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The Latest IPCC Climate Report Sounds a Warning

George Harvey

On March 20, 2023 the United Nations Intergovernmental Panel on Climate Change (IPCC) issued its *Sixth Synthesis Report on Climate Change*, referred to as *AR6*. This report synthesizes three earlier reports, which had been produced in 2021 and 2022. One thing that we want to emphasize about the three earlier reports is that none of them is trivial in scope or size. Each, by itself, is a monumental work of science.

The Physical Science Basis, the first of the three reports, was produced by 234 scientists from 64 countries, who used 14,000 scientific papers as source material. The report itself is 2,409 pages long. To be published, 195 countries had to sign on, and getting them to do so also was not a trivial job as they needed to agree on a line-by-line basis. It was published on April 9, 2021.

The elephant in the living room is a metaphor. The cow on the porch is not. (Jo-Anne McArthur, Unsplash, https://bit.ly/GET-cow-porch)

In its thirteen chapters, *The Physical Science Basis* says that we could still stop climate warming at 1.5°C, provided that we undertook urgent action. In layman's terms, it says this is an emergency, and we should respond to it as we respond to emergencies.

On the other hand, a lack of emergency measures causes us to warm by 2.5°C to 4.0°C, with sea level rises that could range from 0.5 meters to as much as 5 meters. The former would be a severe nuisance in many costal communities. The latter could mean some cities would be abandoned.

An editorial in *The Guardian*, "The Physical Science Basis" was called the "starkest warning yet" of "major inevitable and irreversible climate changes." UN Secretary-General Antonio Guterres said it was "code red for humanity." That was two years ago.

The Physical Science Basis can be found at www.ipcc.ch/report/ar6/wg1.

Impacts, Adaptation and Vulnerability, the second report, is 3,068 pages long. It was accompanied by a 37-page summary for policy makers. It was published on February 28, 2022. It examines impacts of climate change in terms of loss of biodiversity, migration, risks

Cont'd on p.3

CONSEQUENCES OF OUR MILD WINTER

Jessie Haas

What a winter! We had abnormal cold in November, then warmer than normal months with one short, vicious cold snap. Just when it looked like spring would start in February, colder than normal weather reappeared, and the bare ground was covered with snow, and then in some places with an ungodly amount more snow. What many of us want to know is, what will be the after-effects?

The truth is, we do not know. Scientific study requires replication, and it takes years or decades to replicate seasonal changes. We can talk about what we fear and what we see, and speculate as to what might happen next, but that is all.

What will the consequences of our warm winter be for the upcoming seasons in 2023? (Flickr/Tom Gill)

New York Times columnist Margaret Renkle wrote recently about the warm winter in Tennessee, where some migratory birds were appearing early and many plants were blooming two weeks ahead of schedule. The fear is that pollinators and others that feed on those blossoms may miss the window when that nectar is available, and fail to thrive and reproduce. One hopeful sign drawn from Renkle's article is that while the birds are pfaffing about looking confused, they are not nesting early. This matters because egg hatching needs to coincide with maximum caterpiller production in the immediate neighborhood. The earliest blooming plants are not always the natives; native plants are what feed caterpillers and moths. Renkle notes that the severe cold snap this winter killed nonnative trees and shrubs while largely sparing natives; this could turn out to be a net benefit, especially if aware homeowners replant with native species.

Sugaring season? Many places got an extremely early start, in the first part of January, a re-start in February, and are now enjoying an extended March stretch of good sap flow at the appropriate time.

Ticks? It takes a lot of cold, combined with dry weather, to kill them. Scientist speculate that the larvae, which are hardest to see (the size of a sesame seed), will be active early due to the winter warmth. Ticks are active at 29 degrees and above. However, in many places, while March temperatures were certainly favorable, the ticks were buried in leaf litter under deep snow, which at least keeps them away from many of their hosts.

The brief cold snap could have killed some of the invasive woolly adelgid threatening northeast

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Transformational Opportunity:

Making Energy Users Energy Owners

Roy Morrison

The renewable energy transformation is an essential opportunity to build a global standard in ecological and social justice by making billions of energy users become energy owners with an equity interest in the power that drives our civilization. Trillions of dollars are being invested in the renewable energy transformation. But the ownership of the renewable energy infrastructure need not remain in the hands of billionaires. Using available financial tools, energy users can become energy owners along with host community landowners and residents in year six after solar systems are installed by taking advantage of tax equity and depreciation rules applied for common community benefit.

This Chelsea ground-mount solar array is making energy users energy owners. (Unsplash)

This is more than just a case of fairness and justice. This helps establish the basis for common people having a seat at the decision-making table in controlling the future shape of local and global renewables to optimize our collective interest. $27 billion in Inflation Reduction Act (IRA) funds are directed to benefit of low-income census tracks. The use of the IRA grants can leverage IRA benefits by helping support organizing municipal, co-op, and association actions to take advantage of available financial tools. All energy users can

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LETTER FROM THE EDITOR-PUBLISHER

Happy Spring and Earth Day to You All!

This issue of *Green Energy Times (G.E.T.)* comes out about the time that Earth Day is celebrated, but we could all make every day Earth Day. And why not?

It is quite fitting that our center feature is about waste. Waste is a problem! It can generate a lot of methane and increases CO2 levels in the atmosphere. It is not just about plastic bottles being replaced by cans — this isn't solving the ocean debris problem at all. Cans now replace the bottle issue in the oceans and waterways and on our land.

This "Fluffy Polar Bear" represents one of the many reasons to make Earth Day every day -- to save the polar bears. (Ellery, age 6)

Food waste is a huge issue that creates methane as it decomposes in landfills. Food waste is supposedly banned in Vermont. Composting is encouraged. It is likely that a lot of food waste still goes into one's trash can and off to the landfill, unfortunately, often without a second thought. Simple little everyday chores surrounding food waste can make a bigger difference than we realize.

Beyond composting, what about containers that go into the recycle bins that may have food stuck to them? Should they be put into the recycle bin or the trash?

What happens to those items at the waste facility if these containers are put in the recycling stream?

A local facility said that while they do send out a tip sheet to new customers, that is all they do for education about how best to handle recycling versus trash for weekly pickups. While cleaning all containers is encouraged, the dirty ones make things difficult at the facility for the "wishful" items. (Wishful items are those that we hope will be recycled, but we don't

Cont'd on p.20

Kudos to the *Green Energy Times* Team Helping *G.E.T.* Save the Planet

G.E.T. *staff*

Nancy Rae Mallery founded *Green Energy Times* and is its editor-publisher. *G.E.T.'s* mission is based on her experience and convictions.

The homestead of G.E.T.'s *founder, showing solar PV, solar thermal on the roof and a lush garden photo. (N.R.Mallery)*

Mallery developed a love of nature when she was very young. Her interest in the environment led to a simple lifestyle with a dream to go solar one day. At one point, she lived in a situation that was not just off-grid, it used no power at all. That was a time when the hippie culture was rather widespread, and her lack of electricity was by no means unique. She also used a bicycle for much of her transportation. She returned to a more mainstream lifestyle with the increased responsibilities of a growing family.

She returned to college when her children entered school after a number of years of home-schooling. It was at that time that she picked up skills such as journalism and business that were just what was needed for the production of *Green Energy Times*.

In 2001, the time was right to move to Vermont. Having had some experience with off-grid living, including brief use of a very small solar system, she was able to create a self-sufficient lifestyle that was efficient, non-polluting, and largely a waste-free way of life. At the beginning, she priced two different sources of electricity. One was grid-tied, and the other was solar powered. The price of the grid connection turned out to be nearly as high as the cost of a solar system, even at that time, since the driveway was a half mile long.

The 3.8kW photovoltaic system was only half or less of the size most people would use today. To meet energy needs with the smaller solar system, the home was designed and built with many efficiency considerations, but sufficient for conventional living. The off-grid backup battery system was sufficient to provide for a week of low-impact life. A propane generator was still needed but was barely used.

Because solar was so expensive at the time, it was important to be completely aware of energy usage every day. Energy was just not wasted. The passive solar home included triple pane doors and windows with a R-47 roof and R-38 walls.

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IPCC Sounds Warning

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to human activities and health, food security, water scarcity, and energy. It addressed 127 negative effects of climate change, and it said that many of them could not be reversed.

Among the negative effects are that approximately 1 billion people face flooding due to sea level rise, and 3.3 billion are considered highly vulnerable in some way.

Impacts, Adaptation and Vulnerability can be found at www.ipcc.ch/report/ar6/wg2.

The third report in the series is *Mitigation of Climate Change*. Including its end materials, it is 2258 pages long. It deals with a wide selection of topics relating to mitigation. It examines energy and such other resources as agriculture and water. It looks at both the sources of carbon emissions and the ways we can emit less from them. It considers what is needed for cities and industry to reduce emissions and live with the results of climate change, and it also considers the finances that will make the changes possible. It was published on April 4, 2022.

Mitigation of Climate Change can be found at www.ipcc.ch/report/ar6/wg3.

Together, these three reports represent 7,735 pages of dense, scientific reading. There are doubtless some people in this world who would read them all. The IPCC published AR6 for the rest of us, so we can get a grasp on what the reports mean.

So far, the IPCC has not put the body of AR6 on the internet. No doubt it will soon. When it does, it can be expected to be

available at www.ipcc.ch/report/ar6/syr/. In the meantime, the *Summary for Policymakers* is available at that same address.

The document has three sections, which are grouped into a total of 18 subsections. We will not publish all of them here. But we should produce quotations from some that we think are particularly important, all considered by the scientists to be matters of high or very high confidence. We ask readers to remember that these findings have been signed by 195 countries:

A.1 Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850–1900 in 2011–2020. Global greenhouse gas emissions have continued to increase.

A.2 Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred. Human-caused climate change is already affecting many weather and climate extremes in every region across the globe.

A.4 Policies and laws addressing mitigation have consistently expanded since AR5. Global GHG emissions in 2030 implied by nationally determined contributions (NDCs) announced that by October 2021 it is likely that warming will exceed 1.5°C during the 21st century and make it harder to limit warming below 2°C.

B.3 Some future changes are unavoidable and/or irreversible but can be limited by deep, rapid and sustained global greenhouse gas emissions reduction.

B.5 Limiting human-caused global warming requires net zero CO2 emissions.

C.1 Climate change is a threat to human well-being and planetary health. There is a rapidly closing window of opportunity to secure a livable and sustainable future for all.

C.2 Deep, rapid and sustained mitigation and accelerated implementation of adaptation actions in this decade would reduce projected losses and damages for humans and ecosystems, and deliver many co-benefits, especially for air quality and health.

C.3 Rapid and far-reaching transitions across all sectors and systems are necessary to achieve deep and sustained emissions reductions and secure a livable and sustainable future for all. ♻

Energy Users-Energy Owners

– *Cont'd from p.1*

become energy owners. The opportunity also applies to communities that are the hosts for renewable energy development. The model includes maintaining farm land by installing dual-use solar above pasture and row crops.

Financial Tools

Municipals, co-ops, or associations as entities enter into contracts with renewable developers for long term agreements to buy renewable power. The energy users put up zero money. This long-term contract reduces interest rates for developers. The agreement enables the future affordable purchase of the solar systems by energy users.

Commercial solar development is driven by extensive tax credits in the first five years. In year six, the 30% to 70% Investment Tax Credit (ITC) benefits under the IRA are "exhausted" along with the Modified Accelerated Cost Recovery System (MACRS) depreciation. Beneficiaries of the tax credits must own and operate the system to keep the tax credit and accelerated depreciation benefits until year six after solar construction.

Under U.S. IRS rules, solar developers can receive an investment tax credit (ITC) of at least 30% of their capital costs (which now includes interconnection and storage costs) and can reach 50% under the new IRA if more than half of the benefits are shared with resident in low-income census tracks, and 70% meeting domestic content and prevailing wage rules. In addition, the new energy user owners receive accelerated MACRS depreciation based on the value of the purchase.

Steps to Energy User Renewable Ownership at Almost any Scale

1. A municipality or cooperative or association contracts with a renewable developer of their choice. For example, let us say Solar Developer (SD) is to buy solar power for at least 20 years at defined prices. The negotiated price will cover SD's capital cost to build, pay loan interest, operation and maintenance, insurance. SD will work with interested banks or credit unions or community development financial institutions (CDFIs), during the contracting process. The agreement with municipality, cooperative, or the association is key to finance at a reasonable rate for the SD. In addition to solar, the agreement could include wind, geothermal, bio-energy and free-standing storage.

2. SD will finalize negotiations with financial institution for construction funding to be transformed into a long-term mortgage following the commercial operation date (COD).

3. At the COD, renewable power flows to the town, and income flows to the SD to pay its mortgage and maintain the solar and storage system.

4. The contract with the municipality, cooperative, or the association gives them the right to buy a full or partial interest in the solar system plus storage beginning in year six when tax equity is exhausted.

5. Opting to buy the system in year six takes advantage of the stream of income from existing the energy purchase contracts for the system and profit for the SD. The value of the system in year six is substantially reduced after tax equity and MACRS are exhausted. A negotiated fair price can be part of reaching an agreement with the SD and not another buyer.

6. The municipality, cooperative, or the association will have its finance plan to be implemented for year six purchase. Although there is no ITC for the energy user purchase, there is new MACRS depreciation based on the value of the purchase price. Built into the purchase analysis will be a provision for an unexpected potential high number of people unable to pay their electric bills, which is generally small. Unless they are destitute in the midst of economic calamity, people strive to keep the lights on.

7. Each co-op or association member will have their own capital account and ownership share based on annual distributions based on their share of energy purchases and their share of profits based on energy sales and income from storage sales and participation in Virtual Power Plant (VPP) income. Members can use their equity interest for financing. Coop and associations operate on the basis of one member, one vote.

The goal is broader energy user ownership for many millions and establishing available and transparent models for renewable energy transformation.

Roy Morrison builds solar farms. His latest book is The New Green Republic. *Visit* www.SunPartnersSolar.com *or send an email to roy@sunpartnerssolar.com.* ♻

This ground-mount solar array, built in May 2021, is making energy users energy owners. (Courtesy photo)

Vermont Votes Yes to Protect Health and the Environment

Vermont Advances Bill to Protect Vermonters from PFAS and other Toxic Chemicals

The Vermont Senate has voted to advance S.25, which would restrict the use of toxic chemicals like PFAS in personal care products, menstrual products, textiles, and artificial turf. This bill takes important steps to protect Vermonters' health and our environment from these harmful chemicals, targeting specific areas of consumer products that are major sources of exposure and environmental contamination, including:

- Banning a list of 14 chemicals and chemical classes from personal care products and period products.
- Banning PFAS from all textiles, including apparel .
- Banning PFAS from artificial turf fields.

"Personal care products and period products are applied directly to Vermonters' skin and intimate areas every day," said Marcie Gallagher, Environmental Advocate at the Vermont Public Interest Research Group (VPIRG). "Textiles represent the largest source of PFAS in our landfills, and children are exposed to turf over long periods of time. Every exposure pathway matters, and S.25 takes an important step to stop these harmful products from entering our marketplace."

From production of the chemicals, to their transport, their use in products, and disposal in our landfills, toxic chemicals pose threats to communities throughout their lifecycle.

For each of these product categories, there are safer and cost-competitive alternatives available – or the chemicals are not necessary in the first place. This bill aligns us more closely with states like CA and WA, and many retailers are also starting to move away from the use of these toxic substances in the products they sell. It will require more companies to restrict these harmful chemicals in these product classes.

Kristi Lafayette with Vermont Skincare Company., the only Vermont-based brand producing Environmental Working Group (EWG) verified organic skincare, celebrated the Senate's passage of S.25, "This policy will help businesses like ours that have already taken it upon themselves to avoid unsafe or questionable ingredients in our products." Larry Plesent, founder of Vermont Soap Company based in Middlebury, VT applauds this, as well. Their mission is to create a "chain of good" from farm field, to factory, to you.

Read more about this important win for public health and environmental protection at https://VCV-S.25-passes. ♻

Could Conventional Cars Be Converted to EVs to Fight Climate Change?

Olivia Rosane

Reprinted with permission from EcoWatch's blog on Febraury 19, 2023 at https://www.ecowatch.com/conventional-cars-to-evs.html.

Volkswagen Beetle electric conversion. (Flickr/Albert)

As the world transitions to electric vehicles (EVs), what should happen to all the gas guzzlers that will remain on the roads?

This is an important question because even if the U.S. achieves President Joe Biden's goal of 50% new EV car sales by 2030, many people will still be driving their older fossil fuel-powered rides.

"This is something that's not being talked about enough," EVAdoption CEO Loren McDonald said, as The Guardian reported. "We're buying more new gas-powered vehicles each year than we are electric. So the supply of gas car vehicles keeps rising … and people are holding on to their vehicles longer."

One potential solution to this problem is to convert conventional vehicles into EVs. In theory, it's a simple process, according to the U.S. Department of Energy (DOE).

"Although uncommon, a vehicle with an internal combustion engine can be converted to an all-electric vehicle by completely removing the engine and adding a battery pack, one or more electric motors, high-voltage cables, and instrumentation," the DOE explained, adding that it's important to make sure that the converted car both has the space for and can support the weight of the new battery and motors while still meeting emissions and crash-safety standards.

However, in practice EV conversions are pricey and therefore out of reach for many, as The Guardian noted.

For example, the San-Diego-based conversion company Zelectric Motors said its conversions usually start at around $70,000, five thousand dollars more than the average cost of a new EV at $65,000.

"It's not a $5,000 to $10,000 retrofit that's going to save your old car," the company's CEO David Benardo said, as The Guardian reported.

The reason is both the current cost of batteries and the fact that each car has different requirements, demanding specialized labor. The company mostly retrofits vintage Porsches and Volkswagens and only works on around six to eight conversions annually.

