ship for installing offshore wind turbines. Photo: kaʁstn, Wikimedia Commons (https://bit.ly/30TU3v8).*

Two goals of special importance are mentioned to show how much the changeover needs to be sped up. The first is that the European Union (EU) needs to change its renewable energy target for 2030 from 40% to 65%. The second is that it must set a target of achieving 100% renewable energy by 2040.

A reader might wonder why it could be necessary to have 100% renewable energy in 2040, if they are to have net-zero emissions by 2050. The answer is that direct uses of energy, including electric generation, heating, and transportation, are not the only sources of emissions. Others that are important include emissions from industry, land use, and agriculture. If we are to use steel and eat meat, we need to have some way to draw down the emissions associated with those things.

The report looks at the most effective solutions, based on available time and resources. It recommends that the EU move away from nuclear reactors, because they take a long time to build and are not economically as effective for dealing with climate change as renewables and storage.

The DIW Berlin report does address the cost and difficulty of getting to the goals it recommends. It shows that the EU can achieve the goals, as can each country within it. Two countries in particular are mentioned as illustrations. France gets about three quarters of its electricity from nuclear reactors, and they will eventually have to be taken offline. Poland is heavily dependent on coal, and its coal plants will have to be shut down. The report shows that both of these countries can achieve the goals it recommends.

Paying for the changeover will not be easy, but it will also not be all that difficult. Report calculations are that it will cost about €3,000 billion ($3,530 billion), a figure that is not all that far from the amount used to address the COVID-19 pandemic. On the other hand, the switch to renewable energy would save the cost of the fuels it replaces, which is calculated at about €2,000 billion.

A switch to renewable energy and storage would have effects aside from pollution, climate change, and costs. It will make the EU more energy secure, and have positive effects on the economies.

One of the authors made an interesting observation. Bearing in mind that Germany is to have the Presidency of the Council of the European Council for the next six months, Christian von Hirschhausen, the research director of International Infrastructure, Policy and Industrial Economics at DIW Berlin, said, "The German EU Council Presidency could kill two birds with one stone: economic recovery and climate change mitigation. To that end, they must ensure that the expansive economic packages that were implemented in response to the coronavirus pandemic are used for investments in renewable energy and energy efficiency in the context of the European Green Deal."

The EU can achieve its climate goals with actions that also address the pandemic. It is a comforting thought.

What may be more comforting to us, is that we can do the same. ♻





# Despite COVID-19, More Than Half of Cleantech Firms Planning to Recruit in 2020

## Hyperion Executive Search Surveyed Impact of COVID-19 on Cleantech


Results from a recent survey conducted by Hyperion Executive Search, a global talent acquisition company that works exclusively with clean energy and e-mobility, found that despite COVID-19, most cleantech companies plan to expand in 2020. Sixty one percent of the cleantech firms surveyed report that revenues will still be as expected or better and 75% still expect to see growth this year.

*David Hunt*

"Despite the challenges and losses in revenue this year, it's hugely encouraging to see that cleantech CEOs and founders are continuing to drive forward their businesses, adapting plans and pushing ahead with building their teams," said Hyperion Executive Search CEO David Hunt. "I have no doubt that the cleantech sector is ready, willing and able to lead the economic recovery."

More than 60 CEOs and founders in the cleantech industry were surveyed by Hyperion Executive Search. Fifty-six percent of the surveyed companies expect to grow their teams and recruit in the next six months and only five percent expect to reduce employee numbers.

Most respondents stated that there had been only a minor practical impact on their business by incorporating working from home and other logistical changes.

Cleantech leaders did indicate that investor confidence has been impacted by COVID-19, with 86% responding that investor confidence has reduced overall, but they remain optimistic about the long-term future. Eighty-five percent of respondents stated that they are 'very confident' that the post-COVID-19 economic recovery will be led by a green revolution utilizing cleantech, renewables and e-mobility as drivers of growth.

"The survey responses were consistent with what CEOs and founders have shared with me in discussions for the Leaders in Cleantech podcast," said Hunt (https://bit.ly/3btc6w4). As both a cleantech CEO and an executive recruiter, I am encouraged by the overall optimism of the survey responses and I believe that the future for the cleantech industry will continue to be prosperous post-pandemic."

***LATE-BREAKING ENERGY NEWS:***

*Just as* Green Energy Times *(G.E.T.)is going to press, we received an update report regarding the most recent news for electric generation for the United States. It came from the SUN DAY Campaign. The study reported that solar and wind capacity in the U.S.A. grew in the first half of 2020 and produced 16% more than in the first half of 2019. Doing so, renewables produced more than coal or nuclear power.* ♻

# Coming Attractions in Greenhouse Energy Efficiency

*Mike Stiles Ph.D.*

Hello, greetings from the front lines of Green Greenhouses. By way of introduction, I've consulted with the electric and natural gas utility National Grid in upstate New York for the last several years. I've developed methods for quantifying the energy impacts of greenhouse efficiency measures for National Grid's incentive programs.

This article covers very recent developments in energy-efficiency greenhouse design here in the Northeast U.S. But before we begin, I have to lay out some ground rules.

My work with National Grid is covered by confidentiality agreements, so I can't name names or divulge proprietary details with which I've become familiar. This article is also vendor-neutral, and I'm not here to promote any specific products. I can however introduce up-and-coming greenhouse technologies and provide key words to get you started on your own research. For starters, do a web search on "large- scale winter greenhouses New York State."

That said, here are some technologies and developments that may interest you if you're looking to grow crops year-round while minimizing your energy and carbon footprint:

Thermal Curtains: These are made from specialized textile materials for the greenhouse environment. Mounted on motorized rollers, these curtains provide an extra thermal barrier over crops and are also useful for solar control in the summer. Although they are not a new technology, they haven't been adopted very widely in the Northeast. They are prevalent in other parts of the country like California and Oregon where utility company incentives are already available.

In cold climates, thermal curtains save heating energy by about 10 to 30% annually, depending on the crop's heating requirements. Paybacks are on the order of 10 years and will shorten as utility company incentives become available locally. Key words: Greenhouse thermal curtains; Energy Trust of Oregon; SoCalGas heat curtains; PG&E thermal curtains.

Greenhouse Foundations: Building your greenhouse with an insulated concrete block foundation will reduce your heating requirements by about 10%. Additionally, it establishes a "thermal bubble" that keeps soil temperatures above 50oF year-round. This is an important use of the soil as a thermal storage medium during the long winter months when the sun hardly shines in the Northeast.

There is a related technology that pumps warm, moist air from the peak of a greenhouse into the soil enclosed by the foundation via a network of ducts. It saves an additional 10% on annual heating. Key words: Greenhouse foundations; climate battery.

Lighting: Efficient LED grow lights have been the subject of much publicity so it isn't difficult to get information about them. When placed under thermal curtain canopies, they synergistically contribute to heating the crops.

Controls, Controls, Controls: Automation and data logging are becoming increasingly important for integrating and running advanced greenhouse systems. Data records from electronic management systems are also becoming increasingly useful for documenting energy performance for utility incentive programs.

Hemp and Cannabis: They have been the focus of a boutique market that blew a bubble. Emphasis has been on large scale indoor industrial operations that do not take advantage of natural resources like sunlight. Some states have already experienced market saturation under these conditions – how much weed can people smoke, for crying out loud? The commercial future of these plants is in energy-efficient small-scale community greenhouses, depending, of course, on the chaotic legal and regulatory environments we're experiencing. Key words: Evan Mills cannabis

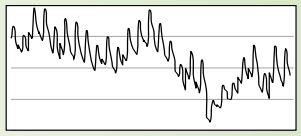
The Future of Greenhouse Design: You're sitting at your computer sipping a cup of locally grown Maghrebi mint tea. After entering your information into an app, you get a screen something like the one shown in the graphic.

*Cont'd on p.35*

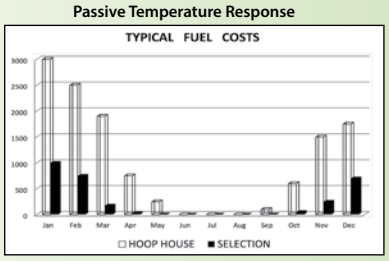
| Crops Selected | % Area of Greenhouse | $/Pound |
|---|---|---|
| Heirloom tomatoes | 50% | $4 |
| Portuguese eggplant | 35% | $6 |
| Wooly Bully (cannabis) | 15% | $6,400 |

| | |
|---|---|
| Greenhouse $/sq ft | $100 |
| Greenhouse Area (sq ft) | 1,500 |

| | |
|---|---|
| Fuel | Propane |
| Fuel Cost $/gallon | $2.35 |



Passive Temperature Response




**ANNUAL EXPENSES AND INCOME**

| | HOOP | SELECTION |
|---|---|---|
| Mortgage ($) | $4,500 | $6,750 |
| Annual Fuel Cost ($) | $12,350 | $2,967 |
| Income ($) | $55,000 | $55,000 |
| Net ($) | $38,150 | $45,283 |

| PROFIT INCREASE, SELECTION VS HOOP: |
|---|
| $7,133 |

*Graphics: M. R. Stiles*

## Net Zero Farming – *Cont'd from p.1*

be a problem. And just as clearly, when it is understood, farming can be one of our most important tools for reducing emissions. In fact, farming can be carbon negative.

To get a really good understanding of how important this is, we could start with something that recently happened in Australia. Much of the impact with farming has on climate change is through methane that escapes from burping cows and sheep. And much of Australia's agriculture revolves around cows and sheep. According to a report from an Australian publication called "Beef Central," the country's largest agricultural association, the National Farmer's Federation, just voted to put its weight behind an industry-wide move to net-zero emissions by 2050.

*John Deere autonomous electric tractor. Image uploaded to YouTube.com by John Deere UK IE.*

This is not to say that the farmers in Australia will give up raising cattle or sheep. What it means is that they are pushing to offset any emissions that come from raising cattle and sheep, along with other agricultural practices that emit GHGs, with actions that draw down carbon.

Part of the solution, perhaps more important, is to reduce directly the amount of methane the livestock produce when digesting feed. *Green Energy Times* ran an article on this in June of 2017, "Research on Bovine Flatulence" (https://bit.ly/2YoQmfn). It turns out that much of the gas can be reduced by adding very small amounts of a common seaweed to the diet. But that is just a beginning of the reductions we can see by changing agricultural techniques.

We have a number of approaches to farming that reduce the amount of tilling down to practically nothing – or actually nothing at all. For example, mycologist Paul Stamets, author of *Mycelium Running*, has shown that in healthy soil, the crops have a complex relationship with soil fungi that is destroyed by tilling. With no-till farming, that relationship can be restored. And, interestingly, so can natural soil fertility, which means that we can avoid the nitrogen-based fertilizers the European Commission showed as a problem.

There are many other ways to reduce farming emissions with different no-till techniques. Wikipedia has an interesting beginning article on the subject, "No-till farming" (https://bit.ly/31h8rhh). It says that one of several reasons to use the technique is that it is often more profitable for the farmers.

Another new technology, which promises to convert deserts into productive farmland, was reported by CNN (https://cnn.it/2CO7JyA). It combines two ingredients, water and clay, in a slurry so fine it can be sprayed. When it is used to wet sand, clay binds with sand particles and the result is better water retention. A test in Dubai shows that it works.

Reducing pesticides can also reduce emissions. It also can eliminate some of the poisons that get into our food. And again, there are many ways to bring this about. One recently appearing example is the use of agricultural robots. CleanTechnica ran an article on these recently, "Swarm Of Tiny Robots Could Help Eliminate Pesticides" (https://bit.ly/3gi3mcV). Small robots that can talk with each other do certain farm chores that make many pesticides unnecessary. Typically, one robot goes through a field identifying needs, and it alerts other robots that are set up to perform specific actions. Weeds and insect pests are zapped one by one, as the robots patiently do their work. These robots can do many other jobs that could have been done by hand by human beings, if only human beings were as patient and as uninterested in pay scales as a robot.

Water seems always to be an issue for farmers. Over the past 40 years, Peter Andrews, an Australian farmer, has developed what is called "Natural Sequence Farming." This technique uses nature, with a little human help, to improve soil and raise ground water levels by preventing rapid runoff. For example, willows, which are very thirsty trees and have no use in the area, were encouraged to grow along a stream on Andrews' farm. Farmers nearby opposed the practice for a long time, believing they would lose access to the water the trees took up, but the practice was soon recognized as beneficial to all, because it raised ground water levels in the entire area by slowing the stream. Similar practices can be used elsewhere (https://bit.ly/3gd8yi8).

*Rigitrac XKE-50. Image: Rigitrac.*

One issue that is of clear concern is the use of petroleum products on the farm. Whether gasoline, diesel oil, or some other product, these contribute to a farm's carbon footprint. There are clear answers to this problem, and the agricultural robots are certainly one of them. Another is electric farm tractors.

John Deere has been working on farm tractors, but probably not what most people would picture when they think of that term. It announced development last year of driverless electric farm tractors, one of which gets its electric power from a cable instead of a battery. The control computer is quite capable of keeping track of the cable so it can be reeled out and in. The autonomous tractors detect where they are and where they should be going.

A number of smaller manufacturers are going into the business of electric farm tractors. Rigitrac, based in Switzerland, sells its products in Europe, and there are other companies in other parts of the world. Solectrac is a rather new company based in California, which sells more conventional looking farm tractors that are fully electric.

While electric cars, trucks, and buses have been in the news constantly, with new models coming often, farm tractors seem to appear rather slowly. The advantages to the farmer, including freedom from pollution and far lower operating costs, suggest that a great deal of progress might be coming soon.

This article barely scratches the surface of what we can use – and what we can discontinue use of – to reduce farming emissions to net zero. And the only differences the consumer should notice are better food and better health. ♻

# Tasker Hill Community Garden, Madison, NH

*Russ Lanoie*

*Community garden with rented beds at the right and CSA beds to the left. Inset: A young family picking fresh peas from the original "community" portion of the garden. Courtesy photos.*

For over ten years we have hosted a small community garden on our property here in Madison, NH just south of Conway Village in the Mount Washington Valley (MWV). The garden consists of 27 individual raised bed plots four feet by twelve feet bordered by two-by-eight or two-by-ten-inches boards. Gardeners come from all parts of the valley for several reasons including a lack of gardening space or exposure to the sun where they either own or rent.

The garden originally came about when members of the MWV garden club asked me to look at a plot near our local dog park. It looked to me like it would be a lot of work making a go of this particular location. So instead, I offered the members a quarter acre spot on my own property where I knew I could provide water and rich soil and also keep an eye on the garden.

So, working from a grant through the MWV Chamber of Commerce we kicked off preparing the site, building the beds, putting up a deer fence and getting water to the site. Fortunately, a friend volunteered his portable sawmill that he set up on my property and milled out a pile of two-by-eight inches lumber (for bed edging) from pine trees that I had already felled and were waiting for such a noble purpose. It would have been better for them to be hemlock but the pine worked fine for more years than I would have expected. (I now have my own sawmill and am scoping out some hemlocks standing nearby that may soon find themselves part of the garden.)

We filled the beds first with a layer of leftover newsprint from our local Conway Daily Sun and then a few inches of fresh leaves topped with leaf compost that I make every year when local landscapers and homeowners haul me their "used" leaves that I turn into a very rich compost. (See photo.) We soon learned that the layer of newsprint was not necessary as the bottom layer of leaves in the beds seemed to stifle the field grasses underneath quite adequately.

