Delay Is Death

Bob Berwyn

The February 28th report on climate impacts, vulnerabilities and adaptation from the Intergovernmental Panel on Climate Change was finalized just as Russia invaded Ukraine. Russian scientists at the online approval session Sunday apologized for their country’s invasion, while the war drew Ukrainian scientists away from the meeting.

It might be hard to concentrate on the new science assessment as a war erupts in Europe, but it’s important to focus on both subjects at the same time because they are deeply related, said Bob Schoonover, a climate security expert with the Council on Strategic Risks’ Center for Climate and Security, and a former United States intelligence officer.

“Your shouldn’t shut one or the other off. Humanity’s relationship to fossil fuel isunderwriting this invasion,” he said. “Putin thought he could get away with it because of Europe’s dependence on Russian gas.”

In the longer term, ending the addiction could even reduce the need for military spending, since much of it goes to securing sources and transportation of oil and gas. “Reducing reliance on fossil fuels enhances national security for the United States and other countries, and we should make that argument,” Schoonover said.

In the report, hundreds of scientists representing nearly every country described spiraling climate impacts, with the deadly, destructive effects like floods, famines and wildfires outpacing even some of the most ambitious efforts to adapt. The scientists warned that some of the changes are so extreme and fast that they will push communities beyond their ability to deal with them in places like the Arctic and along some coastlines, and pose a serious threat to food systems in many places.

STICK IT TO PUTIN – DRIVE ELECTRIC NOW

Paul Gipe

You can—and should—do more to help Ukraine than waving a digital flag on social media. You can stick it to Putin, weaken his war machine, and drive a stake through the heart of oil oligarchs, wherever they are, by going electric. Ditch the diesel truck, park your polluter, get yourself an electric vehicle (EV) and drive on 100% American-made electricity.

Every gallon you pump, every mile you drive, contributes to funding murderous Saudi autocrats, who think nothing of dismembering journalists or beheading their citizens. Venezuelan dictators who starve their own people, or a Russian dictator who threatens nuclear Armageddon.

Oil and natural gas accounted for 68% of Russia’s total export revenues in 2013 and as much as 40% today. Most of this has been siphoned off to build the tanks now rolling across Ukraine.

If we want to help Ukraine, we have to starve the beast. Biden’s banning Russian oil isn’t nearly enough. We must wean ourselves off oil entirely because it’s costly, fuels despots, and leads to war—not to mention drought, wildfires, and catastrophic climate change.

DIY Raised Bed Gardening

Lydia West

So, you’ve done some research and decided that raised garden beds are for you. Now you need to decide what lumber to use, and get some tips on just how to construct your beds.

Wood Characteristics You Should Look for

The wood that you use is going to be constantly wet and will have soil against it. You need something that will stand up to this abuse and that, at the same time, is safe for your produce. Pressure treated wood may seem like a great choice. It’s readily available and is meant to survive for years in the ground or in applications where it is constantly wet.

However, you need to be aware that heavy metal chemicals are used to treat the wood to make it rot-, decay-, and bug-resistant. This is true even for the “new, safe” pressure treated wood that has been on sale since 2003. These toxins

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NYS IS the Top Community Solar Market in the USA

On March 22, 2022, Governor Kathy Hochul announced New York State has become the top community solar market in the United States with more than one gigawatt (GW) of community solar installed and operational. To serve 209,000 homes across the state, NYS also has the largest solar pipeline in the nation with enough community solar under construction to serve an additional 401,000 homes, ensuring continued access to clean affordable solar for all NY-ers for years to come. This announcement accelerates progress towards meeting the Climate Leadership and Community Protection Act (CLCPA) goal to generate 70% of the state’s electricity from renewable sources by 2030 and for 10 GW of solar by 2030.

“Reaching this nation-leading milestone—with more than 1 GW of community solar installed is a testament to NYS’s aggressive pursuit of clean-energy alternatives that will supercharge our economy and bring us one step closer to a carbon-neutral future,” Governor Hochul said. “NYS is once again making clean energy history, and with many families facing the burden of rising energy costs, my administration remains committed to expanding access to solar energy, which will deliver savings and stabilize electricity bills while meeting our aggressive climate goals.”

“Over 1 GW of progress was made today, enough to power over 200,000 homes across New York State,” said Lieutenant Governor Brian Benjamin. “When we think about the future of our state, we must think about both the economic prosperity we aim for, in addition to the welfare of our children. Now, when those future generations of NY-ers look toward today, they’ll know progress was made with them in mind. I’m proud to announce today that NY is the capital of solar power in the United States.”

Lieutenant Governor Brian Benjamin made this announcement in Schenectady County at a 7.5 MW community solar project that is paired with 10 MW hours of energy storage on the site of a former landfill. Located in the town of Glenville, the project was developed by DSD Renewables, which is also the owner and operator of the project. The site is part of a seven-project, 25 MW portfolio made possible through a collaboration with the Schenectady County Solar Energy Consortium (https://bit.ly/Schen-Cnty-Solar-Consortium) that provides over $400,000 in energy savings annually to the municipalities of Duanesburg, City of Schenectady, Town of Duansburg, Town of Glenville, Town of Niskayuna, Town of Princeton, Town of Rotterdam, Village of Delanson, and Village of Scotia.

Community solar supports NYS’ goals to generate 70% of the state’s electricity from renewable sources by 2030 and for 10 GW of solar by 2030.

Earth Day/Green Up Day 2022

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>April 22nd</td>
<td>Earth Day at Green Energy Times, the official Earth Day is celebrated annually on April 22nd. First held in 1970, this day was designed to foster appreciation for the earth's environment. Check out events in your local community on how you can help celebrate Earth. Learn more at <a href="http://www.earthday.org">www.earthday.org</a>.</td>
</tr>
<tr>
<td>May 7th</td>
<td>Vermont Green Up Day rally thousands of volunteers across Vermont to get outside and clean up roadsides and waterways. This year Green Up Day is on May 7th. This is a statewide spring-cleaning of our beautiful environment. Pick up your free Green Up supplies from your volunteer town coordinator and spend an hour or two picking up litter around your town. It makes a huge difference and it feels great to give back to your community. Learn more at <a href="https://bit.ly/GVT-GreenUpDay2022">https://bit.ly/GVT-GreenUpDay2022</a>. Congratulations to Marina H, 7th grader from Shelburne Community School for winning the 2022 Green Up Day Poster Contest!</td>
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Vermont’s 2022 Legislative Update

March 31, 2022

The Vermont Senate passed S.148 the Environmental Justice Bill, by a vote of 28-1. H.740 the state budget bill passed the House 135-4 with historic levels of one-time funding for climate-related projects including:

- $5m for matching funds for Advanced Metering Infrastructure for rural and municipal electric utilities, through DPS.
- $48m to support municipalities with technical assistance, energy assessments and municipal weatherization, fuel switching and other potential energy-saving and resilience measures. This includes $40m in direct grants to municipalities for this work of projects up to $250,000.
- $22m in investments to expand the suite of electric and high-efficiency vehicle incentives.
- $13m in electric vehicle (EV) supply and equipment grants for EV charging stations.

Scott, the Clean Heat Standard with the goal of lowering greenhouse gas emissions from the thermal sector (energy used to heat and cool the places we live and work) passed the House on March 17th after a vote of 96-4. The bill is currently being discussed in the Senate Natural Resources and Energy Committee. Governor Scott has not indicated his support for the bill yet.

There's never been a more overriding public interest in moving rapidly to domestic, American-made, clean, renewable energy. It's time, as Captain Kirk might say, "Scotty, warp speed ahead for all electric, all-renewable future."

Paul Gipe lives in California, has worked with renewable energy for the past four decades and is a member of the prestigious Energy Watch group. He’s driven electric for seven years. (pgrace@igc.org)
It's Not Just About Global Warming—Air Pollution and Health

Janis Petzel, M.D.

Startling news from the science journal, Nature: Scientists are running out of children who have not been exposed to toxic air pollution to use as a comparison group for health studies. More than 90% of children around the world are exposed to dirty air from the burning of fossil fuels.

Internal combustion engine vehicles and coal-burning power plants throw nasty stuff into the air—acids such as sulfuric or nitrous dioxide; heavy metals such as mercury, arsenic and lead (unleaded gas did not eliminate this problem); carbon monoxide; carbon dioxide; particulates; formaldehyde; benzene; ozone to name a few.

Industrial pollutants and car exhaust infiltrate the small spaces in our lungs when we breathe them in, causing direct harm to our bronchial tubes and our alveoli. This makes asthma and bronchitis worse. But what happens in the lungs does not stay in the lungs.

Microscopic particles known as PM2.5 are small enough to pass through the thin gas exchange membrane of the lungs’ alveoli into the bloodstream. Blood containing these particles is pumped by our heart to your brain and the rest of your body.

Where you find gas-or diesel-burning vehicles, you’ll find this tiny but toxic particulate matter. In an area where there is even a small amount of air pollution (like your garage in the winter when you warm up your car) you are breathing in these invisible time bombs.

Inflammation from PM2.5 particles is the link between pollution and a myriad of diseases, from non-insulin dependent diabetes to birth defects in babies and to dementias like Alzheimer’s Disease. We know that air pollution aggravates Covid, hypertension, ischemic heart disease, cerebrovascular disease (strokes), chronic obstructive pulmonary disease, and is strongly suspected to play a role in some mental illnesses, including anxiety, depression, and suicidal thoughts in children.

The American Lung Association reports that children who grow up in areas high in particulate matter and ozone (components of smog) show reduced lung growth. It’s like these children grew up with heavy smokers in the house. And if there were smokers in the house, or sources of indoor pollutants like natural gas burning furnaces or cookstoves, the damage just piles on. Children are at risk even before they are born. Pregnant women exposed to air pollution have a higher risk for pre-term birth and babies with birth defects and low birth weight.

Who do you think is more likely to live near smoggy roads or downwind from a power plant—Bill Gates’ family or a poor family? We know there are social determinants of health (also called disparities in health), and they start early. People who have been discriminated against historically get pushed into lower rent housing close to trucking lanes and industrial sites (see the inspiring Duwamish River Community Coalition’s work to change this: https://www.drrc.org/).

But living away from freeways and industry is not enough to protect your children. Non-free-way roads, and places where cars idle (including intersections with traffic lights) are areas of high air pollution exposure. On sidewalks, children in strollers get exposed to almost 50% more PM2.5 than the parent pushing the stroller—think of which set of lungs is closer to tailpipe level.

Idling cars and school buses produce tremendous amounts of localized air pollution, measurable in the pick-up lanes at schools. Think of that when you’re sitting in front of your child’s school with your engine running. What’s more, the pollutants are getting inside the car or bus while you’re sitting there, so when the kids climb in to go home, guess what they are breathing? Isn’t that disturbing?

Equally disturbing: Across the United States, idling in personal vehicles wastes about three billion gallons of fuel a year. Idling in trucks wastes another three billion gallons. Our fuel purchases fund brutal regimes. For example, the U.S. has been buying the equivalent of 4.9 billion gallons of gasoline and 2.9 billion gallons of diesel in Russian crude oil each year (245,194,000 barrels of crude). While Putin gets richer, our vehicles emit completely avoidable air pollution.

There are so many reasons to stop burning gasoline, diesel, oil, and coal. Has one more brutal war by an oil oligarchy (Ukraine is not the first victim, let’s hope it’s the last) made you decide it’s time to stop buying fossil fuels? Good. If not, what’s it going to take? How about the immediate benefit to your child’s health?

However, it is good to know that children’s respiratory health can rebound when the toxic exposure stops before permanent damage occurs. If you’re not ready to drive an all-electric vehicle, or your school district has not yet purchased all-electric school buses, at least turn off your engine if you’re going to be idling for more than 30 seconds. The U.S. Department of Energy recommends this, and it will not hurt your car.

Janis Petzel, MD is a physician, grandmother and climate activist whose writing focusses on resilience, climate, and health. She lives in Islesboro, Maine where she advocates and acts for a fossil-fuel free future. She serves on the Islesboro Energy Committee and is a Climate Ambassador for Physicians for Social Responsibility.
Barbara Whitchurch

My favorite food, guacamole, has a built-in supply-chain environmental impact. Made from avocados, which are certainly not grown in Vermont, it requires farming, tending, harvesting, packaging, and lots of shipping. And if I want my guacamole pre-smushed and packaged in plastic, that just makes it all worse.

Likewise, a study by the Yale School of Environment (YSE), published in Nature (bit.ly/yale-ice-supply), used lifecycle assessment and energy modeling tools to analyze data about indirect emissions from internal combustion engines (ICE) vehicles compared to electric vehicles (EVs). Researchers calculated what a carbon price on those figures would cost and what effect it could have on the auto market (bit.ly/yale-ice-supply-ct).

They found that the total indirect emissions from EVs are trivial in comparison to the indirect emissions from fossil fuel-powered vehicles. This is in addition to the direct emissions from burning fossil fuels — either at the tailpipe for ICE vehicles or at the power plant smokestack for electricity generation — showing that EVs have a clear advantage in emissions, over ICE vehicles.

“The surprising element was how much lower the emissions of electric vehicles were,” said postdoctoral associate Stephanie Weber. “The supply chain for combustion vehicles is just so dirty that electric vehicles can’t surpass them, even when you factor in indirect emissions.”

EVs offer a cleaner, lower-emission experience for consumers, but some skeptics still criticize the mining, manufacturing and charging practices necessary for their batteries as too dirty. But, compared to what? Do they propose an available alternative? When compared to ICE vehicles, this study shows how minuscule the cradle-to-grave emissions of EVs are.

(Keep in mind that the supply chain for gasoline itself - oil discovery, pumping, transporting to a station near you - means that, just as with my guacamole, regardless of what you end up doing with that gallon of gas you bought, it has already caused considerable damage.)

According to lead researcher Paul Wolfram, the study shows that “the elephant in the room is the supply chain of fossil fuel-powered vehicles, not that of electric vehicles.” He noted that the faster we switch to EVs, the better — at least in countries with a sufficiently decarbonized electricity supply, like the US.

“A major concern about electric vehicles is that the supply chain, including the mining and processing of raw materials and the manufacturing of batteries, is far from clean,” said Yale Economics professor Ken Gillingham. “So, if we priced the carbon embodied in these processes, the expectation is electric vehicles would be exorbitantly expensive. It turns out that’s not the case; if you level the playing field by also pricing the carbon in the fossil fuel vehicle supply chain, electric vehicle sales would actually increase.”

Electric cars have emissions advantages across the entire supply chain, and they’re only going to get cleaner. Keep in mind that buying a hybrid simply combines the worst of both worlds, while keeping you stuck with ICE maintenance, repair and replacement costs.

Barbara and her husband are owners of LEAF and Niro EVs and are Board members of VT Passive House (bit.do/mdx-mec-bldg, bit.do/gkw-lj).
the cost of gasoline suddenly increased. A gallon of gas is $4.29 or $3.29, even if the
smart driving can reduce costs whether a point, because most drivers can best be
swayed to change behavior when cost is involved. These days, as fuel prices at
will provide access to eligible fleets that operate in New York’s disadvantaged com-
unities to create an equitable and impactful transition to a greener New York. Na-
tional Grid is partnering with CALSTART and the New York State Energy Research and Development Authority Truck Voucher Incentive Program to make it even easier and affordable for fleets operating in underserved communities to purchase and lease eligible EVs.
National Grid is focused on tackling climate change challenges and providing energy
solutions. We live in the communities we serve and are committed to improving
our environment by accelerating the transition toward clean transportation and a carbon-neutral future that can benefit every New Yorker. To learn more about the program, please visit: https://www.nation-
algirdus.com/electric-vehicle-hub/

Leslie Vishwanath
National Grid is offering substantial financial incentives to commercial custom-
erly, as part of a statewide joint util-
ity program. The purpose of the EV Make-Ready Program is to accelerate the electric
vehicle (EV) market transition through the implementation of public charging initiatives. The goal of the program is to create enough charging infrastructure to support 850,000 EVs in New York State by 2025. This is the most ambitious EV effort outside of California that supports equitable access to clean transportation choices and helps build a reliable charging network.
By providing greater access and more charging options, National Grid is support-
ing the growth of EV use. The program will balance the transportation ecosystem, which is the largest contributor of greenhouse gas emissions in the United States, according to the Environmental Protection Agency. Consequently, this program will help mitigate climate change, improve air quality, amplify access to cleaner transportation opportunities in underserved com-
unities, and reduce our national reliance on petroleum.