There was a potential sign of hope in January when Toyota debuted two green versions of its classic 1980s Corolla GT-S at the 2023 Tokyo Auto Salon, as KTSM 9 News reported at the time.

"The reality is that we cannot achieve zero carbon emissions in 2050 simply by switching all new cars sales to EVs," Toyota CEO Akio Toyoda said in a speech announcing the conversions.

However, Toyota further told The Guardian that the company did not have plans at the moment to convert its older models en masse.

The two cars displayed at the show were converted differently. One, the AE86 BEV, was electrified using a Toyota Tundra hybrid pickup truck motor and a Prius Prime plug-in hybrid battery pack. The second, the AE86 H2, maintained the combustion engine but ran on hydrogen instead.

So-called clean fuels like hydrogen are the solution pushed by the Rhodium Group in a 2021 paper. Transportation is currently the U.S. sector that emits the most greenhouse gas emissions, and even the highest possible uptake of EVs won't see it reaching net zero by 2050. Even if almost 90 percent of light-duty vehicle sales are electric by 2035, transportation would still emit 525 million tons of greenhouse gas emissions by 2050. The report argued that the remaining emissions could be cut by switching to decarbonized fuels such as biofuels, electro fuels, or fossil fuels that are successfully offset. Another solution? Making travel more efficient.

"The most direct way to reduce emissions from transportation is to move people and goods more efficiently—either by improving the fuel economy of cars, trucks, buses, ships and airplanes, or reducing how many miles those vehicles need to move people or goods," the report authors wrote.

Finally, instead of converting private fossil fuel cars to EVs or running them on alternative fuels, we can move away from a one-person-one-car transportation model altogether. C40 Cities Executive Director Mark Watts said that one of the most important things urban leaders could do to tackle the climate crisis was to prioritize pedestrians and cyclists in transportation design over private motor vehicles.

"A global shift away from cars to more active forms of travel is exactly what the world needs right now," he said. "Replacing a trip by car with active travel is a highly effective way to cut emissions quickly."

Olivia Rosane is a freelance writer and reporter with a decade's experience. She has been contributing to EcoWatch daily since 2018 and has also covered environmental themes for Treehugger, The Trouble, YES! Magazine and Real Life. She holds a Ph.D. in English Literature from the University of Cambridge and a master's in Art and Politics from Goldsmiths, University of London. ♻

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JD POWER'S EV CUSTOMER SATISFACTION

Rivian R1T Ranks Highest Overall; MINI Cooper Electric Ranks Highest among Mass Market Brands

As more battery electric vehicle (BEV) models become available for purchase, owners' satisfaction with their overall experience is shifting to more traditional factors such as quality and styling. According to the J.D. Power 2023 U.S. Electric Vehicle Experience (EVX) Ownership Study,SM released today, the shift is most evident in the respective premium and mass market segment award recipients, Rivian R1T and MINI Cooper Electric.

In its first year of eligibility, the **Rivian R1T** ranks highest overall with a satisfaction score of 794 (on a 1,000-point scale). Owners have high levels of satisfaction with the driving enjoyment and interior-exterior styling factors. **MINI Cooper Electric** ranks highest in the mass market segment with a score of 782, supported by the highest satisfaction score of any EV model in the study's highest-weighted index factor, quality and reliability.

"The electric vehicle landscape is changing quickly, and newer models are bringing in more mainstream, first-time EV buyers," said Brent Gruber, executive director of the EV practice at J.D. Power. "Recent vehicle launches from both new brands and traditional automakers have had a profound effect on what factors are most important in the ownership experience. Today's EV owners are looking for quality, reliability, driving enjoyment, safety and technology features."

Following are key findings of the 2023 study.

- **Differences notable between premium and mass market segments:** For a third consecutive year, owners of mass market BEVs cite infotainment as the most problematic category (19.2 problems experienced per 100 vehicles, or PP100). Among premium BEV owners, the most problematic categories are squeaks and rattles (17.5 PP100) and exterior (13.6 PP100). The largest gap in satisfaction between owners of premium and mass market BEVs is availability of public charging, which is greatly influenced by the Tesla network of chargers. Among premium BEV owners, satisfaction with public charging availability is 589, while satisfaction among mass market BEV owners is 341. "The EV marketplace is dynamic and the important factors that manufacturers need to watch will vary based on their history and experience," Gruber said. "First-time EV buyers who are more mainstream will compare their EV's build quality to what they know about gas-powered vehicles."
- **Towing more satisfying for EV truck owners:** New to the study this year are survey questions specific to EV trucks regarding towing. Interestingly, satisfaction is higher among EV truck owners who have used their vehicle for towing (779) than among owners who have not towed (753). Satisfaction with driving range is higher among owners who have towed (635) than among those who have not towed (617), and

Cont'd on p.6

PLYMOUTH STATE UNIVERSITY EVS TAKE CHARGE

EVs at PSU Delivered 1 MWh of Energy with Fermata Energy Bidirectional EV Charging Platform

A Vehicle-to-Grid (V2G) Installation at PSU Receives Electricity Rates One Day in Advance Through Innovative Transactive Energy Rate Program from NHEC

Two Nissan LEAF electric vehicles (EVs) at Plymouth State University (PSU) provided 1 MWh of energy to the PSU's ALLWell Center, offsetting some of the building's electricity needs. EVs are more than sustainable transportation; they are "batteries on wheels" that can send energy stored in their batteries to a building when paired with a bidirectional EV charging platform.

The university is able to reduce its electricity bill and support grid resilience by taking part in an innovative utility rate program developed by its local utility New Hampshire Electric Cooperative (NHEC), electrification software provider Bellawatt, and Fermata Energy, the developer of the leading AI-driven bidirectional EV charging platform.

The program at PSU is groundbreaking because it brings together EVs, a bidirectional EV charging system, and advance information on hourly electricity pricing – called a Transactive Energy Rate (TER), enabling the university to easily make decisions about using the Nissan LEAF batteries as mobile energy storage assets.

Under the program, PSU sent energy stored in the EVs' onboard batteries to offset the ALLWell Center's building load for approximately 90 hours during a 6-month period. One MWh is equivalent to the electricity used by about 330 homes for one hour.

Through the NHEC application, TER forecasts electricity pricing one day in advance. Daily alerts about the next day's hour-by-hour electricity prices are sent by NHEC to Fermata Energy's AI-powered bidirectional charging platform, which then analyzes those rates, simplifies the information, and advises PSU about times the vehicles can discharge the batteries to maximize value for the university. The university controls whether to discharge by parking the EVs and plugging them into the Fermata Energy bidirectional charger.

"Through this program, we better understand how we use electricity and can actively reduce our electricity costs. We could do that with stationary energy storage systems, but EVs are more affordable and are easy to manage," said Donald Brix, president of Plymouth State University. "NHEC has always been a great partner for us. Fermata Energy's technology puts the EV batteries 'behind the meter,' sending electricity to the ALLWell Center to reduce our costs. Anything left over is shared with the grid. Not only did the university save money, but we provided a fantastic learning experience to our students."

Two Nissan LEAF EVs at PSU provided 1 MWh of energy to the ALLWell Center, offsetting some of the building's electricity needs. Bidirectional EVs, such as the Nissan Leafs' are valuable assets that can help stabilize the grid by dispatching energy stored in batteries when and where that energy is needed most. (Plymouth State University)

The day-ahead electricity pricing enables PSU to buy electricity from the New Hampshire Electric Cooperative at low prices and store that energy in the EV batteries. When the price of electricity is higher, PSU can then discharge the batteries and sell the energy back to NHEC. This is known as electricity arbitrage. The successful outcome of this hourly electricity pricing program creates a pathway for NHEC to compensate its members for power exported from Distributed Energy Resources, such as EV batteries and solar.

"V2G is working today. Bidirectional EVs are valuable assets that can help stabilize the grid by dispatching energy stored in batteries - when and where that energy is needed most," said David Slutzky, founder and CEO of Fermata Energy. "The NHEC program is one of the country's most innovative rates and works very well with our AI-driven, vehicle-to-grid platform."

"We are fortunate to have such great collaborators like Fermata Energy and Plymouth State University (PSU) on this project," said NHEC Vice President of Power Resources and Access Brian Callnan. "Technology from Fermata Energy allows us to purchase the necessary grid services to serve our members from PSU, who happen to be a member themselves. We're thrilled to see members serving members with this program."

Callnan continued, "Bidirectional charging and TER allow the university to redefine their electric vehicles as a distributed energy resource (DER) that benefits them and all our members in the electric cooperative."

The Nissan LEAF is one of the few EVs currently on the road and able to participate in bidirectional charging. Fermata Energy's bidirectional charging platform manages the EV's state of charge, sends alerts to customers, and allows fleet owners to both charge and discharge EV batteries.

Until recently, commercial fleet EV operators could only use unidirectional chargers, meaning the power went from the grid to the EV, costing the EV owner money. Unidirectional charging is also an unpredictable electricity demand that utilities need to manage and plan for. Bidirectional charging changes that dynamic.

Fermata Energy's platform can also monitor building load data, helping to manage electricity usage better. The technology is referred to as vehicle-to-everything and includes V2G (vehicle-to-grid), V2B (vehicle-to-building), and V2H (vehicle-to-home) projects.

Fermata Energy has V2X bidirectional programs working in several New England utilities, including Green Mountain Power, Eversource, and Rhode Island Energy. These programs have proven effective at offsetting surging customer demand by dispatching power from customer-owned batteries. ♻

Choosing A Home EV Charger

Barb and Greg Whitchurch

There are more than 16 million electric vehicles (EVs) on the roads now. Many of us have been driving them for several years, and we live everywhere, from the equator to the Arctic Circle.

Let's quickly get past some disinformation FUD (fear, uncertainty and doubt). The batteries last far longer than most ICE (internal combustion engine) cars last: www.bit.ly/old-batts. Battery fires are far less likely than ICE and hybrid fires: www.bit.ly/veda-car-fires. There, done!

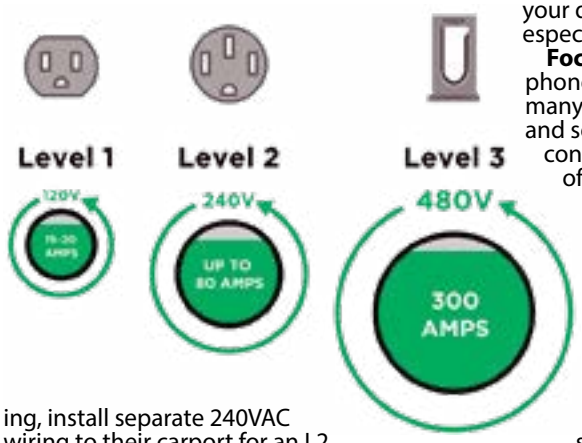
Many who live in condos and apartment buildings charge at work, where they shop, at charging stations, in parking garages, or along streets with combination parking meters and chargers. Since electricity and batteries are so much safer than gasoline, the possibilities seem almost endless.

At home we ourselves just plug the Level 1 (L1) chargers that came with our cars (new ones cost about $200 and are level one and level two combined!) into a regular wall socket in our garage. Some folks run a heavy-duty extension cable (10- or 12-gauge, not more than 25 feet) out a window or door to the charger that came with the car. The charging ports and plugs are designed for exposure to bad weather.

The authors have been driving EVs for seven years and only EVs for five years, and charging is accomplished at home with L1 "trickle" chargers. This method supplies about four miles of range every hour, which easily covers 95% of their driving needs. They charge "away" when traveling more than 200 miles. For instance, they regularly drive 1100 miles round-trip to see grandkids in Canada (where there are still many more chargers than here in New England).

Think this through a bit. How many miles do you drive per day? Per week? You didn't fill up your ICE car every day; you don't need to do so for your EV either. Some owners only fully charge while shopping on the weekend: www.bit.ly/get-ev-110. The authors charge their EVs to 70% at home unless they're going on a trip.

Level 2 (L2): While L1 chargers draw less power than a hair dryer or toaster, a L2 might be the biggest load at your house. Some folks who drive 150 miles every business day (and don't yet have charging available at work) and want faster charging, install separate 240VAC wiring to their carport for an L2 installation.



L2 chargers often come with the car as well; some dealers and car manufacturers will pay for their installation, too. The authors' Bolt EUV came with L1 and L2 and free installation. These deals vary, so check ahead. And don't forget to look into the federal, state and local utility incentives. (Pages 16-17 of any *G.E.T.* issue can help.)

Possible Deal Breakers: (1) If your utility transformer - the big "can" out on the pole, which you might share with another house or two -- can't handle the L2 load you're planning, you'll have to wait and pay for an upgrade from your utility first! **(2)** Your home's entrance panel might not be fit for the new load --- a very expensive replacement or upgrade, but probably a good thing to do for older homes anyway. **(3)** Finally, the car determines the maximum L2 power it'll accept; if you provide more, it'll just not be used. But you could split the power to two vehicles from one two-car L2 charger.

Caution: As with other home wiring projects, safe installation is important. Long-duration heavy loads are often not anticipated in standard home wiring specifications; see www.bit.ly/charger-warning. An experienced and well-informed electrician is important. An electrician familiar with solar and backup battery installations might be a good choice. Do not overlook the normal criteria of whether they are licensed and insured.

A 30-amp L2 can give you 300 miles in 12 hours overnight. But some L2s can draw 80 amps! This would be a HUGE draw on your service panel, main breaker and pole transformer. If you turned on every electrical appliance in your house, a high-powered L2 charger could double your draw. Be careful what you wish for, especially if you don't really need it.

Focus on the future. Our cell phones, computers and TVs (and for many, our doorbells, water heaters and security cameras) are all being connected through the IoT (internet of things). Soon enough our car batteries, home solar PV panels, backup batteries and water heaters, as well as the grid, will communicate with one another in order to keep our bills lower and the grid stable: www.bit.ly/get-geb.

Homeowners will sell grid stabilization service (e.g., peak shaving) and their excess energy storage and solar PV production back to their utility providers. Our cars, backup batteries and solar panels will back up our homes when the grid does fail. More and more EVs are coming with vehicle-to-load (V2L: sockets for 120VAC and 240VAC) capability built in so that they can serve as mobile power sources!

Search: Newer chargers are offering more and more options -- although less so in the U.S., where we are way behind in EV adoption. But things are changing fast. Look for something that offers vehicle-to-home (V2H, bi-directional) backup. Some will charge two cars at once. Look for something that works with the solar PV you might have soon, and which works cooperatively with any home backup battery system you might get www.bit.ly/ct-why-vpp.

Some specifics: L2 chargers are evolving quickly, and satisfaction is pretty dependent upon installation and use. A colleague swears by her portable Grizzle-E charger which she uses at home and when she visits her dad. Start looking here: www.bit.ly/mt-l2, www.bit.ly/cd-l2, www.bit.ly/forbes-l2, www.bit.ly/cnet-l2, www.bit.ly/pm-l2, and www.bit.ly/nyt-l2.

Some will install right at your meter on the power pole or your outside wall: www.bit.ly/mtr-charger! Others will share the clothes dryer 220 amp socket or wiring, selecting between the two automatically: www.bit.ly/dryer-charger. Others can integrate directly with your solar PV array: www.bit.ly/mtr-charger. They can be installed on the incoming power lines before they enter your panel. If you live where re-wiring possibilities are very limited, refer to www.DCCElectric.com/.

See the V2G article in this issue for much more on what to look for in L2 chargers. There are so many options. But consider depending on your L1 just to start --- you might be very pleasantly surprised.

The Whitchurches live cheaply and securely with their EVs at their solar-powered Net Zero+ Passive House. For related articles: www.bit.ly/get-w-ev.

Note: links are clickable in the online edition of this article at www.greenenergytimes.org. ♻

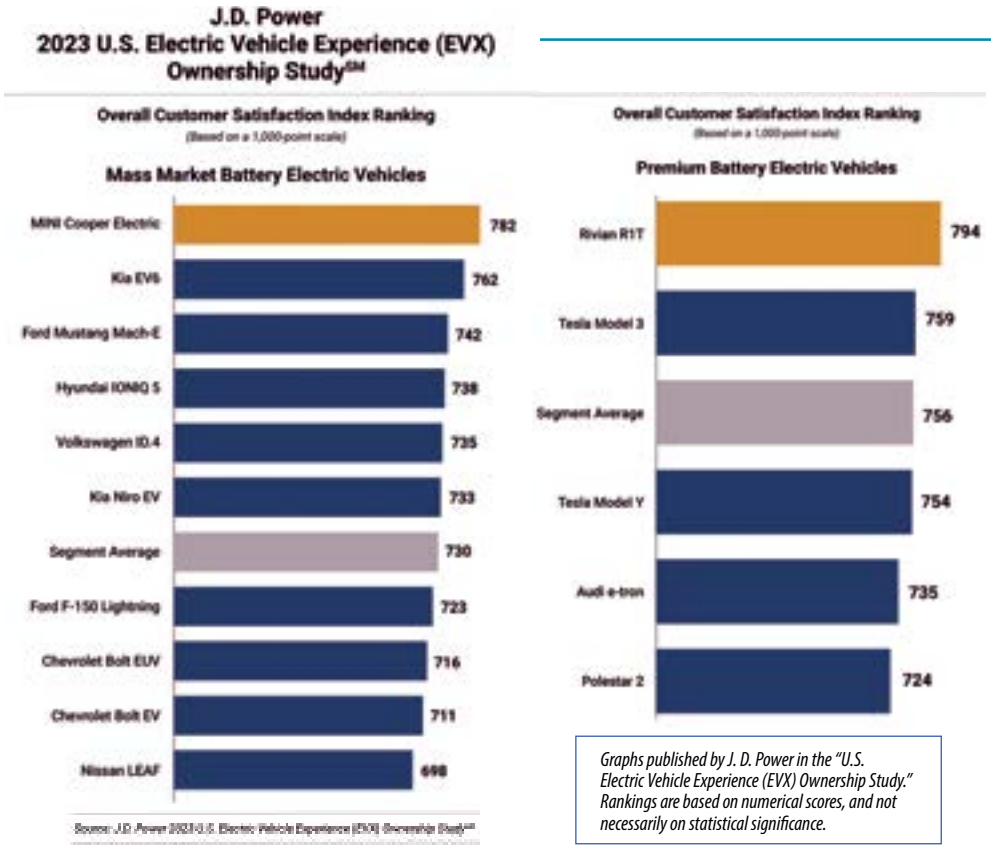
EV charging at your home is convenient. (AdobeStock/485082167)

JD POWER'S EV SATISFACTION

Cont'd from p.4

satisfaction with accuracy of stated range also is higher (707 vs. 680, respectively). Truck manufacturers that communicate the effect that towing has on range—like they do with gas mileage—seem to help set owner expectations.