I initially ran a water line from our town water supply to the garden but have since dug a well very capable of supplying the Community Garden and all of our other outdoor water needs without having to pay a water fee to the town. Even the cost of pumping the water is avoided as our 11kWh solar system provides all of our electricity free.

The first few gardening seasons the Chamber provided a monitor funded by grant money and bed fees. The monitor collected the modest rent fee from the gardeners and also tended to a couple of additional common area raised beds that those gardeners helped tend to raise vegetables for the community at large.

When my daughter, Jennie, returned to our "compound" (which is what my kids have named our growing homestead), she also started gardening and expanded the common beds of the community garden area. Her farming operation now offers CSA membership (Community Supported Agriculture) to a couple of dozen local citizens. She has taken over monitoring the garden and puts much of the bed rental money back into improvements to the garden.

After more than ten years we still have many of the original gardeners. There are thirteen gardeners, several having more than one plot. Many are religious in their attention to their plots while some start with enthusiasm and then lose interest or are called away to other things. A few have been able to start their own home gardens now that they have had a taste of gardening.

Jennie makes sure that everyone follows organic practices. I still donate compost to the gardeners which amounts only a tiny part of the hundred or so yards of compost I make each year. This is something I recommend to anyone thinking of starting a community garden as "used" leaves are free and readily available and best kept out of landfills. Leaf compost provides a

*Cont'd on p.33*

# Here Comes the Sun

***The lush summer greens gradually yield to yellow and orange. A dazzling display of visual warmth to tide us over until Spring.***

***Speaking of great Beatles' songs, another one comes to mind. The sunflowers and photo Peter used for this painting are compliments of his neighbor, Chris Edmunds. Peter remarked, "I get by with a little help from my friends".***

Painting from *A Day in Vermont*, May, 2020. *A Day in Vermont* is a weekly e-mail featuring a new painting each week by local artist, Peter Huntoon.

Enjoy more of his artwork and subscribe to receive weekly paintings to your inbox at peterhuntoon.com. ♻

# New Vermont Brewery Celebrates Opening

## Features Environmental Sustainability and Energy Efficiency

*Reprinted with permission from Efficiency Vermont's July 15, 2020 blog*

Chris Kesler and the Black Flannel Brewing Company team are committed to starting a business that lives the team's sustainable values. The team opened the brewery-distillery-brewpub at The Essex Experience in early July 2020. They wanted to minimize the impact on the planet and commit to sustainability from day one. But economic sustainability is equally important. They wanted to create a business that can become a fixture of the community.

Chief brewer Dan Sartwell watched his former employer, 14th Star Brewing, save thousands of dollars each year through efficiency investments. "Brewing is an energy- and water-intensive process. If we commit to economic and environmental sustainability, we have to look at the energy we are using to make our beer."

*Brewers Chris Kesler (left) and Dan Sartwell (right).*

The team reached out to Efficiency Vermont to understand how they could meet their sustainability goals.

### Good beer needs a good chiller

In high quality beer making, the wort (the mix that will eventually turn into delicious beer) must be cooled from boiling before it can be fermented. One of the biggest energy users -- and operating expenses -- for a brewery is the chiller. Brewery chillers are cooling units that utilize glycol to extract excess heat from a brewing process and dissipate it in a heat exchanger or refrigeration system. Typically, a chiller runs all day, every day, to keep the brewing process going. Many brewers use oversized, inefficient chiller systems that are based on rough sizing estimates to provide the cooling necessary.

Efficiency Vermont referred them to a few Vermont-based suppliers of high efficiency chiller systems, and they chose a system designed by Huntington VT-based Dodge Engineering & Controls (DEI). The model uses high-efficiency components and innovative controls to efficiently cool the beer. DEI's detailed analysis revealed that Black Flannel could be served by a smaller system than they'd originally thought. The smaller chiller can even handle the brewery's three walk-in coolers. Dick Soule Refrigeration, from Enosburg, integrated the chiller with the coolers to complete the highly efficient cooling system.

Finally, to keep the team informed and accountable, they installed meters, which allow seeing the electricity use and efficiency of the chiller system. This will help them identify maintenance issues quickly and share their findings with others in the brewing industry.

All told, the new system is estimated to save Black Flannel $11,243 per year in energy costs.

*Cellar view with serving tanks on the left and fermentation tanks on the right.*
*Image on rt: Disco Montage - flagship New England IPA. Courtesy images.*

### Efficiency from the bottom up

Black Flannel's business design has efficiency baked in. A distillery requires a lot of the same equipment and process as a brewery, for grain-based alcohols. By basing both out of the same business, Black Flannel only needed one system to create the mashes for the brewery and the distillery. This cuts their energy use for the processes in half.

In fact, there's not much about the equipment and processes the Black Flannel team invested in that isn't efficient. Variable frequency drives (VFDs) on their pumps will allow them to run only as much as needed. Dimmable LED lights with motion sensors have been installed throughout the facility. These turn on only when needed and provide welcoming light with LEDs that have a much longer lifespan than other lighting types.

Even the location supports the mission. Peter Edelman owns The Essex Experience. In 2018, he worked with Encore Renewable Energy to make the complex 100% solar-powered. He's eager to

*Cont'd on p.33*

# Five Reasons Radiant Heating Is the Right Choice for Healthful Homes

*Steve Swanson*

Providing superior indoor environmental quality (IEQ) is top-of-mind for consumers, who understand health starts in the home.

While hydronic radiant heating has been around since the Roman times and has been the main form of heating homes throughout Europe for decades, the United States has lagged behind in adopting this technology. Currently, only about 4% of homes are heated using hydronic radiant systems while the majority use forced-air HVAC.

*Underfloor heating pipes. Wikimedia Commons/A. Raab*

However, with the need for more energy-efficient solutions, more homeowners and home builders are looking to radiant not only for its efficiency but also for its extreme comfort and superior IEQ benefits.

**1. Energy Efficiency**

Here's an interesting fact: Water has the capacity to transport energy 3,500 times greater than air. With heating and electricity generation accounting for nearly 25 percent of all greenhouse gas emissions, radiant helps manage energy usage with a system that uses water to transport energy instead of air.

In a hydronic radiant-floor heating system, warm water circulates through flexible PEX pipe embedded in the concrete slab or under the floor between the joists. As the warmth radiates up from the floor, it warms both people and objects in a room.

This is a much more efficient form of creating comfort because the heat stays near the floor where people are located, not up in the ceiling (since hot air rises). In addition, most people are more comfortable with radiant at a lower thermostat setting, such as 68°F, than with forced-air at a higher thermostat setting, such as 72°F. That several-degree adjustment can make a big difference in energy use.

Best of all, radiant floor heating systems work really well with sustainable heat sources, such as geothermal and solar, making the system even more energy-efficient.

**2. Comfort**

Anyone who has ever experienced radiant floor heating will say it is the most comfortable form of heat imaginable. Think about stepping out of a shower onto a warm floor instead of cold, hard tiles, or imagine lying on a warm basement floor instead of cool carpet in the winter. The reason radiant is so comfortable is because it most closely aligns with the ideal heating curve for the human body.

Forced-air HVAC systems, on the other hand, are the most divergent from the ideal heating curve for the human body. So, it's no wonder homes with forced-air heating systems always have a blanket on the couch.

In addition, because radiant systems provide an even heat that reaches every area of the floor, there are no hot or cold spots like with forced-air systems. With radiant, there is a consistent, even comfort that stays near the floor at all times.

**3. Air Quality**

Since hydronic radiant heating systems use pumps to move water instead of fans or blowers to push air, the system does not circulate dust and allergens throughout a home. In fact, many people with severe allergies install hardwood or laminate floors, not carpet, along with radiant floor heating systems to minimize the allergens in their homes.

In addition, radiant floor heating does not circulate odors throughout a home, adding to improved air quality. With radiant, a home can be free of dust, allergens, odors and other nuisances that can be part of the air system.

As an added bonus, since radiant systems don't require ductwork, it also offers greater design freedom from bulkheads and vents in the floor.

**4. Peace and Quiet**

Anyone with a traditional HVAC system knows the sound a furnace makes when it kicks on as well as the sound the air makes as it's rushing through the ductwork (not to mention the expansion and contraction noise of the ductwork as it heats and cools back down).

With radiant floor heating, that's not an issue. Radiant is a quiet system. The various parts, including manifolds, actuators, pumps and boilers, all silently work as they bring comfort throughout a home. In addition, as an added bonus, radiant systems don't require the type of maintenance (air filter replacement, furnace tune-ups, etc.) required with traditional HVAC systems.

**5. Various Installation Options**

Finally, one of the best features of radiant is its ability to be installed in zones. That means a home can have just one or two rooms done with radiant (such as a master bathroom or basement), or the entire house can have radiant.

With zoning, each room has its own temperature control, adding to the comfort and efficiency of the system. And there are many different installation options to meet any application, including staple down, wood panels, aluminum joist plates, knobbed mats and more.

There's so much to benefit from comfort, efficiency, and IEQ standpoints with radiant heating. It makes sense to seek out how radiant can improve the homes you build.

To learn more about the benefits of radiant floor heating systems as well as the various installation methods, see Uponor's radiant heating solutions (https://bit.ly/3iksrVS) or visit these industry websites: Radiant Professionals Alliance (radiantprofessionalsalliance.org/), Heating Help (heatinghelp.com/), or Healthy Heating (healthyheating.com/).

*Steve Swanson is the national trainer for Uponor North America, providing training at the factory and around the nation to contractors and installers on radiant heating and cooling, hydronics and commercial plumbing. He has 47 years of experience in hydronic heating and plumbing. Swanson is on the Board of Advisors for the Radiant Professionals Alliance (RPA) and an ASSE-certified hydronics trainer. Kim Bliss contributed to this article.*

*This article is re-printed with permission. It originally appeared at https://www.greenbuildermedia.com/blog/five-reasons-radiant-heating-is-the-right-choice-for-healthy-homes.* ♻

# INRS Leading 'NH Rural Renewables'

## *Modern Wood Heat Assistance for Small Businesses*

NH Rural Renewables is a team of energy professionals who provide no-cost, vendor-neutral technical assistance to rural NH small businesses for solar PV, energy efficiency and modern wood heat. NHRR is a program of Lakes Region Community College.

INRS is serving as technical assistance expert for small businesses and agricultural enterprises that want to consider modern wood heating options. At no cost, INRS will provide a detailed assessment of the economics and feasibility of replacing an old oil or propane boiler with modern wood heat – wood pellets or wood chips. INRS will help the business connect with experienced, reputable vendors who sell, install and service modern wood heating systems.

Modern wood heat can save the business heating costs through locally and sustainably sourced wood fuels that help reduce greenhouse gas emissions and support jobs and good forestry here in the Granite State. INRS can also help the business identify potential grants, rebates or other funding sources to reduce capital and operating costs. including USDA REAP grants, which cover 25% of the capital cost. Grants up to $20,000 have their next deadline on October 31, 2020.

For more information about this FREE service, contact INRS partner Charlie Niebling at 603.965.5434 or niebling@inrsllc.com. ♻

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# Benefits to the Planet Heating with Forest Products

## AND HOW IT IS DONE SUSTAINABLY

*Jim Van Valkenburgh*

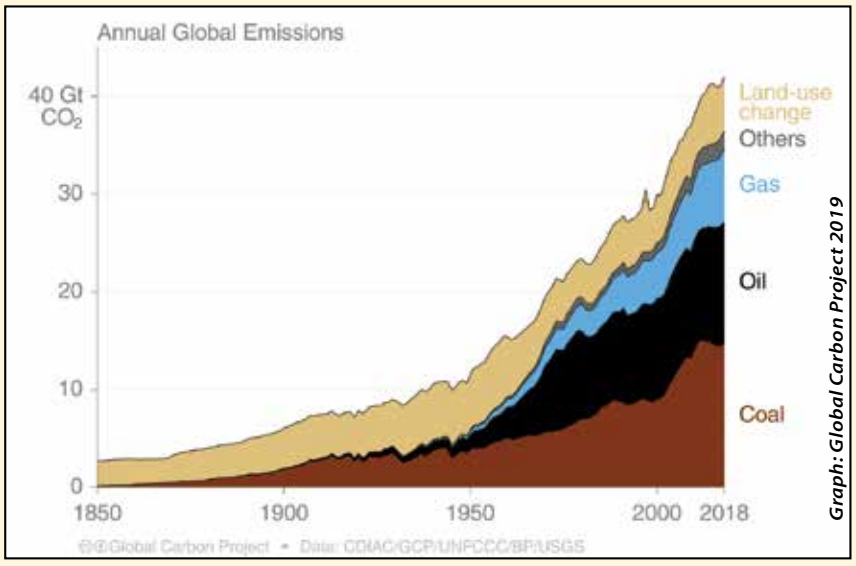
You have probably talked to people with opposing views on using trees for energy. One says it is sustainable and another says it is not. ("It's worse than coal!") I propose that both can be right depending on where they are in the U.S. or the world. Sustainability largely depends on the availability and management practices of the forest resource in a given region.

A quick lesson on the natural carbon cycle: Trees grow and absorb CO2 (carbon dioxide) and then release it over time in different ways. If left undisturbed, limbs and trees fall and decay, releasing methane to the atmosphere as the remaining trees keep growing. A mature forest has a general stability of incoming and outgoing of carbon. Should a forest fire occur, a tremendous amount of carbon is released into the atmosphere, but after that, an increased rate of carbon absorption occurs due to new, rapidly growing trees taking root. Generally, carbon is fairly balanced, in and out.

People often think of unharvested forests as sequestering more carbon than harvested forests. Yes, when trees are removed there is an instant reduction in the sequestered carbon of that stand, but over time, the forests respond to a more open canopy, more sunlight and resources, to grow into a healthier, stronger and more vibrant and resilient forest. So, you can achieve more carbon storage in a managed regime. This is part of silviculture.

Most forest owners have the same goal: Keeping their forests as forests. In the Northeastern U.S., forest owners can be put into three groups:

1. Small owners (1-50 acres) will cull out the dead and dying trees, using it for cord wood for themselves and others to heat their homes.
2. Owners of larger stands (50-250 acres) will hire a professional forester and logging company to manage that. Their goal in doing this is to sell the cut trees so they can pay their forest management expenses and property taxes. Typically, 30% of the trees are valuable while 70% are useful only as fuel.
3. The paper and lumber companies which own the huge stands (250+ acres) use foresters and best practices that will enable them to keep their forests productive and profitable for centuries.



Graph: Global Carbon Project 2019

A few million years ago fossil fuels were once trees and plants. When we burn them today, there is no natural cycle that returns them back to the ground. Some say, "Let our forests eat up all that carbon!" In recent decades, more wood has grown each year in New England than has been harvested, specifically in VT and NH, but consider how much oil, gas and coal is being burned each year. Forests can only make a small dent.

For 10,000 years, atmospheric CO2 levels were very stable at 270ppm. This chart shows the last 140 years of CO2 emissions by fuel source and land-use change (forest to farming). Around 1900, as we expanded our use of fossil fuels, levels began to rise. When oil and gas use skyrocketed in the 1940s and 50s, atmospheric CO2 has risen precipitously.

***What should we surmise from all this?***

Forests, if harvested and maintained sustainably, will account for a steady cycle of carbon out and back in again. It is our intensifying use of fossil fuels that is causing increasing CO2 in the atmosphere. Our rural forests have been sustainably managed during the past 40-plus years, which means we can use trees to offset the use of fossil fuels for heating--without regret. Our forests function within the natural carbon cycle. So, relax. If you heat your New England house with cordwood or your local school with wood chips or pellets, you are doing your part to cut back on fossil fuel use and reduce CO2 in the atmosphere.