New York’s Climate Leadership and Com-
munity Protection Act (CLCPA) addresses the historic effects of climate change on disadvantaged communities and institutes mechanisms to ensure these communi-
ties benefit from the clean transportation transition. The CLCPA requires all state
agencies to prioritize decarbonization in disadvantaged communities to tackle climate change and support healthy neighbor-
hoods. The electrification of conservation and logistics companies, private commer-
cial customers, as well as school districts. National Grid is also supporting the transit

Wayne Michaud
Smart driving, which is also known as eco-
driving, green driving or just “driving more efficiently,” is a method of driving that really matters because practicing it can have positive effects on
each one of us and the planet:
• Reducing CO2 emissions that have an impact on our climate.
• Reducing fossil fuel consumption to keep oil prices low.
• Improving air quality and health. Make us safer drivers.
• Reducing the amount of money spent in fuel use and maintenance.
We’re going to focus mostly on the last point, because most drivers can best be
swayed to change behavior when cost is involved. These days, as fuel prices at
the pump have spiked mainly due to a war, people are saying, “It’s too bad!”
Smart driving can reduce costs whether a gallon of gas is $4.29 or $3.29, even if the
vehicle is an inefficient gas guzzler. Case in point, nearly 50 miles per gallon when I drove a muscle car, the Arab oil embargo hit. As the cost of gasoline suddenly increased by more than 40%, I went from being an irresponsible street racer to practicing

Here’s how we save:
Accelerate and break smoothly. A great example of this is to “play the lights.” An
oblivious driver will notice when a traffic light has turned red a quarter mile or more
down the road. Typically, drivers waste gas accelerating to the light and then braking more which increases brake wear.
Instead, be a smart driver by getting into the habit of immediately taking your foot
off the accelerator, not coasting to a stop at the red light. Gas saved as the car slows down
some and brake wear is minimized. And then, sometimes, the light turns green
before getting to the intersection. You’ve

Just won the “play the lights” game by not stopping to maintain some vehicle
momentum! According to fueleconomy.gov, this practice will increase fuel economy by 10% to 40%.
• Watch your speed. We all know that
speeding wastes fuel. With gas prices at an
all-time high, increasing fuel economy by
7% to 14% by observing the speed limit is a
big deal than ever.
Avoid excessive idling. Prolonged stationary warmups, letting a car idle in a
parking lot, or using drive-throughs can add to costs. From a compact car to a diesel
pickup truck, idling unnecessarily for ten
minutes a day can cost anywhere from $30 to $250 depending on the price of gas.
Do not mention the need of more frequent oil changes. Turn your key, be idle-free.
Additional money-saving tips while driving:
Make sure tires are properly inflated; underinflated tires not only wear more
quickly, but the increased rolling resistance can reduce fuel economy by 3% to 4%.
Store a roof-top cargo box when not in use as it increases aerodynamic drag that
reduces fuel economy anywhere from 2% to 25%, depending on speed.
Clean junk out of the trunk; each one hundred pounds of extra weight reduces
fuel economy by 1% to 2%.
• Set the air conditioning temperature
higher in hotter weather to save up to 15%
in fuel.
The big win of smart driving is that

...
Multifamily Community Implements EV Charging

Jeff Gilmore*

Worldwide we are in the midst of a big transition away from internal combustion cars and their network of gas stations to electric vehicles (EVs) and new arrangements for powering them. This article addresses the challenges of adding chargers at scale to multifamily residential structures where parking is not adjacent to each living unit.

Beginning and scaling up charging initially seems incredibly daunting. Most parking garages, carport structures, and parking lots have very limited electric capacity. And it can be challenging to see how to make the economics of wiring, charger purchase and electricity costs work out.

Ecovillage at Ithaca (http://ecovillageithaca.org) has been working on scaling charging infrastructure to their 100 households since 2017, and has devised some strategies that have made EV buildout practical and reasonably cost effective.

Key Strategies

• Focus on installing 240-volt, charging-ready outlets, not chargers.
• Use daisy-chained wiring for charging circuits.
• Choose chargers with circuit-sharing capabilities.
• Standardize equipment by committing to one brand (manufacturer) of networked chargers.
• Plan ahead for scale.

These strategies are linked – each depends on the others to make them workable.

Let’s look at them one by one:

Installing 240-volt, charging-ready outlets

A useful goal is to have at least one parking space for each household pre-wired and ready to receive a charger. That means focusing first on how to provide the most 240-volt, 40-amp outlets using the financial resources and service capacity currently available.

Why is this helpful? Because it allows for much cheaper wiring strategies and avoids tying up capital in buying chargers today which may not get used for years if particular residents are not yet ready to purchase an EV.

Ideally these outlets should be in the parking spaces already assigned to residents, rather than set up for shared charging, as the resident experience is much more convenient and billing is simpler with dedicated chargers.

Daisy-chained wiring

The problem with typical charger wiring is that large, dedicated circuits are used for each charger, which needlessly ties up valuable electric service resources. For example, if a given garage building is served by a 100-amp circuit, then only two to three chargers could be installed in that entire building unless measures are taken to address that.

One of those measures is daisy-chained wiring. This means that, instead of each 240-volt outlet having its own circuit connected back to the electric panel, you connect five to ten outlets in parallel on the same circuit. Thus, to wire a set of adjacent parking spaces, you need only one home-run circuit to the electric panel and then short hops of wire from one parking space to the next. This reduces the cost per outlet significantly, and allows a small electric service to support many parking spaces.

Choose chargers with circuit-sharing capabilities

To make daisy-chained wiring work without overloading circuits, we need to use chargers that can communicate to dynamically limit charging rates. Such chargers allow for the creation of charger groups for which a total current limit can be configured, and generally require a network connection to make it work. When implemented properly, this feature continually adjusts the rate for all chargers in response to the coming, going and the completion of charge cycles of the vehicles.

It is important to remember that each EV does not need to refill its entire battery capacity each night; most cars daily typically drive 30 miles or less, so they only need a few hours on charge to top off. This can allow, for example, a 100-amp service to effectively serve at least 20 EVs.

Standardize on one brand of networked chargers

Selecting a particular brand of chargers which have the ability to communicate over a Wi-Fi network allows for a number of important benefits:

• Today, only chargers from the same vendor can perform the dynamic circuit sharing described above.
• Using the same vendor means that charging statistics from all chargers can be collected and downloaded in one place. This greatly facilitates billing.
• Maintenance people become familiar with their installation and operation.
• All chargers have the same capabilities, so policies and management are straightforward compared to a random mix of chargers.

The EneIX Juicebox product line is one example of chargers that support this strategy.

Plan for scale

This simply means, operate from the assumption that eventually most of your residents will need access to charging. Thus, you avoid taking shortcuts that work OK at first when there are only a few EVs but which become a major headache later on as EVs proliferate.

• Some examples of scale-related thinking:
• Seek to automate data collection. If you are doing billing for user-charging activity, choose equipment that can automatically accumulate such data in one location that allows for bulk downloading.
• If you are administering resident billing yourself, rather than using an outside network, craft clear policies that work at scale. Questions to answer include:
• Do you charge for power? If so, do you sell at cost or add a markup?
• How do you calculate energy costs and what aspects are included?
• Do you charge any session fees in addition to per-kW/h charges?
• Do you charge any fees to fund ongoing maintenance of your charging infrastructure?
• Who buys the chargers, you or the residents themselves?
• Plan for growing electric service needs. This can mean thinking about how you do wiring today in ways that won't require (much) rework later as you need more capacity. Sometimes it means installing some conduits and wires you don't yet need if it is cheaper to do so now. It also means working with your utility company to...
MEET YOUR SOLAR INSTALLERS

Jessie Haas

603 SOLAR

603 Solar of Exeter, NH, was founded in 2018 by Sean Carlson, Zach Haithcock, and Scott Johnson, who worked with larger companies before going out on their own. The company serves Maine and New Hampshire, installing mostly grid-tied systems for both commercial and residential customers, and offers engineering, procurement, construction, and contracting services. They are not married to any one solar module manufacturer but use several popular models.

The process begins with a site evaluation, including an assessment of yearly electricity use. Then the team puts together a scale model of the home and array so customers can see exactly what it will look like. 603 Solar submits the permitting paperwork, completes the installation, coordinates with state inspectors, and provides monitoring. They can always tell customers what the system is doing and can alert them if there is a problem. The company has installed 4,766 kW, including 1,799 kW in 2021. Haithcock says there have been many inquiries recently, as gas and utility bills rise. Supply chain issues are an issue, but they have not been forced to put any projects on hold. A recent project is installing the 44.8 kW array at the new New Hampshire State Liquor Store in Concord. 603 Solar also worked with the Solarize Canterbury project in the summer of 2019. The project met its goal twice-over, installing 35 new solar arrays in three months, with total installed kW of 340.4. The estimated year one production was 375,231 kWh, and total yearly avoided emissions was 264 metric tons. The Canterbury project was initiated by the town’s energy committee, which put out a request for proposal and ultimately chose 603 Solar for the project.

Community solar. 603’s approach to community solar differs slightly from that of many other installers. With most community solar projects, the ultimate cost depends on how many customers agree to convert to solar. In communities that are less ready to switch over, the cost can be higher. 603’s community-based solar program, Solar Now, is more transparent upfront. Cost is based on the number of panels each home or business needs. Customers can determine the cost of their system immediately. 603 notes on their website, “It also means we are putting our best foot forward right off the bat, instead of relying on other people switching in order to get a discount. The campaign generally lasts three months and anyone within the community that signs up during the campaign will be locked in at the special pricing. Throughout the campaign we work with the community to sponsor educational events, tabling events, advertising, and anything else that will help spread awareness of the campaign.”

Though it is a New Hampshire company, 603 Solar offers financing through Vermont-based credit union VSECU. VSECU membership is normally only available to those who live or work in Vermont or are related to VSECU members, but they also extend membership to the Northeast Sustainable Energy Association (NESEA). 603 Solar customers wanting to finance through VSECU must join NESEA. Memberships cost $75 per year, with reduced rates for students, seniors, and professionals at the start of their careers. There are also business memberships starting at $300 per year for small businesses with one to 10 employees, up to $1,200 per year for industry leaders.

Membership gives 603 Solar customers access to the VSECU no-money-down “VGreen” solar loan. This allows homeowners to start generating their own electricity without the daunting barrier of a large upfront payment. Tax credits and other incentives can be applied to lower your principal. Loans are at discounted, fixed rates. VSECU also offers a VGreen money market account, several types of energy loans, green vehicle loans, and even off-grid home mortgages.

According to Haithcock, VSECU was the only lender willing to have a discussion with them when they were starting their company. “We’ve cultivated a real relationship with them. We know everybody in the Green Loans Department.” 603 has found VSECU excellent to work with, and though they could now go elsewhere, have decided to stick with the credit union that helped give them their start.

Zach Haithcock says the company has grown through being “honest, transparent, providing great customer service, and giving people the best ROI possible. Deep down I feel we’re doing the right thing, helping people get a good product they can believe in. I get to meet people all the time, and I just love what I do.”

Many thanks to our sponsor:

VSECU

AEGIS RENEWABLE ENERGY

Celebrating ten years of helping businesses and municipalities build a clean solar powered future

For Aegis Renewable Energy (www.aegis-re.com), founder and CEO Nils Behn, a native of Vermont’s Mad River Valley, it all began in a tenth grade anthropology class about indigenous people in the Amazon. Those people, he realized, had lived all those thousands of years in their environment, and the environment had thrived with them in it. The contrast with our civilization’s impact on the environment was stark.

And then there, Nils said, he made a pact with himself, “Whatever I ended up doing, I wanted to have a net positive for my existence, my time here on the planet. That’s very much part of the ethos of our company.”

After studying anthropology in college, Nils worked for a nonprofit, then moved to Idaho with his girlfriend, now wife and partner Sonia. The couple built a solar, off-grid strawbale house an hour and a half from the nearest town (population 100). They moved back to Vermont after having their son. Nils worked as a Senior Project Manager for Northern Power systems for nine years where he gained broad experience in commercial and military solar manufacturing and installations. He then ran the wind division of Alteris Renewables. After Alteris merged with RGS Energy, Nils spun the division off into Aegis Wind LLC, now Aegis Renewable Energy, Inc., based in Waitsfield, Vermont. Sonia Behn is the financial controller for the company, and as a woman leader in the construction and renewable energy sectors, works to support women in those industries. She served on the board of the Amicus Solar Cooperative (www.amicussolar.com) which is a member-owned co-op of 68 solar installation companies throughout the U.S. and Canada.

Amicus Solar Cooperative provides Aegis and its other members access to equipment and components at prices typically reserved for only the very largest solar companies in the country. This advantage allows Aegis to...
Chroma Technology Reduces Expenses and Carbon Footprint

George Harvey

Chroma Technology was founded in 1991 as an employee-owned company to manufacture optical filters for a variety of scientific purposes. Its products are used for purposes ranging from biology to astronomy and machine vision. It is a B-corp. It has over 100 employees, and is located near Bellows Falls, Vermont. It also has offices in Germany, Japan, and China.

Chroma Technology built its current facility in Rockingham Vermont (the municipality that includes Bellows Falls) in 2003, with a view to energy efficiency and conservation. The investments made in energy efficiency for the new facility helped save the company 475,000 kilowatt-hours (kWh) of electricity and 6,000 gallons of propane per year, reducing its carbon emissions by over 75 tons each year from propane savings alone (https://www.chroma.com/company/).

Now, Chroma Technology has gone further toward sustainable operation. It partnered with Green Lantern Solar, based in Waterbury, Vermont, to build a solar array near its manufacturing plant. The new array has 1870 solar modules and a capacity of 500 kilowatts, which is enough to provide about 950,000 kWh of electricity per year. The electricity will be sufficient to offset about 800,000 pounds of CO2 each year. That is the equivalent of taking almost 150 cars off the roads. “As a Certified Employee-Owned B Corporation Chroma is committed to sustainable and socially responsible business practices,” Chroma Technology CEO Newell Lessell said. “This new solar array will enable us to significantly reduce our carbon footprint even as our business continues to grow.”

The new array will reduce the energy expenses for Chroma Technology by about a third. The company is still considering options for reducing its carbon footprint further. It is also a growing business with a worldwide presence, so we can expect more progress from it in the future.

“Aegis is also a member of the Amicus O&M (Operations and Maintenance) Cooperative (www.amicusom.com) which collectively provides ongoing maintenance services for the growing number of solar PV systems throughout the U.S. Aegis’ skilled service technicians allow the company to expand its valued relationship with its customers into the full life cycle of the solar project and ensures consistent coverage and standardized services for their customers.”

“Aegis currently works only on commercial and utility scale solar and energy storage projects, including rooftop, carport, and ground-mounted projects. They provide what the company calls “a suite of design-build services that encompass every step in renewable energy project development from feasibility and site analysis, complete engineering, procurement, and construction (EPC) services to final commissioning and maintenance.” They have installed 40MW since 2011, with a strong pipeline of projects for 2022 throughout the Northeast.

On bigger projects, supply chain is becoming a real issue. “Lead times have gotten crazy,” Nils Behn says. One utility recently announced very long lead times on some critical gear for connections.
Community Solar

Green Energy Times has published three articles in its Green Power Series that focused on a number of solar farm companies located in Maine, New Hampshire, New York and Vermont. Drawing from those articles, this article underscores a set of emerging environmental practices that are becoming increasingly important in the solar farm industry, and characterizes the leadership qualities among its developers.

In 1970, the U.S. established the Environmental Protection Agency (EPA), and 25 years later, in 1995, the EPA created the Brownfields and Land Revitalization Program to clean up and return targeted toxic land areas to safe and productive reuse. Unfortunately, the EPA estimates more than 450,000 U.S. brownfields still remain. Solar farm developers have joined forces to collaborate and meet that challenging problem with efforts to take strong, environmentally positive action to reclaim brownfield sites.

In G.E.T.'s February 2022 issue, it was reported that Manchester, New Hampshire reclaimed its 12-acre municipal landfill and installed an 8,000-panel solar array. The project led to a newsworthy visit by U.S. Secretary of Energy Jennifer M. Granholm last September, when she commended them and the city’s leaders for their collaborative environmental project work. G.E.T. also reported how we were struck by the environmental consciousness of Cipriani Energy Group in its New York solar farms, because they have adopted plans to transition from mechanical mowing practices and replace them with grazing animals like sheep and alpacas. Cipriani will interplant their ground-mounted solar farm arrays with native flowering plants that will attract pollinators.