- **Changing landscape of first-time BEV owners:** The study shows an increase of 11 percentage points from 2022 in the rate of first-time BEV ownership, rising to 85% from 74%. However, with a host of new product offerings, the mass market BEV segment is attracting new owners at a more rapid rate, as the percentage of first-time BEV owners in the segment jumped to 89% from 67% in 2022. While more vehicle shoppers are being drawn to EV ownership, satisfaction among first-time BEV owners is higher than among veteran BEV owners in only one category: vehicle quality and reliability (756 vs. 749, respectively). In the mass market segment, 68% of first-time BEV owners say that expected lower running costs and tax credits/incentives were the primary reasons for purchase, while driving performance is the most frequently cited purchase reason (75%) among first-time premium BEV owners.



Graphs published by J. D. Power in the "U.S. Electric Vehicle Experience (EVX) Ownership Study." Rankings are based on numerical scores, and not necessarily on statistical significance.

Study Rankings

Rivian R1T ranks highest overall and highest in the premium BEV segment with a score of 794. **Tesla Model 3** (759) ranks second.

MINI Cooper Electric ranks highest in the mass market BEV segment with a score of 782. **Kia EV6** (762) ranks second and **Ford Mustang Mach-E** (742) ranks third.

The number of award-eligible models in the premium segment has grown from four to five year over year, while award-eligible mass market models have nearly doubled (from six to 10). Satisfaction among owners of premium EVs averages 756, while satisfaction among mass market EV owners averages 730.

The U.S. Electric Vehicle Experience (EVX) Ownership Study, now in its third year, implements a methodology change for 2023 by narrowing the satisfaction index to focus on the first year of ownership. The overall EVX ownership index score measures electric vehicle owner satisfaction in both premium and mass market segments. The 2023 study includes 10 factors (in

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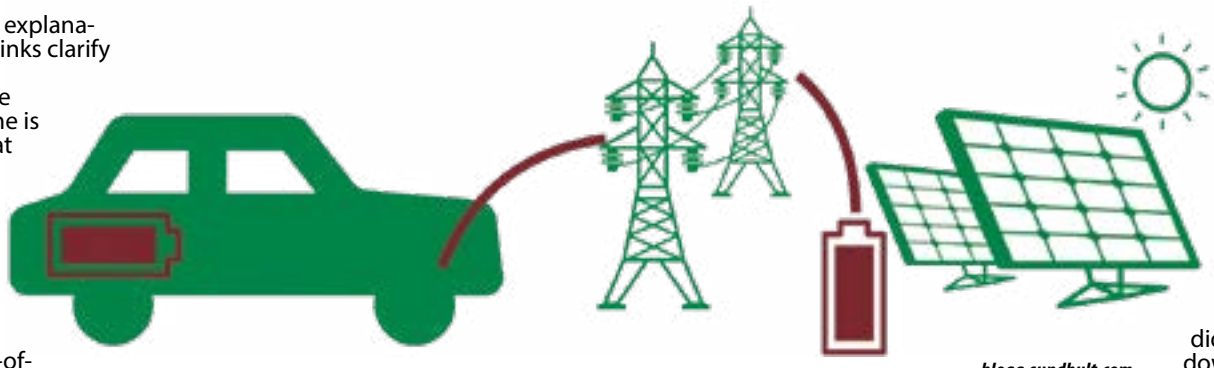
The 'Why and How' of Vehicle-to-Grid (V2G)

Greg Whitchurch



blogg.sundhult.com

Note: Space restrictions limit explanations, but the online, clickable links clarify everything.

Charging your electric vehicle (EV) with power from your home is pretty straightforward. But what about allowing your EV to send some of that power back to the grid? Why would I do that, you ask? Two answers: money and grid stability.

You might know people who are taking advantage of Time-of-Use (TOU; aka: time-of-day (TOD)) pricing for their domestic water heater (DHW), which the utility adjusts for lower electrical rates. TOU DHW acts like a battery, as far as your utility is concerned (www.bit.ly/dhw-batt); and it works even better when the tank is well-insulated: www.bit.ly/dhw-jacket.

Perhaps you have heard of utilities paying homeowners for tapping into their home backup batteries to flatten out power peaks: e.g., www.bit.ly/gmp-vpp. The vehicle-to-grid (V2G) option refers to using EV batteries in this same way.

These three strategies are part of virtual power plants (VPPs): www.bit.ly/ct-vpp. With VPP, the electricity supplied to your home comes from your utility in the usual way, plus some of it comes from backup batteries, EV batteries, and solar PV panels from within a large area: www.bit.ly/rmi-vpp! Whole communities, including their businesses, factories, schools, etc., participate in VPPs: www.bit.ly/uk-vpp

Part of the fear, uncertainty and doubt (FUD being spread by fossil fuel (FF) supporters suggests that "too many EVs will cripple the grid." As you can see, the opposite is true: www.bit.ly/wired-v2g!

What's all this to you? Don't worry, you set the terms, and it is beneficial all-around. The Renewable Energy Vermont 2022 conference featured a program in Connecticut, where low-income underserved renters benefited both financially and with home battery backup coverage during blackouts: www.bit.ly/low-bkp-vpp.

And, beyond VPP, is grid-interactive efficient buildings (GEB), which makes all of this perhaps the most effective solution we have for air pollution and the Climate Crisis: www.bit.ly/get-geb. GEB means that the building envelope is efficient (properly insulated and airtight); heat pumps and induction cooking reduce energy demand; and solar panels, backup batteries and EVs all contribute toward sharing the electrical supply.

As you're probably aware, the U.S. is pretty far behind most First World and even many Second World countries in EV adoption and some other green-energy technologies. But all of these pieces are being employed here and there in the U.S. already, and it won't be long before VPP and GEB will be coming to a town near you!

You'll have the option of joining in on the savings, extra income (www.bit.ly/tx-vpp), efficiency, security, resiliency and pollution reduction that these technologies offer. So, avoid buying soon-to-be-out-of-date technology and being stuck with replacing it or being left out when the time comes. As it happens, V2G technology is available to you now - perhaps through your upcoming purchase of a Level 2 EV charger! (See the article on home chargers in this issue.)

Those Powerwall-type home backup batteries hold about 10 - 13 kWh, whereas EV batteries typically start around 65 kWh now -- some more than 100 kWh. The authors have 130kWh of EV power parked in their garage. You already own your EV. Unlike the Powerwall, your EV's battery isn't a stand-alone, one-trick device which you hope you never have to use. Your EV can run your critical circuits at home for days longer than a couple of Powerwalls can. Then it can be driven to a place where there is power for recharging (www.bit.ly/v2g-demo).

With V2H and an EV or two you could "island" your home when the grid fails – essentially become off-grid and independent until the grid comes back up – some solar PV at your home would make this even easier. A high-performance home running on heat pumps, induction cooking and LED lighting with some solar PV would be perfect.

Step 1: Nowadays, weather disasters are more frequent, widespread and damaging. The grid goes down more frequently and for longer periods. Grids that didn't go down before are going down now. All because the old top-down approach of utility distribution isn't capable of handling our worsening climate. Buying the right Level 2 charger could be your foot in the door to a future partnership with your utility company where you cooperate to keep the juice flowing and your energy costs low!

You might not yet have solar PV, or TOU DHW electricity price reduction, or even a home backup battery system, but you can get started with a bi-directional V2G charger. Chargers able to handle solar and TOU and battery backup and EV charging are available now: www.bit.ly/enphase-pv2ev2h2g.

Ask your car dealer (or charger seller) if your particular car can share its battery power. Ask your solar installer if the inverter can tie into batteries, EV chargers and the grid. Ask your EV charger installer if the charger supports V2G. Don't be left behind. Embrace the future!

The Whitchurches live cheaply and securely with their EVs, heat pumps and induction range at their solar-powered Net Zero+ Passive House. For related articles: www.bit.ly/get-w-ev. ♻

No More Gas Hookups in Beacon, NY

Beacon, NY Adopts All-Electric Construction Law

On March 20, the Beacon City Council (Beacon, New York) passed environmentally friendly legislation, which will require all-electric construction beginning in 2024.

"We think it's the right thing to do," said City Councilman George Mansfield. "We will be leading by example and hopefully others will follow suit."

Mansfield and others gathered at a park across from city hall prior to the city council meeting to praise residents for supporting this legislation.

"There will be no more gas hookups, no more oil heat," said Mansfield. "It will be all-electric, and then ultimately we hope all-electric will be generated in sustainable ways."

Beacon becomes the third city in New York state, after New York City and Ithaca, NY, to pass bans on new building construction using fossil fuels as part of the design. Buildings are considered the largest polluters in the state, releasing 32% of the state's greenhouse emissions.

The State Assembly and Senate recently endorsed statewide bans on fossil fuels in new construction in their budget proposals.

And Dan Aymar-Blair, a Beacon city council member, thinks Beacon should do its part, too. "Beacon has to do its part in cutting emissions," he said.

Reprinted with permission MidHudsonNews.com. *Originally published on March 21, 2023. See https://bit.ly/midhudson-news_BeaconGoesAllElectric.*

[Note from G.E.T. *for a good decision: All of us here at* Green Energy Times (G.E.T.) *would like to commend the city council members for upholding these important environmental standards. This decision will serve the community in ways they may not realize yet. The health of our children and future of the planet will benefit greatly.]* ♻

JD POWER'S EV SATISFACTION – *Cont'd from p.6*

alphabetical order): accuracy of stated battery range, availability of public charging stations, battery range; cost of ownership, driving enjoyment, ease of charging at home, interior and exterior styling, safety and technology features, service experience, and vehicle quality and reliability.

The study is conducted in collaboration with PlugShare, the leading EV driver app maker and research firm. This study sets the standard for benchmarking satisfaction with the critical attributes that affect the total or overall EV ownership experience for both BEV and PHEV vehicles. Survey respondents for the study include 7,073 owners of 2022 and 2023 model-year BEVs and PHEVs. The study was "fielded in" from August through December 2022.

For more information about the U.S. Electric Vehicle Experience (EVX) Ownership Study, visit https://bit.ly/EVX-study.

See the online press release at https://bit.ly/JDP-press-release. ♻

MEET YOUR SOLAR INSTALLER

NEW ENGLAND COMMERCIAL SOLAR SERVICES

HOLDERNESS, NEW HAMPSHIRE

George Harvey

Through the years, *Green Energy Times* has run a number of articles relating to New England Commercial Solar Services (NECSS). They started with "RMI's Solar" in *G.E.T.'s* October 2015 issue, when the company was not yet two years old (https://bit.ly/GET-RMI-solar). A more recent article was "Profile School is Now 100% Solar-Powered," in February 2022 (https://bit.ly/GET-Profile-School). The articles speak to the company's ongoing successes in the solar industry.

The 344 kW Profile School solar array in Bethlehem, NH. Pictured to the right is Ted Vansant, the owner of New England Commercial Solar Services.

NECSS offers an unusual type of service. The customers are commercial, industrial, municipal, and non-profit organizations in Maine, New Hampshire, and Vermont, but NECSS can serve them with an unusual level of personal attention, precisely because it is not the big installer that one might expect such customers to employ.

Ted Vansant, owner of NECSS, told us, "We fill a gap that is often not sought after by big national companies." That gap is the special niche NECSS has found for itself, and it has proven to be a good strategy for the company.

Solar installers tend to specialize on projects of a specific range of sizes. The really big solar installers want to do only big projects, and they can do these especially well because they can take advantage of big buying power and have large crews they can move around the country. Other installers do very nicely working with small projects, such as home-scale rooftop systems.

The Starr King solar array in Plymouth, NH. (Images courtesy of NECSS)

Vansant's business strategy is to provide for customers that are of an intermediate size, and he has worked out a way to do this. He explained this. "My model is different from the average solar installation company. I partner with other installers. So, when there is an opportunity, I find the partner I want to work with. Then I design and manage the system to completion." It is almost like having a business that can be a specific size, according to the specific need.

The largest project NECSS has undertaken so far has been a 4-megawatt (MW) solar installation project on a landfill at Laconia, New Hampshire. But Vansant said, "The sweet spot is under 1-MW." That size is good for a lot of schools and municipalities, and it is a good size for many businesses.

Vansant's business model allows him to deal with the customer personally, in a way that a much larger installer would not be able to do. From the customer's perspective, this means that a project is guided by an individual who is personally interested in how it proceeds and who deals with the client's questions and concerns in an attentive and engaged manner.

The strategy also means that NECSS can employ the best people for the specific jb. Two companies he often partners with are KW Management, in Nashua,

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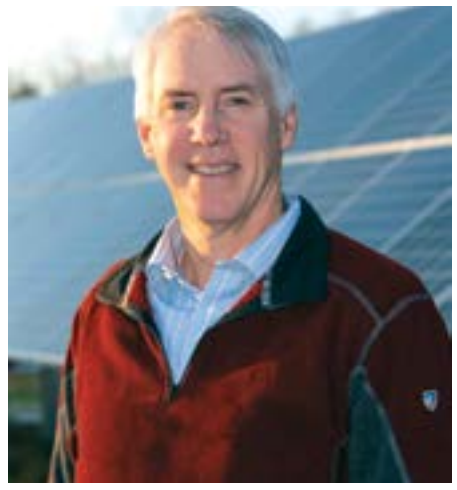


MEET YOUR SOLAR INSTALLER

MAINE SOLAR SOLUTIONS, FREEPORT, MAINE

George Harvey

One thing we can say confidently is that there always is something going on at Maine Solar Solutions (MSS).

We at *Green Energy Times* have been watching for several years as MSS has been building its business, and we have found it increasingly exciting. Our last article on the company, "Maine Solar Solutions Partners with Habitat for Humanity," was in the October 2022 issue (https://bit.ly/GET-MSS-and-HH).

The partnership provided a solar system to a home in Kennebunkport, with the panels and installation donated by Maine Solar Solutions.

Sam Zuckerman of Maine Solar Solutions. (Jason A. Frank Photography)

The donation of time and materials happened because Sam Zuckerman, owner of MSS, wanted to "give back" to the community he had been serving for ten years. If more people followed that ethic, the world would be a better place.

Using numbers provided by Zuckerman, we can take a look at what happened at MSS in 2022, and what we see is impressive. MSS received 4,480 customer inquiries about solar in 2022. That is a 77% increase from the previous year. Based on these, their solar consultants went on 2,253 site assessments, up 87% from 2021. MSS gained 609 new jobs in 2022, which was an increase of 79%, year over year. It installed 441 rooftop arrays and 26 ground-mounted systems. It also installed 87 Tesla Powerwalls along with various other types of work.

Clearly, MSS is not just growing, it is burgeoning. There are reasons for that, and we might look at what some of them are.

To start with, MSS is really interested in being certain that the customer does understand all the available options. Zuckerman told us, "Our goal has always been to educate our customers so they can make informed decisions." In fact, not only is there a lot of information at the MSS website, mainesolarsolutions.com, but more is coming. MSS offers pricing information now, and we are told that it will soon have a tool that allows potential customers to get ideas for themselves of what their specific installation might cost. And a visit to the site during business hours brings up a window for a potential customer to chat with a solar advisor.

When MSS designs a system for a customer, it typically presents a set of three or four options for the design. There are different ways a specific system could be optimized. For example, customers should be able to decide whether they want the greatest amount of electricity for a particular site or the most effective use of their investment.

Choices of what panels to use are also presented. One that is often considered is the use of black panels versus standard. Many people prefer the appearance of black panels, but they do tend to cost a bit more.

MSS installs batteries for both grid-tied and off-grid applications. The choice of batteries depends on the use, with SimpliPhi or Rolls AGM batteries used for off-grid, and Tesla batteries commonly used for grid-tied. One new battery is the Tesla Powerwall Plus, which has a battery with an inverter and controller. For most batteries, SolarEdge inverters are used.

MSS only serves Maine, but it does work to provide solar systems for homes, businesses, industrial operations, municipal sites, and non-profits. Maine is a place where solar power is growing fast. As it happens, the area of Maine that MSS does most of its work has not been having the difficulties that are reported by other installers getting approvals elsewhere in the state.

With the fast growth in demand, MSS has had to increase its staff. It now has 48 employees, making it quite possibly the largest installer dedicated to working in its state.

Zuckerman's view of the future of solar power in Maine is worth considering. Some areas of the state have disadvantages because of old transmission infrastructure. The fact that some of the state's utilities are owned by investors does not help this situation, because the investors' goals are rather strictly profit-driven. In contrast to this are a number of smaller utilities that are operated as customer cooperatives, which make their decisions based primarily on quality of service and need. Zuckerman says the relatively low level of difficultly his business experiences is because the areas where it does most of its work are in the latter group.

One way or the other, the amount of our electricity coming from renewable resources is increasing. And Maine Solar Solutions is a fast-growing part of that story.