*Jim Van Valkenburgh is the Vice President of Marketing at Froling Energy.* ♻


*The new steam boiler at Mill River Union High School in North Clarendon, VT uses dried wood chips. The silo holds over 40 tons of chips, with energy equal to that of 4000 gallons of heating oil. Photo credit: Froling Energy.*

# CASH FOR COAL CLUNKERS - NEW VT $ INCENTIVES

The Clean Energy Development Fund (CEDF) announces a new program to help homeowners and businesses convert from old coal to new wood pellet heating. Beginning today the CEDF offers up to $10,000 to Vermonters still heating with coal. The new Coal Change-out Incentive Adder is designed to encourage the few home and business owners in Vermont still using coal for heating to switch to local renewable wood pellet heating.

Andrew Perchlik, Director of the CEDF, said, "We know there are still coal heating systems in Vermont, and that some of these owners are interested in replacing these old polluting systems. We want to help them afford to get these old systems out of their basements. This is part of our effort to transform the State's heating sector to be cleaner and more supportive of Vermont's local economy."

A homeowner that changes-out a coal stove or boiler with an eligible pellet stove or central heating system can receive up to 50% of the cost (or $10,000, whichever is less) paid for by the CEDF, including disposal costs for old coal systems. New pellet heating systems are also eligible for incentives and financing through Efficiency Vermont.

"Our Clean Energy Development Fund continues to develop innovative programs to grow Vermont's local wood heating sector, which is critical as we seek to lower heating costs while increasing our use of renewable energy," said June Tierney, Commissioner at the Public Service Department that houses the CEDF.

Commercial customers can receive up to $30,000 for changing a coal heating system to an eligible pellet system.

For information on this incentive go to http://www.rerc-vt.org/coal-change-out.

For information on other incentives available from the CEDF, visit www.rerc-vt.org or https://publicservice.vermont.gov/content/funding-opportunities-projects.

For a complete list of all wood heat related incentives and rebates available in Vermont, visit http://fpr.vermont.gov/incentives.

For more information, please contact: Vermont Public Service Department, Clean Energy Development Fund, Tel: 802-828-4017, Email: Andrew.Perchlik@vermont.gov. ♻

# Choosing Insulation for Carbon Value

## — Why More is Not Always Better: Part 2 —

*Catherine Paplin*

In Part 1 (see issue #60 of Green Energy Times), we discussed XPS (extruded polystyrene) board and closed-cell polyurethane spray foam insulation, which are produced with blowing agents (HFC, hydrofluorocarbon-based) that put more carbon into the air during construction than they save during building operation. If we don't use these insulations, however, what do we use?

*Mineral wool board insulation, blown in mineral wool, and mineral wool batt insulation. Courtesy photos.*

### Insulation Alternatives

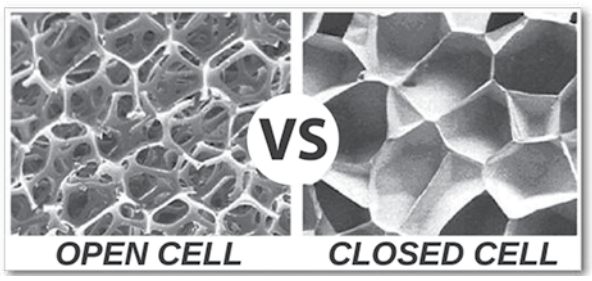
The answer in many cases is new materials. Honeywell developed a new blowing agent, a hydro-fluoro olefin (HFO), and manufacturers (e.g., Demilec and Carlisle) are coming to market with a closed-cell polyurethane spray foam that uses this agent. These spray foams have an excellent R-value and performance qualities, as well as air and vapor barrier capability, conformance to irregularities and penetrations, etc. However, they also exhibit downsides – high flammability, potential off-gassing post-application, and they are petroleum products.

Soy-based plastic spray foams (open- and-closed cell) are lower-carbon, less toxic alternatives. These are water-blown and do not off-gas. However, soy foams are made with urethane, so they are petroleum products. The closed-cell versions do act as air and vapor barriers, but they have a lower R-value. To date, these foams are only used in the residential single-family market and there is some controversy over their long-term dimensional stability.

Several expanded plastic insulations are blown with low- or zero-GWP (global warming potential) agents. Foil facing or vacuum wrapping has been used with these (as well as with mineral and glass fiber insulation) to provide a vapor barrier. So far, nothing replicates HFC-blown XPS insulation board, particularly for subgrade applications. Will it be possible to develop an HFO-blown version of XPS board? Can mineral or organic fiberboard materials be wrapped or treated to perform as effectively as XPS?

Mineral fiber (wool), available in board, batt, and sprayable form, is a possibility. These products are fire-resistant, routinely used as part of firestopping assemblies; can achieve the same compressive strength as XPS board; are unaffected by water; and, can be used in layers to create continuous insulation on the exterior of buildings (beneath cladding or stucco). However, mineral fiber insulations are not air or vapor barriers.

Batts, either fiberglass or mineral fiber, are less useful because of their inefficiency. For example, in metal framing, batt garners 40% of its nominal R-value at best. Moreover, mineral fiber is made from rock and fiberglass is silica-based – both are energy-intensive to manufacture with high embodied carbon costs.




Organic fiber-based insulations (wood, hemp, straw) have been used in single-family and smaller commercial buildings. The El Dorado is that with responsibly managed forestry or crop growth and low- or no-fossil fuel burning processing and transportation, these materials could be carbon negative (removing carbon from the atmosphere). This is a line of development to be pursued, although organics are not applicable to commercial construction. Insulation developed from recycled and reused materials, such as post-consumer cellulose, denim and plastic are also in this category.

### Doing the Math

Lots of options, but without accounting for air and water barrier effectiveness, there is a potential for disaster, primarily in the form of condensation and consequential mold growth. Understanding the complex interaction of materials and systems and the hidden dangers and best options for any condition is key. Carbon Footprint Analysis (a sub-set of comprehensive environmental, or Life cycle assessment, LCA) accounts for carbon emissions associated with a building or material from cradle to grave. Building professionals can take advantage of computer applications, such as Athena, LCA One-click, Tally, and most recently EC3, to assess and compare the carbon value of building materials and processes. Considering relationships allows us to make better decisions at design conception, inception and throughout design and construction.

### The Greenest Building is the One That's Already Built

Whenever we build new, we design assemblies and choose from a variety of materials.

Yet, most new buildings – even operational net-zero buildings – rack up carbon debt, which is compounded if an existing building is destroyed to make way for the new. To quote Carl Elefante, "The greenest building is the one that is already built." From an LCA/embodied carbon point of view, the logical conclusion is that conservation and reuse of existing buildings should be prioritized.

Older buildings represent an opportunity for carbon savings, especially if they are retrofitted to lower their operational carbon. HFC-blown XPS insulation products may be the best solution because of their unique combination of thermal, moisture and air management benefits. Not demolishing a building and not building new may actually offset the carbon expenditure of the insulation material. Tools for quantifying embodied carbon are increasing our understanding of embodied carbon and our decision-making processes.

### We Can Do It!

It is easy to become overwhelmed by the enormity of climate change, but we should take a moment to recognize how far we have come, what we have achieved, and how much we already have put in place. It is a matter of persistence, heart and will – we can do it.

*Catherine Paplin is a Senior Building Enclosure Consultant for Steven Winter Associates, Inc.* ♻

# Building with the Sun

*Russ Lanoie*

Like many first-time do-it-yourself homebuilders, I made lots of mistakes when designing our solar saltbox home. Not enough closets, family and dining areas not adjacent to each other, primary chimney in the wrong place and more. The main thing I did correctly, however, was to orient the house directly south and maximize windows on the south side.

*House from Northwest: Visitors arriving see nothing to make them aware that this is a passive solar house. Images: Russ Lanoie.*

We built in 1976 at the height of the "owner-built home" movement that followed the oil shortages of the earlier seventies. Many of the owner-built practices involved using recycled materials resulting in houses built on old telephone poles or pilings, recycled storm windows for fixed (non-operable) windows, and wood scavenged from wherever possible. While I avoided going to those extremes and used a poured concrete foundation and almost all new building materials, I did manage to construct a substantial house for a $25,000 construction loan. Framing and siding were from local mills and I produced our modified post and beam frame right from standing timber on our own property. The result of this was an early example of "building green" that simply meant to us that we got pine sap in our hair as our freshly cut timbers dried out.

The house has a mix of traditional windows and fixed glazing that includes a solar greenhouse on the south side totaling 200 square feet, and only two windows on the north. One of those original north small double hung windows was replaced with a fixed sliding glass door panel after we became Window Quilt dealers in the eighties so we could have more visibility but keep the heat in during the winter nights. Almost all of our other windows now also have Window Quilts that are still used regularly both winter and summer to keep heat either in or out.

Shortly after we built, a local quality home builder constructed a home designed by a well-known solar design group from southern NH that featured a hybrid system of south- facing glass and vertical solar hot-air collectors connected to a rock filled bin that stores heat for distribution when it's needed. This house was featured on the NBC Today Show during a Sun Day observance a few years after it was built.

After about twenty years the first owners decided to move out of the area but found it difficult to sell this unusual structure and, I've heard, finally turned the keys over to the bank. I also heard that it was an HVAC technician who ultimately ended up with the house. While not as off-beat as the owner-built homes on telephone poles, the house was too "far out" for an average person to be comfortable with its novel solar-heating system. Likewise, when owner-builders tried selling those telephone pole perched houses years later they found it difficult to find interested buyers.

Our house, on the other hand, appears much more conventional and visitors hardly notice anything unusual unless they happen to come on a cold but sunny winter day when the house is awash in the warmth of the sun. While I have no interest in selling and hope that the house remains in the family after my wife and I pass on, the next occupant will benefit from the house's simple solar design along with the 11kWh, 40 panel solar electric system that now graces our barn and adds to our self-reliance.

The lesson from our building experience is that it only takes a little planning and forethought to harness the sun when building a new home or commercial building.

*House from Southeast: This view from the southeast shows the solar features of the house including the array of windows and fixed glazing in the basement, the rooftop hot water system, greenhouse and the clothes dryer.*

"Why Not Just Build the House Right in The First Place" is an article by Ray Bliss, a very early solar pioneer from the 1940's who lived in nearby Tamworth, NH. Ray stated that simply by orienting the long dimension of the house East-West and placing the majority of the windows to the South, you'd pick up about 25% of the home's heat from the sun.

Although not every building site lends itself to capturing the sun, I constantly see local examples where homeowners and builders miss the golden opportunity to take advantage of the sun's warming rays. It is disappointing and indeed frustrating to see that some of the worthwhile lessons of the owner-builder movement following the energy crises of the seventies have been forgotten. For whether a house is built on telephone poles with salvaged lumber and old storm windows and sliding glass door panels, or modern high tech windows and energy efficient building materials, just facing the windows to the south can provide much of the heating demand of the house even if the designer put the family room in the wrong place. It's much easier to move rooms around inside a house than to change its orientation to the sun.

*Russ Lanoie is a long-time solar proponent in New Hampshire's White Mountains and operated his Alternative Systems business in the 1970s—80s 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. www.RuralHomeTech.com.* ♻

# What Climate Change in the Far North Means for the Northeast

*George Harvey*

With a changing climate, we are increasingly seeing extreme weather. A tiny amount of that is extreme cold. Most is hot. Hot, dry weather produces droughts and wildfires. Hot, rainy weather produces floods. In all of this, one thing we can be quite sure of is that the world's glaciers are melting and increasing the rate of climate change.

When floating ice melts and when glaciers melt, there are different effects. Melting sea ice does not cause the sea to rise directly, because the ice is already floating on the water, but its loss is nevertheless part of a vicious cycle of warming. Ice is really good at reflecting sunlight. Water is not. As floating ice melts, the ocean is able to absorb more sunlight that otherwise would have been reflected back into space. So, less ice means that the ice melts faster. An article from BBC Focus Magazine reports that the UK's Meteorological Office (the country's national weather service) now estimates that the Arctic Ocean will be clear of ice by 2035 (https://bit.ly/2Qfpiuv).

When glacial ice melts, in addition to the problem of exposed land being heated by the sun to speed melting, the water runs into the ocean, causing sea levels to rise. And we can be sure they are rising. Measurements of sea level are taken by NASA satellites, thousands of times per second. The entire ocean is mapped, and the resulting averages are said to be correct to within about a tenth of an inch (https://go.nasa.gov/2FGFnHC).

According to an article published by NASA in 2019, global warming had increased the rate of melt from Greenland. In the 1990s, it was about 25 billion metric tons per year, but what the article calls the "current" average is 234 billion metric tons (https://go.nasa.gov/3hfJ0SR). Unfortunately, that study provides an average based on data collected over a period of years, so the average is over conditions during that time – not the current rate.

*Iceberg floating away from Greenland. Brocken Inaglory, Wikimedia Commons. https://bit.ly/3aLJgXn.*

According to a CNN report, a study focusing on more recent data shows a continuing rise in the rate of melting in Greenland to 280 billion metric tons during its study time. The study states the glaciers have gone to a point where they may never be able to recover, regardless of what we do to stop climate change . That same study projects that sea-level rise from all sources will come to three feet by the end of the century. It states that because most of our big cities are on ocean water, three feet is enough to displace about 40% of the population of the United States (https://cnn.it/2EvAn83).

Now comes the really bad news. According to another study reported by CNN, the ice on Greenland is melting far faster than any of the earlier studies indicated. This particular study focused on just the melting for the year 2019, meaning it is as close to current as it could be. It states that the amount of ice lost in 2019 was 532 billion metric tons, with 223 billion metric tons lost in July alone (https://cnn.it/2YqgUNl).

The numbers here indicate that the rate of melting from Greenland may be doubling every six years. This makes me wonder whether the projections of a three-foot rise in sea levels during this century might be far too conservative.

We should reflect on what this means for all of us. Certainly, the U.S. already has internal climate refugees. It has been three years since the residents of Isle de Jean Charles in Louisiana were offered $48 million by the federal government to move because of a combination of rising seas and subsiding land. Refugees are also moving from other coastal areas. (https://bit.ly/2Yt0eou)

Although, three feet might not sound like much, even the inches that have already happened cause regular flooding in places like Miami. Last year, a report from local radio station WLRN, focused on pressure put on residents of the city's Little Haiti neighborhood to move out. This is happening because wealthy people want to be able to move in and take advantage of the fact that Little Haiti has an altitude of seven feet above sea level (https://bit.ly/2Yr44hL).

Nearly every community near an ocean or tidal river is in jeopardy. It is just a beginning of a trend that could reach overwhelming proportions in the next two decades, because people will start to move out when they understand that a problem is coming up. And for some, the problem is already starting to get difficult.

Ports are already having trouble with the few inches of sea-level rise. With three feet, they will have to be rebuilt, as will railroads and highways. New sites for all the waste collected at all the nuclear plants and chemical facilities near the coast will have to be found. The list goes on.

Here in the Northeast, the future will undoubtedly see large numbers of people moving inland from Boston, New York, and other coastal communities. States like Vermont and New Hampshire could see large increases in population. This means people will find it harder to afford rent. There will be pressure on the land just as farmers are puzzling over what crops they can grow in a changed climate. Energy, road, municipal infrastructure, and more will need to be upgraded.