In Maine, Massachusetts, and New Hampshire, ReVision Energy's goals and efforts demonstrate their respect for the ecological spirit and philosophy of what is possible for best practices in solar farm site design and management. ReVision's co-founder, Phil Coupe, recently wrote an inspiring piece published in the company’s newsletter, which captures the essence of the ecological spirit and philosophy of what is possible for best practices in solar farm site design and management.

Coupe's essay reflects Solar, to “increase food and renewable energy production and to see if the ‘dual use’ approach of agrivoltaics can help improve food and energy security,” according to Coupe.

Coupe added, “Based on early results from Jack’s Solar Garden, and from ongoing research worldwide, agrivoltaics (dual use farming) has immense potential to alleviate some of our worst problems. According to the 2021 report Dual Use, Dual Value Solar Agrivoltaics Power Farm Economics,” by Dr. Maggie Teliska and Michael P. Totten, just 1% of existing cultivated agricultural lands installing agrivoltaic microgrids could meet worldwide energy demand.

He continued by citing “Agrivoltaics: Producing Solar Energy While Protecting Farmland” by Bill Pederson and Brooks Lamb, which shows how “the dual use approach can dramatically increase land productivity.” The proof? Kominek produced 8,600 pounds of produce by planting seeds between the rows of his farm’s solar panels in 2021.

Coupe concluded; “Food production and energy generation have long been viewed as incompatible on the same patch of earth, if not mutually exclusive. The successful proof of concept that is Jack’s Solar Garden, along with solar grazing initiatives, has debunked the notion that clean, zero-emission solar energy production conflicts with farming. While crops can grow robustly between rows of solar panels, it turns out that livestock are the ideal ‘lawnmowers’ for ground-mounted solar arrays, because they keep vegetation from growing tall enough to shade the panels.”

All of these positive initiatives taken by solar farm management teams in the Northeast and farmers like Kominek in Colorado show that solar farms are increasingly aware of, sensitive to, and acting on environmental issues. And they can and do contribute to diversifying food production yields, environmentalism, and to promoting and protecting positive land use, biodiversity, clean air, clean water, and regional native species.

Toby Martin lives in Islesboro, ME, where he works locally and statewide to strengthen Maine’s clean energy sustainability. A founding member of the Islesboro Energy Team and the Islesboro Energy Committee, he also coordinates the Islesboro Energy Conference, and contributes to Green Energy Times as a writer and founding member of its Maine distribution team.

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A flock of sheep is grazing on a solar farm. This is an ideal combination, as the sheep keep the grass short and the solar panels provide shelter for the flock. (Photo: Evelyn Simak)

Gardens under solar panels in Boulder, CO produced more than 6,000 lbs of produce, while the panels above generate enough power for 300 local homes. (Kirk Siegler/NPR) (https://n.pr/3712BXc)
Coos County NH Communities Vote for Clean Energy

This year during town meeting season, five Coos County (NH) communities approved funding for solar and energy efficiency projects which combined will result in over a half million dollars in energy savings over their lifetimes, and leverage as much as $340,000 in grant support.

• The Town of Whitefield voted unanimously to replace and insulate the roof of their fire station, and put solar arrays on the roofs of the fire station, library and town buildings, totaling 66 kW in generation capacity.

• Franconia voted to install an 18.2kW ground mounted solar array behind their town hall.

• Randolph set aside $20,000 for an energy efficiency capital reserve fund to improve the energy performance of municipal buildings.

• The Gorham-Randolph-Shelburne Cooperative school district voted to fund a 124kW ground-mounted solar array to help offset the electrical bills of the Edward Fenn Elementary School.

• The Town of Gorham voted to create a $10,000 capital reserve fund to install solar on municipal buildings.

• The Town of Stratford voted to install a 50kW solar array at the town transfer station, after having already installed a 20kW array at the town hall in 2021.

In all, these projects are expected to generate more than six million kilowatt hours of clean electricity for these communities over a 25-year period. The energy savings will not only reduce the local municipal energy bills but also push down regional wholesale electricity prices whenever the arrays are generating power.

“We are excited to be a part of the solution and hope we get the grant,” said Gorham Randolph Shelburne Cooperative School District Superintendent David Backler.

Since 2011, NY-Sun has helped:

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NEW TECHNOLOGY: NEW CHOICES FOR ENERGY STORAGE

George Harvey

Our least expensive and least polluting forms of electricity generation happen to be intermittent or variable. We can bring them up to being highly reliable, highly responsive forms of energy by the simple addition of energy storage. But a question arises about what sort of energy storage we should use.

The answer to that question is not a problem because of a small number of difficult choices. It is quite the opposite. There is a huge number of choices, probably more than most people would care to count. In many cases, the question will arise only to find which of several choices is best. And many cases, the question will arise only to be too big for use in vehicles, but they have numerous advantages. There are many types and a lot of work is being done to develop them. The article at Wikipedia may be helpful for those who want to know more (www.bit.ly/Flow-battery).

Gravity

There are several types of gravity storage systems. The one that has been getting attention in the news lately was developed by Energy Vault. This system has a tower with apparatus for lifting very large, heavy blocks to some height. When power is needed, the blocks are allowed to go back down, generating electricity as they do. A recent article in CNN explains this further (www.cnn.it/3Nnd9A).

Chemicals

A lot of work is going into what is called “green hydrogen.” Most hydrogen is currently made using natural gas or coal, but green hydrogen is made by hydrolysis of water using renewable energy. Hydrogen can be used in a number of ways to create electricity or be used for fuel, but it is also important as a chemical. Some green hydrogen projects are intended to replace natural gas. A post at Rethink Technology Research says Fortescue Industries, an Australian industry giant, pledged to put up $50 billion Australian ($32.5 billion US) to replace one third of the UK’s natural gas with hydrogen (www.bit.ly/Replace-natural-gas).

Heat

We should consider heat for storage. Energy has been stored as heat for conversion to electricity later for some time. A lot of research is being done to use heat as much as months after it is stored. We might feel that this technology is still young. An article on the subject is in Wikipedia (www.bit.ly/Wiki-thermal-storage).

Compressed air

There are different ways to store energy by compressing air. One is to compress it to the point that it liquefies, then boil it to turn turbines, using just ambient heat. Highview has a project underway in Vermont to do just that. An article in Energy Storage News says that Highview has raised $70 million to build such projects, including one in northern Vermont (www.bit.ly/Highview-Vermont).

The cost of storing energy is declining rapidly. As it does, more options are becoming available.
Derry, New Hampshire Contracts for 2.2 MW Solar On Closed and Capped Solid Waste Landfill

George Harvey

The Town Council of Derry, New Hampshire, has signed contracts for a 2.2 megawatt (MW) solar array to be built on a solid waste landfill that the town had closed and capped in 1998. The town owns the land, but because of its prior use, almost nothing can be built on it. A solar array turns that nearly useless land into a community resource and will also reduce carbon emissions by over 2,555 tons per year. The power generated by the solar project will be fed into the Town of Derry’s waste and waterworks facilities, where part of the electricity will be used. The remainder of the electricity will be exported to the grid and the town will be compensated for it by the local utility. The site still has potential to expand in the future.

The contract for the array was awarded to Encore Renewable Energy, of Burlington, Vermont. Encore will undertake nearly all of the necessary work to get the array built, including financing, design, construction, installation and operation. The project will be designated as Derry Solar, LLC.

The array will come with no upfront cost to the town. Nevertheless, it is projected that it will save the town $3.5 million over the term of the 25-year contract. That indicates a saving of about $140,000 per year, which is a substantial benefit for the town.

Recently passed Federal legislation announced by Senator Jeanne Shaheen (D-NH) will support economic development and infrastructure projects across New Hampshire and accelerate installation of clean energy systems for communities to reduce energy expenses and meet sustainability goals. It’s anticipated that $500,000 will be provided to support the Derry Solar Project, helping further reduce the cost per kilowatt-hour about 10%, thus saving the town about $4 million over the Power Purchase Agreement contract’s lifetime (www.bit.ly/Derry-landfill-solar).

At 2.2 MW, erected on seven acres of the 10-acre landfill site, the array will be one of the largest in New Hampshire. It will also set the town ahead of its schedule of having a net-zero renewable electric supply. The Town of Derry had a goal of getting to net-zero by 2025, but it now appears that it will be achieved about two years early, with this Derry Solar Project operating in late 2023.

Work on the specifics of the array was begun by the Net Zero Task Force over two years ago, though the group was started several years previously. The group includes engineers, business people, energy experts, and members of the public. Key organizations that have representation are schools, the Department of Public Works, the Planning Board, Code Enforcement, the Conservation Committee, and Economic Development.

The work done by the Net Zero Task Force was extensive. It had to coordinate communications with the people in the community, while supporting state legislation. It also had to get a buy-in from Governor Chris Sununu.

“Moving forward with this solar project is a major win for our community and our town,” said Joshua Bourdon, Derry Town Councilor-at-Large and founder of the Net Zero Task Force. “I ran for re-election with a promise to reduce our taxes while maintaining services through creative solutions. Achieving Net Zero Energy through the efforts of the Task Force and Derry Public Works Department contributed to that creative solution.”

Council Chairperson Moulton added, “This project is the culmination of six years of planning and engineering work performed by the volunteers of the Net Zero Task Force. In advance of this project, the Task Force benchmarked the energy use of all 40 town and school buildings, implemented a number of energy initiatives that are currently saving the town over $900,000 per year, and in 2018 installed an 86-kilowatt solar project at the town’s transfer station, currently performing above its expected output.”

A competitive request for proposals was solicited by the Town of Derry in September of 2021. Seven companies submitted proposals, and Encore Renewable Energy was chosen from among them. Encore has also had considerable previous experience with brownfield and landfill development. Over a period of ten years, it has installed over 170 MW of solar capacity on nine projects of this type.

“Encore provided the best value power purchase agreement proposal for the town,” according to Mike Fowler, Executive Director, Derry Public Works. “As a future partner, Encore brings engineering and technical expertise to successfully develop this type of project. The favorable economics and experience with landfill solar development were the most important factors in awarding the contract to Encore.”

Chad Farrell, CEO and Founder of Encore Renewable Energy, said, “Tapping into the opportunity for sustainable energy development on under-valued properties like landfills is part of the DNA of our company.” Said, “We’re excited to bring our deep expertise in the reuse of landfills as host sites for community-scale solar arrays to Derry to help support the community’s transition to the clean energy economy.”
Brandon, Vermont
THE BIRTHPLACE OF ELECTRIC POWER

Kevin Thornton

In February 1837, Thomas Davenport of Brandon, Vermont was awarded the world’s first patent for an electric motor. The time has come for us to celebrate his achievement as a landmark in technological history, because it was. The Town of Brandon and the Brandon Museum are working in concert to make that celebration happen.

An electric motor is any device that uses electric power to create mechanical motion. The electric motor is one of the most important inventions of all time, ranking with the internal combustion engine and the transistor as devices that improve all of our lives, every day. We rarely think about electric motors, because they are so common and so reliable that we take them for granted.

In your kitchen your refrigerator uses an electric motor. So does your dishwasher. So does your microwave. Have a coffee grinder, food processor or mixer? They use electric motors. Have a heat pump, air conditioner or a few fans in the house? They use electric motors, too. Your hair dryer uses an electric motor. Perhaps your toothbrush does as well. Every electric tool in your basement or shop is powered by an electric motor. Your washing machine and clothes dryers run on electric motors. Your car has as many as forty electric motors in it, in the windows, door locks, climate control system, windshield wipers, and seats. Every computer in your house has one. How about that phone in your pocket? It vibrates because of an electric motor.

Every day of your life you benefit from Davenport’s invention forty or fifty times. (That’s a conservative estimate.) Multiply that by billions of people, and you get a sense of the magnitude of his invention’s impact on the world.

Davenport first got the idea that changed history when he witnessed an electromagnet at work in 1833. Electro-magnets themselves were very recent inventions (the first one had been invented in England only in 1821). By 1834, with the help of his wife Emily and her cousin, Orange Smalley of Forestdale, he had successfully built a functioning motor. By the end of 1835, he had demonstrated the invention to a series of the leading men of American science. By 1836, he had perfected a vastly improved motor and become the second person in the world to apply electricity to transportation, building a model railroad that proved electric-powered travel was possible.

In February 1837, he was awarded his U.S. patent. In August 1837, he was awarded a British patent. The British patent is significant because Britain was by far the most industrialized country in the world at the time. Davenport’s patent there is proof of his belief in the industrial potential of the motor.

Davenport demonstrated his motor in New York in 1837. The New York Herald proclaimed his invention “The Dawn of a New Civilization” while the New York Evening-Star called it “the application of an entire new and immeasurable agent of mechanical power.”

The electric age had begun. Over the next few years, mostly divided between New York and Brandon, Davenport built over 100 motors, continually innovating and improving prior designs. Among them was a motor powered entirely by electro-magnets, an innovation which greatly increased the device’s rotational speed and power. In 1840 he built a reciprocating motor that powered the world’s first electric printing press, on which he printed his short-lived journal, The Electro-Magnet and Mechanics Inteligencer.

Given all that, why isn’t Davenport’s name as well-known as Henry Ford’s or Thomas Edison’s? The short answer is through a combination of bad luck and bad timing. Davenport was ahead of his time in many ways.
The Green Mountain State’s Electricity Isn’t So Green

Peter Sterling

Vermont’s electric sector is estimated to contribute only 2% of our climate-change-causing greenhouse gas emissions—seemingly insignificant compared to the whopping 74% of emissions coming from our transportation sector and from heating and cooling our homes and businesses.

But this 2% figure is quite deceptive and masks the level of pollution that comes from our electricity, especially during the winter when Vermonters are quite likely using energy from fossil fuels such as natural gas and increasingly, oil and coal.

After the cold snaps during the winter of 2017-18 drove up the price of natural gas used for heating, “winter reliability” rules were enacted New England-wide so that electric power plants could switch quickly from gas to oil when the temperature dropped, and more natural gas was needed for heating and less was available to run power plants.

And that is why, on average during the run of cold weather this past January, roughly 13% of the electricity mix Vermont purchased from the New England electric grid was fueled by burning oil and coal.

So, what can be done to reduce the amount of coal, oil and natural gas used to generate the electricity we rely on for our everyday lives? For starters, the cleanest energy source is the one not used—meaning that by weatherizing our homes and putting in efficient heating systems powered by renewables, we can avoid using dirty power that accelerates the climate crisis.

But it is important to note that, as Vermont works to move away from fossil fuels and towards electricity to power our cars and trucks and to heat our houses, we must ensure this electricity comes from renewable sources such as wind and solar. Current law in Vermont calls for 10% of all electricity to be generated from renewable energy sources by 2032. When the law was created in 2017, this seemed like a reasonable goal to combat climate change.

But the climate change crisis is accelerating faster than most scientists had anticipated. Our laws must evolve, too. The Vermont Legislature must act by doubling or even tripling the amount of renewable electricity Vermont generates within our borders.

If we don’t act soon, all of the good work we are doing to ‘electrify everything’ to reduce greenhouse gas emissions will be simply replacing the fossil fuels we now use for home heating and running our vehicles, with fossil fuels used to power electric power plants.

Fortunately, important components of the solution are already in place. Vermont has a vibrant clean energy industry, which though declining in recent years, employed just over 19,000 Vermonters in 2017 representing just over 6% of the state’s workforce. And, we already have a cost effective statewide program, called net metering, in place to help make installing solar power more affordable for Vermonters.

Renewable Energy Vermont commissioned a study on the New England-wide impacts of solar programs like net metering. The study examined data from 2014-2019 collected by the U.S. Environmental Protection Agency and found that solar power helped avoid 4.6 million metric tons of carbon dioxide emissions and avoided millions of pounds of criteria pollutants proven to have negative impacts on human health contributing $87 million in public health benefits and another $515 million dollars in climate benefits in addition to providing a clean and renewable source of electricity for tens of thousands of people regionwide.

While the amount of solar power we produce grows every year, deploying wind power has lagged well behind, held back by an unsupportive Governor, a small but vocal group of NIMBY activists and a regulatory process with the strictest wind sound rules in the nation. Since wind and solar output tend to peak at night and day respectively, they are highly complementary clean energy resources.