The Maine Solar Solutions website is mainesolarsolutions.com. ♻

Solar trackers at Pooh Corner Farm. (Maine Solar Solutions)

Replenova Farm's solar array consists of 59 panels producing about 31,600 kilowatt-hours of electricity in its first year of operation. This reduced carbon emissions by 48,938 pounds. (Replenova Farm)

Madison, NH Solar Exceeds Production Expectations

Madison, NH Energy Team

This 63 (DC) kWh array is ground-mounted at an optimum 35-degree angle facing due south on a south-facing slope behind the town ballfield. ReVision Energy installed the solar system. Since monitoring began June 9,2020, this system has generated 199,115 kilowatt hours of clean energy, offsetting 267,000 pounds of CO2 emissions, and the equivalent of 6784 days of electricity usage in an average American house.

In 2014, voters in Madison, NH. established a citizen's energy committee at town meeting. The committee first worked to bring weatherization to as many town buildings as possible before looking at the possibility of establishing the first municipal solar system in the Mount Washington Valley.

At a following town meeting, voters approved a warrant article that authorized selectmen to enter into a lease agreement with a third-party investor to provide a piece of town property for the purpose of the installation of a ground-mounted solar array.

The Madison Solar 63-kilowatt array, consisting of 180 panels, was installed by Revision Energy behind the town ballfield in July 2020. ReVision Energy had submitted a Power Purchase Agreement (PPA) acceptable to their investors, the committee and board of selectmen. No taxpayer money was spent by the town for the installation. The projected savings for electricity is $1,000 annually (for the combined usage of town hall, highway and maintenance garages, historical society, and transfer station). As stated at the time the Madison Energy Committee concluded this project, there are long term favorable cost savings for the town. Several years down the road, perhaps following the conclusion of the 2018 10-year school bond, the town can consider purchasing the PV system at a greatly reduced price. Once the purchase of the PV system investment is recovered, the town will be producing much of its electrical energy for the above listed town buildings at little or no cost.

The projected average production for the array was 76,000-kilowatt hours of energy annually. However, after two full years of operation, the solar kWh production is exceeding this projection. In 2021 the production was 76,981 and for 2022 it was 79,839.

The 2021 cost savings for the electricity usage for the town buildings covered by the PPA was $1,000 as projected. But the cost savings for the electricity usage for 2022 exceeded projections for a total of $5,500. The cost of (the electric utility) Eversource Energy rose from $.0886/kWh in Feb., 2022, to $.107/kWh, and in August up to $.226/kWh. The town hedged the more than doubled increase in energy costs mid-year and saved almost enough to cover the 2022 electricity costs of the fire station and the library combined ($6,098). In summary for 2022, the extra solar production and the increased Eversource Energy costs have produced an even more positive outcome for the town.

ReVision Energy of Maine and New Hampshire estimates this project to save the Town of Madison almost $370,000 over the 40-year lifespan of the system. So far it appears that this figure is conservative given the extra solar production and increased Eversource rates.

Madison is fortunate to have citizens committed to energy conservation and solar, especially Russ Dowd who is the former general manager of the wood-powered Pine Tree Power of Tamworth, who understands the technology of power generation and the grid. Other members are a part of the solar-powered Tin Mountain Conservation Center of Albany's valley-wide Energy Team that has partnered with Window Dressers to provide low-cost energy saving inserts to households throughout the Mount Washington Valley.

To view the current Madison solar array production visit https://bit.ly/powerdash_MadisonNH.

The Madison Energy Team members contributing to this article are Russ Dowd, former manager of Pine Tree Power, Noreen Downs, Retired IT systems and project management consultant, and community and environmental causes volunteer, and Russ Lanoie, contributing writer and distributor for Green Energy Times. ♻

Introducing Iron Edison's Amazing New UL Listed Affordable Lithium Iron Battery

George Harvey

We recently received a press release from Iron Edison introducing us to their new battery, the REVOLT4 lithium battery for residential energy storage.

For those who do not know, Iron Edison is very much its own battery company, doing its own thing. For example, Iron Edison sells nickel-iron batteries, which were invented by Thomas Edison. The market for them is not big, but they can do things that no other battery does. We are told there are ninety-year-old batteries based on nickel-iron chemistry still in use.

Iron Edison is not stuck in history, however. And so, we can take a look at its most recent battery technology. Its REVolt batteries, using LFP (LiFePO4) technology, have been around for a while. And now the REVOLT4 is here.

Readers of *Green Energy Times* tend to be aware of some facts about lithium batteries: They are more expensive than other batteries initially, but because they can be discharged deeper and have much longer life, they are less costly over a long period. Lithium batteries have other advantages also, as they are far easier to maintain than most older types.

The new REVOLT4 battery takes the REVolt LFP battery to another level altogether. They have chemistry that is pretty much the same, but they are very different in many ways. One thing changed is a reduction in prices. Where a 5-kWh REVolt battery costs $4,195, the newer 5.12-kWh REVOLT4 battery has an initial cost of $3,395.

But please do not think the reduced price is the only difference. The new REVOLT4 has important improvements. While comparing the REVolt batteries to older types might be like comparing apples to oranges, comparing the REVolt batteries to the new REVOLT4 is a bit like comparing apples to apple pie, except that there are ingredients in the apple pie that you can't just pick up in the market yourself.

A lineup of four new Iron Edison REVOLT4 batteries. (Courtesy image: Iron Edison)

One thing about the new REVOLT4 battery is that it is UL1973 listed. That has some rather important implications about permitting and approvals, making the whole process much easier.

The differences go rather far beyond that, however. Brandon Williams of Iron Edison shared a few observations with us. To start with, he said, "The REVOLT4 is by far the most advanced battery we have ever sold. It sounds cliché to write that, but it's true. The UL listing is just a stamp on the outside of the box, but it truly represents a lot of work."

He explained, "The UL testing is a rigorous review process. They look at the cells, the pack, the enclosure, wiring, as well as the BMS [battery management system] and software running the battery. There are performance tests and destructive tests designed to show the battery performs at expected levels and is still safe if pushed outside design limits. There are also onsite visits from the UL team to the production line to confirm the facility is operating at clean room and technical standards." Clearly, this is not trivial.

The REVOLT4 battery has a lot built into it that a person might want for the earlier systems. It is a sealed, maintenance-free unit, with integrated control systems that prevent such problems as over-charging and over-discharging. It also has an integrated readily-accessible DC disconnect for NEC code compliance.

The battery has a Wi-Fi system built in allowing it to be monitored remotely using the internet. The owner can see charge and discharge amperage in real time, keep an eye on state of charge, and even control the system to stop a discharge cycle or set a charge schedule. And all these things can be done from any iOS or Android device.

Not only can the batteries be in communication with the owner, they can communicate with each other, so as many as fourteen of them can be combined into a single group, and the groups can be stacked to capacities of over 200 kWh.

Iron Edison points out that LiFePO4 is the safest of any lithium technology. The danger of such things as thermal runaway is not an issue with it, as it is with lithium cobalt oxide batteries. And with the addition of its sophisticated management system, the REVOLT4 is a product that can be relied on.

The REVOLT4 batteries are expected to be good for a life of approximately 20 years. During that time, it will operate at a lifetime cost per kilowatt-hour well below that of lead-acid and other older batteries. This is because older types of batteries would need to be replaced multiple times during the 20 years.

The Iron Edison Battery Company is based in Denver, Colorado. Its web site is www.ironedison.com. ♻

NE Commercial Solar Services

Cont'd from p.8

NH and Barrington Power, in Barrington, NH. NECSS itself is in Holderness, NH. Vansant's partners are installers with whom he has built relationships based on experience and trust.

While this model works well for Vansant, it also works well for the other solar companies that he works with. But an overarching point is that it is better for the NECSS customers. Part of the customer benefit is an aspect worth reiterating. Because of his unusual business model, Vansant can manage the project himself. This implies a personal level of attention on his part, applied to the specifics of each project.

The field of solar power is changing because the technology is improving, and this also requires attention. This is especially true of storage. Vansant said he plans to do more work on storage projects in the future. But he also plans for a lot more solar installations.

NECSS has grown over the years, and the Covid-19 pandemic did not slow it down. But even with all the demands of business, Ted Vansant has also been active for the solar industry outside of his own business. He has been Chair of the Board of Directors for Clean Energy NH, the state's leading clean energy advocate and educator. He expresses hope for the future of clean energy in New Hampshire, saying that better laws would benefit the state, particularly when it comes to billing by time of use and net metering. And, in fact, he writes about clean energy and was the author of an article that appeared in *Green Energy Times* in October 2017, "Hollis, NH Public Schools – Solar on the Roof, Solar in the Classroom" (https://bit.ly/GET-Hollis-PS).

The New England Commercial Solar Services website is www.necsolarservices.com. ♻

Over Half of U.S. Electric Generation Expected to be from Solar in 2023

Paige Bennett

A new report from the U.S. Energy Information Administration (EIA) expects 54% of new electric-generating capacity in the U.S. to come from solar energy for 2023. Developers are planning to add 54.5 gigawatts of new utility-scale electric-generating capacity to the country's power grid this year, most of it being solar, according to EIA's Preliminary Monthly Electric Generator Inventory, in which developers and power plant operators report upcoming projects to EIA.

Developers have about 29.1 gigawatts of utility-scale solar capacity planned for 2023, following a recent decline of 23% from 2022 compared to 2021. Prior to that decline, solar electric-generating capacity had been rising since 2010, but supply chain issues and the pandemic lead to a decline last year. EIA predicts that delayed projects from 2022 may be part of the high percentage of the electric-generating capacity coming from solar projects for 2023.

EIA also noted that should all of these planned projects go into operations for 2023, this year will have the highest amount of utility-scale solar capacity added in one year. The current record is 13.4 gigawatts of utility-scale solar capacity added in 2021.

Texas will be home to the highest amount of new solar capacity at 7.7 gigawatts, followed by California at 4.2 gigawatts.

After solar, battery storage makes up the next highest percentage of new utility-scale electric-generating capacity in the U.S. for 2023, comprising 17% of projects planned for the year. Developers expect to add 9.4 gigawatts to the country's current 8.8 gigawatts of battery storage electric-generating capacity.

"Battery storage systems are increasingly installed with wind and solar power projects," EIA explained. They continued, "Wind and solar are intermittent sources of generation; they only produce electricity when the wind is blowing or the sun is shining. Batteries can store excess electricity from wind and solar generators for later use. In 2023, we expect 71% of the new battery storage capacity will be in California and Texas, states with significant solar and wind capacity."

Other utility-scale electric-generating capacity projects include 7.5 gigawatts of natural gas, with the two largest projects planned for Ohio and Illinois, 6.0 gigawatts of wind power, primarily planned for Texas, and 2.2 gigawatts of nuclear energy. For the first time in over 30 years, two new nuclear reactors have been built in the U.S. and are expected to come online this year, following a several-years delay.

In 2023, EIA reported that only one offshore wind project is expected to begin operations this year, the South Fork Wind plant off of New York.

Based in Los Angeles, Paige Bennett is a writer who is passionate about sustainability. She earned her bachelor's degree in journalism from Ohio University and holds a certificate in women's, gender and sexuality studies. She also specialized in sustainable agriculture while pursuing her undergraduate degree.

Reprinted with permission from the February 6, 2023 EcoWatch blog at https://bit.ly/ecowatch-newelectricgeneration2023. ♻

Rooftop photovoltaic panels at Premier Gardens Zero Energy Home Community. As part of the DOE's Zero Energy Homes Initiative, Premier Homes built 95 entry-level houses in Rancho Cordova near Sacramento, California, in 2004. Each is built with advanced energy-saving features and a 2.2 kW photovoltaic system. (Office of Energy Efficiency and Renewable Energy)

Solar for Farms is a Cash Crop

Between state and federal incentives, and the ability to offset rising utility costs, there are many outstanding financial reasons to install solar panels at your commercial farm. Not to mention: climate change and its effect on weather are heavily impacting farms, so taking steps to reduce our carbon impact is critical for all of us depending on healthy farms and a healthy planet.

A typical for-profit farm is eligible for a 30% federal solar Investment Tax Credit (ITC), plus depreciation, state incentives, and more. What does that mean in terms of dollars and cents? **Almost half of the cost of installing a commercial solar system is covered by these tax credits and incentives.** The payback timeline on a commercial solar system ranges from 5 to 10 years, and after that, you’ll have free electricity for the life of the solar installation.

These days, people care about sustainability, and they’ll feel good supporting businesses that share their values. Having a publicly visible commitment to clean energy in the form of solar isn’t just good for PR and social media – it can be a draw for customers, too!

Being an incredible steward of the land means incorporating regeneration and sustainability into every step of your business. However, if you’re not factoring in energy use as a part of your overall environmental strategy, you’re missing a big piece of the puzzle. **Contact SunCommon today to see how we can help you power more than just your crops with the sun.**

Certified B Corporation

Contact SunCommon today at solar@suncommon.com
suncommon.com/get

Test Your Favorite Climate Solution

John Gage

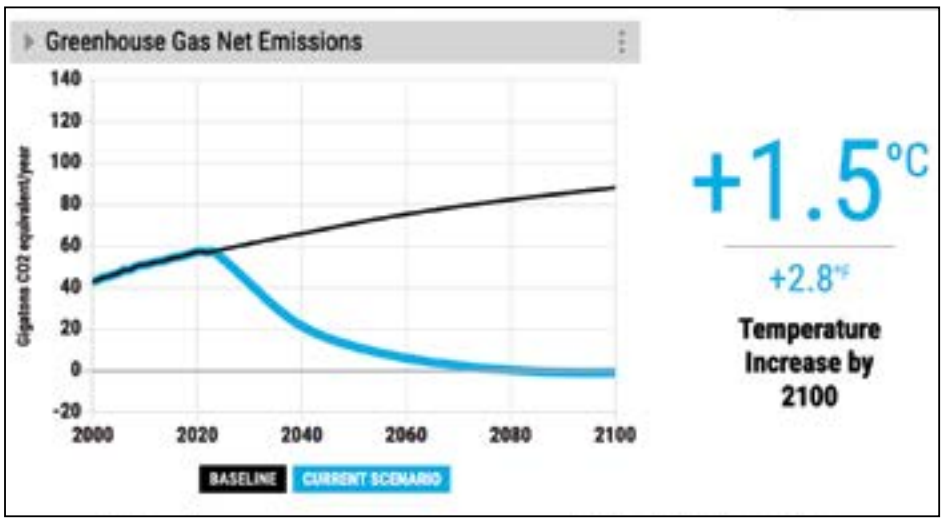
Many of us reduce our carbon footprints as best we can because of concerns about climate pollution. We can increase the energy efficiency of our homes, electrify our transportation, heating, and cooking, and transition to clean energy sources. These provide a variety of co-benefits and often save money. But holding global warming below 1.5˚C cannot be accomplished through individual efforts alone. Policy changes are required to accelerate investment, innovation, and choices to achieve national and international climate goals.

The U.S. recently made significant climate policy progress, but not enough. We must demand more from our elected leaders. But how can we (and they) know which additional policies offer the best chance for success?

En-ROADS can provide insight! En-ROADS is a free web-based tool created by Climate Interactive and MIT that lets anyone compare the effectiveness, cost, and impacts of dozens of climate policies and explore how they interact. It was created to inform people what experts know about climate policies.

Are you ready to put your favorite climate solutions through a rigorous test? You will see the effects on energy sources, energy usage, cost of energy, future greenhouse gas emissions, global temperature, sea level rise, and human health. To get started, type en-roads.climateinteractive.org into your computer or laptop browser.

En-ROADS displays the impacts of the global policy mix you specify. The initial views across the top show the resulting future sources of energy, emissions, and temperature increase by 2100. The model uses configurable assumptions with



From En-ROADS: a sample policy mix of complementary policies to achieve a 1.5˚C warming limit.

initial values from the IPCC. Across the lower half, policy controls are grouped by energy supply, energy use, land use, industry, and carbon removal. The initial policy settings reflect the global policy mix in place today, and the dangerous amount of warming that will result.

Are you curious how growing lots more trees compare with subsidizing electric vehicles on climate? Try moving one policy slider at a time to see the impact of each on temperature by 2100. Observe how each policy affects the energy source mix, energy usage, and net emissions. Dive into the details by clicking the three vertical dots to the right of any policy name. Explore other impacts of your policy selection by switching views. You can display the effects on the cost of energy, sea level rise, species loss, human health, and more. Your En-ROADS experience will produce surprising insights and new reasons for hope and concern.

You will also realize that there is no silver bullet. Try some policy combinations. Watch out for a cumulative impact that is less than the sum of the individual policies. We need to minimize redundancies to get the most bang for our policy buck. Each policy has costs, takes time and political will to implement, and may involve a struggle against special interests that will oppose it. Selecting only complementary policies will maximize results at the least cost and effort.

Finally, design a policy combination to hold the temperature to 1.5°C at the least possible net cost. Consider the viability of your solution. Some policies are easier to do than others. This exercise will likely direct you to favor the most powerful stand-alone policy – the policy experts say must be included in the solutions mix to achieve our ambitious climate goal: carbon pricing.

En-ROADS does not let you directly model the financial benefits to families of a cash-back carbon fee on fossil fuel production, the most well-supported climate policy by economists (clcouncil.org/economists-statement). But you can compare the revenue raised with the total increased energy cost. En-ROADS demonstrates the most effective climate policy – a carbon tax paid by fossil fuel producers – is so economically efficient that it raises more money than needed to fully compensate people for the trickle-down total higher costs they pay for energy. This explains why most people get back more than they pay in higher costs from cash-back carbon pricing (carboncashback.org/benefits). A carbon tax will be accepted by the public if the revenue raised is rebated to households.