These are problems we have no choice about. The work must be done. There may be good news in this for those of us who are young and inclined to be part of the solution. Difficult as the future might seem, it may also be a time of great opportunities to do great things.

Climate migration was also discussed in the October 2018 issue of *Green Energy Times* (http://bit.ly/Climate-Migration-GET%20Oct%202018). ♻

# *NEW ENGLAND'S COMING CLIMATE-REFUGEE CHALLENGE*

*John Bos*

When you turn on the evening news each night, you see various maps of America with each state color-coded to reflect some aspect of the response to the COVID-19 pandemic. One section of the country stands out in relief from its neighbors. New England.

New England provides geographic relief from population centers where the coronavirus is spiking. Wealthy urban dwellers are flocking to their summer homes in Maine, the Catskills, the Hamptons, Massachusetts to escape the virus.

As we continue to experience COVID-19, I see the pandemic "refugee crisis" as a harbinger of a larger refugee crisis looming for New England. Within just a few decades, hundreds of thousands of homes on U.S. coasts will be chronically flooded. By the end of the century, six-feet of sea-level rise would redraw the coastline with familiar parts – such as southern Florida, chunks of North Carolina and Virginia, much of Boston, all but a sliver of New Orleans – missing.

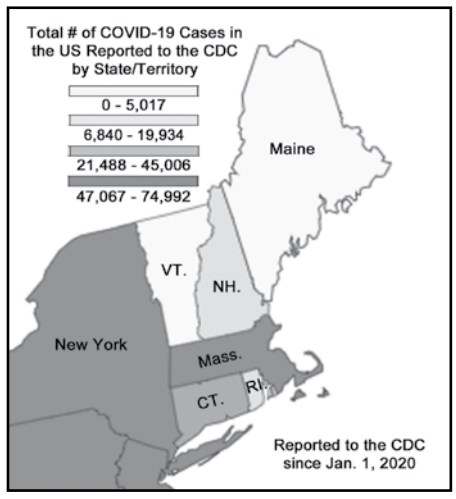
Coastal flooding is only one piece of the environmental emergency facing New Englanders. Ever hotter summers and lower levels of rainfall in the Midwest and the South are forcing generations of farmers to seek a more fertile climate elsewhere, like New England. Warming temperatures will fuel gigantic hurricanes – like the devastating triumvirate of Irma, Maria and Harvey in 2017, followed by Florence this year – that will scatter survivors in jarring, uncertain ways.

People displaced by extreme weather events and slower-developing environmental disasters are often called "climate refugees," a term popularized by journalists and humanitarian advocates over the past decade. What happens when climate change causes extreme events to become chronic, potentially rendering some communities unviable? This question is fueling a new strand of global research focused on "climigration." Climigration is the planned relocation of entire communities to new locations farther from harm. And it has already begun.

The population shift gathering pace is so sprawling that it may rival anything in U.S. history. "Including all climate impacts, it isn't too far-fetched to imagine something twice as large as the Dustbowl," said Jesse Keenan, a climate adaptation expert at Harvard University, referencing the 1930s upheaval in which 2.5 million people moved from the dusty, drought-ridden plains to California.

This enormous migration will probably take place over a longer period than the Dustbowl, but its implications are both profound and opaque. It will plunge the U.S. into an utterly alien reality. "It is very difficult to model human behavior under such extreme and historically unprecedented circumstances," Keenan admitted.

"I don't see the slightest evidence that anyone is seriously thinking about what to do with the future climate-refugee stream," said Orrin Pilkey, professor emeritus of coastal geology at Duke University. "It boggles the mind to see crowds of climate refugees arriving in town and looking for work and food."




Pilkey's new book, Sea Level Rise Along Americas Shores: The Slow Tsunami, envisions apocalyptic scenes where millions of people, largely from south Florida, will become "a stream of refugees moving to higher ground." New England has a lot of higher ground.

The projections are starting to materialize in parts of the U.S. forming the contours of the climate migration to come. At the moment, our internal "refugee problem" pales in comparison to the global climate-refugee crisis. In 2018, the World Bank estimated that three regions (Latin America, sub-Saharan Africa, and Southeast Asia) will generate 143 million more climate migrants by 2050. In 2017, 68.5 million people were forcibly displaced, more than at any point in human history. While it is difficult to estimate, approximately one-third of these (22.5 million to 24 million people) were forced to move by "sudden onset" weather events - flooding, forest fires after droughts, and intensified storms. The growing climate-refugee movement will exacerbate many humanitarian crises and may lead to even more people being on the move.

The Obama administration undertook myriad efforts to update the institutions that can address climate. Several of President Obama's executive orders, particularly Executive Order 13677, which required incorporating climate resilience into decision making on development assistance, took on the climate crisis. For the first time in the Department of Defense's history, the 2010 Quadrennial Defense Review (QDR) recognized climate change as a "threat multiplier," with the potential to exacerbate current challenges.

Millions of Americans will confront hard choices as climate change conjures up brutal storms, flooding rains, receding coastlines and punishing heat. Many are already opting to shift to less perilous areas of the same city or to havens in other states. Towns from Alaska to Louisiana are looking to relocate, in their entirety, to safer ground. Isle d Jean Charles in Louisiana is the first U.S. community to undergo federally sanctioned climigration. These options were previously considered for

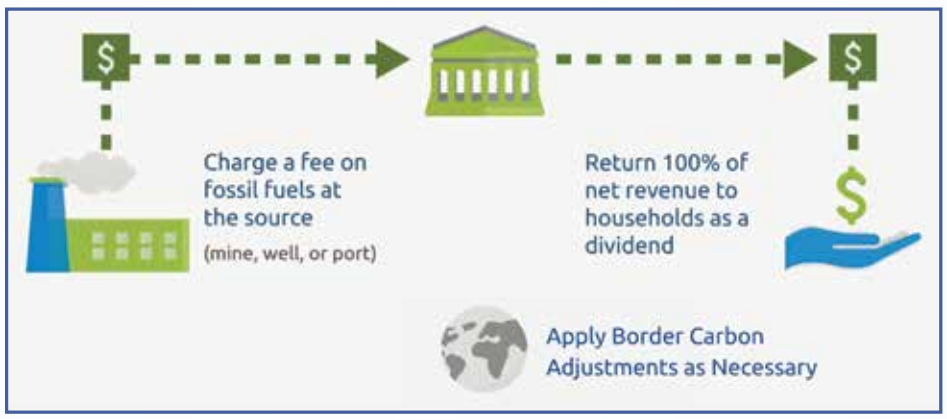
*Cont'd on p.30*

# U.S. On Track to Pay Climate-Pollution Tariff to the EU

*Katharine Gage*

When we purchase gas for our cars, food, clothes, and other everyday essentials, we pay the price listed on the items' price tags. When deciding among similar items, customers will naturally pick the one with the lower price. Currently, goods and services that were produced by fossil fuel-based energy are cheaper to purchase, so our producers and consumers prefer them.

It's nice to buy inexpensive things now, but the problem with these fossil fuel-based goods and services is that they are actually very expensive – the expense comes later. These expensive hidden costs emerge in harm from local air pollution as well as climate pollution. For example, Lauri Myllyvirta of the Centre for Research on Energy and Clean Air (CREA) found that in 2018, air pollution from fossil fuels killed 4.5 million people, which comes to an average of 12,000 people every day. In terms of climate impacts, Thomas et. al found that our climate situation has already committed 18% of the world's species to extinction by 2050. It is hard to assign an exact monetary value to the death of a human or the loss of an entire species, but these are examples of the costs from burning fossil fuels that are encountered down the road, rather than when the purchase occurs.




*The Energy Innovation and Carbon Dividend Act uses this three-part approach to reduce climate pollution. Image: Citizens' Climate Lobby.*

The solution to this energy-market failure, where a fossil fuel-based product appears cheap but holds external costs which get paid by society later, is a carbon price. The European Union (EU) currently has a carbon price of $26 per ton of carbon dioxide-equivalent emissions. It is great that the EU is using a carbon price to reduce its carbon pollution. However, climate change is a global problem and requires global carbon pricing to drive down carbon pollution worldwide. The EU just announced that in 2023, they will adopt a border carbon adjustment. This means they will put a tariff on trade with other countries that do not have an equivalent price on carbon pollution. This will help ensure that companies do not relocate from the EU to other countries where pollution is "free," then export into the EU, because now the carbon price will be applied at the border. In addition to protecting EU jobs, this new border adjustment will also help enact carbon pricing around the world.

Starting in 2023, when the U.S. imports to the EU, it will have to pay the EU its carbon price of $26 per ton of carbon. When the U.S. imports from the EU, they will take their carbon price out of the export. This will go on until the U.S. implements a carbon price of at least $26 per ton of carbon. If the U.S. implements a higher carbon price and adopts border carbon adjustments, we can experience the same trade benefits that the EU is looking forward to.

Although the U.S. does not currently have a carbon price, there is a promising bipartisan carbon pricing bill in the House of Representatives. This bill is called the Energy Innovation and Carbon Dividend Act (HR 763). HR 763 puts a steadily increasing fee on the production of fossil fuels at the source that will start at $15 per ton of carbon and increase by an additional $10 per ton every year. Second, it will return all the money collected from the fee equally to all American households as a dividend each month. Third, it will use border adjustments to protect U.S. jobs and encourage global carbon pricing. This approach was recommended by a record consensus of more than 3,500 economists in the Wall Street Journal, because it is the most efficient and equitable way to reduce climate pollution.

Please take two minutes to ask your congressional representatives to support HR 763 at cclusa.org/write. Thank you!

*Katharine Gage, age 17, has been volunteering with Citizens' Climate Lobby for four years. She is also a competitive nordic skier and loves New Hampshire winters.* ♻

# Capitalism, Courage and Justice

*Dr. Alan K. Betts*

The response of the United States to the confrontation with the COVID-19 virus has been revealing. The strengths and weaknesses of America's core values of freedom, justice and courage have been exposed, along with the blatant immorality of capitalism and white racism. Little has changed since the famous "Tale of Two Cities" speech by Mario Cuomo in 1984 about how the economy leaves so many poor and fearful.


*Image: mronline.org*

The continued collapse of our central government has been stunning. This crisis needed leadership and fast decisive action in Washington; but leadership is impossible if you cannot face the basic truths of a pandemic. Lost in angry narcissism, the president tried to hide his irresponsibility and incompetence by lying and blaming others, from Democrats to the Chinese to the World Health Organization.

Simultaneously, the pandemic exposed the cruel nature of unregulated capitalism, which exploits everyone and life on Earth for profit. Nurses, doctors and underpaid essential workers showed up with courage to work, but the central government, which had trashed the virus emergency plans left by the previous administration, was useless. Hospitals had little personal protective gear for the emergency, and capitalism had outsourced manufacturing to wherever in the world it could be made more cheaply, and supply chains had collapsed. To avoid responsibility, the government said: "Let the free market provide." In coded capitalist language, this means someone should be able to make a profit out of all these people dying. True, I have not been properly trained in polite euphemisms. But under the cover of COVID-19, the government greedily cancelled as many clean air, clean water and clean car regulations it possibly could to encourage corporate polluters to send more money for the reelection of the present Administration. In reality hundreds of thousands will die; but money trumps everything, and the right-wing will not be held responsible for those that perish – an echo of the tobacco companies' playbook.

Meanwhile, the U.S. consumer economy, which was clearly not essential, collapsed in less than a month. The Earth breathed a sigh of relief as air pollution and greenhouse gas emissions plummeted with the reduced burning of fossil fuel. But tens of millions of people have become unemployed. They have received some payments, and economic incentive money has been sent to many citizens, while more than a trillion dollars has flowed to rich corporations to prop up the stock market.

To keep profits high, we have long refused to pay a living wage to all Americans, so few have savings. Minorities, poorly paid and living in polluted areas of cities, have suffered the most. As minorities, they have been treated as expendable by rich white capitalist society, which clings to its racist roots. As murders by police exposed the truth, the rebellion demanding justice has rightly spread across America. Yet the president, backed by his racist supporters, thinks troops should be sent to gun down protesters, and crush free speech protected by the Constitution. Pathetically, a president who lies every day is furious that Twitter is now fact-checking his lying tweets that endanger and threaten Americans.

The other dark side is that America is the only rich country that refuses to provide health care for all. We have a health care system that is the most expensive in the world. However, for much of it the key unspoken goal is not to optimize the health of the nation, but to maximize profit for hospitals, drug companies and insurance companies. The political right keeps trying to destroy the limited effort to expand health coverage with Obamacare, because providing healthcare to the underpaid is not profitable. Unfortunately, their guiding rule that the poor must work to serve us, even if they are sick, is a problem in a pandemic.

When COVID-19 struck, hospitals started losing money when they lost their profitable elective surgery, and they laid off nurses, staff and doctors. What they could not do with their surplus capacity was provide critical healthcare for the hard-working poor, the unemployed and for minorities. Right-wing politicians just continued to insist that the state should not provide healthcare for 'them'.

Many have died in our nursing homes in this crisis, which were also unprepared. The American Health Care Association opposed 'burdensome regulations' for emergency preparedness for pandemics, for the simple reason that these reduce profits. Again, we see this conflict between profit and people's lives in unregulated capitalism. Capitalism cannot prepare for future emergencies, whether a pandemic or climate change, since it places no value on the future. So, building resilience is viewed as simply reducing current profits. And with deregulation, current profit for shareholders is their prime responsibility, not justice for people or for the Earth itself.

It will take courage to shake and reframe this immoral world, but now is the time. We all deserve better.

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


*Image: allegrasloman.com*

# Passive House at Maple Corner: Part 1

*Barb and Greg Whitchurch*

In the world of Passive House (PH), it is often said that a PH can look any way you want, from an igloo to a traditional New England farmhouse. The important elements are mostly not visible after the house is completed: the insulation in the walls, roof, and around the foundation; the moisture and air barriers; the lack of thermal bridging errors; even the details of the windows.

Passive House is the most efficient path to getting the home you want. It is an extensively researched, decades-old (yet continually updated) process for assuring that you and your architect or builder understand exactly how to achieve your goals: a cost-effective, comfortable, low-maintenance, energy-efficient home or remodel: bit.do/ph-principles

Off a small dirt road in Maple Corner, Vermont, Montpelier Construction has built yet another beautiful PH. The owners, Meg and John Dawkins, hired Matt Lutz, an Associate Professor of Architecture at Norwich University who lives nearby, to help them achieve their vision of a home that would fit into its rural setting of woods and hayfields.

To fine-tune his design for PH elements and prepare the build for PHIUS Passive House certification, Lutz, who is himself a CPHC (Certified PH Consultant) was pleased to work side-by-side with Chis Miksic, CPHB and lead PHIUS CPHC, and Indigo Ruth-Davis, CPHC and lead Project Coordinator, both partners at Montpelier Construction. (Note: VT has perhaps the highest per capita of PH-certified architects, designers and builders in the nation.)

The Dawkins were looking ahead to aging in place, so they decided to build on one level, from the driveway through the entire house. The house is built on a slab, avoiding the considerable cost of a basement. Because a PH requires minimal utilities, the heat pump water heater, water softener, well pressure tank and ventilation equipment are grouped in a small utility room in the attic space.

Fresh, filtered air is provided by a Zehnder ERV (ZehnderAmerica.com/), which provides continuous, balanced energy recovery ventilation, where outside intake air is equal to the air exhausted. In winter, heat from outgoing air is transferred to incoming air at 90% efficiency. It costs about $60 per year to run.