Finding a way to bring wind power back to Vermont will be essential to displacing fossil fuel generated electricity.

Thanks to the Legislature’s override of Governor Scott’s veto of the Global Warming Solutions Act, Vermont is undertaking some bold steps to reduce our greenhouse gas emissions. Vermont’s net metering, in place to help make renewable energy available to Vermonters.

Peter Sterling is the interim Executive Director at Renewable Energy Vermont, the trade association representing Vermont’s renewable energy industries.

Since wind and solar output tend to peak at night and day respectively, they are highly complementary clean energy resources. (image: alce.org)

BIRTHPLACE OF ELECTRIC POWER – Cont’d from p.14

than one. 1837, the year he received his patents, also happened to be a year when a terrible economic depression started in America. The modern banking system had yet to be developed. As a result, he found it almost impossible to raise money. During the 1830s, he appears to have mortgaged everything he owned in Brandon. He was not a wealthy man to begin with. Instead of making him rich, his invention wound up impoverishing him.

The other problem was technological. Davenport invented his motor before any one developed reliable electric power, or the ability to transmit it. His motors ran on expensive, somewhat unstable batteries. It was not until the 1840s that inventors in Britain began to solve the problem of generating power, using dynamos that were essentially Davenport motors in reverse. It would be decades before reliable electric power would become widely available. Unfortunately, by the mid-1840s, Davenport appears to have been bankrupt, exhausted and ill.

But Davenport never stopped believing in an electric future. In his unpublished memoir, he repeatedly makes that clear, arguing that electricity was a safer, quieter and cleaner source of energy than anything that came before. He envisioned a time in which electric power would benefit everyone. He would be thrilled and gratified by the myriad ways in which electric power has improved human existence. He’d be overjoyed to see an electric car.

He foresaw it all, but none of it would happen in his lifetime. In 1848, his father-in-law, a prosperous farmer, gave Davenport’s wife, Emily, land in Salisbury, VT “for the consideration of my love and affection and… one dollar.” Tellingly, Thomas’s name does not appear on the deed. Davenport lived his last few years as a Vermont small farmer. He died on July 6, 1851, three days before his forty-ninth birthday. Despite his poverty and his many frustrations, he never gave up. Shortly before his death, he had been working on an electric piano.

On July 9 (Davenport’s birthday) the Town of Brandon will be holding the first Brandon Electric Fest, celebrating both the achievements of Davenport and the incredibly promising future of electric vehicles. State Representatives Stephanie Jerome and Butch Shaw are sponsoring a resolution in the Vermont House in honor of the occasion.

In the meanwhile, David Hammond of the University of Vermont physics department, an expert in early scientific equipment, is building a working replica of Davenport’s motor for the Brandon Museum, to be installed as the centerpiece of a forthcoming major exhibit on Davenport. The museum has also begun outreach to the schools. An Otter Valley High School course on “The Electric Motor and Its History” is running this semester, and the Neshobe School is also planning to teach this great Brandon story to local kids.

Together the town and museum want to honor Brandon’s great inventor, make his name known as widely as it deserves and claim Brandon’s place as “The Birthplace of Electric Power.” In the process we just may position ourselves to have a role to play in the electric future that Davenport so clearly foresaw.

So here we are, 185 years after Thomas Davenport’s first patent, in a world polluted by carbon and heading down a path of an uncertain future. We are finally realizing the value of Thomas Davenport’s invention. Not only did he contribute to mobility, but he contributed towards a sustainable future. Now we live in a time where renewable energy is expanding, and younger generations are demanding we change our actions for a cleaner future, and we must re-ignite the passion that Thomas Davenport had towards electrifying the world.

Join us July 9th from 11-6pm at the Estabrook Park in Brandon VT to honor Thomas Davenport’s contribution to sustainability and to experience the future of what an all-electric world would look and feel like.

Kevin Thornton is Brandon, Vermont’s historian in residence.

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Since wind and solar output tend to peak at night and day respectively, they are highly complementary clean energy resources. (image: alce.org)
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 through 2022. For commercial geothermal generators, 20% of cost is a credit.

BIOMASS HEATING SYSTEMS TAX CREDIT

The ITC for biomass heating systems is 26% of the purchase and installation costs (with no cap or lifetime limit) for tax years 2021 and 2022; reduces to 22% of purchase and installation costs in 2023 (under Sec. 25D of the U.S. tax code).

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 improvement; energy audit funding is awarded on a competitive basis, grant funding cannot exceed 25% of eligible project costs.

FEDERAL INVESTMENT TAX CREDIT

- Applicants include Feasibility studies/regular ARAPs: 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.

Source: Vermont Research News - Center for Tropical Agriculture and Rural Development.

Effects of increased energy efficiency on buildings and homes: Significant energy savings and reduced emissions. For more information go to www.vrnrcc.org or call (877) 888-7372.

Vermont’s GMP Extends Rebates Through 2022

Green Mountain Power (GMP) is extending its popular rebate programs through all of 2022 to help more customers save money while reducing carbon emissions.

In 2021, GMP customers saved with more than 7,000 rebates when they made the choice to switch away from fossil fuel at home and on the road – for heating, driving, mowing their lawns, and electric motorcycles. Rebates include a $1,500 rebate on all electric vehicles, plus an extra $1,000 for low- and moderate-income customers, and a $400 base rebate on cold climate heat pumps with an extra $800 in incentives for income-eligible customers in partnership with Efficiency Vermont.

The Vermont Natural Resources Council (VNRC) cut costs with GMP incentives while completing the renovation of a historic house in Montpelier to serve as new office and expanded meeting space.

One of our goals was a net-zero building, and GMP’s incentives were a huge help in swapping out an old, inefficient oil-burning boiler for cold climate heat pumps,” said Brian Shupe, VNRC’s executive director. “GMP’s incentives also helped us install an electric vehicle charging station to help staff and visitors convert to electric vehicles.”

In 2021, the rebates and customized projects with business customers around the state will offset more than 173,000 metric tons of lifetime carbon emissions – the equivalent of taking 38,000 gas-fueled cars off the road.


Many thanks to our sponsor:

Vermont Natural Resources Council

New Hampshire Renewable Energy Incentives Offered Through the NH Department of Energy

NH DOE: Get up-to-date information at: www.bit.ly/GT-NH-1

Commercial Solar Rebate Program

Effective March 6, 2020, incentives are limited to 25% of the total project cost or $10,000, whichever is lesser. 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 for incentives.
- Incentive levels for solar thermal systems are as follows:
  - $0.12/ft² of collector for solar thermal systems and $0.12/ft² of collector for biomass boilers.
  - Incentives are available for new, high-efficiency wood pellet stoves or furnaces.
- Other Opportunities to Save
  - Home Energy Loan – finance up to $50,000 at a 0% interest rate with no balloon payment.

Incentives for Pro-environment Agriculture Behaviors

To protect the ecosystem around the Lake Champlain Basin, several programs have been introduced to encourage environmentally-conscious farming in the area by providing monetary incentives. A recent study has looked at two of these programs (Incentive: Vermont GMP-CREP study), the Environmental Quality Incentives Program (EQIP) and the Conservation Reserve Enhancement Program (CREP). Both programs aim to reduce agricultural runoff by providing financial incentives to farmers to adopt conservation practices.

VT TAx CREDIT

- Vermont offers an investment tax credit for installations of renewable energy equipment on business properties and wood and pellet heaters with at least 75% efficiency. The credit is equal to 100% of the “Vermont property portion” of the federal business energy tax credit.


Tier III programs

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

EFFICIENCY VERMONT

- Vermont offers investment tax credits for installations of renewable energy equipment in buildings and homes. The credit is equal to 26% of the federal business energy tax credit.


- Vermont Research News - Center for Research on Vermont, 1, 18.21.
Residential Solar/Wind Rebate Program
- Currently closed, 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 for ALL Rebates at www.bit.ly/GET-NH-1.

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


LOCAL INCENTIVES

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/energy for more information.

- Plug-in Hybrid Electric Vehicles (PHEV), and $300 on Electric Motorcycles.

NH Home Performance with ENERGY STAR®
Sponsored by all NH electric and natural gas utilities in partnership with 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 inspections found). 75% instant rebate for eligible weatherization improvements up to a $8,000.

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/on-line rebates are available as part 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/nhrebates.
- 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 select ENERGY STAR® certified LED light bulbs purchased or through participating NH retailers/offers vary by retailer, see store associate for details!
- Visit: www.NHSAVES.com/nhrebates.

- 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, EFL.

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/tom 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 offer low or no interest rebates or financing for energy efficiency projects.

Visit www.NHSAVES.com/resource/ for individual utility contact information.

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

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

NH Weatherization Assistance Income-Eligible Programs
Home Energy Assistance and NH community action Weatherization Assistance Program. Financial assistance paying fuel bills, and free weatherization improvements for qualified applicants. Funding from U.S. Dept. of Energy, NH utilities.
- Visit www.bit.ly/GET-NH-4 for application criteria, FAQs and local program contacts.

Community Development Finance Authority (CDFIA) Clean Energy Fund
Low-Interest Financing for Businesses, Non-Profits & Municipalities:
- to support energy efficiency and renewable energy projects.

Small Business Energy Audit Grants
Rural Small Businesses & Agricultural Producers can apply for grants to cover 75% of a comprehensive energy audit cost.

Community Facilities Energy Assessment Grants
Non-Profits and Municipalities can apply to receive a grant covering 75% of the cost for an energy-related study.

Find out more at: nhdcf.org/energy.

UP-TO-DATE INCENTIVE INFORMATION CAN BE FOUND AT: www.DSIREUSA.ORG

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NYSDERA
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 NYSDERA: For the latest NYSDERA solar, ground source and air source heat pumps, EV residential and commercial incentives...

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

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

Extended Federal Tax Credits for Renewable Energy
Good news for renewable energy and climate action!
A budget package has finally been developed that begins to address the climate crisis.

Making local renewable energy more affordable, this bill translates directly into good jobs, less climate pollution and more resilient communities.

Among the most significant measures are extended tax credits for renewable energy.

SOLAR: The investment tax credit (ITC), which was scheduled to drop from 26% to 22% in 2021, will stay at 26% for two more years.

ADVANCE
D WOOD HEAT: For the first time, a 26% tax credit applies to the installed cost of home heating and hot water systems that utilize wood pellets, chips and cordwood at efficiencies greater than 75 percent high heat value.

GEOTHERMAL HEAT PUMPS: The 26% tax credit was also extended for geothermal heat pump projects that begin construction in 2021 and 2022. Overall, the bill includes $600 million for wind energy, $1.35B for solar, and $1.35B for grid-scale energy storage. It also includes a plethora of stimulus measures for small businesses.

National Grid: Electric Vehicle Charging Station Make-Ready Program
- National Grid will do an analysis of your business or municipality to evaluate the need for EV charging at a single-family home.

Visit our website for more information:

www.NYSERDA.org/energy-Programs-and-Services


Efficiency Maine
Efficiency Maine offers instant rebates for eligible battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) at participating Maine car dealers. Learn more at https://www.efficiencymaine.com/eve/

Home Insulation: Efficiency Maine offers weatherization rebates up to $9,600 for income-eligible homeowners and up to $5,300 to other Mainers. See bit.ly/EFFME_HomeInsulation.

Heat and Cooling: Efficiency Maine offers rebates and financing for installing high-efficiency heating systems. To find out more, see bit.ly/EFFME_HomeSavings.

Contact: bit.ly/GET-NH-3 for more information.

Heat Pumps: Residents of any income are eligible for heat pump rebates up to $1,200. Income-eligible residents qualify for rebates up to $2,400, and businesses are eligible for incentives up to $5,000. Learn more at bit.ly/EFFME_HeatPumps.


Electric Vehicle Charging Solutions:
Charging at a single-family home is convenient and inexpensive. Most EV drivers do over 80% of their charging at home using either a Level 1 charger cord or a fast Level 2 charger. For public sites or multi-family residential sites, installing EV charging can increase employee satisfaction, show sustainability commitments, strengthen relationships with customers and attract new ones. See bit.ly/EFFME_Work_EVCharging.

Electric Vehicles (EVs): Efficiency Maine offers instant rebates for eligible battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) at participating Maine car dealers. Learn more at https://www.efficiencymaine.com/eve/.

The standard rebate is $2,000 for a BEV and $1,000 for a PHEV. Higher rebates are available for low-income customers, government entities, and select nonprofits. For a limited time, Efficiency Maine offers a promotion for businesses with five or more vehicles registered in Maine, paying rebates of $4,500 on a BEV or $3,500 on a PHEV for the first 50 vehicles on a first-come, first-served basis. Maine businesses can also receive up to $8,000 for the purchase of an all-electric commercial van for business use. See bit.ly/EFFME_EV_Rebates.

Commercial: Efficiency Maine has programs for businesses of all sizes, some multi-family buildings, and Maine’s largest energy customers. Examples of eligible organizations include nonprofits, for-profits, education; municipalities; education facilities; manufacturing and industrial facilities; other non-residential facilities; and residential buildings with five or more units. To learn more about Efficiency Maine’s incentives for any of these, visit bit.ly/EFFME_AWork.


Room Air Purifiers: $25 rebate available for ENERGY STAR® certified room air purifiers; bit.ly/EFFME_AirPurifier_Rebate.
Socially Responsible Investing

These economic powerhouses are investing their capital on new platforms with new criteria. According to a recent COGNITION Smart Data survey:
• Nearly 60% of millennials report that their sustainable investing, citing climate change, is necessary to understand a bit about ESG and corporate governance.
• Nearly 50% of millennials say that their sustainable investing, citing financial returns, which led to the founding of the Burlington office.

By aligning their dollars with their values and using social media to spread the word, millennials are democratizing finance, accelerating the adoption of the issues that they care deeply about, and finance, accelerating the adoption of the values and using social media to spread planet.

Nearly 60% of millennials report that they have sold stock and stopped purchasing 13 distinct companies that are not aligned with their values.

By aligning their dollars with their values and using social media to spread the word, millennials are democratizing finance, accelerating the adoption of the issues that they care deeply about, and driving unprecedented levels of transparency and accountability, which will be with us for the long term.

Green Banks, Clean Stocks, and ESG Funds

When exploring sustainable finance and investing options, the first step is to analyze existing investments, the local community, banking relationships, savings accounts, and institutional relationships.

Green banks are emerging across the country, such as Climate First Bank and Aspiration, offering a spectrum of sustainable banking, lending, and finance options. Climate First Bank recently launched Regeneration Checking, a new consumer checking account developed in collaboration with Paul Hawken and his team at Project Regeneration.

The account offers a $100 donation to Project Regeneration for every new qualifying account, and 100% of the interest earned on the account is donated to Project Regeneration.

To ensure that investments and savings dollars are being allocated in sustainable ways, it’s important to look up the holdings of mutual funds or exchange-traded funds (ETFs). Websites like Fossil Free Funds help investors align their dollars with their values by analyzing the fossil fuel exposure and carbon footprint of thousands of U.S. mutual funds and ETFs.

Many traditional 401(k) and IRA plans place money in mutual funds that are heavily invested in fossil fuels. Fortunately, there are now plenty of alternatives for sustainability-minded investors, like the iShares Global Clean Energy ETF (a BlackRock offering) that focus on investments in renewable energy and Clean Tech companies.

ESG Ratings and Financial Factors

A wide spectrum of mutual funds with ESG criteria now incorporate environmental, social, and governance metrics into the asset management and investment selection process. And, investors don’t have to worry about giving up returns for mission alignment: These sustainability-focused funds often outperform their conventional counterparts.

Financial services companies like Newday Impact help investors develop truly bottom-line portfolios that align E with financial returns.

Interactive Brokers, which operates the largest electronic trading platform in the United States, recently launched IMPACT, a mobile trading platform that allows conscious investors to develop investment plans based on their personal values by providing information about ESG practices, including accountability and transparency metrics.

The simple IMPACT app enables investors to personalize their values, such as clean air, pure water, ocean life, land health, ethical leadership, gender equality, racial equality, and sustainable product lifecycle. Investors can exclude investments based on categories like animal testing, fossil fuels, greenhouse emissions, hazardous waste, and water usage.

Some savvy sustainable investors rely on robo-advisors, or online financial advisors that utilize algorithms to develop portfolios based on risk tolerance, desired returns, and liquidity needs. Companies such as Betterment, Personal Capital, Acorns, M1 Finance, Ellevest, and Marcus Invest offer robo-advisory services for investors that want to put money into green companies without high investment minimums, management fees, commissions, or transaction costs.