There is a recorded En-ROADS Ambassador-led workshop at www.bit.ly/ccl-marc-en-roads-2022. You can register for a live En-ROADS climate policy simulation workshop on April 24 at 7:00 pm or find a recording after the event at newhampshirenetwork.org/events. And En-ROADS ambassador training is free to anyone who wants to learn how to give demonstrations and lead interactive workshops.

En-ROADS offers realistic climate hope. It underscores the urgency and provides a policy roadmap to achieve important climate goals. The other piece of the puzzle is you. An informed and engaged public can create the political will for the policy changes necessary to hold warming below 1.5°C. Learn how you can help do that at www.citizensclimatelobby.org.

John Gage is the volunteer NH State Coordinator for Citizens' Climate Lobby. ♻

What's in a Name? Carbon-Free is Just a Rebrand of Status Quo

Jonathan Dowds

We can prosper and save the earth at the same time. (singularityhub.com)

Cigarettes did not get any safer or less addictive when Philip Morris "rebranded" as Altria. Facebook did note get any less polarizing when it changed its name to Meta. Nuclear power is not any more appealing to Vermonters just because it is rebranded as carbon-free. A proposal in the Department of Public Service's 2022 Comprehensive Energy Plan to establish a "carbon-free" standard amounts to a rebranding to promote an ongoing role for aging nuclear power plants at the expense of the deployment of new renewable generating capacity.

To fight climate change, we need action, not rebranding that supports the status quo. We need to get to a place where every new car sold is electric and where every aging furnace is replaced with a heat pump. And we need to power it all by increasing our renewable electricity generation not by increasing our reliance on nuclear plants.

Instead of a branding change to switch to a carbon-free standard, we need to update our current Renewable Energy Standard to require our utilities to provide 100% renewable energy. Under a carbon-free standard, we can just keep grinding away with the status quo. This is a status quo that asks our New England neighbors to live in the shadows of nuclear reactors long after we have shut down nuclear power in Vermont and a status quo that continues to slow-roll new renewable construction.

When Vermont Yankee closed its doors, many Vermonters sighed in relief. But residents in Connecticut, New Hampshire, and Massachusetts are still dealing with the realities of living next to nuclear facilities. Nuclear facilities that are aging with signs of wear at a time when extreme weather from climate change is placing new stressors on these plants. The people that live and work near these plants live every day with warnings like this one from the Massachusetts Department of Emergency Management stating that, "People that live, work, or vacation within ten miles of a nuclear power plant should be prepared for an emergency at a nuclear power plant." A carbon-free standard would codify the status quo and perpetuate an environmental injustice.

Rebranding as a carbon-free standard now would be all even more misguided because, with the passage of the landmark Inflation Reduction Act (IRA), there has never been a better time for Vermont to invest in renewable energy alongside the electrification of our thermal and transportation sectors. The IRA provides tax credits that will cover 30% of the cost of a new renewable energy or battery storage project and includes new provisions that will allow non-profits and municipal governments to access these benefits as well. Doubling the amount of in-state renewable energy that we build by 2030 would result in hundreds of millions of dollars of federal tax credits flowing into Vermont. The IRA is already credited with creating more than 100,000 new jobs across the country and by investing in renewable energy and electrification, we can bring new jobs right here to Vermont.

The IRA also includes a host of other tax credits and rebates that support families and businesses as they transition to electric vehicles, heat pumps, and electric stoves, and invest in other efficiency measures. Electrification helps combat climate change and protects Vermonters from an increasingly volatile fossil fuel market. Making sure that electrification is powered by renewable energy maximizes these benefits.

Real success fighting climate change comes from pairing electrification with the development of new renewable energy. Vermont legislators have a choice: they can update our Renewable Energy Standard so that it really spurs the development of new renewables in Vermont and throughout the region, or they can rely on rebranding measures like a carbon-free standard in hopes of making us feel better about the same old path. I know what I want. It is real Vermont leadership on climate, not another meaningless "rebrand."

Jonathan Dowds is the Deputy Director, Renewable Energy Vermont. More information is available at revermont.org. ♻

It's the End of the Road for the Merrimack Station and Dirty Coal Plants in New England

George Harvey

In all of the six New England states and New York, there is only one coal-burning power plant left. It sits on the Merrimack Station, in Bow, New Hampshire. The first of its two coal-burning units came online in 1960, generating 114 megawatts (MW). The second began operating in 1968, producing 346 MW. Sometime in the next few years, these generating units will probably be switched off for good.

There have been long and loud protests against the plant, based on a number of issues. Because of the very fine particulates produced when coal is burned, thousands of Americans die sooner than they otherwise would every year. The Merrimack Station burns bituminous coal, which is dirty. Another problem is that all fossil fuel burning adds to climate change, and coal is worse than many other fuels.

Merrimack Station in Bow, NH, the last coal plant in New England and New York. (Flickr/Jim Richmond)

A final problem with the Merrimack Station came up recently, and it may be enough to close the plant for good. That problem is that running it is too expensive. Some people might find this hard to believe, because they have been accustomed to the idea that coal provides the least expensive electricity, but that idea is a bit out of date.

Coal did provide the least expensive electricity at one time, but it does not any more. It is expensive compared to natural gas, and even more expensive compared to solar or wind with battery backup. Coal generating of electricity hit a peak in 2007 and has been in decline ever since, primarily because of cost. Where it accounted for most of our electricity at one time, it now produces less than 20%.

In regard to economics, the Merrimack Station is especially bad. Like nearly all coal-burning plants, it was designed to deliver base-load power. Base-load power is attractive because of its low cost, which comes because the plant is designed to run at 100% of capacity 100% of the time. But clearly, base-load plants are not built to follow changes in demand, and this means that it would be more expensive to run for this purpose.

Recently, the Merrimack Station has not been supplying base-load power as it was designed. It is, instead, being run as a peaking plant, which only produces power when demand is very high, but which produces the highest cost electricity around.

The Merrimack Station is contractually obliged to be ready to provide electricity as needed. To do that, it must be kept hot enough to start quickly, even when it is not producing power. And this means that even though it might not be generating, it needs cooling. A few months ago, a lawsuit was brought by the Sierra Club and the Conservation Law Foundation to force the plant to stop putting the amount of heat it produces into the Merrimack River.

In the auction last year, the Merrimack Station was awarded $785,000 per month to be ready to provide power as needed during the 2025 to 2026 year. That money, $9.42 million for the year, is paid whether the plant is generating or not.

For this year's auction, covering the period of 2026 to 2027, Merrimack Station failed to qualify. That being the case, it will probably have no source of revenue and will have to close.

There are some very interesting options for what to do with old fossil-burning power plants when they close. The one that seems to be most often pursued is to install a battery with a power capacity close to what the old plant had. Such a system can store energy generated by renewable facilities that are relatively near. One example of such a replacement is the Ravenwood Development on the East River in Queens, NY. The battery will have a capacity of 316 MW of power and 2,528 MWh of energy. The electricity that charges it will come from offshore wind turbines sited off the shore of Long Island. It will replace two gas-powered peaker plants with far less expensive energy, taking advantage of the transmission lines that are already in place. The same thing could be done at Merrimack Station, possibly even providing an opportunity for community energy storage analogous to community solar systems. ♻

How to Wean the Vermont Grid Off Fossil Fuels

Jonathan Dowds

Electrification is the central pillar of Vermont's climate strategy, and rightfully so. Electric vehicles, heat pumps, and other electric appliances are more efficient than their fossil fuel counterparts and generally offer a better user experience as well. While their superior efficiency means that going electric offers climate benefits now, these benefits are greatly enhanced when they are powered by 100% renewable energy.

So how close are we to 100% renewable energy and what do we have to do to get there? The bad news is that we've got a ways to go. The good news is we have all the tools we need to make it happen.

Is Vermont close to 100% renewable energy? (Roa.cedia.edu.ec)

If we look at the power that Vermont utilities purchased in 2021, more than a third came from either New England's dirty "system mix" (17%) or nuclear power (18%). In New England, system mix is dominated by natural gas generation and, during intense cold snaps, it gets even dirtier as oil and even coal plants come online. For example, when temperatures dropped this past December 24th and demand for natural gas for home heating rose, the share of electricity coming from oil jumped to an astounding 29% of the mix. Even the most efficient heat pump is going to struggle to provide the emissions savings that we need when the grid looks like that. Absent a strong push for more renewable power, the growing demand for electricity risks increasing the use of these dirty fossil fuel plants.

To get to 100% renewable power, we need to build enough new renewable generating capacity to squeeze the existing system mix and nuclear power out of the picture while also meeting the growing demand for electricity to heat our homes and power our vehicles. From a technical perspective, getting to a 100% renewable future is actually pretty simple: we need more solar, more wind, more energy storage, and a more sophisticated process for balancing supply and demand. All of this is completely feasible with the technology we have today. As Stanford Professor Mark Jacobson recently wrote in the Guardian, we don't need a miracle to get to 100% renewables, we just need to "focus on what we have and deploy as fast as possible... The number one barrier is that most people are not aware that it's possible."

The most straightforward way to get 100% renewable energy from "it's possible" to "it's reality" is to reform our Renewable Energy Standard (RES). Earlier this year, the Vermont House introduced a groundbreaking proposal to do just that. The bill, H.320 sponsored by Rep. Caleb Elder, would prioritize the development of new renewable resources and truly reduce greenhouse gas emissions across the region. It would require Vermont utilities to get 100% of their power from renewables by 2030, including 60% from new renewables built in Vermont and New England. It is this requirement for new renewables that gives the bill its climate teeth, because this is the power that can wean us off of fossil fuels.

Vitally, while addressing the climate crisis, H.320 also addresses another deep environmental injustice in Vermont's current energy system: our current practice of exporting the impact of our own electricity consumption. In 2020, Vermont ranked 49th in the country in terms of the share of the electricity that it used that it generated within its own borders. Vermont does not have a single coal, oil, or natural gas-fired power plant that contributes significantly to our energy needs. So when Vermonters don't rely on in-state renewables, we are asking our neighbors in Quebec, New York, and throughout New England to bear the environmental consequences of our need for electricity- land flooded for hydropower, the impacts of living next to a nuclear power plant, and the health-related impacts of air pollution from coal, oil, and natural gas-fired power plants. By requiring that Vermont utilities purchase 20% of their power from in-state sources by 2030 and 30% by 2035, the bill helps limit the environmental harms that we impose on our neighbors.

Luckily, the Inflation Reduction Act (IRA) signed by President Biden this past summer has given Vermont – and the rest of the country – a once-in-a-generation chance to get hundreds of millions of dollars in federal money to make the transition to renewables even more affordable and help us kick our addiction to electricity made from burning fossil fuels. This means that we have the technical solutions, the policy solutions, and the financial resources to wean off of fossil fuels and get to 100% clean energy in this decade.

Jonathan Dowds is the Deputy Director, Renewable Energy Vermont. ♻

FEDERAL

FEDERAL INVESTMENT TAX CREDIT

• To learn more about federal tax credits for home owners, home builders, and commercial buildings:, go to: https://www.energystar.gov/about/federal_tax_credits.

• Learn more about electrification rebates and tax credits associated with the Inflation Reduction Act at https://www.rewirin-gamerica.org/app/ira-calculator.

USDA RURAL DEVELOPMENT PROGRAM

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

• To see the USDA programs and services available in your state, visit https://www.rd.usda.gov/programs-services/all-programs.

Biorefinery Renewable Chemical, and Biobased Product Manufacturing Assistance Program

This program provides loan guarantees up to $250 million to assist in the development, construction, and retrofitting of new and emerging technologies. These technologies are: advanced biofuels, renewable chemicals and biobased products. For more information, visit https://bit.ly/usda_emerging_technologies_programs.

REGIONAL

The Grassroots Fund's Grant Programs

The grant program is designed to energize and nurture long term civic engagement in local initiatives that create and maintain healthy, just, safe and environmentally sustainable communities.

Three grant programs are offered:

• Seed grants are designed to support new (often less than 1 year old) environmental projects.

• Grow grants support initiatives that look to deepen their work or broaden participation.

• The Young Leaders program supports efforts with significant leadership by organizers under 25 years old.

Learn more at https://grassrootsfund.org/grant-programs

VERMONT

CLEAN ENERGY DEVELOPMENT FUND

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

All incentives are listed at: RERC-vt.org.

Advanced Wood Heating Advanced wood pellet heating systems -- $6,000 per pellet boiler/furnace (in partnership with Efficiency Vermont). Commercial spaces over 5,000 sq. ft. may also be eligible for incentives. See www.rerc-vt.org or call (877) 888-7372.

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

• Residential Bulk Pellet Bins. Up to $3,000 rebate.

• We now have a pellet boiler adder for income qualified homes. All information is at www.RERC-VT.org. Adders for the pellet boilers can be an additional $8,000!

• Coal Change-out adder. Up to $7,000 additional incentive for a pellet heating system if replacing a coal heating system. Businesses can get up to an additional $27,000 incentive. Details at www.rerc-vt.org or call (877) 888-7372.

• More info at at www.fpr.vermont.gov/woodenergy/rebates. Unfortunately this FPR web site is now longer up-to-date. There is good info. there still but some is outdated.

Other Utilities Heating Offers

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

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

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

• GMP rebates available through December 31, 2021

VT TAX CREDITS

• 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 24% of the "Vermont property portion" of the federal business energy tax credit.

• More info on the 2021 IRS Tax form at https://www.irs.gov/pub/irs-pdf/f3468.pdf.

Tier III programs

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

EFFICIENCY VERMONT

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

Lighting

• Special pricing on select ENERGY STAR® LED fixtures at Vermont retailers.

• LEDs for indoor growing: $100 back for qualifying fixtures

Weatherization

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

• DIY: $100 back for completing eligible projects, like weatherizing windows and doors, and sealing air leaks in your attic and basement.

Appliances (must be ENERGY STAR)

• Dehumidifiers: $25 - $40 rebate

• Clothes Dryers: $200-$400 rebate

Heating/Cooling/Water Heating

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

• Advanced pellet or cord wood stove: $400 discount at participating retailers for replacing an old stove.

Heat Pumps:

• Air-to-Water System: $1,000/ton rebate

• Ducted Systems: $1000-$2000 discount at participating distributors

• Ductless Heating & Cooling System: $350-$450 discount at participating distributors

• Ground Source Heat Pumps: up to $2,100/ton rebate

• Heat pump water heaters: $300-$600 discount at participating distributors;

• Moderate-income Vermonters are also eligible for bonus rebates up to $500 for heat pumps and heat pump water heaters.

• Window air conditioners: $100 for select ENERGY STAR Most Efficient models.

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

• Electric utility rebates may also be available.

Other Opportunities to Save

• Home Energy Loan – finance up to $20,000 in energy-related home improvements with interest rates starting at 0%. Restrictions apply.

• Additional incentives may be available through your local electric utility provider.

Contact your utility for more information.

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 (http://bit.ly/EQIP-CREP-study), the Environmental Quality Incentives Program (EQIP) and the Conservation Reserve Enhancement Program (CREP). Both programs could benefit from reduced transaction costs and administrative complexity.

** Source: Vermont Research News - Center for Research on Vermont, 1.18.21.*

Vermont's GMP Extends Rebates Through 2023

Green Mountain Power (GMP)is extending its popular rebate programs through all of 2023 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 2022, 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.

Learn more about GMP's rebates on electric vehicles and charging at www.bit.ly/GMP-rebates-2, and heating and yard care at www.bit.ly/GMP-rebates-3.

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Department of Energy

NH DOE: All of NH DOE's programs, save the Residential Solar Water Heating and Residential Solar/Wind Rebate Program Rebate Program are now OPEN.

Commercial Solar Rebate Program

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

Incentive levels for PV systems are as follows:

• $0.20/watt (lower of AC and DC) for new solar electric facilities.

• Expansions to existing solar systems are not eligible.

• Incentive levels for solar thermal systems are as follows:

• $0.12/rated or modeled kBtu/yr for new solar thermal facilities fifteen collectors in size or fewer; $0.07/rated or modeled kBtu/yr for new solar thermal facilities greater than fifteen collectors in size;

• Expansions to existing solar systems not eligible.

Contact: https://bit.ly/NH-DOE_CommercialIndustrialSolar or at (603) 271-3670.

Residential Solar/Wind Rebate Program is currently closed.

Residential Solar Water Heating Rebate Program is currently closed.

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. https://bit.ly/NH-DOE_CommercialIndustrialWoodPellet

Residential Wood Pellet Boiler/Furnace

• 40% of installed system up to $10k

• Must meet thermal efficiency and particulate emissions standards

Contact: https://bit.ly/NH-DOE_Residential-WoodPellet for more information and current program status.

LOCAL INCENTIVES

Many communities provide property tax exemptions for renewables. Check your town website for more information.

• *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.energy.nh.gov/energy-information.

• **Plug-In Hybrid Electric Vehicles** (PHEV), and $300 on **Electric Motorcycles**.

While we try to keep things up to date, incentives are always changing. Please be sure to check with the appropriate sources provided for the latest information.

NH Home Performance with ENERGY STAR

Sponsored by all NH electric and natural gas utilities in partnership by the U.S. Dept. of Energy. Fuel-blind eligibility using the Home Heating Index (BTUs of heating fuel / conditioned square feet / heating degree days). Must provide at least 12 months of heating fuel history. Once qualified, eligible homes get a $450 value comprehensive energy audit for $100 (rebated if improvements installed), and 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/online rebates are available toward the purchase of the following ENERGY STAR® certified products: Clothes Washers, Clothes Dryers, Room Air Conditioners, Room Air Purifiers, Refrigerators, Dehumidifiers, and Pool Pumps. For current rebate information and forms go to www.NHSaves.com/nh-rebates.