*The Dawkins Passive House built by Montpelier Construction. The porch roof keeps the summer sun off the windows, but allows winter sun to heat the home. Photos: Kurt Budliger, for Montpelier Construction.*

The heating and cooling are provided by a Mitsubishi Hyperheat cold climate heat pump (MitsubishiComfort.com/). There are three small built-in resistive heaters in the house just in case of a prolonged super-cold spell. PH itself guarantees VERY low heating and cooling needs through air-sealing and superinsulating. Remember, you only need to add heat to offset the heat that you let escape (bit.do/ph-lose-heat)!

Inside, you enter a large open kitchen-dining-living room. The feeling is airy and peaceful. Whitewashed wood paneling, pale sage sheetrock, and a pale gray polished concrete floor offer a feeling of spaciousness. Skylights in the ceilings of the kitchen and master bathroom add to the airiness of the south and west-facing windows, which are Klearwall triple-pane (R-6.5); the glass is formulated to allow maximum solar heat gain for the winter. The use of light-colored wood in the butternut kitchen cabinets (designed and built by Eyrich Stauffer of Montpelier), closets, and trim, creates a Scandinavian look.

*Kitchen and bathroom of the Dawkins Passive House. Note the skylights.*

Compared to more standard construction, PH calls for increased up-front expenses, some of which are offset by incentives and special "green" loans for sustainable construction [see Part 2]. Increased insulation, air sealing and better windows guarantee energy and maintenance savings down the road. The monthly cost of the mortgage plus energy bills is less for a PH right off the bat (bit.do/ph-cost, bit.do/ph-worth).

These small expenses are actually an investment, and will provide a huge return in the form of energy savings and reduced maintenance costs, typically thousands of dollars per year, over the life of the building -- not counting the personal benefits of increased health, comfort, and home equity. Next year, the Dawkins are investing in a small solar PV array which will completely offset all of their energy use, as their PH uses only about one tenth of the total energy of standard construction.

By going the PH route, the Dawkins used about 1% of their budget to enroll with an internationally-recognized building science organization, who assigned a specialist at their national headquarters to review the plans and the progress through the completion of the project. A locally-based, certified consultant runs the WUFI Passive computer program, overseeing the entire project, which is verified by a certified rater who reviews all stages of the construction through site visits, photographs and measurements and provides the final certification award at the end of the project.

WUFI Passive is a modeling tool that tracks every aspect of the site's location: climate, weather history and soil types, as well as building layout and solar orientation, building materials, mechanicals, and appliances. The result? The Dawkins knew their energy costs before they broke ground, and they now have certifications from PHIUS, Efficiency VT, and the Appraisal Institute (bit.do/ai-green-appraisal) which prove the value of their home.

In Part 2 (see page 29 of this issue), we will discuss how you could start the process for the best-case outcome for your remodel or new build. It's not that hard!

*Barb and Greg are board members of VTPH.org and have their own Passive House in Middlesex, VT bit.do/phc-vtbiz.* ♻

# Passive House at Maple Corner: Part 2

## HOW TO BUILD YOUR OWN PASSIVE HOUSE OR REMODEL

*Barbara and Greg Whitchurch*

In this article, we'll describe how you might go about building your own Passive House (PH) or remodel.

**First:** Get a certified PH professional. Try Vermont Passive House (bit.do/vtph-mem) or Efficiency Vermont (bit.do/een-evt) to find people who are certified to build to the PH standard. There are many of these builders and architects in New England. (More: bit.do/phius-cphc and bit.do/phi–cphc.)

Your project's lead consultant will run the WUFI Passive or the PHPP program. (Matt Lutz says that every high-performance home project should have such a person on board.) If you want an architect, but your builder is the lead consultant, then the architect doesn't need the designation.

[The Dawkins (see Part 1 on page 28 of this issue) had Chris Miksic and we had Indigo Ruth-Davis (both of Montpelier Construction) as our lead PH consultants. We built our PH in 2014 without an architect or designer. Greg drew diagrams of what we wanted. It was the first PH effort for any of those involved. But, since the PH process guides builders in such detail, we were nonetheless assured a great performing building. It was the team's very first–award-winning!– PH effort here: bit.do/phc-vtbiz]

**Second:** Line up your incentives. These are your own tax and utility dollars being targeted right back at you to encourage more responsible choices for everyone's sakes. These incentives add up to many thousands of dollars, and considering that your electric car can serve as grid backup for your house, they cover electric vehicles (EVs), cooking, heating and cooling, hot water, fridges, weatherization upgrades, bikes, lawn mowers, etc. Your certified PH consultant (CPHC) should be aware of all these opportunities. (E.g., bit.do/evt-hphp, in MA there's a special incentive for PHs phmass.org/masssave/.)

**Third:** Your mortgage. Be sure your bank employs a Certified Green Appraiser who uses the green addendum (bit.do/ai-green-appraisal). More info: bit.do/vbra-appraisal. In VT: bit.do/evt-loans, bit.do/vsecu-vgreen.

**Fourth:** Some excuses and myths. (bit.do/ph-excuses, bit.do/ph-myths)

***PH is too expensive:*** Two of Vermont's PHs are Habitat for Humanity homes. We know of folks who are not well-to-do who have PHs (including us). If your builder claims PH is not worth the effort, ask them about the certified PH they built that disappointed them or their clients.

***Net Zero is good enough.*** The Dawkins (soon), our, and many other PHs are net zero - no big deal. With enough money and solar panels you can net zero a stone castle. PH requires very few solar panels to net zero, saving money, space, and resources. Also, net zero does not address comfort, health, or maintenance, while PH does.

***A house needs to breathe.*** If you hear this from a builder, they're actually saying that their construction method depends on air leaks to keep the walls from rotting. A house needs to be sealed and vented in specific ways. Airtightness is of paramount concern in any modern building. Blower door testing should be run on any new house multiple times during construction. PH guarantees all of this.

*Award-winning PH built by Central VT Habitat for Humanity, Bruce Landry of 5 Star Energy Tech, volunteers, the homeowners, and Chris Miksic of Montpelier Construction.*

***Some old-fashioned ideas and baggage to be rethought for any modern home:*** basements, steeply-pitched roofs, wood stoves, attics, and more.

E.g., basements no longer need to serve as foundations, root vegetable storage, or housing for your messy furnace or boiler, hot water heater, water pump, pressure tank, and fuel storage. All of these functions are minimal in a PH and can be housed in a large closet anywhere. The Dawkins' house has a pull-down ceiling ladder to a tiny mechanicals room in the attic space. A simple concrete slab or pier system often serves as the foundation of modern homes. And heated floors are absolutely unnecessary.

*Charlotte, VT Habitat for Humanity PH. Modules built at Preferred Building Systems of NH (bit.do/ph-pbs). Image: PHIUS.*

A flat-ish roof will save lots of lumber and keep the snow off your shrubs, sidewalks and entryways, while using that snow as a very effective insulating blanket.

*Whitchurch Passive House Cottage, Middlesex, VT. Courtesy image.*

Do you still think of windows as views and light sources only? PH nudges you to consider their energy costs and benefits, too. Proper solar consideration can make huge differences in your energy use and comfort throughout the year.

Remember: You can always finish or upgrade countertops, lighting, cabinets, bath fixtures and floors later on with your energy savings to avoid overburdening your original mortgage. But you only get this one chance to correctly design the continuous insulation, air sealing and non-thermal-bridging of the walls, roof and foundation assemblies.

Conclusion: Keep in mind that PH is not the end of a continuum - one can get much more careful about sustainability, environmental impacts, and energy use. PH is designed to hit the sweet spot where a smaller investment costs you a lot more in the long run, while more investment gets you relatively little extra performance. By staying focused on the outcomes of your choices, PH allows you to make informed choices based on proven engineering science.

All of the considerations and metrics involved in PH also exist in every other type of home --- the performance characteristics of the lumber, insulation, windows, and appliances for ANY building are available from the manufacturers. But PH actually uses this information effectively, instead of relying on advertising, store sales, contractor markups, and the builder's feelings about how things should be done. ♻

*Just A Bunch of B.S.* (*Building Science, of course)*

# THE WINDOW IN WINTER: A COOL LITTLE MICROCLIMATE

*Nate Gusakov*

"We really need new windows. There's always a draft coming through them!" I hear this a lot from clients who are looking to improve the comfort and efficiency of their home. In certain cases, this is probably true (e.g. old single-pane 'barn sash' windows or malfunctioning windows that won't shut and lock anymore). Of course, it is always important to be reaching for more efficient comfort; however, I rarely end up recommending new windows as a top priority.


*Side-by-side office windows. Window on right has thermal shade drawn, window on left is uncovered. Photo: Zone 6 Energy.*

Even a modern, Energy Star-approved window won't have an insulating value any better than about R-5. While R-5 is good for a transparent window (and better than the R-2 to R-3 of older double-pane windows), it still falls short of the R-25+ insulation that will likely be found in the walls of a modern house. This means that whenever the outside temperatures are cold, these windows are radiating exponentially more heat to the outdoors than the walls around them. In addition (and more important, for this particular article), the surface temperature of the inside pane of glass is going to be much colder than the surface temperature of the wall around it.

The result is that this rectangle of very cold glass acts as a little refrigerator for the air that is directly next to it. This air loses its heat through the cold glass, becomes denser than the air around it, and sinks. More warm air comes from above to replace it and is subsequently cooled by the glass chilling plate (or window pane, as we like to call them) and also sinks. Voila, we have a convection loop! When you sit down on your couch on a cold winter night just below the living room windows and feel an annoying cool draft on the back of your neck, it's probably not a leaky window—it's probably the convection loop of cooled air from the window's microclimate washing over you. So, what's to be done about this? Ultra-high efficiency triple-paned windows certainly can help, as the innermost pane is a good deal warmer than the second pane (which would now be in the middle of an argon gas sandwich). These windows are expensive, however, and replacing windows is a significant undertaking.

Thermal blinds are a great answer– they usually cost $75-$150 per window. If diligently pulled at night and on cold dark days, they will serve to block the convection loop from developing, presenting a much warmer surface area to the inside of the house.

## PROS:

- Aesthetically pleasing (design choices available)
- Retain access to windows
- Can be left installed year-round and offer light and privacy control

## CONS:

- A little expensive
- Often forgotten
- Still allow interior humidity to reach cold glass window pane (more on this in the next issue)

Another answer is to install the thin plastic film that you tighten with a hair dryer. If you do it carefully, it makes an excellent 'third window pane' on the inside of your window. The thin plastic won't radiate heat the way a glass pane does and will again present a much warmer surface area to the inside of the house.

## PROS:

- Very inexpensive
- Still lets light in
- You don't have to remember to pull the blinds
- If sealed well, prevents humidity from reaching cold glass window pane (more on this next issue)

## CONS:

- Can be punctured easily
- Hard to seal on certain window types
- No access to the window through the winter

If you think you need new windows but just can't afford them or aren't sure yet, try one of these methods this winter. You just might find that the drafty old windows are suddenly performing much better than you thought they could.

*Nate Gusakov is a BPI-Certified auditor, home performance contractor, and energy consultant for Zone 6 Energy in New Haven, VT.* ♻

## CLIMATE REFUGEE – *Cont'd from p.26*

the village of Newtok, Alaska. Climate-induced coastal erosion has threatened its livability for many years. In 2003, its residents voted to relocate to higher ground but that relocation looks like it will not be completed until 2023.

Though it's possible for coastal cities to build new infrastructure and artificial barriers to protect themselves from climate change, time is running out. Here are the eight cities in the US most likely to disappear underwater by 2100. In Boston, where many neighborhoods have been built and recently expanded in low-lying areas, an estimated $2.4 billion will be needed over the next several decades to protect the city from flooding according to one study. That report came as the city abandoned plans to build a harbor barrier that would have cost between $6 billion and $12 billion, which researchers concluded was economically unfeasible. Then there's Houston, Miami and New Orleans which has yet to recover from the impacts of Hurricane Katrina 20 years ago! Next comes Atlanta, Charleston, Virginia Beach and finally the big one, New York City, where Michael Bloomberg proposed a $19 billion sea wall around Wall Street when he was mayor some 18 years ago.

All of this leads to my question about how New England, as an ideal target territory for resettlement by American and foreign climate refugees, is prepared to welcome and assimilate a growing population base in an eco-friendly way?

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

# Efficiency Vermont's EEN Contractor Spotlight: *Alliance Mechanical of Essex Junction, VT*

## Interview with Tim Campbell, Energy Solutions Manager

*Green Energy Times Staff*

*The Alliance Mechanical Team of Essex Junction, Vermont. Courtesy photo.*

***1. What is your area of expertise?***

Alliance Mechanical's expertise is in proactive maintenance, HVAC system repair and replacement, building automation, and boiler services, all for commercial customers. Building automation includes the latest energy management for the entire building, thermostats, humidistats, time clocks, and related matters.

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

Some people attempt to do proactive maintenance without training. Typically, they change filters and belts. When they have done this, they often consider their work done, but some issues they might miss are maintaining settings; checking motor actuators, sensors, damper actuators, valve actuators, fan motors, condensers, and contactors. Also, sequences need to be checked. Lack of good maintenance is a big energy waste and eventually costs a fair amount.

***3. If you could only choose one type of project o reduce someone's carbon footprint or improve efficiency, what would it be and why?***

To choose one type of project, it would have to be to replace the temperature controls of a building with the latest building automation system. With good design, programming, and commissioning, a new system can operate efficiently and do such things as customized scheduling and calculating set points and trending. A very common set point is a boiler loop where temperatures may be adjusted as the building and outside temperatures change. A calculated set point makes it possible to adjust heating and cooling to satisfy requirements of the space while saving energy.

***4. What in your field of specialty is most valuable for our readers to know?***

Our specialty is diagnosing poorly designed, poorly installed, or poorly maintained systems. We can provide field analysis on all HVAC equipment, including electrical control systems, chill water systems, boiler systems, cooling systems, and more. We can also provide steam trap testing, refrigeration leakage testing, and compressed air leak testing. We have the ability to repair or replace any system we identify as needing energy upgrades, while providing the best cost effective and energy efficient solution.

***5. Why should people use an Efficiency Excellence Network (EEN) contractor over someone else?***

People should use an EEN member because of the quality resources that are provided. EEN members are committed to providing good services to save energy in the interest of the environment, so the customer gets the benefit of a great set of resources available from a wide range of partners. The membership also ensures that the contractor is a professional who works in the best interest of the customer.

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

For commercial customers, such as ours, we recommend that a professional contractor help decide which of two possible routes, prescriptive or customized incentives, to take. There are times that a prescriptive incentive can be helpful. Prescriptive incentives put up specific financial support for specific units.

In some circumstances, there is a need to work with the utility and Efficiency Vermont or NHSaves to engineer a customized energy saving program. Customized incentives apply to custom engineering based on field analysis, that justifies the investment with the intended payback, when correctly implemented. They are awarded on an individual basis. They help the customer get the project done by providing financial support for the project to reduce energy use in specific buildings.

Our business tends to do more of the customized incentives because of our commercial work.