Green Crypto Currency

Millennials and Gen Zs are also displaying a penchant for crypto currency. While options like Bitcoin, Ethereum, Cardano, and Dogecoin are popular, their “mining” process is highly energy-intensive. Greener crypto options include companies like Carbon. These companies should consider planting trees or purchasing carbon offsets to counterbalance the environmental impact of their investment activities.

Of course, investors can also keep their eyes open for private investment opportunities in emerging carbon tech companies, a mushrooming sector that has received nearly $90 billion in private investments over the past two years. High growth areas within the carbon tech sector include electrification technologies, blockchain, carbon removal, clean hydrogen, smart grid technologies, advanced controls, vehicle-to-grid integration, high-performance materials that sequester carbon, food waste technology, and plant-based biofuels.

Sara Guttermann is the cofounder and CEO of Green Builder Media.


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Carbon Pricing Misconceptions

Katharine Gage

The Intergovernmental Panel on Climate Change (IPCC) recently released the second part of its Sixth Assessment Report on climate change, focusing on impacts, mitigation, and adaptation, again drawing attention to the deteriorating future of the climate and the urgent need for action. It reports that many impacts are irreversible, but future damages to people, society, and ecosystems can be substantially reduced with near-term actions that keep global warming close to 1.5°C.

The IPCC finds carbon pricing to be the "most powerful and efficient" emissions reduction policy, and a "critical tool" in any cost-effective climate change mitigation strategy, as it provides a mechanism for linking climate action to economic development. The United States remains one of only two developed countries that are not yet pricing carbon. The IPCC report also identifies rhetoric, misinformation, and polarization as key factors that have "delayed mitigation and adaptation action, most notably in the US." Let’s explore some common myths that are delaying effective carbon pricing legislation.

Myth #1: Carbon pricing will increase our cost of living

What matters is the net effect. If we charge fossil fuel producers and importers a carbon fee, industries will pass these higher costs down to consumers. And as we know from current world events, increased fossil fuel prices raise our cost of living. Pairing carbon pricing with a cash-back dividend ensures that citizens are compensated (or even overcompensated) for these higher costs. When all of the money collected from the carbon fee is distributed to all households on an equal, per-capita basis, 85% of households will receive more in their dividend than they pay in trickle-down higher prices from the fee.

Breaking our reliance on fossil fuels and transitioning to clean energy solutions will prevent energy price spikes from production and inherent market problems, such as what we are seeing with Russia’s invasion of Ukraine. As a bonus, taking the profits out of selling fossil fuels will also defund Russian aggression, because Russia relies heavily on its fossil fuel exports for war funding.

Myth #2: Carbon pricing will have regressive social impacts

An increase in fossil fuel prices has regressive social impacts because low-income households spend a higher proportion of their budget on those fuels. However, a carbon price with a full, equal household dividend has a progressive social impact, because it protects and helps low-income, middle-income, and marginalized communities. Low-income households naturally have smaller-than-average carbon footprints as a result of a lower-consumption lifestyle; so when everyone receives the same dividend, low-income households make money – to the point where 99% of the poorest fifth of the population will either break even or come out ahead. Minority communities will also disproportionately benefit, with about 90% of households breaking even or coming out ahead. A carbon price with a full, equal per capita dividend is an efficient step toward achieving environmental justice goals.

Myth #3: Carbon pricing will hurt the competitiveness of U.S. businesses in the global market

While it is true that implementing a national carbon price will temporarily increase U.S. production costs, carbon pricing policies can be designed to equalize these costs relative to our global competitors. Border carbon adjustments can be used to charge our carbon price on imports and rebate our carbon price to our exporters during trade with other countries that do not have a similar carbon price.

Since U.S. manufacturers are less carbon-intensive than those in many countries we trade with, pricing carbon actually gives U.S. exporters and manufacturers a competitive advantage. For example, a price on pollution will make cleaner U.S. steel cheaper than dirty steel from China.

Myth #4: Carbon pricing won’t reduce carbon emissions fast enough

The IPCC calls for carbon pricing because it will make a big impact – for instance, one border-adjusted, cash-back carbon pricing bill in Congress is projected to reduce United States carbon emissions 47% by 2030 and 90% by 2050. This policy alone is nearly enough to put the United States on a path that aligns with the global emission reductions needed to hold 21st-century warming to 1.5°C. Supplementary policies can get us the rest of the way there.

When looking at the climate crisis from a global perspective, carbon pricing is the only national policy that allows us to hold other countries accountable for their emissions and incentivize them to harmonize their climate policies with ours. This is accomplished with border carbon adjustments, which World Trade Organization rules only allow to be used with an explicit price on carbon – not with other policies like regulations, subsidies, or incentives.

As the importance and likelihood of enacting strong climate policies increases, it is essential to consider the policies that will be best for the climate, the people, and the economy. We need options that reduce carbon emissions rapidly, protect Americans financially, ensure that our businesses can compete on a level playing field in the global market, and have an influence on emissions at a global scale. The best policy option for satisfying these objectives is border-adjusted, cash-back carbon pricing – please ask your congressmen to enact this important legislation.

Katharine Gage is a freshman at Bowdoin College and has volunteered with Citizens’ Climate Lobby (VTL) for five years. She co-leads a CCL NH and a Bowdoin chapter.

References in this article will appear online when it is posted.

Energy Hub - Cont’d from p.18

“number please;” he would ask to be connected to the operator of a load-following plant. If things went well, everything was back on kilter within a few minutes. In the meantime, output might have had to be adjusted so there was enough power, but not too much. Not enough would mean burnout motors and other such problems. Too much meant transformers melted down, and the grid would fail hopelessly.

Using a new, distributed system, small generating plants, which could include solar and wind power, but could also include lots of other options, such as small hydropower, biomass, micro-turbines, pumped storage, batteries, and so on, down a long list. Also, instead of an almost unregulated demand system, some types of demand can be automatically deferred, and these include water heaters, electric vehicle charging, and certain other systems.

The problem with this is not that the sun doesn’t always shine and the wind doesn’t always blow. That really is no worse than the fact that the baseload power plant can’t easily change output. The problem is that controlling the grid doesn’t have some person noticing that demand changed using a phone to call the person at the load-following gas plant to tell him or her to change output. Instead, it requires a whole huge bunch of monitors calling a whole huge bunch of generators and users and doing that in a well-coordinated manner. And while that cannot be done using equipment made in 1922 by AT&T, it could easily be done by a set of relatively small computers. One hang-up, of course, is that the computer has to be programmed, and that is not easy, considering the complexity of the assignment.

Packetized Energy developed unique algorithms that run on devices, such as their smart water heater thermostat, which allows the aggregate demand from distributed loads to track, in real-time, the needs of the grid. They not only developed the algorithms but also demonstrated their effectiveness with real devices in real homes and showed load coordination at shorter time-scales than competing approaches.

And that is what Packetized Energy did to make itself worth buying. And that, indeed, is why this is a big deal. It may be the future of our electric power system. The founders of Packetized Energy wrote a very readable paper about their technology that appeared in the IEEE Spectrum. It is “How to Prevent Blackouts by Packetizing the Power Grid,” and it can be read online at www.bit.ly/Packetized. There is also a very well-done YouTube video on the Just Have a Think channel (youtube/NU3woCaFSZ3).

Many thanks to our sponsor:
A Solar-Powered DIY Irrigation System

John Pincince

For some years, my wife, Lucy, and I used a small gasoline generator to run a well pump for irrigation. This was not in keeping with our desire to reduce our consumption of fossil fuels. So, we looked into a photovoltaic (PV) system. Serendipitously, the Natural Resource Conservation Service was offering grants for alternative, low carbon footprint projects. We sized our system and included the amount of drip tape and accessories needed then applied and received a grant to cover a fair percentage of the cost.

Now our solar-powered Grundfos deep-well pump supplies all the irrigation water we need for our 26-foot by 48-foot hoop house and our over half acre of mixed annual vegetables, asparagus, gourds, fruit trees, strawberries, elderberry bushes and perennial flowers.

The pump is powered by four 250-watt solar panels connected to a general duty safety switch, a small Grundfos digital control panel, a 100-psi pressure tank then through underground conduit directly to the well head and down to the pump. We used two-flow reduction valves at the spigot because there was so much pressure it was blowing the end caps off the drip tape system we use. It is critical to have the correct pressure tank control switch so the tank does not go over the pressure that it is rated for.

We also have a lot of iron in the well water. The microscopic particles of iron were beginning to clog the drip tape, so we placed two in-line water filters to absorb some iron.

The PV panels are mounted on structures we built using mostly northern yellow pine and galvanized steel from a set of school bleachers. We used the steel pieces to make two supports for each of the two panels and there was so much slack - good planning and good luck.

To install the solar system, we had expert help from a friend who is an electrician and between my wife and I we had enough basic plumbing skills to plumb the system. We set the well pump into the well and hooked up the pressure tank, but we did need advice regarding the pressure switch. It needs to be matched to the pressure tank and able to work with direct current. The tank is rated to 100 psi. Ours is a 60/40 switch. When the pressure reaches 60, the switch shuts off. When the pressure goes below 40, the switch turns on.

We always disconnect the well pipe at the well head and at the pressure tank before the heavy freezes signal the approach of winter. To store the 25 fifty-foot lengths of drip tape for winter, we keep each strip at full length, bunch them together and stretch them on the ground on the north side of the hoop house with some weight on them. They are out of the sun and won’t blow away. Although despite our best efforts, well maybe they could be better, the wind sometimes makes the tapes to cross over one another, but we’re able to deal with that pretty easily. Doing it alone however is not recommended!

It is possible to use these panels along with storage batteries to provide lighting need less water than others. Keep in mind that until the plants are well established the drip tape needs to be secured with ground staples. You can make your own with 12-gauge galvanized wire or purchase them from FEDCO in Maine.

The drip tape system is very efficient. The water goes directly onto and into the ground near the seeds, seedlings and maturing plants. Very little is lost to evaporation and aside from the spring laying out and autumn retrieval and storage, very little of my time is needed to irrigate. The downside is that the drip tape is plastic. We have used the same drip for tape five years or more. Still, it is plastic and we wish we could use it for ten years at least.

The beauty of it all is that when the sun is out, the system is working, except when there is enough water above ground when we turn it off. When it is raining, we obviously don’t need it and even if the system is still switched on, it is not getting any sun so it is not pumping.

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Find us on: Green Bee Lawn & Garden
**Feature: Gardens & Lawns**

**DIY Raised Bed Gardening**

Alicia Brisson, Krista Fillion, and Lyndsey Parrott

On Dec. 1, the Vermont Climate Council released and adopted the state's first Climate Action Plan. This provides strategies to reduce emissions within Vermont to meet the goals of the 2020 Global Warming Solutions Act, which includes reducing greenhouse gas pollution 26% below 2005 levels by 2025. To meet these objectives, significant lifestyle changes are needed. In particular, this includes the way we acknowledge green spaces within Vermont as individuals working towards a collective future.

Transforming turfgrass lawns — the biggest irrigated crop in America — into sustainable alternatives may be one of the most cost-effective approaches to achieving these goals within the state of Vermont.

Historically, front lawns were a luxury of the wealthy, which indicated an investment of time and equipment. After World War II, the middle class emulated the keeping of lawns from the affluent as a material manifestation of the American Dream and the pinnacle of suburban development.

In many communities today, there is peer pressure to keep a well-manicured lawn to reflect socially desirable resources such as wealth, education and property values. Given this context of lawns as an institution for status, it is time to create new traditions with how we use our green spaces to reflect the values of today.

Many residents misuse the amount of water that is necessary for proper turfgrass care. Lawns do not require water every day, as many believe. Most turfgrass is overwatered daily, which causes excessive mowing, wastes water, and increases stormwater runoff. A recommendation given by a University of Vermont professor states to not exceed 1 to 1.5 inches of water each week, including rainfall. Irrigation of lawns creates a strenuous impact on lakes such as Lake Champlain, due to excessive runoff that includes phosphorus and carbon emissions.

Improper application of fertilizer containing phosphorus during winter months can lead to nutrient runoff into the lake. The Law to Lake Initiative of the Lake Champlain Basin Program determined that 1 acre of urban-suburban land contributes twice as much phosphorus to the lake as 1 acre of farmland.

Furthermore, the 2021 State of the Lake calculation for the United States, western states, indicates the lake's tributaries deliver close to 2 million pounds of phosphorus. Lake Champlain, with its proximity to Burlington, is at the receiving end of phosphorus runoff, which can lead to eutrophication, cyanobacteria, reduced clarity, and loss of species.

The perception of a well-manicured lawn, free from weeds and pests, has detrimental effects on the future of natural spaces such as Lake Champlain. This pursuit of aesthetics is evident in the 5.5 million gallons of gasoline that Vermonters burned in 2019 on lawn care. Fidous maintenance practices — including irrigation, mowing, fertilizer and pesticide application — have been found to add up to 1 ton of CO2 each year per acre of traditional lawns. Shockingly, it takes only a half-hour of yard work with a two-stroke leaf blower to generate the same amount of emissions as a 3,900-mile drive from Texas to Alaska in a Ford Raptor. It takes hours of time invested weekly to upkeep a pristine monoculture of turfgrass at the expense of the climate, all for the sake of upholding outdated norms.

Within Vermont, greenhouse gas emissions peaked in 2005 at 9.98 million metric tons of CO2 equivalent. This level had decreased to 8.64 million metric tons as of 2018, but a continued reduction is needed to be on track for Vermont's goals.

Although Vermont has already made strides toward reducing the size, the state still possesses an untapped opportunity for improvements. In Vermont, the median yard space is 73,979 square feet, which is the largest yard space within the United States, well above the average of 10,871 square feet. Due to the amount of lawn area in Vermont, curtailing maintenance practices will make a drastic difference.

As stated by the Vermont Climate Council, "It is critical that we act to become more resilient and adaptive to climate change. And we must act now and act together, and that we do more to reduce the emissions that have brought us to this point, in order to create a habitable future."

To meet the target emission goals of the Global Warming Solutions Act and protect the future of Lake Champlain, lawn conversion initiatives can be a cost-effective approach to reduce the overarching threats of climate change without making a large personal sacrifice.

Having a unique polyculture such as a lawn comes with a variety of benefits, both aesthetic and practical. The area around our homes is a place that can be used for pollinator habitats, food production, increased biodiversity and native species. This shift in mentality will deter the excessive use of water, phosphorus runoff, and carbon emissions that are associated with the maintenance of a turfgrass monoculture lawn. Growing herbs and vegetables can serve as supplemental food security — or even income, with some entrepreneurial spirit.

This article has numerous reference links. They will be available in the online post of the article.

The authors are students at the University of Vermont. Alicia Brisson, class of 2022, is studying environmental studies, Krista Fillion, class of 2023, is studying community development and food systems, and Lyndsey Parrott, class of 2022, is studying community and international development.

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1. Native eastern hemlock

   In New Hampshire, one of our most prolific indigenous species is eastern hemlock. We have found that, at a fraction of the cost of cedar or fir, it will last in the ground up to seven years. It is definitely the local favorite wood choice for raised bed gardening. Eastern hemlock is also local and ecologically responsible in the following ways.
   - The logs are harvested and dried in the same way you created your end wall.
   - The sale of hemlock supports the local economy at every level of production.
   - It avoids the cost and transport of the red cedar.
   - It avoids the cost and transport of the Douglas fir.
   - Galvanizing or special coating for structural screws.

2. Douglas fir

   Douglas fir, or Doug fir, is another great wood to use. It is readily available locally, and although it is largely grown in the western states, the trees are often planted in New Hampshire. There are several grades of Doug fir available. The most cost-effective is essentially a mill-run grade that allows for sound tight knots. This means that the knots will not fall out and create holes in your piece of lumber. Even this grade will cost approximately four times the cost of the eastern hemlock.

3. Western red cedar

   Also grown in the western regions of the United States, western red cedar is readily available. If you are locating your raised beds more as planter boxes on your deck, you may want to consider using a knot-free grade, usually denoted by ‘A+’ or ‘CVG’ (clear vertical grain). If you still like the idea of the red cedar, but not the price tag on the higher grade, take a look at the mill-run or knotty grade. It’s still pricey, at a little more than six times the cost of the Eastern Hemlock but is a fraction of the cost of the clear grade.