- 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 through participating NH retailers(offers vary by retailer, see store associate for details) Visit: www.NHSaves.com/nh-rebates.
- Rebates are available to residential electric customers of the four NHSaves utilities.

NHSAVES Online Store

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

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

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

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

NHSaves: www.nhsaves.com

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

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

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

Other NH Electric Utility Programs

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

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

New Hampshire Electric Cooperative (NHEC) offers a slate of additional programs hat are available for NHEC members only. They include:

Electric Vehicle & Charging Incentives:

- Up to $1,000 incentive on the purchase or lease of a qualified EV (Residential).
- Up to $300 incentive to install Level 2 or larger charging stations, w/ Off-Peak charging rate (Residential).
- Up to $2,500 incentive to install Level 2 or larger charging stations (Commercial & Municipal).

High Efficiency Heat Pump Incentives:

- $500 per ton, w/enhanced rebates up to additional $500 per ton; 2% financing available. (Residential & Commercial)

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 (CDFA) 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: www.nhcdfa.org/energy.

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED IN NEW YORK

There are 169 programs and incentives available at: https://www.dsireusa.org (enter your zip code).

Also visit https://www.nyserda.ny.gov/All-Programs/EmPower-New-York-Program for the latest NYSERDA solar, ground source and air source heat pumps, EV, residential, and commercial incentives.

Select New York State utilities offer incentives for heat pump systems.

Please check with your local utility for more information or to learn more about heat pumps, available rebates, and financing options on the NYS Clean Heat program website at https://cleanheat.ny.gov/.

Clean Energy Incentives and Tax Credits for Renewable Energy

- SOLAR: Incentives to install renewables: https://www.nyserda.ny.gov/ny/PutEnergyToWork/Energy-Program-and-Incentives/Renewable-Technology-Programs-and-Incentives
- **ADVANCED WOOD HEAT:** A 22% investment federal 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% federal tax credit was also extended for geothermal heat pump projects that begin construction in 2022. NY homeowners are eligible for a 25% State tax credit up and additional incentives could be available from their utility provider.
- **AIR SOURCE HEAT PUMPS:** Most utilities also offering incentives on both central air source heat pump systems as well as mini-splits.

Electric Vehicle Charging Station Make-Ready Program

- National Grid and other utilities will do an analysis of your business or municipality to evaluate installing EV stations and accessing the type of EV needed for your fleet. Learn more information from their website: (https://bit.ly/NG-EV-MakeReadyProgram.

Check out your local utility's website for was to save more on your energy-efficient projects:

- **National Grid:** https://ngrid.com/3H7hBPU
- **Central Hudson**: https://bit.ly/CENHUD_SaveEnergy
- **NYSEG**: https://bit.ly/NYSEG_SaveEnergy
- **PSEG Long Island:** https://bit.ly/PSEGLI_SaveEnergy
- **RG&E:** https://bit.ly/RGE_SaveEnergy

MAINE

EFFICIENCY MAINE

All incentives and rebates are subject to change without notice. For information on Efficiency Maine's programs go to efficiencymaine.com or call 866.376.2463

Home Insulation:

Efficiency Maine offers insulation rebates of 80% up to $8,000 for income-eligible homeowners and 40% up to $4,000 to Mainers of all incomes. .

See bit.ly/EffME_HomeInsulation. Residents can estimate home energy efficiency with the calculator at bit.ly/EffME_SavingsCalculator.

To find a vendor go here: https://www.efficiencymaine.com/at-home/vendor-locator/.

Multifamily Insulation:

Efficiency Maine also offers incentives for multifamily insulation and air sealing. Multifamily buildings with five or more units may be eligible for attic and basement insulation with air sealing incentives of 50% of the project cost, up to $5,000.

For more information go to https://www.efficiencymaine.com/at-work/insulation-solutions/

Heat and Cooling:

Rebates and financing for the installation of high-efficiency equipment. To find out more about heating solutions, for your home go to: https://www.efficiencymaine.com/heating-solutions/. For business heating and cooling solutions go to: https://www.efficiencymaine.com/at-work/heating-and-cooling-solutions/. Homeowners can estimate their annual heating costs for different heating systems using the Home Heating Costs Calculator here: https://www.efficiencymaine.com/at-home/heating-cost-comparison/. To find a vendor go here: https://bit.ly/EffME_VendorLocator. To find a qualified partner for business solutions, go here: https://bit.ly/EffME_BusinessSolutionsPartner.

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 $4,800. Learn more at the Efficiency Maine heat pump website: bit.ly/EffME_HeatPumps.

Heat Pump Water Heaters: Efficiency Maine offers mail-in rebates and instant discounts up to $950 on heat pump water heaters. Low-income Mainers can qualify for an installed unit at no cost. Learn more at www.bit.ly/EffME_WaterHeatingSolutions. A Water Heater Cost Calculator to estimate savings is at bit.ly/EffME_WaterHeatingCostComparison.

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/ev/.

Electric Vehicle Charging Solutions: Charging in a single-family home is convenient and inexpensive. Public EV charging host sites at businesses, municipalities, or multi-family residential complexes can increase employee satisfaction, demonstrate sustainability commitments, strengthen relationships with customers and attract new ones. Efficiency Maine offers information and tips for consumers and businesses looking to install EV chargers. Learn more at: https://www.efficiencymaine.com/at-work/electric-vehicle-charging/

Commercial: Efficiency Maine has programs for businesses of all sizes, including multifamily buildings with five units or more and Maine's largest energy customers, businesses, for profit or nonprofit; municipalities; schools and higher ed facilities; industrial facilities; non-residential facilities; multifamily and condominium buildings with five+ units. To learn more about incentives for energy efficiency solutions, how to get started, and program details, visit https://www.efficiencymaine.com/at-work/. To find a contractor participating in Efficiency Maine programs as a Qualified Partner: https://bit.ly/EffME_BusinessSolutionsPartner.

Appliances: $50 rebates available for ENERGY STAR® certified clothes washers: bit.ly/EffME_ClothesWasher_Rebate

Room Air Purifiers: $25 rebate available for ENERGY STAR® certified room air purifiers: bit.ly/EffME_AirPurifier_Rebate.

REGIONAL: OTHER

The empower program is a good place to start by making your home or apartment energy efficient, more comfortable and healthy

Commercial Buildings EPA 179D

Take up to $1.88/ sqft if qualified) Visit https://www.energytaxsavers.com/ for more details.

https://www.energy.gov/eere/buildings/179d-commercial-buildings-energy-efficiency-tax-deduction

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While we try to keep this up-to-date, incentives are always changing. Please be sure to check with the appropriate sources provided for the latest information.

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

Voluntary Carbon Offsets: A Good Idea Gone Bad?

Martin Wahl

A Good Idea Once Upon a Time?

The idea, back in 1988, seemed good: Applied Energy Services working with World Resources Institute created the first documented carbon offset program in the U.S. by planting 52 million trees in Guatemala to offset carbon emissions from a coal-fired plant it was developing in Connecticut. Mark Trexler developed the methodology of the program; it was the first reforestation carbon offset project.

In the thirty-five years since then, things have changed, and not all for the better. Rights to carbon offsets in units of one metric ton of CO2 or greenhouse gas (GHG) equivalent, can be purchased by entities to offset, or reduce, carbon emissions they generate. For some background on carbon offset credits and their market, see the box below.

So, What Went Wrong?

Back in 1988 the commercial technology to build a renewable power plant was not available, so reforestation offsets seemed the next best thing.

Some projects issuing carbon offsets today are renewable power generation plants claiming to offset carbon emissions by avoiding construction of GHG-emitting plant. Today, most renewable energy projects rarely need the additional funds that offsets generate, because wind and solar are now the cheapest sources of new energy in most of the world.[1]

In addition to renewable power generation projects, most carbon offsets are now derived from reforestation projects themselves, which have come under scrutiny for being hard to evaluate due to:

- "Leakage, "where the protection of one forest simply causes deforestation to happen elsewhere.
- "Additionality," where for example, a project would not provide additional carbon storage if it protects a forest that was never in danger of being cut down.

Carbon offsets can be purchased by entities to reduce the carbon emissions they generate. Care must be taken to verify the validity of a carbon offset program. (blogs.lse.ac.uk)

A National Resources Defense Council report details these issues.

Stonyfield Farm of Londonderry, NH in 1997 was the first corporation to use acquired offsets to achieve carbon neutrality.[2] Since then, many corporations and other entities have announced carbon-neutral programs, some claiming they already are. Some of the offsets being purchased are from questionable sources, most recently those Qatar bought in order to claim the 2022 FIFA World Cup "carbon neutral." They were acquired from Qatari-owned Global Carbon Council (GCC) whose program standards have been questioned. The claims for the 2022 Beijing Winter Olympics have also been questioned. The voluntary carbon market, valued at nearly $2 billion in 2021, is subject to deceptive practices. In fact, as pointed out in a report by the Center for American Progress, "(l)ow-quality offsets may be worse for the climate than no offsets at all."

From a strategic, global standpoint, using carbon offset credits as a means to reduce GHG emissions in the long term is questionable. Mark Trexler, the "father" of carbon offsets, makes clear in an interview with Bloomberg that, "Originally, offsets were meant to go away, but are now entrenched. An offset market depends on the supply of carbon to offset, so if CO2 emissions are actually reduced, the market ends. Carbon offset is grasping at a straw when policies are not changed to actually reduce CO2 emissions."

Another structural issue with carbon offsets is that it represents a conflict of objectives; the carbon offset market has two goals, potentially in conflict:

- To mitigate climate change by reducing overall carbon emissions.
- To reduce costs to companies for complying with carbon-reduction objectives or rules.

Seeking the lowest cost usually wins out, leading to a "race to the bottom," as companies acquire lower-cost offsets issued by less costly projects that potentially aren't as rigorously vetted as others. A January 2023 Guardian exposé article presented results of an investigation into Verra, the world's leading standard for the voluntary carbon offsets market, showing that 94% of rainforest carbon offsets were "worthless." Worse, some projects have been discovered to have human rights violations associated with them.

Because the carbon registries are paid by the projects applying for carbon offset registration, their standards have often been found to be low. The Grantham Research Institute on Climate Change found egregious examples, including wind farm projects in India where at least 52% of the carbon offsets were for projects that would have likely been built anyway.

United Airlines CEO Scott Kirby has said in many interviews that carbon offsets are not a meaningful way to achieve "100% green" operations because most offset projects are about planting trees, susceptible to the Additionality and Leakage flaws explained above. – Accordingly, United is investing in sustainable aviation fuel to achieve their goal of going 100% green by 2050.

Hope for the Future?

In response to the Guardian's January 2023 article, Verra, after initially responding with a refutation of the Guardian's data, techniques and sources, has announced it is replacing its rainforest offsets program in 2025. As other greenwashing scandals come to light, some offset buyers are becoming concerned about their image, and governments are being asked to crack down on the market for carbon offsets and draw up new rules for its oversight.

Until the voluntary markets become more reliable and verifiable, instead of buying carbon offset credits from a vending machine at the airport, consumers should consider putting their money towards the purchase of replacement appliances (heat pump hot water and space heaters to replace gas are most effective for GHG reduction) or a zero-emission vehicle.

Footnotes: *[1] Note that hydroelectric plants, while they do not emit GHGs, are not considered a "renewable" producer. [2] In 2019 Stonyfield committed to reduce its carbon output by 30% under the auspices of The Science Based Targets initiative (STBi).* ♻

WHAT IS THE CARBON OFFSET MARKET?

A carbon offset credit is tradeable instrument certified to represent an emission reduction by a project of one metric ton of CO2, or an equivalent amount of other greenhouse gas (GHG).

- Projects meeting a standard organization's requirements issue carbon credits.
- Purchasers of carbon offset credits retire them to claim the emission reductions

There are two types of carbon markets, mandatory and voluntary.

- Mandatory markets are created and regulated by national, regional, or international carbon reduction programs. California's Cap & Trade Program and the Regional Greenhouse Gas Initiative (for power plants in eleven Eastern states, including NY, VT, NH and ME) are examples. Mandatory market carbon credits are sold only to emitters that must comply with their standards; not on the open market.
- Voluntary markets function outside compliance markets and enable companies and individuals to purchase carbon offsets on a voluntary basis with no intended use for compliance purposes. The value of the voluntary carbon market is around $2 billion.

Key criteria to evaluate the legitimacy of carbon offset projects include:

- Additionality – a project that without carbon offset sales wouldn't have happened.
- Permanence – The carbon reduction must last a long time, and not be easily reversed.
- Leakage – The emissions will not be moved somewhere else.

Each of these criteria have lengthy explanations and examples, and are hard to verify on a continuing basis.

Participants in the voluntary carbon market include:

- The project developer who applies for the credit(s) EG:
  - A renewable energy project.
  - Reforestation project.

The organizations promulgating the programs, EG:

- Verra: The Verified Carbon Standard (VCS).
- The Gold Standard (GS).
- Climate Action Reserve (CAR).
- American Carbon Registry (ACR).

These organizations maintain registries of approved third party verifiers/validators who assess project compliance with their programs.

- Carbon credit exchanges and brokers link offset providers and purchasers.
- Purchasers who retire the credits to support their GHG reduction goals. ♻

NH Communities Saving Big on Electricity Through CPCNH

Electric Customers in Ten Communities to Generate Tens of Millions of Dollars in Savings and Benefits

Henry Herndon

Community Power, authorized under NH RSA 53-E, democratizes energy governance by empowering towns, cities, and counties to choose where their electricity comes from on behalf of their residents and businesses, work with utilities on local energy infrastructure upgrades, and provide electricity supply rates and services to all customers participating in the program.

On March 13, on the steps of Nashua City Hall in New Hampshire, The Community Power Coalition of New Hampshire (CPCNH) announced their base electric rate of 15.8 ¢ per kilowatt-hour, which starting in May 2023 will generate $5.8 million of dollars in savings for electric customers in ten New Hampshire communities in the first three months alone.

This historic announcement marks the launch of Community Power, enabled by the legislature in 2019 and is now launching with an initial wave of ten communities: Enfield, Exeter, Hanover, Harrisville, Lebanon, Nashua, Peterborough, Plainfield, Rye, and Walpole.

The Coalition's rate represents a 22% savings relative to Eversource's energy supply rate, 28% relative to Liberty Utilities, and 39% energy supply savings for Unitil customers. CPCNH provides service to communities served by all three utilities. Under Community Power, electric distribution utilities continue to own and operate the power grid while local communities gain control over where their power is sourced from.

Nashua energy customers are expected to save $2.6 million in the first three months of Nashua Community Power service. "Nashua is proud to be among the first ten communities that are charting a new path when it comes to where we get our energy," said Nashua Mayor Jim Donchess. "Community Power Coalition is a brand-new institution that gives Nashua and other communities the ability to control price volatility in the short- and long-term, and the tools to accelerate the transition to a more economically and environmentally sustainable energy system."

On March 13, on the steps of Nashua City Hall, Community Power Coalition of NH members announced a base rate of 15.8 cents per kilowatt hour, which will result in savings for ratepayers totaling $5.8 million in the first three months of the program. (Courtesy photo)

"Innovation is central to the mission of Community Power," said Clifton Below, CPCNH Board Chair, "our Coalition power agency is equipped to build community-scale renewable energy projects that directly benefit our cities and towns for the long-term, and to push other innovations that empower customers with distributed energy resources."

CPCNH is a locally governed non-profit power agency led by a Board of Directors that consists of individuals appointed by the member communities. CPCNH was formed to:

- Use our collective buying power to lower electricity rates for customers,
- Offer more choices for cleaner supply to customers,
- Give local decision makers and communities control over energy choices, and
- Lead development of smarter state energy policies that directly serve community and customer interests.

"Community Power is about more than short-term rate savings," said Lisa Sweet, the Town of Rye's representative on the CPCNH governance board. "Community Power allows us to build reserve funds controlled by our local communities — not out of state, for-profit corporations — and decide how those funds are spent and to counter future market volatility and invest back into our local communities. Our ten communities are generating $8.1 million in reserves in the first three months of operation — that's local wealth to benefit customers for the long-term."

A total of 30 communities have already voted to join the Community Power Coalition and are currently in the process of launching their own Community Power programs. "A key value of the Coalition is the ability to manage a portfolio of energy resources and hedge risk, and for communities to control and adjust rates over time to ensure they can maintain discounts relative to utility pricing. The benefits of Community Power are made possible by a combination of local and state leadership working together to ensure that every city and town in New Hampshire has the opportunity to chart a better energy future for their community" concluded Henry Herndon, Consultant to CPCNH.

Henry Herndon is a principal at Herndon Enterprises and a consultant for the Community Power Coalition of NH. ♻

The Wayside Restaurant Joins the Small Business Community Solar Alliance

George Harvey

Wayside's inspection team, Jeff Virge, Karen Zecchinelli, and Chris Moore, at the solar array site in Perkinsville, VT. (Courtesy photo)

In December of 2011, *G.E.T.* published an article on the Wayside Restaurant. "Wayside Restaurant Earns Vermont Green Restaurant Designation," reported that it had been awarded the designation of "Green Restaurant." Brian and Karen Zecchinelli had worked ten years to bring their restaurant to a high environmental standard (https://bit.ly/GET-WR-12-11).

To be designated a Green Restaurant meant meeting eight specific core environmental standards, but it also meant developing an Environmental Action Plan to reduce impacts further. Commenting on this, Brian Zecchinelli said, "The Wayside will continue to focus on waste reduction, water and energy conservation, pollution prevention, transportation efficiencies and sustainable promotion."

One of the initial goals that was difficult to meet was composting. There was a lot of waste to compost, because the Wayside serves about a thousand customers per day. To meet this goal, the entire staff of the restaurant had to be aware of what was needed and had to participate in the work.