***7. What are some questions you recommend customers ask when selecting someone to do work to meet energy efficiency goals?***

How long has the contractor been in business, and how experienced are they? Has the contractor ever worked on a similar project? Can the contractor provide references? Do they have the resources to complete the project in a timely manner? How much of the work will be performed by the contractor – will any portion need to be subcontracted. ♻

# Energy Efficiency Appears Prominently in New Climate Plans

*Wendy Koch, ACEEE Senior Director, Marketing and Communications*

Energy efficiency appears prominently in recent proposals to address climate change, underscoring its ability to deliver dramatic cuts in greenhouse gas emissions.

Nationwide building retrofits, net-zero construction, fuel efficiency, electric vehicles, and industrial decarbonization — cornerstones of the nonprofit American Council for an Energy-Efficient Economy's (ACEEE) new Call to Action — are features of several sweeping proposals. Research shows that energy efficiency could halve U.S. energy use and emissions by 2050.

This week, former Vice President Joe Biden unveiled a climate plan that consolidates several Democratic proposals. By spending $2 trillion over four years, it aims to slash emissions, revive the economy, reduce racial inequities, and by 2035, derive all electricity from carbon-free sources. It sees energy efficiency as a key way to cut emissions and make energy more affordable for low-income households and communities of color, which have been disproportionately affected by COVID-19 and climate change.

Earlier this year, a group of House Republicans led by House Minority Leader Rep. Kevin McCarthy, R-Calif., introduced its own climate plan. This plan focuses on removing carbon dioxide from the air rather than reducing energy waste or promoting zero-carbon energy sources. It seeks to plant a trillion trees, which President Trump has endorsed, and expand a tax break, which Trump signed in 2018, to capture and sequester carbon dioxide before it leaves smokestacks. It would also increase federal R&D funding for carbon capture at natural gas plants.

In contrast, the Biden plan has multiple efficiency provisions. It calls for energy-efficient retrofits of four million commercial buildings and weatherization of two million homes over four years, which it estimates will create at least one million "good-paying" jobs. It proposes building performance standards, strict building codes, and cash rebates and low-cost financing to upgrade and electrify home appliances and install more efficient windows. It suggests a technology-neutral Energy Efficiency and Clean Electricity Standard (EECES) for utilities and grid operators.

In the transportation sector, Biden proposes increased spending on public transit, walkways, and bike lanes. He seeks to establish ambitious fuel economy standards; provide consumer rebates to swap old, less fuel-efficient vehicles for more efficient ones; buy clean vehicles for federal, state, tribal, postal, and local fleets; promote electric vehicles and their charging facilities; and convert all 500,000 U.S. school buses to zero emissions.

The plan also mentions the need to decarbonize industry. It calls for creating an Advanced Research Projects Agency on Climate, a cross-agency ARPA-C, to develop technologies that would decarbonize industrial heat needed to make steel, concrete, and chemicals and reimagine carbon-neutral construction materials.

Biden's new plan has similarities to the House Select Committee on Climate Crisis' recent majority report, and incorporates many of the recommendations of the Biden-Sanders Unity Task Force, which was co-crafted with supporters of Sen. Bernie Sanders, I-Vt.

While Rep. McCarthy's climate plan focuses on carbon sequestration, Republicans have included energy efficiency measures in several bills. For example, the pending bipartisan Energy Savings and Industrial Competitiveness Act by Sens. Rob Portman (R-OH) and Jeanne Shaheen (D-NH) would promote better building energy codes and mortgage lending that recognizes the value of efficiency in homes. An ACEEE analysis shows it would cut energy bills by $51 billion, save 32 quadrillion BTUs of energy, and avoid 1.3 billion tons of carbon dioxide emissions cumulatively for measures achieved through 2050.

Conservatives for Responsible Energy Solutions (CRES), a nonprofit that engages GOP policymakers, has endorsed the Portman-Shaheen bill and other bipartisan ones. Such bills include the New Home Energy Efficiency Act to extend and update the home energy efficiency tax credit through 2022 and the Streamlining Energy Efficiency for Schools Act to help schools make efficiency retrofits.

What happens to any of these proposals or pending bills remains to be seen. Congressional approval could be difficult if Congress remains largely deadlocked. Yet the inclusion of robust energy efficiency measures highlights its importance in the fight against climate change.

*This was originally posted at https://bit.ly/EnergyEfficiency-NewClimatePlans-ACEEE.* ♻

# NEW DOE RULE FOR EVALUATING ENERGY CONSERVATION OF APPLIANCES & EQUIPMENT

*Effective : Oct. 19, 2020.*

The U.S. Department of Energy (DOE) has published a Final Rule amending its decision-making process for selecting energy-conservation standards by specifying that it will conduct a comparative analysis of the relative benefits and burdens of potential energy-conservation standard levels in determining whether a specific energy- conservation standard level is economically justified.

*Appliance and equipment standards are saving consumers and businesses billions of dollars. Image: energy.gov.*

### Appliance & Equipment Standards Program

The Building Technologies Office (BTO) implements minimum energy conservation standards for more than 60 categories of appliances and equipment. As a result of these standards, American consumers saved $63 billion on their utility bills in 2015 alone. By 2030, cumulative operating cost savings from all standards in effect since 1987 will reach nearly $2 trillion. Products covered by standards represent about 90% of home energy use, 60% of commercial building use, and 30% of industrial energy use.

The program provides a resource to help consumers make informed decisions when selecting products in order to save energy and money. eeCompass has easy-to-use tools that allow consumers to research, evaluate and compare covered products by brand and model, along with a number of other performance attributes.

- Issues regulations for appliance and equipment standards and test procedures, and for implementation, certification, and enforcement.
- Issues waivers for appliance and equipment test procedures.
- Provides further guidance to aid in the implementation of certain regulations.
- Announces all public meetings and comment deadlines, provides information on how to participate, and explains how to access rulemaking dockets and documents.
- Supports the voluntary ENERGY STAR® program by working with the Environmental Protection Agency to ensure products that display the label meet Energy Star specifications.
- Collaborates with Natural Resources of Canada through the Regulatory Cooperation Council.
- Provides information on its history and impacts, statutory authorities, regulatory processes, plans and schedules, and program reports and publications.

For more information related to Appliance and Equipment Standards Program, email ApplianceStandardsQuestions@ee.doe.gov.

*Links available at greenenergytimes.org under the individual articles for the Sept. 2020 edition of* Green Energy Times. ♻

# No-Till Gardening: Good for Crops and the Environment

*Jessie Haas*

Most people don't realize that we are living through two carbon crises (plus a pandemic, plus mass political craziness. I know, right?) We have too much carbon in the atmosphere and not enough in the soil, and there's a connection: between 50 and 70% of the carbon in world farmland soils has been off-gassed due to tillage. Plowing, cultivating, and harrowing has sent 792 billion tons of carbon into the atmosphere in the past 250 years.

Tillage also introduces excess oxygen into soils; that temporarily provides abundant growth, but it also increases the decomposition of soil organic matter (SOM). Tillage is mining the soil of carbon, putting it where it doesn't belong and heating the planet. It's also depleting soil fertility and reducing the nutritional value of crops.

These twin problems, though, are actually a huge opportunity, and one that Cedar Circle Farm and Education Center in East Thetford has been exploring. For the past five years, the farm and education center has been experimenting with various forms of no-till vegetables growing on crops such as broccoli and kale. They have used rollers to crimp and kill cover crops (without using Roundup, one of the drawbacks of mainstream no-till), and also the extremely low-tech methods of solarizing and occultation. Solarizing is covering a piece of ground with clear plastic for a short period, usually just a day or two in warm, sunny weather. This kills weeds, weed seeds, and slug eggs and leaves a bare seedbed for planting. Occultation is the same process done much more slowly using tarps put on black side up.

Cedar Circle has put in its strawberry plants for the 2021 season, and has experimented with planting directly into a crimped and solarized cover crop. The bed looks as if it's already been mulched. To test the theory that no-till helps soils retain moisture, the Cedar Circle team has installed a soil moisture reader in the experimental bed and another in the traditionally planted bed a few rows over. It will be interesting to hear about the results.

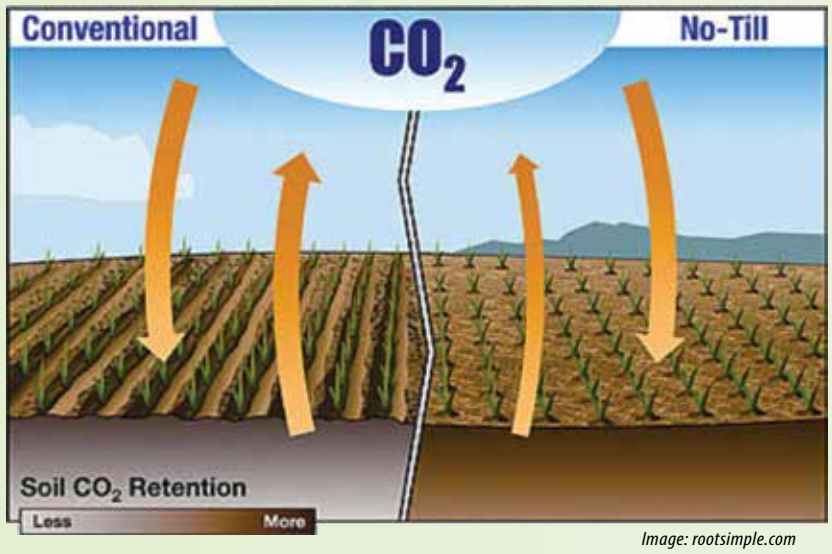



*Image: rootsimple.com*

No-till scales in both directions; many dairy farmers drill seed directly into killed cover crops, and home gardeners can use the techniques as well. It's not too late to get started; cover crops are an important part of building soil carbon, and many cover crops, such as buckwheat, oats, and annual rye grass, can still be planted. They may not reach maturity before frost, but that's okay. They will still feed soil microorganisms with their living roots, and build SOM once they've died and fallen, contributing their incorporated carbon.

SOM is 58% carbon, and that carbon is what allows the microbial soil network to digest minerals and trade them with plant roots. Without adequate carbon, plants lack nutritional value. SOM also helps soil aggregate, creating structure that lets it store more air and water. It builds an absorbant soil sponge that is resilient to both drought and excess rainfall. And it can be a key to farm profitability. Many market gardeners who switch to no-till find they no longer need a tractor. This helps lower the costs of getting into farming. It can also allow a marginal piece of land to be made productive; many no-till market gardeners build their soil literally from the ground up with manure, compost, and cover crops.

No-till is a climate solution that anyone can participate in. Grow Your Soil!, by Diane Miessler (Storey 2020) is a cheerful, practical resource for home gardeners who wants to draw down carbon in their own front yards. Miessler happily accepts weeds as cover crops and details methods for 'chop and drop' weeding, where you simply cut or pull the weeds and leave them where they are, covering them with mulch to prevent the garden from looking too messy. Another good resource, geared to the market gardener, is The Organic No-Till Farming Revolution, by Andrew Mefferd (New Society Publishers 2019). There are multiple resources for large-scale farming; one of the most inspiring is Dirt Into Soil by Gabe Brown (Chelsea Green, 2019).

If gardening is not your thing, you can still ask at the farmers' market if the produce you are buying is grown by no-till methods. If farmers hear that customers are interested in buying no-till crops, they will start thinking about growing them. Any moves in that direction help solve both climate crises and the what's-for-dinner crisis in one fell swoop.

*Source links:*

*https://cedarcirclefarm.org/blog/seed-starting*

*https://www.storey.com/books/grow-your-soil/*

*https://newsociety.ca/books/no-till-farming*

*https://www.chelseagreen.com/dirt-to-soil/*

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

*No-till vegetable garden. Image: Flickr/Jackie Caserta*

*No-till field of peas and oil radishes, after harvest. Image: Volker Prasuhn, Wikimedia Commons. https://bit.ly/3blLvB4*

## VT Brewery –Cont'd from p. 21

help his tenants reduce their carbon footprint, including helping Black Flannel weatherize the business before they moved in.

"Black Flannel will be one of the most energy-efficient brewers and restaurants in the state," said Pat Haller, Senior Energy Consultant at Efficiency Vermont. "That wouldn't have happened without their engagement from day one and their willingness to work in collaboration to find innovative solutions at every level of their business."

In all, these improvements will help Black Flannel save almost $24,000 each year on energy costs.

### Ready for business

Due to COVID-19 restrictions on restaurants, Black Flannel's opening in July wasn't exactly what they initially planned. They have more seating outdoors and space for social distancing. Their kitchen is focusing on take-out. They've also decided to can more beer than they had originally planned to.

But Kesler, Sartwell, and the rest of the team are excited to turn the efficient machines on and put them to their intended use.


"There are some really good breweries in Vermont. We plan to be among some of the best," Kesler shared with a modest chuckle. "But we're also aiming to create a unique experience for our customers to help them learn more about beer and the process of making it. I'm excited about sharing our passion and our love for brewing and tasting beer with other people."

Sartwell echoed the sentiment. "It's going to be a really cool place to hang out and have a beer. I can't wait to sit at the bar with all of our guests and enjoy talking beer with them." ♻

*Food and beer pairings At Black Flannel Brewery. Courtesy images*

## Tasker Hill Community Garden Cont'd from p. 21

well-balanced source of nutrients as it is nature's own way of producing rich soil.

***On the side:*** Although having a separate "common area" for plot owners to help maintain is a noble idea, in reality it is unlikely that they will be maintained by anyone other than the garden monitor. Having a garden monitor be a part of the overall community garden with growing space adjacent to the rented beds seems to be a key to the overall success of both.

Since much of the initial grant through the Chamber of Commerce was used to provide a porta-potty that we thought would be necessary but found in time that gardeners were seldom at their gardens long enough to require such a facility, we have not had one since that first year.

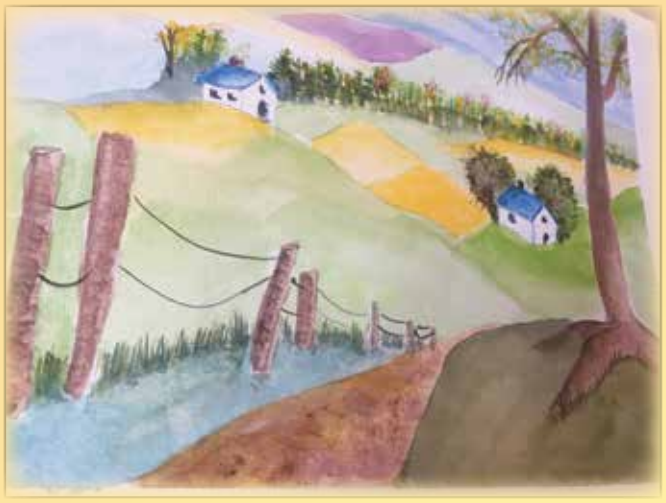
When laying out the wood-sided raised beds be sure to space them far enough apart to allow the lawn mower that will be used for keeping grass under control to fit between them. We originally covered the aisles with wood chips but it did not take long for the grass to overtake every uncultivated space. The neatly mowed grass actually looks better than wood chips with clumps of grass sprouting here and there.

*Russ Lanoie is a long-time solar proponent in New Hampshire's White Mountains and operated his Alternative Systems business in the 1970s and 80s selling solar hot water systems, composting toilets and Window Quilts®. He has lived in a passive solar home for forty years. www.RuralHomeTech.com.* ♻

## Elmore Roots' Permaculture Know-How

# Pathways

*David Fried*



*Artwork courtesy of Joyce Dutka.*

In a hectic world, I like to be surrounded by plants as I walk along, tasting, breathing it all in.

Like a bee visiting flowers, I walk the pathways between the plants.