**Size of Your Raised Bed**

A common width for raised beds is four feet. This makes the entire bed within your reach. But you need to be mindful of the length of your raised bed. The longer the bed, the greater the outward pressure from the soil. The maximum length of each bed should be six to eight feet. If you want it longer, you should add interior partitions. Construct the interior partition the same way you created your end wall.

**Fasteners**

When assembling your raised bed, screw-type fasteners are the way to go. They should be at least 3 ½ inches long and have these features:

- Big heads or washers under the heads to resist the outward pressure of the soil.
- Self-cutting threads are the best.
- Galvanizing or special coating for longevity.

Lumber supply stores have many types of fasteners. Ask for coated structural screws.

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**Lake Champlain State of the Lake Ecosystem Indicators Report**

**2021**

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**THE SKIN OF OUR TEETH**

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**DIY Raised Bed Gardening**

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Storytelling Helps Overcome Barriers to Adopting Climate Solutions

Colleen Ward

I grew up in beautiful Colorado and experienced the multiple impacts of climate change firsthand. They shaped my passion to communicate and drive climate actions that we can all take.

I was at my childhood home when our house flooded overnight. Unaware of the extent of the widespread flooding in the morning, I started driving down a hill until I saw the road and entire valley was submerged under a large body of flowing water – only a few feet away from me. I have also experienced wildfires and tornadoes. As I write this from where I now live in Vermont, a fire is burning near my old high school and destroying forests.

These events have destroyed my family and friends’ longtime homes and neighborhoods and continue to threaten their safety and health.

Seeing your community in flames, underwater, or facing any climate catastrophe stops you in your tracks. You ask yourself, “What can I do? What can we all do?”

People in the U.S. hold immense power to mitigate carbon emissions, shape energy policy decisions, and address the climate emergency. We all have the opportunity to protect the people and places we love.

Nearly 70% of people in the United States “feel a personal sense of responsibility to help reduce global warming” according to the 2021 study, “Climate Change in the American Mind” by the Yale Center for Climate Communication and George Mason University Center for Climate Communication.

While everyone plays a crucial role, most people do not know that we, as individuals, can be part of climate actions that make an impact. Most individuals don’t know what specific actions they can take to reduce carbon emissions, which actions provide the highest carbon reductions, or how to adopt clean technologies.

Right now, in Vermont, more residents need to be empowered to take actions that mitigate carbon emissions immediately to address the climate emergency and meet Vermont’s state climate goals. According to the Yale Center for Climate Communications, 65% of Vermont residents are worried about global warming. These alarmed and concerned groups are the prime individuals to be a part of climate solutions. However, these individuals may not be engaged in the most proven, effective solutions and strategies from the clean tech industry.

Solution-oriented, human-centered storytelling is the most effective method for driving behavior change, as supported by studies from the Yale School for Climate Communication, Columbia University, George Mason University, ECoAmerica, and others. These studies demonstrate that first-person personal stories have the power to build empathy, shape mindsets, and change behaviors to participate in climate solutions.

These leading voices are studying the psychology that motivates climate action and have found that local, personal stories are a key strategy to drive behavior change. Columbia University’s Center for Research on Environmental Decisions Guide specifically suggests the following principles: know your audience, tap into social identities and affiliations, make behavior change easier, encourage group participation, and utilize concrete experience.

It’s critical to rapidly engage and increase the number of people to go from the consideration to adoption phase of clean technologies. Testimonials are a form of storytelling that allows those interested to learn and connect to the person, and human stories of adopters of the technology. The adopter stories help answer questions, ease concerns, explain the full range of benefits, and provide those interested the confidence to adopt the technology knowing it has worked through it. There is plenty of evidence within clean energy industries that these principles work:

- Data shows that there was a 44% increase in solar installations nationwide within a half-mile radius after one rooftop system was added.
- Testimonials are the most effective tool for adoption of rooftop solar along with other clean technologies.
- One-third of customers out of 230,000 SolarCity rooftop solar installations nationwide were referred by a friend or a neighbor.
- “How to Get Involved” is the most viewed type of video across our Bloomcradle.com website videos, which hosts stories of individuals taking climate action. Coupling testimonials with video (i.e.,

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The Hopes and Hazards of Climate Intervention

... CDC's three priorities: air pollution, infectious diseases, and climate change...
Delay Is Death – Cont’d from p.1

The body of scientific research on global warming’s health impacts, including on mental health, has grown since the IPCC’s last climate assessment cycle in 2014. It shows that warming is wreaking havoc on the environment, wildlife, human health and infrastructure. In the U.S., nearly 7.7m acres (3m hectares) burned last year, and these blazes are getting increasingly harder to fight. We spend a lot of money fighting fires, but very little on planning, preparing and recovery. This is a familiar pattern as our society spends rather little on reducing climate change, yet it tacitly accepts the strategy of the Fossil Empire and many business sectors to maximize their profits by burning all the fossil fuels. The current 22-year megadrought in the southwestern US. continues, and water supplies are becoming critical. It has overtaken a major drought in the 1950s, and based on tree rings that go back to 800 AD it is now the most severe in 1200 years. 2021 continued a pattern of reduced rainfall in the west and increased rainfall and many storms in the east, coming from the Atlantic or the Gulf. We are not grasping the entire picture of the economic damage to society. NOAA estimated climate disasters in the U.S. in 2021 that cost $1 billion or more, totaled $145 billion and killed 688 people. However, the increasing severity of storms and more frequent severe tornadoes, even into December, damaged over half a million homes with an estimated cost of $124 billion. After striking the Gulf coast, Hurricane Ida merged with a frontal system, intensified and damaged 1.2 million homes in the north-east with estimated record reconstruction costs of $395 billion. Yet society still refuses to bill the Fossil Empire for these damages, even though the oil industry knew forty years ago that greenhouse gases are responsible. This is a delusion about this ever since. This is absurd: many business sectors accept the strategy of the Fossil Empire for these damages, even though the oil industry knew forty years ago that greenhouse gases are responsible. This is a delusion about this ever since. This is absurd: many business sectors accept the strategy of the Fossil Empire for these damages, even though the oil industry knew forty years ago that greenhouse gases are responsible. This is a delusion about this ever since. This is absurd: many business sectors accept the strategy of the Fossil Empire for these damages, even though the oil industry knew forty years ago that greenhouse gases are responsible. This is a delusion about this ever since. This is absurd: many business sectors accept the strategy of the Fossil Empire for these damages, even though the oil industry knew forty years ago that greenhouse gases are responsible.
Finding and Redressing Flood Risk Inequities

Michael J. Daley

Even with a heroic effort to turn every bit of cropland, pasture, hayfield, and barren ground into forest, a unique study of flooding in the Lake Champlain watershed by University of Vermont (UVM) scientists generated sobering news: such a massive change in use of the land would only prevent about 20% of the predicted damage climate change induced flooding would cause during the next 100 years.

Also, the benefits of such drastic intervention would mainly accrue to high value property owners leaving most mobile home dwellers, low-income people, and the disadvantaged, well, down the river without a paddle.

A paper describing the study titled “Inequities in the distribution of flood risk under floodplain restoration and climate change scenarios,” appeared in the British Ecological Society journal People and Nature. A UVM press release announcing publication quotes lead author Jesse Gourevitch, “This research shows that the Vermonters least able to prepare and recover from flood damages disproportionally face the greatest threat.”

Fortunately, in a separate but relevant development last year, the Vermont Legislature established the Flood Resilient Communities Fund (FRCF) in an effort to correct some of these disparities. The FRCF focuses on buyouts of flood-vulnerable properties, emphasizing projects that prevent repeated losses for low-income and marginalized Vermonters. Applications for the third round of grants are due by October 2022 with $4.6 million in funding available.

Third round FRCF applications are due by October 2022 and are open not only to municipalities, but non-profits, and others. Vermont Emergency Management Director Erica Bornemann is encouraging eligible applicants to “think creatively about what types of projects could make a difference in their communities.”

The authors note, “This bias in monetary valuation is codified by FEMA’s hazard mitigation assessment methodologies, through their use of benefit-cost analysis. In the absence of equity weighting, these methodologies create perverse incentives in prioritizing flood mitigation interventions, whereby wealthier property owners often receive greatest protection.”

This forthcoming no doubt influenced Vermont legislators to create the FRCF. Experience with disaster recovery after Irene revealed many instances of inadequacy in FEMA reparations. Many of the first round FRCF grants awarded directly seek to help people who felt the cruel and unrelenting cronyism as a young family in the Town of Rockingham whose home became dangerously unsafe due to a landslide. Of the nine municipalities awarded grants in the first round of submittals, five were to finance buyouts of flood prone properties.

Finding and Redressing Flood Risk Inequities

“Now is the time to turn rage into action. We have the tools to make sure floods do not kill again. Let us turn this rage into action.”

I know people everywhere are anxious and angry. I am, too,” Guterres said of the growing anguish over global warming. “Now is the time to turn rage into action. Every fraction of a degree more warming, every voice can make a difference. And every second counts.”

Bob Berywn an Austria-based reporter who has covered climate science and international climate policy for more than a decade. Previously, he reported on the environment, endangered species and public lands. He’s also worked as an editor and assistant editor at community newspapers in the Colorado Rockies. Follow Bob on Twitter @bberywn

Reprinted with permission from Inside Climate News.

Michael J. Daley is a life-long renewable energy educator and advocate, except for a brief time in high school when he thought nuclear power was cool. He lives in a tiny off-grid cabin in Westminster, VT with his wife, Jessie Hoss.

Source links available in the posting of this article at: greenenergytimes.org.

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On June 29, 2021, rainfall and subsequent flooding caused a significant landslide dangerously close to a young family’s home. (Photo: Joseph Endris.)
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- Burns cleanly and efficiently
- We deliver biofuel at no additional cost


Other than capturing the sun through windows for passive solar heating, for many years the most effective way to utilize the free energy of the sun was with a solar hot water system. For years organizations sparked by the Plymouth Area Renewable Energy Initiative, PAREI, helped local homeowners install solar hot water systems in barn raiser fashion.

With the changing emphasis to solar electric installations, solar hot water systems have given way to a new technology that can harness the energy of the sun to produce hot water in a very different manner. This new twist with heating domestic hot water is electric water heaters with heat pump technology built in. This means that the heater uses electricity to take heat from its immediate environment and transfer it into the water rather than use only a built-in electric heating element as do most electric water heaters. As with other heat pump systems, this makes the system two to three times more efficient than a traditional electric water heater by using one unit of energy to produce two or three units. It uses the same technology that is popping up everywhere in the form of “mini-split” heat pump systems with the largest component of the system, the compressor, outside the house, and one or more “heads” that transfer the heat or cooling remotely.

During extremely cold periods, mini-splits heating a building might have to rely on fossil fuel backup heating, because when they are working in an extremely cold environment their efficiency drops back to performing like any other electrical resistance heating unit with one unit of energy in and one unit out. Because water heaters seldom operate in sub-freezing temps, there should never be a time that a heat pump water heater should ever lose an effective level of efficiency. During periods of high demand, heat pump water heaters can be set to supplement that demand with a backup standard electrical coil built into the tank. There are several advantages to this type of water heater besides its increased efficiency including that it can help cool the inside of a building in summer by taking the heat from the room where it is located and transferring it into the water, and also that it can use electricity from a building’s PV system resulting in another way of using the sun to heat water. It is worth considering that several states and utilities provide rebates for heat pump water heaters.

Cont’d on p.28

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Biodiesel is usually blended with some percentage of diesel fuel or heating oil. The blend is named according to the percentage of biodiesel in it. So, for example, B10 indicates that 10% of the oil is from biological sources. It can be used as a drop-in replacement for diesel oil and managed similar to conventional diesel and heating oil.

Levi Bourne, President at Bourne’s Energy said, “At the Bourne’s Energy plant we can blend any blend of biofuel using recycled cooking oil and feel good that this fuel is produced locally for our Vermont community. It’s biodegradable, nontoxic, and ecologically the best and highest use of waste vegetable oil. It’s a full circle and since it doesn’t require any additional investment or change to your equipment, it couldn’t be any easier to reduce your carbon footprint with biofuel.”

In 2019, at the National Energy and Fuels Institute conference the heating oil industry unanimously resolved to fully embrace Bioheat® and increase the percentage of biologically derived fuels to 50% by 2030 and to the point it hits net zero carbon emissions by 2050.

It happens that home heating oil and diesel fuel are nearly identical in their makeup, so it makes sense to use biodiesel for heating a home or business instead of traditional fossil fuels. In this way, the carbon emissions from heating can be reduced without any change or additional investment to the heating system.

We should be clear about this. For nearly any application where home heating oil is used, the carbon footprint of heating the building can be reduced quite a lot by simply changing the blend of oil that is used.

To assess the implications for a particular home, we must consider several factors. First of all, we should think about the age and condition of the current heating system. If an oil-burning furnace is really on its last legs and needs to be replaced, that is one thing. But if the heat is coming from a new, high efficiency oil furnace, that is another altogether, because it has its own embodied energy, so air sealing and insulation might be better uses for money than putting in a new heating system. In that case, it would make perfect sense to reduce the carbon footprint of the fuel by going to a blend with less fossil fuel in it.

For Green Energy Times readers Main-Care Energy and Bourne’s Energy supply Bioheat®. MainCare covers regions in northeastern NYS and areas in VT near Bennington and Rutland. Bourne’s Energy supplies Bioheat® to Vermont.

For more information, additional resources can be found at MainCareEnergy.com/BioHeat
SOLAR HOT WATER – Cont’d from p.26

Heat pump water heater is the fact that it is taking heat from its environment which might be fine if it is in a room with a wood stove or alternative-fueled furnace, but not if it is stealing heat that is generated by an expensive non-renewable energy source, in my opinion.

As for the future of stand-alone solar hot water systems, the complexity and expense of a system appears to make little economic sense when compared to a PV powered heat-pump system. On the other hand, keeping an existing solar hot water system operational makes abundant sense so long as major components do not need replacing. Unfortunately, there are existing solar hot water systems that are not functioning simply because of a minor component that a subsequent homeowner or an unfamiliar plumber does not have the wherewithal to troubleshoot.

We’ve found that solar raisers from years ago served to take away the mystery of solar hot water for the several plumbers who took part as they came to realize that solar hot water systems are little more than any other domestic hot water system except that the source of the heat was the sun beaming on solar collectors instead of some kind of gas or oil-fired system or some wires hooked to the grid.

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 Quilt®. 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.
A BUNCH OF B.S.* (*BUILDING SCIENCE, OF COURSE!)

The Next Frontier in Sustainable Building: Deep Altruism

Nate Gusakov

For the last few decades, most of the leading discussion, innovation, and progress toward a more sustainable building industry have been centered on reducing operational energy use. In other words, learning how to make buildings use less energy while they keep people at the same level of comfort. More insulation, better air-tightness, innovations in appliance efficiency, siting and glazing for solar gain… all of these are geared toward helping buildings use less in their day-to-day operations. Less oil, less natural gas, less coal, fewer electrons – it’s the same idea across the board. To some people (probably many of whom are readers of Green Energy Times), there is a great deal of global consciousness and eco-awareness behind this work. However, the larger part (by far) of the building industry is mostly motivated by the good ol’ bottom line. Spending less money to get the same result is, and always will be, an excellent selling point. So, it should have been a snap for the mainstream building industry to see widespread adoption of technologies that absolutely maximize reductions in operational energy use, right?

Well, let’s try to measure. One simple way to measure a building’s annual energy use is with a metric called Energy Use Intensity (EUI). It’s expressed in thousands of BTUs per square foot of floor space, or annual kBTU/ft². For example, the most stringent of today’s building standards (certification by the Passive House Institute of the US or PHIUS), requires an EUI of slightly less than five kBTU/ft². However, the latest available numbers from Efficiency Vermont show that the average VT home currently has an EUI of over 64 kBTU/ft², and the latest numbers from www. energystar.gov show an average EUI over 86 kBTU/ft² across all U.S. building sectors! This means that on average our buildings use 1500% more energy than the levels we are capable of! We are obviously still a far cry from selling everyone in the industry on maximizing reductions in building energy use.