Now there is more to report. Having already built its own solar hot water system, the Wayside Restaurant has expanded its use of sunshine by getting the electricity it needs from a solar photovoltaic system.

Working with Norwich Solar, the Wayside and five other businesses partnered on a solar array in Perkinsville, Vermont. The Wayside Restaurant has joined with these businesses as members of the Small Business Community Solar Alliance. The array is maintained by Norwich Solar. The system has 2,160 bifacial solar panels and is rated at 500 kilowatts.

The bifacial panels can collect light from both sides. This means sunlight reflected from the snow is collected at the back of the panel, while the front is lighted directly by the sun, increasing the output of the array.

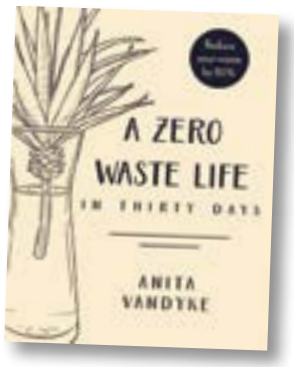
The Wayside Restaurant is open from 7:00 AM to 8:30 PM, every day. During that time, it can use a lot of electricity. As a customer of Green Mountain Power, the restaurant can take advantage of its net-metering system, so the solar system is reducing its electric bills considerably.

The solar array is expected to generate about a million kilowatt-hours each year. That amount of electricity would power about 138 average Vermont homes. ♻

A Zero Waste Life in Thirty Days

By Anita Vandyke, Apollo Publishers, 2020, 178 pages, $17.99

Review by N.R. Mallery

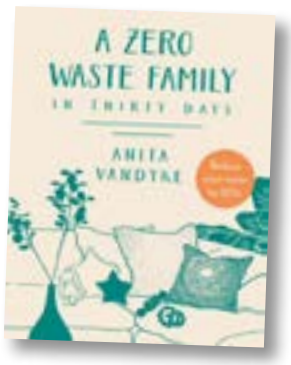


It is quite fitting to include this book review in this issue with our feature section about waste. Let's start with a review of the waste problem itself:

Waste is a problem related to climate change for several reasons:

1. Greenhouse gas emissions: Waste that is sent to landfills produces methane; a potent greenhouse gas that is more than 20 times as potent as carbon dioxide in terms of its impact on climate change. According to the Intergovernmental Panel on Climate Change (IPCC), landfills are responsible for approximately 5% of global greenhouse gas emissions.

2. Resource depletion: The production, transportation, and disposal of waste requires a significant amount of resources such as energy, water, and raw materials. As these resources become depleted, it becomes more difficult and expensive to produce goods and services, leading to increased prices and reduced access to basic necessities.



3. Habitat destruction: Landfills take up large amounts of space and can have a significant impact on natural habitats, leading to the destruction of ecosystems and loss of biodiversity.

4. Pollution: Improperly disposed waste can pollute waterways and soil, leading to harmful effects on human health and the environment. This can also contribute to climate change, as polluted environments can release more greenhouse gases.

Reducing waste and improving waste management practices can help to mitigate these impacts and reduce the overall impact of human activity on the climate.

In *A Zero Waste Life*, Vandyke has created a daily journal as a practical guide to reducing our waste impact on the world — reducing one's waste by 80%.

Starting with an audit of your recycling bins can be an eye-opening experience. Plastic waste, food waste, paper and cardboard, as well as cans and bottles of different materials are all parts of our waste stream. Reducing one's waste also has a considerable cost savings as well. The author also shows how it helps to create a clutter-free healthful living environment.

I encourage our readers to take a look at the book. It is not only beneficial to those just realizing the need to follow this path but is also helpful to those of us looking for additional ways to reduce our waste. You will find many helpful tips — even for those who may think they can't do any more.

This is one of two books by Anita Vandyke. She also offers a digital copy for the whole family called, *Zero Waste Family*. It is available online and also as an e-book.

The wood used to produce this book is from Forest Stewardship Council (FSC) certified forests, using recycled material or controlled wood sourcing and standards.

Interesting is the fact that the author is a qualified rocket scientist and is passionate about zero waste, minimalism, and all things related to green living. She was born in China, raised in Australia where she studied medicine and lives in San Francisco. Vandyke accredits her own journey to her family. She states "To my family, who taught me to not waste my life."

Read and learn more on her website at: www.anitavandyke.com. ♻

Letter from the Editor-publisher

Cont'd from p.2

know for sure.) It turns out that used containers have to be put in the landfill if they are not rinsed well. The recycling facility does not have the time or means to clean these items. This all causes more work at the waste facility to put them on into the trash.

To get people to handle waste properly, they have to understand it better, which is really all about education. And that is what we attempt to achieve in *Green Energy Times*.

Of course, our waste stream goes far beyond food waste. Everything we do today seems to create waste. We live in a truly wasteful society.

Some people have concerns about the waste from solar panels and batteries. I question how this is so different from the waste from any electronic devices or gas fueled vehicles. Solar panels have a very long lifespan and it is still unclear how long they last. With no moving parts, what is to break? From my own experience with living off the grid with solar for 20 years, the original solar panels and all of the components are going strong without much loss in power production. There is also a re-use option for them should newer higher wattage solar options entice one to upgrade a system. And technologies for recycling silicon are just becoming available.

Utility and phone companies have used battery storage for a very long time. I know of off-grid homeowners who use discarded batteries and continue to use them. There is life left to most of these batteries long after they are replaced. EV batteries can be re-used for backup storage after they have been used in an EV. And new technology is being developed every day as R&D makes headway to create sustainability for re-use and recycling. We know we need to move away from the use of fossil fuels for so many reasons. Not to do so will only lead to a future that we will not be happy with, the same result as if we continue to resist change.

And that is why *G.E.T.* keeps bringing you ways to reduce your waste and our whole carbon footprint with every topic covered.

We hope that this and every edition of *G.E.T.* helps you understand the consequences of our waste stream. Our everyday lives can make Earth Day every day by taking the extra steps needed to help the future of our planet.

Happy Earth Day. Happy spring! – Nancy Rae. ♻

Turning Coal Waste into Energy Storage

Ohio University awarded $2 million from Department of Energy to develop products from coal waste

Coal waste pile west of Trevorton, Pennsylvania. (Wikimedia/Jakec)

The U.S. Department of Energy (DOE) has funded six research and development projects that will repurpose domestic coal resources for high-value graphitic products and carbon-metal composites that can be employed in clean energy technologies. Ohio University's Institute for Sustainable Energy and the Environment was awarded two of the six awards, one that explores how coal waste can be reimagined as energy storage and the second aims to develop ultra-conductive carbon metal composite wire for electric motors.

Turning coal waste into energy storage

The DOE awarded $999,976 to support the coal waste project, which will focus on developing electrochemical processes to convert coal-based materials to two-dimensional carbon materials for supercapacitor applications. The project is led by principal investigator John Staser, associate professor of chemical and biomolecular engineering. Additionally, OHIO faculty members Jason Trembly, professor of mechanical engineering and director of the Institute for Sustainable Energy and the Environment, and Damilola Daramola, assistant professor of chemical and biomolecular engineering, will support this project, alongside industry partners CFOAM LLC and Capacitech Energy.

Supercapacitors are typically used for energy storage. The project aims to develop advanced processes, called the electrochemical coal to two-dimensional materials (e-Coal2D) process, to transform coal-based materials into new materials that enhance the capacity of electrochemical supercapacitors. CFOAM, one of the industry collaborators, has developed coal-derived materials that are used as the raw material to generate the final product. Then, Capacitech Energy, a leader in cable-based capacitors, will evaluate the two-dimensional materials in their systems.

Coal's unique structure and composition make it well-suited for use as a raw material for producing various high-value carbon products. The ultimate goal of this project is to continue to find ways to reimagine coal waste to reduce greenhouse gas emissions and create jobs.

Understanding Ultra-Conductive Carbon Metal Composite Wire for Electric Motors

Led by principal investigator Yahya Al-Majali, assistant professor of mechanical engineering and assistant director of the Institute for Sustainable Energy and the Environment, this project aims to develop cost-effective carbon metal composites with enhanced bulk electrical properties for use in electric motors. This project was developed from a broader mission to increase American energy efficiency and reduce greenhouse gas emissions globally.

Using materials derived from coal waste, specifically nano-graphite and graphene, carbon metal composites will be created using novel metal forming processes. The performance of the finished material, which will take the form of an ultra-conductive wire, will then be tested and quantified to ensure readiness for real-world applications. The wire is intended to be used in electric motor applications, which further supports technology to ultimately reduce greenhouse gas emissions.

The award from the DOE totals $1 million with a $250,000 cost share. Industry partners include MetalKraft Technologies LLC, Fisk Alloy Inc., CONSOL Innovations, Hydro Precision Tubing North America, AmeriCarbon LLC, SP2 Carbon Technology Co and Clear Skies Consulting LLC. Additionally, a team of OHIO researchers will support this project, including Jason Trembly and David Drabold, distinguished professor of physics.

Development of the carbon metal composite wire will not only reimagine use for coal waste, but its application will offer key environmental and economic advantages. This technology will reduce carbon dioxide emissions, improve electric vehicle efficiency and create new manufacturing jobs for coal communities.

Introducing coal-derived graphitic carbons into electrical wire could significantly reduce American energy consumption, preventing up to 14 million tons of carbon dioxide emissions, and saving consumers $4.3 billion annually if just 20% of alternating current (AC) motors use ultra-conductive wire. Lastly, this technology will potentially create new manufacturing jobs for coal communities.

Ohio University is a student-centered, transformative learning community, where students realize their promise, faculty advance knowledge, staff achieve excellence, and alumni become global leaders. Ohio University is a Carnegie R1-classified research-intensive institution with a record of advancing knowledge through discovery and innovation in the natural and biomedical sciences, humanities and arts, and engineering. Visit www.ohio.edu/engineering/isee for more information. ♻

See Gallois SP2 Carbon USA's ad on p.40

Mattress Waste Solution: Recycling vs. Dumping

Michael J. Daley

You, gentle reader, may be as appalled as this writer was to learn that our society is stuffing Mother Earth full of discarded mattresses, an item that when deconstructed is nearly 95% recyclable according to Joshua Costa, owner and founder of Sleep Well Recycling of Burlington, Vermont. Only four states prohibit the practice of dumping mattresses in landfills --- California, Connecticut, Rhode Island and Oregon, soon to be joined by Massachusetts, where over 600,000 are disposed of each year.

When I expressed my dismay to Costa, he said "I have been in the waste business so long, I don't get so upset about that as much anymore. What's needed is people taking initiative to divert valuable materials from disposal, then things change."

Costa is that kind of person. He's 30 years old now and those years in waste management engendered a passion for reducing the waste stream. Land-filling mattresses is a prime example of a really bad thing to do. They are bulky, do not compress well, don't readily decompose and take up an enormous amount of space in the ground.

The other aspect that made them a prime target for his notice and a successful business model: "the high gate fee and high recyclability."

Mattresses are broken down to recycle the different components properly. (Flickr/ Springback Mattress Recycling, City of Fort Collins / John Robson)

Typical disposal fees are $25 to $30 depending on the mattress size.

"I give people the choice. Twenty-five to thirty dollars to do it wrong or the same to send it to me," Costa said. "It's a no-brainer. So many people want to do the right thing these days, and this one is a really easy choice for individuals and businesses to make."

He started Sleep Well Recycling in 2020 with 3 employees and the ambitious goal of ensuring that every discarded mattress in New England would be recycled by 2024. Today, with those same three and occasional hires, he is well on his way to recycling over 10,000 mattresses per year.

In less than a quarter hour, Costa can render the typical mattress into several income-generating components. All Metals Recycling in Williston, Vermont buys the spring assemblies. Foam padding is shipped off to become new products like underlayment padding for carpets. Wood scraps are hauled to the nearby McNeil power plant to be burned as fuel. Intact pinewood box-spring frames seem to be a popular reusable item that people snap up whenever he offers them on Facebook marketplace. Fabric scraps and what he calls "mystery stuff" — a black waterproof lining of indeterminate composition --- are the most difficult to market.

Asked how his plans to become Mattress King of New England are coming along, Costa laughed. "I've cut back on that ambition a bit. Other states, like California, set up centralized recycling. But it just doesn't make a lot of sense to haul hundreds of mattresses hundreds of miles. For now, I'm content to be an intermediate recycler."

UTEC is another great business that recycles mattresses throughout northern New England. UTEC is a Lowell-based youth services organization that picks up, deconstructs, and recycles mattresses. The UTEC contracts with municipalities, hotels, schools, universities, assisted living facilities and hospitals.

Young adults involved with this organization participate with the pick-ups and deconstruct the mattresses at the Lawrence facility while learning valuable workplace skills.

We at *G.E.T.* certainly hope that Costa's and UTEC's successful example will inspire many more entrepreneurs across our region, so that we can all sleep a little more soundly knowing the ultimate fate of our mattress will no longer befoul our precious Earth.

The Sleep Well Recycling website is sleepwellrecycling.com. The UTEC website is https://utec-mattress.org/.

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

Preventing Contamination and the Food Waste Stream

Michael J. Daley

You would not use compost with ground glass in it, or shreds of food service gloves, or fragments of deli containers, would you?

Unfortunately, these are just three of many types of contamination commercial composters struggle with in the food waste stream, posing a threat to the success of large-scale food recovery efforts.

To research this article, I reviewed a June 2022 webinar on source contamination of food wastes hosted by Better Earth. This Chicago and Clarkston, Georgia-based company is dedicated to fostering a circular economy providing products, sustainability services, and expertise for the food industry from farm-to-plate to compost. A1 Organics is a commercial composter in Colorado that handles hundreds of thousands of tons of food waste each year. Marketing manager, Clinton Sander represented A1 at the webinar and graphically illustrated the many ways that food wastes arrive at their facility contaminated.

I quickly learned commercial composting is not an endeavor for the faint-hearted or those with weak stomachs. Confronted with image after image of collection bags full of the vomit of our convenience-based food system, I was humbled by the sheer volume and mess of the wastes and sincerely grateful that there are people passionate about preventing this waste from ending up in a landfill or incinerator. They are dedicated to keeping those precious organics from falling out of the web of life --- and of course, running profitable composting businesses.

The problem in a nutshell – or I should say (plastic) clamshell – is much the same as faced by all-in-one recycling models: contamination ruins otherwise reclaimable materials forcing them to be disposed of conventionally, that is, to trash Mother Earth. There are compostable packages and food containers, but how is the average person to sort through it all as they face the food collection bins, especially in situations where there may be a mix of standard plastic containers and utensils as well as some compostable things like cups?

Better Earth strives to convince food providers to use 100% compostable containers, but this can be a hard sell as many competing issues drive choice. For example, many compostable plastics are not clear so people can't see the food inside the way those oh-so-familiar black deli containers allow them to. There are always simply mistakes, inattention, and haste which in this case does indeed make waste.

The use of compostable cups and other dinnerware helps to eliminate the compost material from being contaminated with items that are not biodegradable. (chaf.haddad/Flickr)

Sander showed what a nightmare it is on the receiving end to have to open bags of food waste suspected of contamination. Sorting is tedious, gruesome, costly and sometimes dangerous. And mistakes there lead to entire piles of compost contaminated by things like one missed bottle smashed to a thousand smithereens that cannot be sifted out. That leads to entire batches of finished compost having to be disposed of.

Mitch Hedlund, founder of Recycle Across America, participated in the webinar. She created the first and only society-wide standardized recycling bin labeling system. Her amazing contribution resulted in over nine million standardized labels in use leading to 50 to 400% increase in recycling levels while significantly reducing people's mistakes at the bins. She spoke with the authority of lessons learned suggesting that food collection for compost efforts failed to benefit from first establishing universal standards for the packaging and for public education. She felt that the composting industry would benefit from regrouping and resetting its efforts to focus on "food first". After all, in our school cafeterias, we all learned the basic skill of scraping the leftovers off our trays before handing them to the dishwashers.

Hedlund emphasized the need for unity in the compost industry to promote standards of compostable packaging and universal usage, public education, and uniform labeling. In a sobering moment, she reminded participants that some powerful forces would like to see the food recovery movement FAIL – such as the virgin plastics industry losing market share to biodegradable containers and landfill operators losing tonnage from the diversion.

There was broad agreement on how to tackle the problem: reduce contamination at the source with recurring training for food service staff, standardized sorting and signage, use of 100% certified compostable packaging materials, continual public education, and legislation such as extended product responsibility laws to help fund these efforts.

Almost one year later, how are things going? A glimpse of the answer comes full circle to A1 Organics, which just announced that as of April 2023 they will no longer accept any type of mixed food waste. They will ONLY be accepting food scraps, yard wastes, and three-gallon certified bags of food waste to protect the quality and integrity of their finished compost product. So, it looks as though Hedlund called it right: "food first" and more work to be done.

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

Sourc links:

- *The Better Earth Webinar: What is one of the biggest challenges to composters and scaling the composting industry? (www.becompostable.com)*
- *BPI - Certified Compostable. (bpiworld.org)* ♻

Fear of Change can Lead to Worsening Change

John Bos

From the industrial revolution to the advent of artificial intelligence, societies have undergone fundamental changes in how people live and comprehend their place in the world.

Some transformations are widely regarded as bad, including many of those connected to our climate crisis.