When I walk around the farm, one path takes me from the blueberries to the grapes. Another path leads around the pond to the paw paw patch. If I go the other way, I happen upon the haskaps.

If I were a bear, I would think that I had stumbled into bear heaven. There is so much fruit to eat. All I have to do is turn this way or that way, and a new path will bring me to the farmhouse blackberries. When I ramble through the birch tree opening along a short forest path, I enter the hidden meadow, full of ripe raspberries, asparagus and plums.

"Lord well I was born a rambling man, trying to make a livin' and doing the best I can..." The Allman brothers sang this in the mid-70s. I took it to heart. I am motivated to plant new fruit groves here and there on the farm, and I always connect them with winding paths. Many a farm manager has told me I am ridiculous. Farms have to be run efficiently with rows in straight lines. We need to make use of all the space. Curves and rambling paths take away precious time and make us do more maintenance than we need to. My grandfather, Papa Ben, taught me "the shortest route between two points is a straight line." He was right, of course, but it also meant that we had to sit through a lot of traffic lights and noise and boring store signs, because the shortest way is not always the quickest or the most interesting.

For years now I actually work the curves into the layout plan. If I am on a forest or mountain hike and the trail is straight for a while, this is the boring part of the hike. I like to keep exploring, not knowing what will be around the next bend. While I lay out the straight rows of grape vines and blueberries for easy mowing and mulching, each of these groves are connected by meandering paths. The whole farm is like this. It feels good. We walk along the edge of the elderberries, cross the brook and see the tall seaberries with their bright orange juicy fruit on one side of the path. Across the path gooseberries grow, shorter, more compact with light purple baby beach ball fruit.

We want to walk down paths together as a family, as a people, as a country, as a part of a wondrous world. We want to walk down paths that are interesting, inspiring, that give life. As a member of the North American Fruit Explorers, I am always looking for that new volunteer promising berry plant growing, seeded by birds and never existing before in the history of the world. Or the easy to crack and delicious and nutritious nut planted by squirrels. I wake up in the morning and start out on my path. Tasting. Observing. Listening.

A friend told me when he came to visit, he saw me walking up one of these pathways and right behind me was a skunk following behind at about the same pace. So many enjoy this nonlinear experience. Soft field grass pressed by moose, deer, and a hundred dancing chipmunks, all going about their day.

The old timers say, "The best fertilizer is a gardener's footsteps." It's about caring, nurturing, being sensitive to what is around us, plant or animal or smooth stone. Somewhat like the old player piano that has a lever to crank around and around so music will flow for a while, the winding pathways get me where I need to be.

*David Fried, Elmore, Vermont , August 2020.* ♻



*Larry Plesent*

# Ingredient of the Month
# I Like Killing Flies!

My wife owns a bakery and, as you know, flies and restaurants do not mix. Hence, the title of this month's musing on all things natural and sustainable, "I LIKE Killing Flies".

Did you know that all insects "breathe" through their bellies? Their abdomens are coated with an oily substance that helps their spiracles or air holes to pull oxygen out of the air and expel carbon dioxide. Air travels throughout the insect's body through a tube-like ventilation system to get to the cells.

And therein lies their fatal kryptonite weakness. Soap washes away oil, and, thus, it attacks and kills insects four ways.

First, it dissolves and washes away the oils that protect the insect's spiracles, immediately disrupting their respiration. Many high metabolism flying insects, like wasps, drop immediately upon contact with soapy water at the appropriate dilution.

Second, liquid soap gets sucked up into the insect's trachea where it then comes into direct contact with various cells and structures. Once inside the body of the insect, soap acts on the fatty layers of these cell membranes, dissolving them and causing the cells to spill their contents and die. This is similar to what happens when you wash your hands.

Third, soap dissolves the exoskeletons of many insects.

And fourth, as the soap dries, it coats and clogs up the spiracle holes disrupting respiration.

In many ways soap is the ideal insecticide. It is completely safe and nontoxic to mammals, and most plants are unaffected by it at standard concentrations. While soap usually kills adult insects very quickly, it does not always destroy the eggs. And so, it is very common to use two or three spray-soap-spray treatments over a week to turn the tide on a garden insect infestation.

Start with the best 16-ounce spray bottle you can find. You want a trigger type sprayer for outside and plate glass use. You can transfer some into a four-ounce bottle with a button sprayer (not a trigger spray) for occasional inside use.

Fill your 16-ounce bottle ¾ full with warm water and add castile (preferably locally made) liquid soap.

Screw the sprayer on tightly. Turn upside down and right-side up several times to mix. Then wash off the outside with soapy water on the bottle for a better grip.

For Mediteranean fruit fly flies, gnats, no-see-ums and other soft bodies little insects add one ounce of castile liquid soap. A shot glass works great for measuring. These insects can be taken down while circling with a fine mist sprayed above them that filters down onto their bodies.

For cabbage worms and general garden use, start with two ounces of soap per 16-ounce bottle. These will need a direct hit to take them out. Adjust the sprayer so that it is neither a wide mist nor a single line of fluid. You want to give yourself a roughly three-inch splat area for coverage. The insect must be completely covered in soap water to be effective.

For house flies, cluster flies, "Japanese" beetles and larger insects use three ounces of soap per 16-ounce bottle. Add another shot if they seem resistant to the spray.

A few plants such as tomatoes becomes more sensitive to light damage after being sprayed with soap solution. It is a good idea to do a whole tomato plant spray treatment, and then rinse the leaves off a half hour later just to be extra safe. Castile soap will not harm your garden and improves soil permeability to water in dry conditions. It is potassium based, which is a necessary plant nutrient.

The beauty of this system is that if you notice your solution is not strong enough for a certain critter, just add more soap. There is a limit point at which your sprayer will not work properly. If that happens slowly, add more water to the bottle and squeeze out some of the foam on top.

Clean up by carrying a cloth or paper towel with you to wipe off excess spray soap. You are literally cleaning surfaces as you purge your space of the demon invaders. Clean large plate glass windows with 1/2 shot soap spray and a squeegee or paper towels.

Now you can say goodbye to toxic organophosphate insect sprays and use organic soap instead!

Now that's a foaming success story!

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

*Author is ready to take care of flies with his soap solution. Courtesy photo.*

# NatureFest Goes Virtual

*Joan Rech*

NatureFest is an enjoyable and educational event sponsored by Friends of Moreau Lake State Park (just north of Saratoga Springs, NY). "Friends" is a non-profit group that sponsors activities and in general supports the park. NatureFest is their biggest event. Non-profits and government agencies provide information on sustainability, renewable energy, raptor rehabilitation, and Lyme disease to name a few topics. Activities for kids include pumpkin painting, birdhouse building, and rope making. And, of course, there are animals - rescue dogs, the park's reptiles and we hope, raptors. With 50 exhibitors side-by-side and 1500 to 2000 attendees, NatureFest as usual would not be possible in a pandemic year. Thinking outside the box (or, in this case, beyond the beach) was necessary, and with some trepidation "Friends" decided to attempt an online event. Fortunately, one of the members is tech-savvy, and she quickly claimed the website name, NatureFest2020.org.

"Friends" then advised prior-years' exhibitors about the 2020 plans and asked if they might submit a video or presentation. Since 2016, "Friends" has focused on waste reduction with the goal of making NatureFest a zero-waste event. In 2019, 72.8% of the total waste was diverted from landfills. NY's Department of Environmental Conservation has partnered with the group, and their Reduce, Reuse, Repurpose, Recycle group offered to record a plastics recycling demonstration and provide links and resources. The Adirondack Mountain Club suggested links to their "Trailside Talks with ADK," including "Hiking with Dogs," "How to Pack with a Bear Canister," "Water Crossing Awareness" and other videos. Sustainable Saratoga chimed in with a backyard composting video, and Crandall Library (Glens Falls) responded positively. So did the Lyme Disease Network, NYSERDA, and Wilton Wildlife and Preserve, and more responses are coming in each day.



*NatureFest 2019 showcased the bag monster and taught children how to build birdhouses. In 2019, 72.8% of the event's total waste was diverted from landfills. Courtesy photos.*

But a big part of NatureFest is animals. In past years, a rescue group brought live raptors and released a rehabilitated bird on the beach to the excitement of onlookers. "Friends" members offered to film rescued animals at the facility. Park staff thought of a slideshow of animals encountered by park rangers, and another member will record nighttime sounds at the park. The resident reptile specialist is hoping to record turtles hatching (which occurs in September around the time of NatureFest). Another park ranger does a popular fish fillet and fry (of park-caught fish), and he plans an online demonstration of the process – not as tasty but more informative.

What started as "maybe we can do this" has grown in size and enthusiasm each day. NatureFest2020.org will be available on September 12 (the pre-pandemic date of the live event). "Friends" invites you to visit NatureFest virtually this year and we hope all can join us in person in 2021.

For information, contact Nancy Dwyer, NatureFest Chair, at ndwyer12@gmail.com or the author at runner1930@hotmail.com

*Joan Rech is part of the New York* Green Energy Times *distribution team and enjoys visiting Canada.* ♻

# USDA REAP Grants Awards for Farmers, Ag Producers & Small Businesses

*Kevin Lambert*

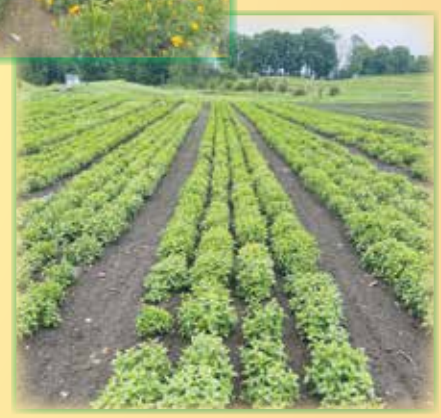
On August 20, it was announced that the United States Department of Agriculture (USDA) has awarded $919,474 in grant funding to farmers, producers and small businesses in New Hampshire, and $772,881 to those in Vermont, under the Rural Energy for America Program (REAP). Funds will be used to improve energy efficiency and create renewable-energy systems in the two states.

*Foster Farm Botanicals in East Calais, VT will use its grant award to install a74.4kW ground-mount solar array. Photos courtesy Foster Farm Botanicals.*

USDA Rural Development State Director, Anthony Linardos, issued a statement commending the investment. "Renewable energy and energy efficiency are at the heart of keeping New Hampshire and Vermont farms and businesses competitive and productive during the COVID-19 pandemic and well into the future," he said. "Under the leadership of President Trump and Agriculture Secretary Perdue, the USDA is focused on helping them succeed, and this investment highlights that commitment."

Positively impacted businesses include:

- DCI Furniture in Grafton, NH, recipient of a $250,000 grant to fund the installation of a 300HP combined heat-and-power biomass boiler system;
- Foster Farm Botanicals in East Calais, VT, awarded $43,600 to install a 74.4kW ground-mounted solar array that provides almost all of its electrical load;
- Ridgeline Maple Works in Jeffersonville, VT, which received $20,000 to purchase and install high-efficiency maple syrup production equipment;
- Manning Hill Farm in Winchester, NH, beneficiary of an $18,875 grant to install a roof-mounted solar array that will generate 35,080 kWh annually;
- Green Power Farms in Wardsboro, VT, which will use a $131,250 grant to install three 30kW wind turbines estimated to generate 330,000kWhs annually; and
- Patch Forest, LLC, in Lebanon, NH, recipient of $14,272 to implement a reverse- osmosis system for its maple syrup operation, reducing energy needs by 53%.



USDA Rural Development provides loans and grants to help expand economic opportunities and create jobs in rural areas. This assistance supports infrastructure improvements; business development; housing; community facilities such as schools, public safety and health care; and high-speed internet access in rural areas. For more information, visit www.rd.usda.gov. Contact: Kevin.Lambert@usda.gov. ♻

## Greenhouse Energy Efficiency – Cont'd from p.20

In the upper left corner of the graphic is a visual of your selection and a summary of its energy performance – the more efficient it is, the less heating fuel you will need, but the more expensive its first cost will be. The graph in the lower left shows your energy savings compared to "business as usual" and is the basis for your utility incentives, rebates, and so on.

The upper right corner is a summary of your crop selections, your projected energy rates, and other operational metrics. The app has optimized your options given your growing requirements and geographic location. The bottom right panel shows your bottom line in a typical year of growing conditions.

OK, we're not quite there yet, but you see where I'm going with this. As soon as you add a foundation to a greenhouse and stock it with efficient heating, ventilation, and lighting equipment, it starts acting much more like a building than a plastic wrapper out on the field. And we know from the last 50 years of building science how to design buildings for energy efficiency with materials you can buy commercially. Stay tuned folks!

*Mike Stiles is a Senior Energy Engineer at L&S Energy Services Inc. and can be reached at mstiles@LS-energy.com. For additional technical information on advanced greenhouse designs visit https://ls-energy.com/advanced-greenhouse-development/.* ♻

# 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…

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# Weatherization Help for NH Residents

If you missed the August 17 Weatherize Webinar with NHSaves, view it at https://vitalcommunities.org/energy/weatherize/.

This 45-minute program covers home-energy- efficiency basics, rebates and financing, recent rebate changes, and COVID-safe weatherization practices.

Weatherization is one of the best ways for people living in homes to immediately start saving money while experiencing greater comfort and shrinking their carbon footprint. ♻

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# Tips to Keep Food Scraps Out of Your Trash

*Cassandra Hemenway*

The fastest route to stinky trash is through food scraps, but there are ways to avoid it. If you are already keeping food scraps out of the trash, you are part of a growing movement. Currently, four New England states and New York lead the nation with laws that ban food scraps from the landfill. The laws vary, with Vermont's as the most comprehensive, but they have in common that they recognize food scraps as a valuable resource for compost, energy production, or animal food. Additionally, they address the fact that food scraps decomposing in a landfill release methane, a greenhouse gas at least 30 times more powerful than carbon dioxide.


*Food scrap drop-off site at the Vermont Compost Company in Montpelier, VT. Photo: Cassandra Hemenway.*

It's simple to manage food scraps while you get them from your kitchen to a backyard bin or a local drop-off site (or, if you're lucky, to your curbside compost hauler). Here are some tips for managing kitchen waste so it doesn't stink or attract pests.

Tip 1: Reduce food waste! The average American wastes about $1,500 a year on purchasing food that will not be eaten. Consider using all parts of your food, including stems, peels and more. Learn new recipes, and tips for buying, storing and cooking food to minimize waste here: https://scrapfoodwaste.org/

Tip 2: Use a countertop pail. Anything with a lid will do. Here are a few things to know about countertop pails:

- Filters are not necessary. These are marketed as eliminating smells or fruit flies. However, it's more effective to empty your pail frequently. Filters become problematic when washing your container, and aren't always easy to find when you need a replacement. Emptying the pail every day or two is more effective for odor control than a filter.
- Skip biodegradable bags if you can. Not all "Biobags" are created equal, and not all commercial compost facilities will accept them. If you must use a biodegradable bag, make sure it is BPI-certified (BPI is the Biodegradable Products Institute). BPI certified bags will break down in backyard compost, but they may not be accepted at all food scrap drop off sites.
- Try lining your pail with a paper bag or folded newspaper, both of which can go directly into a backyard bin and safely decompose in the compost. If you drop off food scraps at a collection point, check with the site manager before using this strategy.
- You don't actually need a liner. Consider simply washing your container with warm soapy water after each food scrap drop off.