Now that we’re into the 2020’s the discussion at the forefront of sustainable building practices is changing. Increasingly over the last five years or so, if you’ve spent any time at a regional sustainable building conference (NESEA’s Building Energy Boston, or Efficiency VT’s Better Buildings by Design, for example) you’ll have seen lots of attention paid to the topic of embodied carbon (EC). This is the overall amount of CO₂ released into the atmosphere during the creation, transportation, assembly, maintenance, and decomposition of a product or material (usually expressed in kilograms of CO₂ per kilogram of product or material). If you subscribe to the global scientific understanding of the causes and dangers of atmospheric climate change, then you can understand why embodied carbon is such an important topic. Regardless of how many dollars or BTUs a certain material will save during its time in a building, if more CO₂ emissions are thrown into the atmosphere just during its manufacture and transport than it will eliminate during its lifetime, we have a losing proposition. Add to this the fact that operational savings take years to accumulate while EC represents emissions that have already happened before the building is even finished, and you can see doubly the importance of saving money and paying attention to EC.

Ok, so where am I going with all this, and what does it have to do with ‘deep altruism’ (whatever that is)? Here’s the thing – even with very direct bottom-line savings as a marketing tool, significant reductions in EUI have been slow to spread, even across decades. Why? It’s that the case is a big long snarly question, and not one that I’m getting into here. Regardless, it’s true. And now the conversation needs to change (broaden, really) to include EC concerns as well. The big catch: there’s very little immediate, tangible benefit to representing emissions that are more expensive to achieve low-EC construction goals (although that’s changing by the moment), and the trust return on investment is clearly not going to be realized for many, many years. If and when there is a payoff from the hard work of tracking and minimizing EC, it will come in the form of reduced global atmospheric carbon levels and the resulting potential reduction in the severity of climate change. That is the currency. The return on our investment will be the possible alleviation of future suffering of other living beings who may or may not live their lives far away from us in place and in another time. Perhaps to those with a more indigenous world view, used to taking into account the effects of their actions on life seven generations later, this is not news. As for the rest of us, well friend, this is not a bottom line that most corporations (or homeowners, for that matter) are keeping on their spreadsheets, and that’s got to change. In order to invest ourselves truly in EC issues at a significant level right now, the actions of the entire building industry will need to become altruistic beyond our current imaginations. I call that deep altruism, and I wish us luck.

Nate Gusakov is an air-leakage specialist and building envelope consultant who aspires to be like Friar Tuck in the Sherwood Forest of modern building science.
This is the first in a series of articles based on Wes Golomb’s newly published book and video series, Warm and Cool Homes, Building a Comfy, Healthy, Net-Zero Home You’ll Want to Live in Forever. The book is a look at five high performance homes, four of them net-zero, and the techniques and technologies used to build them. A net-zero home is built to be airtight and efficient with enough electrical generating power to supply the home’s energy needs. This requires an overall strategy for our society’s transition from a fossil fuel to a sustainable energy economy. I call it the three-legged-stool approach. The first leg of the stool is efficiency. We use as little energy as absolutely needed to accomplish a task. A net-zero home achieves efficiency through a series of air, moisture, and thermal barriers built to keep heat and moisture where we want them and to eliminate infiltration of outside air. The second leg is electrification. We use only electricity instead of fossil fuels. This approach generally saves at least a third of the energy needed. High efficiency homes replace the combustion of fossil fuels with heat pumps, which use a technology similar to a refrigerator to heat or cool efficiently, as needed. Gas cook stoves can be replaced by equally fast induction stoves. The third leg of the stool is to produce all the electricity we need to with sustainable energy. Thanks to their precipitous drop in costs, this means we are able to use solar photovoltaics (PVs) to supply our electricity. Let’s look at the general strategies used by net-zero home builders, and how they were applied to Mike Marion’s home in Newmarket, New Hampshire. We start with efficiency. Designers of high-efficiency homes take a holistic view of the project. This means dividing the job into tasks. The first task is to define the building “envelope” which includes the surfaces that provided the air, moisture, and pressure boundaries between conditioned inside space, and the unconditioned outside. The keys to a highly efficient home are air-sealing, effective insulation, and controlled ventilation. Minimizing infiltration is critical so it is important to seal every penetration into the house including the sill. To do this, we use a blower door test to measure how air-tight a house is, and we test prior to insulating so problems can be fixed. (THIS IS CRITICAL!!!) To do the blower door test, we put a large fan into a door, air-sealing it to the frame. All the doors and windows are closed, and the fan is turned on blowing air out of the house. This lowers the air pressure inside, relative to the outside pressure. When the house has been depressurized to -50 Pascals (Pascals are a measure of air pressure), the amount of air being pulled through the fan is measured. From this information, the number of air changes per hour (ACH50) is determined. Mike Marion’s home tested at 0.6 ACH50. This is less than a tenth of the NH standard of 7 ACH50. It is good for a net zero home, as they generally get less than 1 ACH50. The basement walls of the Marion’s home were poured and then rigid foam insulation was installed on the inside to minimize moisture.
Interview with Bryn Oakleaf, the Efficiency Excellence Network (EEN) Program Manager

G.E.T.: How did you become interested in energy efficiency work?

Bryn Oakleaf: I started working for Efficiency Vermont in 2019 after many years working for state government in environmental policy roles. I was drawn to working with Efficiency Vermont for their cutting-edge programs, direct benefits to Vermont customers, and core values.

What types of contractors and suppliers do you primarily work with?

BO: EEN members include builders, architects, HVAC contractors, weatherization contractors, equipment suppliers, electricians, lighting designers, and more. These members provide services to both residential, commercial, industrial and institutional customers. The EEN also recently expanded to include electric vehicle dealerships starting in the fall of 2021. Through the EEN, we are able to provide both a skilled workforce, and dedicated supply chains stocking energy efficient products to complete projects with.

How does your work with the Efficiency Excellence Network help meet customer needs?

BO: My work managing the EEN helps customers find skilled contractors not only to complete their project, but who are familiar with Efficiency Vermont incentives to lower costs and help finance projects. The Home Energy Loan is a great asset to residential customers looking to finance projects at 0% interest up to $20,000 for eligible projects. This benefit is only available to customers using contractors in the Efficiency Excellence Network. In some cases, program-specific rebates are only available when using EEN members such as Home Performance with Energy Star projects, often called weatherization projects. Changing to meet the needs of our customers.

What resources are available to help someone just beginning to learn about services that the EEN provides?

BO: You can find Trade Partner information on the Efficiency Vermont website here: https://www.efficiencyvermont.com/trade-partners. Our Find a Pro tool https://www.efficiencyvermont.com/find-contractor-retailer is another excellent way to see the variety of companies in the EEN and the numerous energy efficient services they provide. Our rebates page also indicates whether an EEN offers a Home Performance plan for certain projects, which can be a great option for customers who want to finance their project.

Why should a customer use an EEN member for their project or service needs?

BO: Customers that utilize EEN members can have confidence that their contractor has baseline experience for the service they’re listed for on our website. They can also be assured that the contractor is paired with an Efficiency Vermont specialist to assist them with questions on eligibility for project incentives to minimize expenses and make their dollars go further.

What are some questions you recommend customers ask when working to meet their energy efficiency goals?

BO: Customers should start the process of finding a contractor early in their planning. It’s good to reach out to multiple contractors to ask what their estimated costs and timelines are, and estimated time for project completion. This will give customers an idea of how contractor capacity fits into their personal timeline. Customers may also want to see if sub-contractors are needed for any aspect of the work too. For example, heat pump installations often need an electrician to complete the project. Knowing if a subcontractor is used will also help with timeline expectations. Lastly, it’s good for customers to ask about operation and maintenance to ensure that their project is optimized to their needs.

Any additional thoughts about the EEN that would be of interest to customers?

BO: The EEN is comprised of skilled and talented trade professionals committed to energy efficiency design and operation of our built spaces. They are the backbone of meeting, and exceeding, state climate goals and reducing utility costs of Vermont businesses and residents.

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Getting to Net-Zero Everything: Part 3

Sara Gutterman

This three-part blog series outlines the urgent need to transition to achieve net-zero energy, water, and carbon. This final installment explores how the quickening pace of our climate emergency is fueling the drive to reach full-scale elimination of carbon emissions.

The transition to the decarbonization economy will effectively require a complete overhaul of our socio-economic system. We won’t be able to shoehorn sustainability into old systems, meaning that we have the rare and thrilling opportunity to redesign our economy at a scale and scope that equals the transformation brought about by the Industrial Revolution.

While recent climate reports issued by the United Nations and scientists across the globe are soberingly dire, many of the world’s best minds are focused on mitigation and adaptation solutions. The transformation will be scary for some – namely, those who cling to antiquated business models, obsolete energy sources, and outdated technologies. They will fight, attack and fashion every conceivable obstacle possible to impede progress. But just as earlier naysayers couldn’t suppress the adoption of breakthrough innovations like indoor plumbing, incandescent lights, or the combustion engine, efforts to hinder progress will ultimately be futile.

Our world is evolving into a cleaner, greener, and better version of itself, and the good news is that all of us – including even those that launch the most vigorous assaults on advancement – will reap dramatic rewards. We will all enjoy clean air, fresh water, fertile soil, protected species, vibrant ecosystems, social justice, and a flourishing economy that is not only free of carbon emissions, but that also offers opportunity for incredible capital gains for those willing to take a little ambition and imagination.

While this utopian vision may seem idealistic, improbable, and out of reach, I am convinced that it is the inevitability of our species and the next stage of our evolution.

Roadmap to Decarbonization

Getting to net-zero carbon will require an inspired, novel, multi-pronged approach, with strategies ranging from simple, nature-based solutions like planting trees to deep energy retrofits to the deployment of complex enabling technologies.

**Essential tactics include:**

- Sequestering existing emissions in the atmosphere through the protection of forests, oceans, and other critical habitats.
- Driving renewable energy adoption, investing in super-efficient solar, wind, and battery storage technology, and implementing a national clean energy standard that requires utilities to derive increasing amounts of electricity from carbon-free sources.
- Transitioning the entire built environment to net zero and all-electric by implementing energy efficiency retrofit programs and ratcheted codes, mandates, and incentives.
- Electrifying transportation, requiring that all new vehicle sales be electric and implementing a “cash for clunkers” trade-in program to incentivize the transition to clean vehicles.
- Reimagining industry and manufacturing, primarily in highly resource-intensive and polluting categories like cement, steel, chemical, and paper.
- Transforming agricultural practices to reduce the impact of food production and preserving more land that can be used for carbon sinks.
- With the net-zero commitments that these institutions have recently established, those dollars are now being shifted into the burgeoning areas of carbon tech, climate tech, renewable energy systems, battery storage, and the electrification of homes and buildings.

**Decarbonizing the Built Environment**

The built environment plays a major role in carbon emissions. The sourcing and manufacturing of materials, construction, and operations of homes and buildings require an immense amount of energy to produce and a substantial amount of pollution.

*The Department of Energy (DOE) estimates that homes and buildings in the U.S. account for 40% of our nation’s total energy use, 70% of electricity use, and 40% of total emissions.*

It is estimated that if all buildings were net-zero embodied carbon (including the manufacturing, transportation, construction, operation, and end-of-life phases), then the United States could reduce its greenhouse gas emissions by more than 50%.

On a global scale, the UN avows that emissions from buildings must be reduced by 50% by 2030 and 100% by 2050 if we stand a chance at staying within a 1.5-degree temperature rise. Lamentably, we have a long road to travel—not even 1% of existing buildings and manufacturing of materials, construction, and operations of homes and buildings require an immense amount of energy to produce and a substantial amount of pollution.

The Department of Energy (DOE) estimates that homes and buildings in the U.S. account for 40% of our nation’s total energy use, 70% of electricity use, and 40% of total emissions.

Globally, we are seeing first-hand the benefits of strategies such as Passive House, which has a water-activated bacteria that reacts with steel’s density and 10 times its strength, sequestering existing emissions in the atmosphere through the protection of forests, oceans, and other critical habitats.

While the built environment plays a significant role in carbon emissions, it is not the only sector that needs to be transformed. To achieve net-zero carbon, we must also consider the electrification of homes and buildings.

**Clean Electric Technologies**

To get to net zero, we need a full-scale adoption of renewable energy, as well as the adaptation of infrastructure, regulations, and financing to support this transition.

Fortunately, the clean energy future is already here. Wind and solar energy are now cost-competitive in most parts of the world, and clean energy technologies can now harvest more power using less space and fewer resources than ever before. In fact, power sourced from wind and solar is now less expensive than power produced by fossil fuels on a national scale, and it is less expensive to build new onshore wind and utility-scale solar power generation facilities than it is to operate existing fossil fuel facilities in many markets.

The adoption of clean energy technologies is leading to the transformation of electric-grid architecture. Power generation is becoming more distributed and localized, with enhanced load management and optimized demand-side energy management.

The Internet of Things (IoT) is enabling intelligent devices to remotely manage everything, from manufacturing to building operations to vehicle fleets to power grids, with the goal of optimizing efficiency, while Artificial Intelligence (AI) technology is monitoring cybercrime and enhancing digital security across grid networks.

Advances in battery storage are also enabling the transformation of our power systems, further facilitating peak load shifting and enhancing the resiliency of the built environment.

The cost per watt-hour of battery storage has decreased by approximately 70% since 2015, which is not only helping to fulfill the promise of distributed energy generation but is also spurring a revolution in vehicle electrification.

Some experts predict that economies of scale will bring down the cost of batteries to allow electric vehicles (EVs) to reach price parity with gas-powered vehicles by as soon as 2024, increasing the number of EVs on the road to 550 million globally by 2040—up from 13 million vehicles today.

Vehicle-to-grid technology, or the ability to store power in EVs and send it back to the electrical grid when demand is high, is also evolving, taking its rightful place as an essential tool for optimized demand-side energy management.

Smart charging software and bidirectional chargers not only allow EVs to draw power from or feed power back to the grid, depending on demand, they also enable EVs to serve as a backup power source for homes and buildings during emergencies and blackouts.

**Carbon Tech Transforms Greenhouse Gases**

Another burgeoning industry that is facilitating the transition to net-zero is Carbon Tech, technology capable of capturing and embedding large amounts of carbon into products and materials.

Companies throughout the economy are getting creative about keeping greenhouse gas emissions out.

**Cont’d on p.33**

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of the air from industrial and manufacturing activities, as well as capturing existing CO2 particles and repurposing them into a valuable raw material.

Companies like Carbon Engineering and Climeworks are removing CO2 from air using massive fans and storing the gas permanently underground in a process called Direct Air Capture. CarbonCure is injecting CO2 from factory exhaust into a cement mix so that it can mineralize in concrete—an essential innovation given that concrete production is one of the most intensive processes in our entire economy, accounting for approximately 7% of annual global CO2 emissions. Not only does this process reduce emissions, the addition of the CO2 yields a stronger concrete material.

By using carbon, these companies are turning harmful greenhouse gas into valuable raw material, offering utilities, manufacturers, and other carbon emitters a much-needed economic incentive to capture carbon particles rather than release them into the atmosphere.

All Hands-on Deck for Decarbonization

When it comes to reaching net zero, a new wave of consumers is driving the bus. Imbued with an inherent ethic of sustainability, millennials and Gen Zs are facilitating market transformation, making a decarbonized future inevitable.

In a recent COGNITION Smart Data survey of this influential audience segment revealed that:

• 86% of females and 81% of males responded that they prefer to buy products from companies that demonstrate a strong commitment to sustainability.
• 77% of millennials are willing to pay more for sustainable products.
• 79% of millennials are concerned about the environmental impact of products they buy.

In response to mounting public pressure, multinational corporations have entered a fierce competition to become the sustainability leaders in their sector, pledging to become net neutral with respect to energy, water, materials, emissions, waste, operations, packaging, and mobility within the next decade. Sustainability is now a moral imperative, driving business strategy, innovation, and sales.

Companies large and small are finding ways to solve for mounting environmental challenges. Behemoths Amazon, Best Buy, IBM, Philips, Schneider Electric, Unilever, and Verizon have all pledged to reach zero carbon by 2040. Companies like Whirlpool and Facebook have made global commitments to

• Incentives for energy efficiency upgrades.
• Reduced emissions from agriculture.
• Lowered toxic emissions from industrial processes and manufacturing (including CO2, methane, hydrofluorocarbons, and other potent climate pollutants).

The United States has recently set aggressive targets to become net-zero carbon by 2050. China has pledged to cut carbon emissions by over 65% by 2030 and become carbon-neutral by 2060. India has committed to reaching net-zero emissions by 2070.

France, Britain, China, and India have all announced intentions to phase out combustion engine vehicles as early as 2035. Germany has shifted to primarily renewable energy and decreased its emissions by 23% since 1990. Britain has dropped its emissions by an impressive 43% since 1990, including a 65% decrease in its power sector emissions resulting from the phase-out of coal and super pollutants like methane and hydrofluorocarbons.

Emissions Reduction Must Happen Now

While these commitments are certainly encouraging, the reality is that they’re not enough to keep us below a 1.5-degree temperature increase.

According to the UN, current climate commitments would only cut global greenhouse gas emissions by approximately 1% by 2030—a frighteningly far cry from the 45% cut needed to limit global warming to 1.5 degrees.

In fact, at our known and foreseeable rates of progress, we’re expected to surpass 2 degrees Celsius within a shockingly short five years.

With climate change wreaking havoc across the globe, reaching net zero has become an absolute imperative, and the window for action to safeguard our planet is closing fast.

As we race against the clock and more people wake up to the reality of our climate emergency, expect the pace of change to accelerate.

Buildings + Beyond podcast

Available now on iTunes, Google Play, Stitcher, or your favorite podcast platform.

www.swinter.com/podcast

Make no mistake, the revolution has begun.

To learn more about getting to net-zero energy, water, and carbon, watch Green Builder Media’s webinar at https://bit.ly/GBM-webinar.

Sara Gutterman is the cofounder and CEO of Green Builder Media.

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RenewAire To the Rescue for Avon Old Farms School

Barb and Greg Whitchurch

Remember the spring of 2020? Covid was a “thing.” Scientists and health officials say, “Watch Out!” Our top-ranking politicians and other so-called influencers call it a hoax, or at worst a passing cold or flu. And the Avon Old Farms School in Avon, CT approaches the end of their school year with trepidation.

Avon Old Farms (AOF, www.AvonOldFarms.com/) is a boarding school for young men. Among their many and varied responsibilities is the personal well-being of their students, faculty and staff. And they needed to address the pandemic seriously, successfully and soon — by the time of school re-opening in the fall.

A primary vector for Covid transmission is air-borne respiratory droplets, so masking of uninfected people is helpful; removing the air-borne virus and replacing it with fresh, filtered air is also very important.

If you’ve heard of indoor air quality (IAQ) it might have had to do with the unhealthy effects of using propane or natural gas appliances inside of living spaces (schools, homes, etc.; bit.do/gascocok); or perhaps as it related to smoke from wildfires infiltrating poorly sealed homes; or mold spores inside homes with poorly designed exterior wall systems. But two years ago, it became clear that IAQ was an important factor in fighting Covid, and that balanced, filtered ventilation could help.

Another problem that emerged was that uncontrolled carbon dioxide levels in classrooms or other stagnant air spaces affect thinking and sleeping. High particulate levels (smoke, gas cooking) affect one’s ability to resist respiratory infections; other indoor air contaminants are more and some are less dangerous. Modern high efficiency buildings (from Passive House to Energy Star) of all sizes are now designed with carefully balanced energy-recovering fresh, filtered air ventilation systems. RenewAire ventilation equipment is a popular choice in this field.

The school called in van Zelm engineering (www.van-Zelm.com/), a huge firm fully capable of designing a Covid-safe solution that would also greatly improve the overall IAQ of the old buildings.

Van Zelm called in Melia Associates (www.MeliaAssociates.com/) for design assistance and specified RenewAire ventilation systems (www.RenewAire.com/) distributed by RST Thermal (www.RSTThermal.com/). Then they created a plan to address AOF’s needs within the extant spaces and constraints - ducting, venting, pass-throughs, etc. RST expedited the RenewAire equipment deliveries. Not willing to farm out such a delicate operation to others, Glenn Wilcox, director of facilities at AOF and his team performed the actual installation, always with the buildings’ preservation in mind. You can find RenewAire’s description of the job at bit.ly/renewaire-aof and a YouTube of the result at bit.ly/renewaire-aof.

But they’re not done! All of this was accomplished in just seven weeks, almost two years ago, and although fully effective, the design and equipment were meant to meet an emergent situation as quickly as possible. To avoid unnecessary long-term compromise of the historical architecture, much of the work was left exposed and temporary.

Now AOF is taking the time and spending the money to remove most of the equipment and replace it with new RenewAire systems more tightly integrated with the buildings and spaces so that their appearance is as discreet as possible. So, the original process is to be repeated, but now with everyone familiar with one another and with the experience of having gone through a most thorough dress rehearsal.

The lead of Avon Old Farms can serve as a model for how to approach special-needs projects involving IAQ.

Over-the-counter pain reducers (NSAIDs) are a $2 billion-a-year industry in the USA, just 11% of the total $18 billion annually spent on pain medication. Over 100 million Americans are in chronic pain. It’s time to take a step back and ask WHAT THE HELL is going on here?

One in three American adults are in pain every day. Is this normal for humans? Probably not.

So once again your hippy grandmother had it right. If you don’t have a hippy grandmother, try to borrow one. Just remember to bring her back.

My hippy grandmother believes in vegetables. She also believes in saturated fats and thinks current food fads and processed convenience meals are hurting people’s health. She includes home canned fermented vegetables in her diet and king arthur flour in her bread. What she doesn’t believe in is equally important.

She doesn’t believe in bottled water, except in emergencies. And she doesn’t believe in sweetened drinks either, except when there is no other choice. But as for packaged from the store. Make a pot of rice once a week and incorporate into your meals. It will save you a bunch of hard-earned dollars.

How about some rice and eggs with spinach cheddar and nutritional yeast? Yum! Goes great with homemade or bakery-made bread.

Stop by your local co-op and try the bulk soy sauce. It’s called tamari there and blows away any other soy sauce you have tried outside of Japan. It’s made in the same tank and at the same time as miso, a paste that is used to make a kind of instant soup. Take a heaping teaspoon and put it into a cup. Add three to four ounces of boiling water. Stir and sip slowly. Miso soup is incredibly healing and especially useful when recovering from illness.

So once again your hippy grandmother, try to borrow one. Just remember to bring her back.

Eating Well for Your Health

Larry Pleasent

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RESOURCES

350-Vermont: General group that coordinates a variety of statewide actions. To join this group go to: www.350vermont.org

American Council for an Energy-Efficient Economy: aceee.org


Carbon Tax: carbontax.org

Clean Energy NH: www.cleanenergynh.org/

CO2Earth: See emissions harms, scientific advice, and pathways to follow. www.co2earth.org


Dept. Public Sv. (CEDP): publicservice.VT.gov/energy/ee_cleanenergyfund.html

Dsireusa.com: Renewables & Efficiency. Find state, local, utility, & federal incentives for renewable energy & energy efficiency. www.dsireusa.com

Energy Efficiency: A must-go-to site for immeasurable amounts of info. www.efficiencyvermont.com


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/about/federal_taxCredits.


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-

Home Energy Saver: Interactive site to help you identify & calculate energy savings opportunities in your home. A list of great information! - hes.lbl.gov


NAECP/ 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


NeighborWorks Alliance of Vermont: Low-cost energy loans - www.rethomeownership.org

New York Solar Energy Industries Association/NYSEIA: www.nysia.org


NFRC Independent rating & labeling system for the windows, doors, skylights www.nfrc.org/

NH Energy Division: www.nh.gov/osi/energy/index.htm

Renewable Energy World: www.renewableenergyworld.com

Renewable Energy Vermont: www.revermont.org


SmartPower: www.smartpower.org

Solar Components: www.solar-components.com

Solar Jobs: Listed by city, state, and district, SolarStates.org

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 Office of Energy Efficiency & Renewable Energy (EERE): develops & deploys efficient & clean energy technologies that meet our nation's energy needs - www.eere.energy.gov

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

VPIRG: understand the clean energy resources available to VT - www.vpirm.org/cleanenergymguide

VT Energy Investment Corporation (VEIC): nonprofit organization that issues home energy ratings for new & existing homes. 800-619-6069 - www.veic.org


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Email Michael at bcollarcleanouts@yahoo.com with questions, a description and photos for an estimate. Local references provided upon request.

CLEAN ENERGY NH: JOB

Clean Energy NH, the state's leading clean energy advocate, is hiring a full-time Community Energy Coordinator. Provide support to businesses and homeowners in Coos and northern Grafton counties to access programs and funding to complete energy efficiency and renewable energy projects. For more info about CE NH and the position visit www.cleanenergynh.org/openings.

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Some specific examples from Ecovillage at Ithaca

Ecovillage at Ithaca has been making use of these strategies since 2017, and is well along the way to their goal of one charger per household. They currently have around 25 EVs for their 100 households, with more added monthly. Here are some implementation details that may be of interest.

One question is where to mount outlets and chargers within a carport? They typically mount the chargers up high above the vehicles, because that simplifies wiring and protects equipment from damage. Then they attach the charging cable to the ceiling and drop it down conveniently wherever the charge port happens to be located on that specific vehicle.

Generally, chargers are purchased directly by residents and the maintenance crew mounts and configures them. That saves capital and leaves the residents responsible for any service or replacement costs.

For charging outside of roofed structures, they use a simple fence-like structure to mount charging outlets. This makes it easy to wire multiple outlets by running along the cross beams, and it is easy to expand. They have benefited greatly from incentive programs to help fund this build out. Be sure to check for any local or federal incentives to support your efforts.

EVs are coming fast, so access to charging will become a key factor in attracting residents. Now is the time to start getting ready so you can do your part to move this transition forward.

Jeff Gilmore is an engineer consulting on computer technology and renewable energy projects under the name Localforce.io. He and his family live at Ecovillage at Ithaca in Ithaca, NY.

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Behind the Blue Bin – What Is Recycled?

Adam Minter

Local governments began distributing recycling bins in the 1970s. Those bins were largely reserved for the flood of daily headlines, as newspapers were attractive raw material for paper mills.

By the 1980s, many cities had also signed contracts with materials recovery facilities (MRFs), which use sophisticated tools to separate different types of metal, glass, paper, and plastic that they then sell. People may recycle out of idealism, but it’s all business at the end.

MRFs have made modern blue-bin recycling possible, but they have also created an aura of mystery around what is and isn’t happening. Reliable data has never been collected on how much is actually recycled from blue bins nationwide. What happens to those objects you optimistically recycle depends on many factors. Here are a few possibilities.

- The humble aluminum can is the most recycled item, largely because it’s easy to sort and melt into new versions of itself. Nearly half of all cans are recycled.
- In theory, polypropylene (PP) is recyclable, but there are only a few facilities in the United States that accept it—and most MRFs aren’t anywhere near one. For now, an MRF worker will likely place a yogurt container in a landfill- or incinerator-bound trash bin, especially if it has foil or a different kind of plastic attached.
- There’s no shortage of manufacturers who want to use recycled glass in their products. Unfortunately, not enough recyclers have installed the technology to sort clear from colored glass, and thus large volumes end up as waste.
- High-density polyethylene (HDPE) was once virtually unrecyclable because it was so cheap to make. Now that manufacturers use more recycled material in packaging, the price for HDPE has skyrocketed in just a year from $0.04 to about $.60 per pound.
- Known as “mixed paper” in the recycling world, junk mail was once exported almost exclusively to China. Now it goes to India and Southeast Asia as well as domestic paper mills, which pulp it to feed the cardboard boom.
- About a third of polyethylene terephthalate (PET) containers, one of the most easily recyclable forms of plastic, are washed, shredded, and melted down. Some companies glue labels made of a different kind of plastic to PET containers—an innovation that renders some unrecyclable unless the label comes off.

In 2017, after decades as the biggest buyer of U.S. recycling material, China decided to restrict its import. The price of discarded cardboard fell by 84% making recycling economically impossible for some municipalities. Today, new and refurbished paper mills in the U.S. are cranking out cardboard boxes for the pandemic-fueled boom in online sales. Cardboard trades at $171 per ton (up from $60 in 2019).

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When University of Vermont (UVM) Business student Niels Arentzen was in high school, he operated a lawn care business, and explored the possibility of starting a commercial electric mowing company. His research into the technology highlighted the emissions and fuel savings, as well as noise reduction, but the upfront costs were too high for his small-scale operation. He didn’t give up on the idea of electrified lawn care equipment, and once on UVM’s campus, he realized that UVM could make the transition to electric mowing. The University needs to have the grounds cut sharp, in an efficient and timely manner, while classes are going on, and students, staff and faculty are living, learning, working and playing in and around the grounds. Complaints about the noise and emissions from lawn equipment often mean that the groundskeeping crew must adjust its schedules around building occupancy, exam schedules and quiet hours around residential buildings. This was the perfect setting to pilot electric lawn equipment.

In January 2020, Niels reached out to Peggy O’Neill-Vivanco, the Coordinator for VT Clean Cities Coalition at UVM’s Transportation Research Center. Together they wrote a proposal to UVM’s Clean Energy Fund (now called the Sustainable Campus Fund), to pilot a 60" zero-turn (ZTR) electric lawn mower. To support the pilot proposal, Niels got over 500 signatures from students and faculty on a petition for the pilot proposal, Niels got over 500 signatures from students and faculty on a petition for the pilot proposal, Niels got over 500 signatures from students and faculty on a petition for the pilot proposal, Niels got over 500 signatures from students and faculty on a petition for the pilot proposal, Niels got over 500 signatures from students and faculty on a petition for the pilot proposal.

The goal of the project was to evaluate the efficacy of an e-mower for UVM’s lawn care needs. While the pandemic delayed the pilot’s rollout, the mower was finally purchased and put into use at UVM during late summer 2021. It was in use for 150 hours of mowing during the 2021 season and resulted in 7582 kWh of electricity used; saved 225 gallons of gasoline and over $731 on fuel; reduced noise pollution from 100 to 85 decibels; and prevented over 2,000 lbs of CO2 emissions. (The sound-pressure scale in decibels is logarithmic, making this sound reduction very significant.) University students, employees, and visitors reap the health benefits of breathing less-polluted air during the mowing months of the summer and fall. Additionally, students, faculty, and staff were spared having to compete with the sounds of noisy conventional mowers outside their classrooms and offices.

This success, and the positive feedback from the Grounds crew on the efficiency and operating of the electric lawn mower led Matt Walker, Grounds Manager at the Physical Plant Department (PPD), to propose additional funding for electric chore tools – push mowers, trimmers and leaf blowers – for campus crews to use. Building off the electric lawn mower pilot, and with support from VCCC, Matt’s 2022 proposal to the Sustainable Campus Fund seeks to support the purchase of electric lawn tools to help PPD decarbonize a significant portion of its landscaping tools. In addition to reducing carbon emissions, the electric leaf blowers will comply with the new City of Burlington noise ordinance and will not exceed the noise level of 65 decibels. Again, equipment electrification will have a direct and positive impact on campus climate by improving students’ learning and health by reducing localized air pollution, noise pollution and greenhouse gas emissions around residential and academic buildings. These projects highlight great collaboration between a UVM student and the Grounds Department. This isn’t to say that there was a seamless and easy conversion by the crew to the e-mower, but support from the Grounds Department leadership made an easier path for the pilot to take place, and the crew to be part of an exciting electrification project.

Peggy O’Neill-Vivanco conducts program outreach and coordination at the Transportation Research Center at UVM. Peggy holds an MA from NYU. She is a year-round bike commuter, and advocate for safe bicycle and pedestrian infrastructure for all users.

Niels Arentzen studies Finance and Art at UVM and will graduate in May 2022. He can often be found in the lake or in the mountains. He looks forward to continuing his work with sustainability on the supply chain team at Beta Technologies and through impact investing at the Hula Fund.

Replacing fossil fuel-powered mowers with e-mowers that use 100% renewably-sourced electricity will help UVM reach its commitments to climate neutrality by 2025. According to an EPA study, a 24 HP commercial ZTR mower, similar to the ones used by UVM, running for an hour is equal to 88 cars driving at 55 MPH or 4,840 vehicle miles traveled in terms of emissions. In contrast, operating one 60" commercial electric mower for 400 hours annually produces zero emissions, versus the nearly 8,000 lbs. of CO2 produced by a comparable conventional commercial mower.

The pilot supported the Clean Energy Fund’s goals and the UVM’s Climate Action Plan by reducing localized air pollution, noise pollution and greenhouse gas emissions around residential and academic buildings. This was the perfect setting to pilot electric lawn equipment.

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