Tip 3: Keep a supply of wood shavings or sawdust available. Most farm and garden stores sell them for less than $6.00 a bale. If you are composting at home, you need three times as many "browns" to "greens" in a backyard bin; so, having a supply on hand is vital to successfully composting. Even if you are dropping off food scraps or have a hauler pick them up at your home, wood shavings will help keep your materials clean and odor free. Here are some ideas for using them.

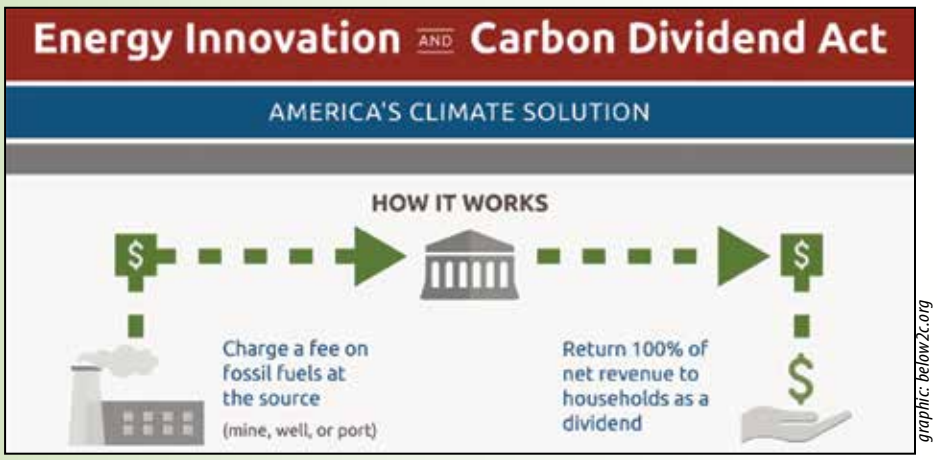
- Add a layer of wood shavings to the bottom of your kitchen food scrap pail to absorb moisture.
- Add a layer of wood shavings on top of your food scraps pail at the end of each day.
- If dumping your small kitchen pail into a larger bucket that you are storing for a drop-off site, add two to three inches of wood shavings on top of the food scraps every time you add to the bucket. This will reduce or eliminate smells and flies.
- If backyard composting, keep wood shavings (or other browns like dried leaves, hay, etc.) in a container next to your bin, so every time you add food scraps, you can add three times as many browns.

Options for managing food scraps are in place throughout New England and New York at this point, from backyard composting to curbside pick-up, to an array of drop off sites. Check with your state's Department of Environmental Conservation, or your local solid waste management district to learn more about your local options.

*Cassandra Hemenway is the outreach manager and compost educator at the Central Vermont Solid Waste Management District. She leads compost webinars and has set up five community compost sites in central Vermont.* ♻


*World War I era U.S. government poster still applies today. Wikimedia Commons. https://bit.ly/34X29ph*

## BRENT SUTER (MILWAUKEE BREWERS) – *Cont'd from p. 1*




graphic: below2c.org

years, Congress gives clear direction to the EPA to regulate those emissions to meet those targets. The pause does not have an impact on EPA regulations related to water quality, air quality, health or other issues. This policy's price on pollution will lower carbon emissions far more than existing and pending EPA regulations."

The bill's tight focus on climate change makes it a natural to receive the support of player Brent Suter. Born in Chicago in 1989, Suter has spoken of his environmental awakening which resulted from seeing Al Gore's film, An Inconvenient Truth, as a high school student. The snow-lover recognized that the normal winters he loved were in danger of disappearing. Suter attended Harvard, where he played baseball and studied environment and public policy. He was drafted by the Milwaukee Brewers in 2012 and made his major league pitching debut in 2016. He is a left-handed starting pitcher who achieved a 3.91 career ERA before being sidelined for a year with an injury. After undergoing Tommy Johns surgery, he spent much of that year working to eliminate plastic waste. He founded the Strike Out Waste initiative with his cousin.


Dugout Image: Jim Bauer/Flickr

In doing so, he brought a day-do-day environmental ethic—composting, turning out lights when leaving a room, reusing grocery bags, installing solar panels on his house—to the Brewers' clubhouse. In a 2018 interview with SportTechie Suter said, "I didn't get ribbed that much for my Tupperware and my bottle at all when I got called up, and I haven't gotten much since, just the occasional fun ribbing. The really cool response was when I went around asking teammates if they want to do StrikeOut-Waste and use a reusable water bottle that we can get them instead of the cups and plastic bottles at the facility. Over 100 guys responded with a resounding yes. We shipped over 100 out to the guys and saw a pretty big dent in our spring training plastic usage, so that was a pretty cool sign that the guys were on-board. I'm looking to increase that number in the next couple of months and years."

Suter isn't alone in his environmental concern. Major league baseball has turned to solar panels and LED lighting in many stadiums. Many franchises have taken up composting food waste, and some stadiums have roof gardens.

Suter is also a member of Players for the Planet and is involved in local environmental programs in Milwaukee. He plans to become an environmental consultant or work in a sports league sustainability office when he eventually retires from baseball. He spent the COVID-19 quarantine growing food with his family and is currently playing the abbreviated season with the Brewers.

*Source links available on* GET's *website.*

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

## *The Peck Company* – *Cont'd from p.17*

first year, (2) partnered with GreenBond Advisors to access capital that provides engineering, procurement, and construction (EPC) revenue as well as asset ownership in the solar projects we build for the partnership, and now (3) we are delivering on the third prong of our strategy with an exciting accretive acquisition. We have been focused on executing these important initiatives for our shareholders and expect the acquisition of Sunworks to provide many more opportunities for long-term growth and profitability."

Chuck Cargile, Chairman of the Board and Chief Executive Officer of Sunworks, added, "By joining with Peck, our vision for spreading clean solar energy throughout the U.S. is amplified and expanded. Peck has demonstrated the ability to grow revenue and maintain profitability, and we believe that the combination of our teams, customers, projects and partners will materially accelerate revenue growth and earnings. Peck's strong partnership with GreenBond Advisors will allow us to offer financing to a broader range of customers and increase our addressable market. Additionally, our expanded scale will enable us to source solar panels and equipment through Peck's established relationships at lower costs, benefiting our profit margins. Being part of Peck's platform is exciting, and in the best interest of Sunworks shareholders, customers, business partners and employees." ♻

# Avoiding Harmful Chemicals in Plastic

### *Reduce Exposure to Toxic Household Plastics*


humannhealth.com

Everyday plastic items contain many chemicals, some of which have documented negative health impacts. Most notably, phthalates and bisphenols are known endocrine disruptors and have health impacts ranging from reproductive development and fertility issues to behavioral problems and asthma in children. Exposure to these chemicals is of special concern during fetal development, infancy, and childhood.

Research still needs to be done to fully understand the health impacts of these additives, but we know that at least some of them are toxic, and all can leach out of the plastic products we use every day. As the New York Times reported in July, this means we are all touching, eating, drinking, and breathing toxic chemicals. While many of us spend more time at home, here's how you can reduce your family's exposure to toxic chemicals contained in common household plastics.

### Plastics to Avoid

1. Avoid eating foods stored in plastic. When possible, buy and eat food without plastic packaging, including whole foods or unwrapped items. If this isn't realistic, you can transition your food into metal and glass containers when you get home.

2. Swap out plastic containers labeled with codes 3, 6, and 7. It may not always be possible to avoid plastic food packaging and storage containers. If you cannot avoid it entirely, certain plastics are worse than others. Plastics marked with recycling code 3 are known to contain phthalates, while those with recycling code 7 contain bisphenols. Plastics labeled with recycling code 6 contain styrene, a probable carcinogen according to the National Institutes of Health. Plastics 3, 6, and 7 are also the least recyclable.

### Household Products to Replace

1. Swap out plastic toys. When shopping for new toys, choose items made from non-plastic materials like wood or silicone. This is especially important for infants and toddlers who are likely to put toys in their mouths.

2. Replace vinyl products. Phthalates are commonly found in vinyl products in your home, like placemats, floors and shower curtains. Use of these products can release chemicals linked to health issues for adults and children.

3. Use a HEPA-filtered vacuum. If you can, purchase a HEPA-filtered vacuum. These can filter out tiny particles, while other vacuums release the chemicals in the air blown out of the back.

### Cooking and Storing Without Plastic

1. Do not heat plastics. Stop washing plastic in the dishwasher or heating it in the microwave, and avoid putting already hot foods into plastic containers. Higher temperatures increase the likelihood of chemicals leaching from the plastic. Changing this small habit will reduce the risk that harmful toxics find their way into your food and drinks.

2. Ditch the plastic wrap. Plastic wrap is known to contain phthalates. So, when it's time to store your leftovers, 1.aluminum foil (with parchment paper between food and foil), just parchment paper or natural wax paper can be a better option.

*Reprinted from U.S. PIRG. Originally posted at https://uspirg.org/feature/usp/how-avoid-harmful-chemicals-plastic.* ♻

# Municipal Solar Madison, NH

*Cont'd from p.13*

represents Ray's legacy of a person who fostered and promoted a learning culture," said Dowd, who used to host O'Brien's school classes on field trips to Pine Tree Power where he underscored that Pine Tree wasn't about creating energy — it was about converting energy, a lesson that O'Brien explained to his students in terms that would stay with them.

Chuck Henderson, local representative for Senator Jeanne Shaheen, was present at the ceremony, which was attended by about 17 people. Speaking on behalf of Senator Shaheen, Henderson said, "Each successfully completed community solar project helps town committees and project champions to do the homework, gain the confidence, build consensus and go forward with their project. Today, we honor one such project champion by dedicating the project to Ray O'Brien. Ray approached the challenges of changing our energy use with boundless curiosity, perpetual excitement and the conviction that we can make the world a little better by working together to get something done."

The project is installed under a Power Purchase Agreement (PPA) where an investor owns the solar array and sells electricity to the town at a discounted price over the utility's rate. For the town of Madison, that investor is Blue Haven Initiative, an impact investor dedicated to putting wealth to work for positive social and environmental change. Blue Haven is able to take advantage of a 26% Federal Investment Tax Credit and equipment depreciation write-offs that the municipality cannot take because it doesn't pay taxes.

The town benefits because it can purchase the facility in the future at a reduced cost instead of owning it from day one. At the start of year six, the town can purchase the installation from Blue Haven at a fair market value, normally around 60% of the original cost. After the purchase, the town owns all the power generated. This project is estimated to save the Town of Madison almost $370,000 over the 40-year lifespan of the system, according to Brittany Angelo of Maine and New Hampshire's ReVision Energy. In her remarks Angelo said ReVision Energy "is honored to work with the town."

Madison is the first community in the [Mount Washington] valley to build a solar system for its town use, though the North Conway Sewer and Water district have a large array to power their wastewater plant.

Madison's Energy Advisory Committee consists of individuals who also sit on the Albany, NH solar-powered Tin Mountain Conservation Center's valley-wide Energy Team.

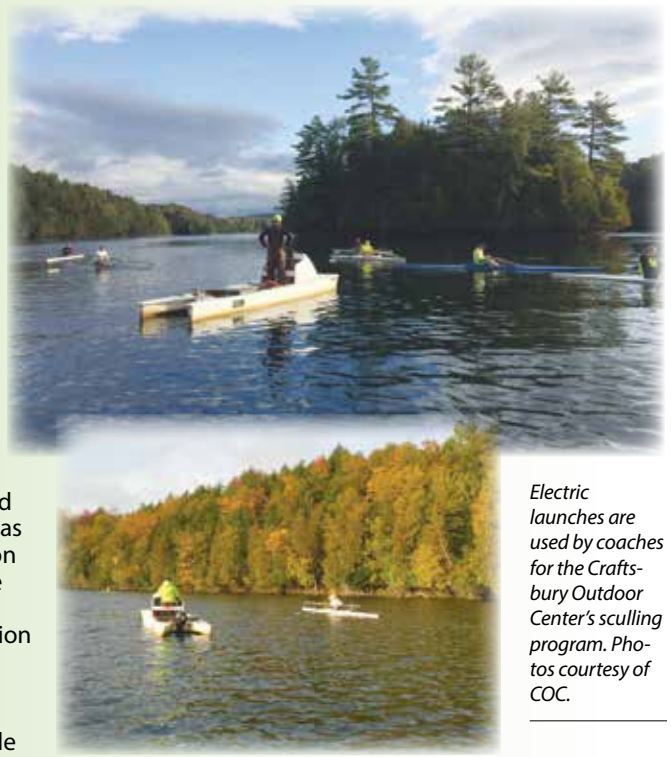
For more information, go to madison-nh.org.

*Tom Eastman is a reporter for the* Conway Daily Sun. ♻

# Craftsbury Sculling Program Enlists Electric Boats

*Roger Lohr*

Seven years ago, the Craftsbury Outdoor Center's (COC) sculling program director, Troy Howell, received a mission-oriented directive from the organization to look into acquiring and using electric boats for the operation. In November 2008, Dick Dreissigacker and Judy Geer purchased the Center that was established in 1976 in Craftsbury Common and reformed the company as a non-profit organization with a new mission. The mission was to support and promote participation in cross-country skiing, rowing, and running as lifelong sports, using and teaching sustainable practices while protecting and managing the surrounding environment.



*Electric launches are used by coaches for the Craftsbury Outdoor Center's sculling program. Photos courtesy of COC.*

COC fleet manager Erika Sloan stated, "We use the electric launches for two main purposes: coaching and safety. Coaches drive the launches around the lake to work with the athletes, including sculling campers, local community rowers, and resident high-performance athletes. For safety, the coaches use the launches to keep an eye on and assist any athletes who may need help during a session. For example, if a sculler flips their single, the coach can drive over to them in the electric launch and assist them getting back into the boat."

According to electric motor boat manufacturer, Elco, there are 13 million boats registered in the U.S. today. If only 5% of them repowered with electric motors, there would be one billion pounds of CO2 emissions eliminated.

The coaches go out in two to four launches per class, and there are about 35 camps per season with a total of about 850 campers. The COC sculling program is offered in a full week program that each has about 35 participants and 4-day or weekend programs that each has 25 participants.

The launches are charged each night and used for two or three sessions in the morning (from about 7 AM - 1 PM). They're then plugged in to be partially recharged for one to two afternoon sessions (4-7:00 PM), after which they are plugged in to recharge overnight. They have batteries and a charging station. The electricity is sourced by COC's grid-tied solar array. COC does have one gas-powered motor if needed for an emergency.

Electric launches were acquired seven years ago as an affordable option for the boat motors. Originally, they acquired ten horsepower motors from a company named Torqeedo, which are made in Germany, but these motors were not easily serviced. Now COC uses motors produced by Elco, a company that has been in the electric motor business for 80 years. This motor is built within the housing of a regular gas outboard motor. It takes a few hours to charge the batteries for the 7-15 HP Elco motors.

*Electric Launlh parked on the dock and charging.*

The COC summer sculling program is sold out with pre-registered participants. There is usually a wait list, which has become a "wait and see" list this year as the program has been suspended until further notice due to the COVID-19 outbreak. The COC is awaiting governor guidance on opening the program for this summer.

The COC sculling program is an important factor to the northeastern Vermont economy as almost all of the 850 campers stay at COC where there are 114 beds ranging from shared dorms to private cabins. There are three full time coaches at COC and about fifty seasonal coaches that lead three to four camps each.

For more information about the Craftsbury Outdoor Center sculling program, contact www.craftsbury.com.

*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. ♻