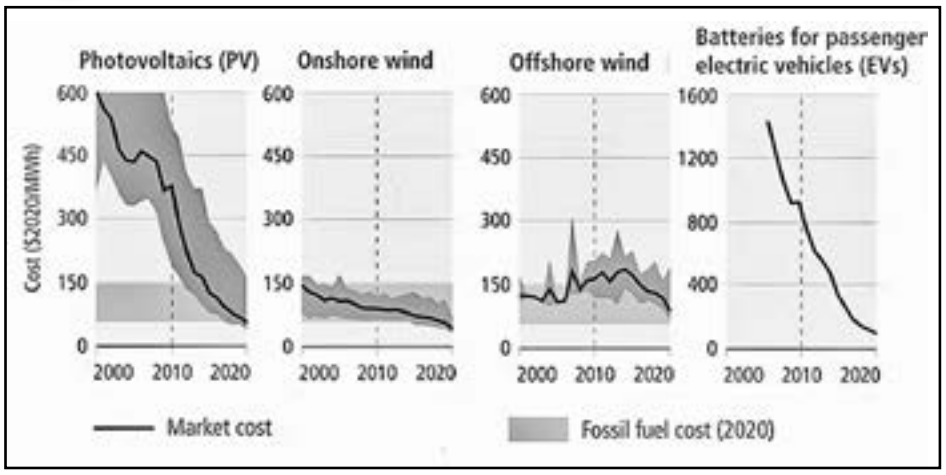
Transformations can have both good and bad effects. There is no question that the industrial revolution vastly raised standards of living for many people. It also spawned inequality, social disruption and environmental destruction.

We often resist transformation because of our fear of losing what we have. That fear is more embedded than realizing that we might gain something better. Wanting to keep the status quo explains all sorts of individual decisions, from who you vote for, to not wearing a mask even when studies have shown that doing so inhibits Covid-19 infection.

This status quo effect is much more pronounced when it comes to larger changes. Ending our reliance on fossil fuels is at the top of the list. History has shown that in the past, delaying inevitable change has led to transformations that are unnecessarily harsh. As more people are now experiencing the unavoidable impacts of climate change firsthand, they are beginning to realize that energy transformation is inevitable if they are to survive.

In the psychology of human behavior, "denialism" can be thought of as a person's choice to deny reality as a way to avoid a psychologically uncomfortable truth. In the sciences, denialism is the rejection of basic facts and concepts that are undisputed in favor of ideas that are radical, controversial, or fabricated. Blatant examples include Holocaust denial and AIDS denialism that ignore or reject the facts of these historical realities.

The fact that human activities have transformed the planet at a pace and scale unmatched in eras of the distant past is also a historical reality. Leading scientists worldwide have warned us that the world's "plans" to combat the change have been inadequate and that more aggressive actions must be taken to avert catastrophic warming.



Costs are falling for key forms of renewable energy and electric vehicle batteries. (IPCC sixth assessment report)

The report released on March 20 by the United Nations Intergovernmental Panel on Climate Change (IPCC) found that the world is likely to miss its most ambitious climate target — limiting warming to 1.5 degrees Celsius (2.7 degrees Fahrenheit) above preindustrial temperatures — within a decade. Beyond that threshold, scientists have found, climate disasters will become so extreme that people will not be able to adapt. Basic components of the Earth system will be fundamentally, irrevocably altered. Heat waves, famines and infectious diseases could claim millions of additional lives by century's end.

These unavoidable transformations are, and will continue to be, the results of too little, too late. It's easy to feel pessimistic when scientists around the world are warning that climate change has advanced so far, it's now inevitable that societies will either transform themselves or be transformed.

The latest reports from the Intergovernmental Panel on Climate Change includes a Synthesis Report. The Synthesis Report is based on the content of the three IPCC Working Group Assessment Reports: WGI – The Physical Science Basis, WGII – Impacts, Adaptation and Vulnerability, WGIII – Mitigation of Climate Change, and the three Special Reports: Global Warming of 1.5°C, Climate Change and Land, The Ocean and Cryosphere in a Changing Climate.

The Working Group I report addresses the most updated physical understanding of the climate system, bringing together the latest advances in climate science and combining multiple lines of evidence from paleoclimate, observations, process understanding, global and regional climate simulations. It shows how and why climate has changed to date, and the improved understanding of human influence on a wider range of climate characteristics, including extreme events. There is a greater focus on regional information that can be used for climate risk assessments.

While this comprehensive review describes the changes facing us, it also describes how existing solutions can reduce greenhouse gas emissions and help people find ways to adjust to the unavoidable impacts of climate change. These IPCC reports make clear that the future inevitably involves more and larger climate-related transformations. The question is what the mix of good and bad will be in those transformations.

To slow the environmental damage already underway, it is not new news that the world must shift how it generates and uses energy, transports people and goods, designs buildings and grows food. There is some reason for a little optimism. For example, renewable energy is now generally less expensive than fossil fuels. Therefore, a shift to clean energy can begin to mitigate greenhouse gas emissions and save money.

The IPCC chart below graphs the diminishing cost of solar and wind energy and increasing capacity of electric EV vehicles.

Transformation is inevitable. It will either result from too little action or from efforts to adapt to, and mitigate, our climate crisis. There have been substantial advances in the last five years. They are simply not sufficient to prevent the climate transformations already underway.

Doing more to disrupt the status quo with proven solutions can help smooth these transformations and create a better future in the process. The status quo includes the vast fossil fuel- industrial complex for which profit, not plants or people, is always the bottom line.

No one group alone can enact these changes. Everyone must be involved, including governments that can mandate and incentivize necessary changes. Like the incentives I have to switch to a heat pump from my propane powered heating and cooling system. It is also not new news that corporate influence controls many of the decisions about greenhouse gas emissions. We, the people, have to turn up the pressure on corporate and political leadership if we want our grandchildren to have a breathing chance for a good life.

John Bos is a contributing writer for Green Energy Times. His column, "Connecting the Dots," is published every other Saturday in the Greenfield (MA) Recorder. Questions and comments are invited at john01370@gmail.com. ♻

OP-ED

The Energy Crisis of the 1970s and Jimmy Carter's Sustainable Vision

Wes Golomb

On February 18, 2023, it was announced that former president, Jimmy Carter, age 98 is in hospice care. I am sad for his imminent loss, because I respect him more than any other president who served on my lifetime.

Several things about him have earned my respect. He was honest. He told it like it was and didn't try to fool the nations. There were no wars during his presidency, and although he is a truly religious man, which I respect, he never tried to foist his views on me, or the nation. Instead, he led, in office and since, by example.

Big issues surrounding energy consumed Carter's presidency, OPEC's oil embargo which caused the first oil crisis and runaway inflation. I remember waiting in line for hours to get gas.

Then there was the Iranian revolution, in large part a result of previous U.S. policy bit Carter in the butt. In 1953 Iran had nationalized the countries, oil, industry, and in response, the CIA fomented a coup d'état in Iran, which overthrew the legitimate government.

Prior to nationalization of the oil industry, foreign interests were reaping most of the economic benefits of Iran's oil. Think about it: how would you feel if some foreign country took over our resources and took them away giving us only pennies on the dollar for their value? This was the situation before nationalization. Foreign oil companies were benefiting while most of Iran remained impoverished, and certainly not benefiting from their own resources.

The coup replaced Mohammed Mosaddeq with the Shah. He was a brutal dictator, who, represented U.S. oil interests. Through the Shah, the U.S. effectively occupied and controlled Iran and its oil. After 27 years of brutal dictatorship, the Iranians had had enough and overthrew the Shah, and the US.

Unlike 1953 we did not try to overthrow Iran, and unlike Carter's successors, he did not take our nation to war over oil. Carter identified fossil fuels as a source of national insecurity, and a way out of that, by making the nation less dependent on oil through what we now would call sustainable measures such as conservation and solar.

During his presidency, the first energy tax credits, incentives for people to do something about our energy situation, were started.

Carter put solar hot water on the White House. This served two purposes, to save money and energy, and to act as an example for the rest of the country. This example and the economic benefits spurred many companies to get into fields related to sustainable energy.

For the first time the tax credits opened up the market for people who wanted to cut their energy costs. It was at this time that I began energy auditing, and soon after that selling solar energy gear for Sears. Some of those systems are still working today, more than 40 years later.

The election of 1980 between Carter and Reagan was a turning point, in US energy policy. There was a clear choice on our energy future a move to a sustainable future or using our might to get what we wanted.

President Carter with a sweater on, in front of a fire, talked to the nation. He talked about conservation and efficiency and new technologies for generating energy. He spoke of a flourishing country, independent of future 'oil crises' and better able to control inflation based on rising energy prices.

Then Governor Reagan spoke about energy, being our inalienable right, and offered the nation a path of power, and might as the source of our energy.

The nation chose Reagan who beat Carter in a landslide in the 1980 election. The tax credits ended and the solar panels were taken off the White House. (They ended up at Unity College).

After his 1980 election, Reagan and his successors, (remember G.W. Bush's "drill baby drill") have taken the path he charted. We've had one war after another all to protect our fossil fuel supply, Iran Iraq, Kuwait conflict in the Balkans (where World War I was sparked over oil), Afghanistan for minerals and hopes of an eastern sea port for shipping oil.

We've traveled a continued imperialistic path for the last 40 years to supply ourselves with

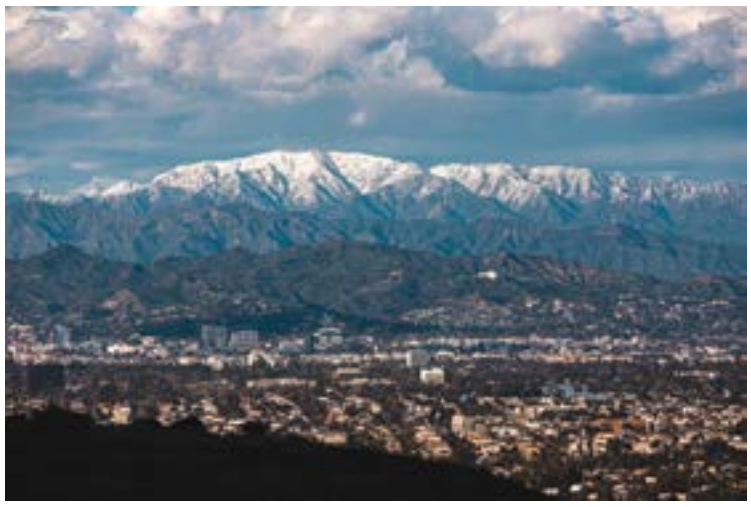
Cont'd on p.23

Winter Climate Extremes in the USA

Dr. Alan K. Betts

The winter climate extremes across the U.S. have been striking. We know that we are responsible for them, but we listen to the webs of lies and pretend we do not know. Back in 1978, James Black, the chief scientist of the current Exxon-Mobil did the global modeling and correctly concluded that doubling atmospheric CO2 would be a disaster for the global climate and for life on Earth. He told management they had five years to change their business plan. Their response was simple: "Be quiet. We have trillions of dollars to bribe politicians and fund webs of lies and advertising to confuse the public for decades." This is exactly what they have done for 45 years. Hundreds of politicians have accepted large bribes to deny climate change. This criminal behavior of the fossil fuel empire, who are consciously and deliberately killing life on earth to maximize their profits, is staggering. The recent COP 27 meeting in Egypt in November 2022 is typical. There were a record number of 636 paid fossil fuel lobbyists to make sure their companies' profits remain protected. Yet we refuse to hold them responsible and bill them for the damages caused, so we are collaborators.

California has had some remarkable weather extremes this winter as the Pacific El Nina circulation has enhanced the west coast storms. Southern California had blizzard warnings for the first time with five feet of snow to the east of Los Angeles. Some towns in Los Angeles County had temperatures as low as 18oF, which were record lows. Atmospheric rivers of moisture coming in across the Pacific brought heavy rain and flooding on other occasions. San Francisco saw more rain over a two-week period than at any other time in 150 years. Some communities were washed out, powerlines were destroyed and dozens were killed. The heavy rains and heavy mountain snows may partly balance the earlier drought conditions, and may also help with moisture and reservoir supplies in spring. Time will tell.



Snowcapped San Gabriel Mountains from MacArthur Park, Los Angeles, CA after the historic snow storm of February 2023. (Adobe Stock/577249596)

With 10 feet of snow in the mountains, emergency workers scrambled to help scores of residents and tourists who were unaccustomed to the sheer amount of precipitation. Snow berms trapped people in cabins and cars in driveways, preventing them from leaving Lake Arrowhead and Big Bear Mountain. Day-tripping skiers and snowboarders from Southern California were simply unprepared, and many had insufficient supplies of food and prescription medicines. Natural gas lines were fractured, sparking five fires in two days. When firefighters arrived to extinguish the flames, they found hydrants encased in ice and feet of snow. The first week of March, Gov. Gavin Newsom declared a state of emergency in 13 counties affected by winter storms, as another 3ft of snow fell the first weekend in March and residents were trapped behind walls of snow and concerned about their dwindling supplies. Yosemite National Park, which broke a 54-year-old daily snowfall record, was closed indefinitely. As I write another atmospheric river threatens heavy rain on deep snow and more flooding.

A winter ice storm hit Texas, Oklahoma and Arkansas, from January 31 to February 2, as an Arctic cold front made its way south to meet with warm, moist air from the Gulf of Mexico. Interstates were closed as accumulating ice led to more than 100 car accidents. Many in Texas lost power as ice brought down trees and power lines.

Other thunderstorms across the southern U.S. brought tornados. In January and February there were more than 173 tornadoes affecting a remarkable list of states: Alabama, Arkansas, California, Florida, Georgia, Illinois, Iowa, Kentucky, Louisiana, North and South Carolina, Tennessee and Texas. The Houston Weather Service office declared a tornado emergency for the first time.

At the beginning of March winter weather advisories and warnings were issued for much of the Upper Midwest and Northeast. The first significant snowfall of what had been a mild winter fell overnight. Up to eight inches of snow blanketed some communities with much more in the mountains. Heavy snow fell across east central New York, western and central Massachusetts, southern New Hampshire and Vermont to western Maine. Road travel was difficult and there were many flight cancellations or delays. A second much larger snowstorm driven by a powerful Nor'easter followed on March 13-15. New York as far south as Albany and all the New England states were blanketed in heavy, wet snow ranging from one to over four feet in higher terrain.

The weather service does a great job warning the public to prepare for unusual extremes, but it may not explain the ongoing climate situation. However as the public experiences so many unprecedented events, understanding the new climate extremes is spreading. Some of the mass media commented correctly that scientists say climate change, supercharged by humanity's burning of fossil fuels, is making storms more ferocious.

This winter an exceptional number of eleven atmospheric rivers brought heavy rain and snow to California and the west coast, and storms have covered the entire country. The central issue, discussed in the first paragraph, is that our society refuses to face the truth and bill the fossil fuel empire for the widespread damage that these climate extremes have caused this winter. The fossil fuel empire has been consciously destroying life on Earth, including our children and grand-children for decades to maximize their profits. This is clearly a crime against all life on Earth, which we should not accept. It is time to simply bill the fossil empire for all the ongoing damage and death they have caused.

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

OUR MILD WINTER

– Cont'd from p.1

What will the consequences of our warm winters mean for sugaring seasons? (Flickr/Watershed Post)

hemlocks, or it might not have been long enough. Again, time will tell. That is one undoubted downside to warmer winters; the adelgid has been able to move north through Massachusetts, and into Vermont and New Hampshire, due to the absence of prolonged below-zero weather.

Warm winters can have an impact on farms and gardens by allowing insect pests to winter over in higher numbers. With a higher accumulation of warmer-than-normal days, notes Penn State Extension fruit and vegetable educator Timothy Elkner, growers can expect to see pests like allium leafminers, aphids, and thrips, emerge earlier, and reach damaging levels more quickly. This probably means more damage, as the insects will be munching on plants that are younger and more vulnerable. If this is happening in the garden and farm field, for sure it is happening in the wild. (We can hope, though, that more bugs will mean more food for birds to feed their young.)

There is some speculation that the warm winter may increase harmful algae blooms this summer, but it's important to note that spring did not actually start early. The warm winter weather was bookended by cold and snow. Therefore there will likely not be an increase in organic matter and nutrient flow. We'll have to wait and see.

Big picture; in a warm winter people use less heating fuel, which is good for the planet, and in an open winter they do less snowmobiling, also a net good until electric snowmobiles become widely used. The effect on wildlife is probably mixed. Deer had no need to yard up for most of the winter and probably fared well—but we have too many deer for ecological balance. Rodents like mice and voles lacked snowcover to hide under—bad for them, good for owls, who suffer when there is a heavy, crusted snow layer. As it was also a poor acorn year, the rodent population may take a hit, but that is all part of natural cycling.

There is a lot that we cannot know about the effects of the winter, because they are getting more wild and unpredictable than what used to be normal. We can expect them to be generally warmer, but we should not count on that. As the elder flowers and dandelions are coming out on schedule by the calendar, other new spring activity in nature has been pushed ahead, as we have seen. The times are very confusing.

And yet, there are things that we do know, and for those of us who have been working on reducing our carbon emissions, the path should be obvious. They mean a stronger effort to see that the use of fossil fuels is eliminated. We have the tools, and we know the strategies. We just have to do the work – and hope we can succeed.

Jessie Haas lives in an off-grid cabin in southern Vermont with husband Michael J. Daley. She is the author of over 40 books, most recently The Hungry Place. ♻

***Jimmy Carter** – Cont'd from p.22*

oil, but the cost in dollars and human lives has been exorbitant. However, if you're invested in fossil fuels or munitions, the past forty years have been a boom time.

Despite 40 years of continued conflict, the war in the Ukraine and the recent rise in gas prices and the resulting inflation remind us we are just as vulnerable now to international effects on our energy supply as ever. And now we know about climate change.

As I think about President Carter, I can't help but wonder what our country would be like if we had made a different choice in November 1980. It's time we gave a serious look to our energy options and commit our nation to energy independence through sustainability. It is not be too late for us to make the right choice.

Wes Golomb is a clean energy advocate and author of the recently published book and video series Warm and Cool Homes, Building a Comfy, Healthy, Net-Zero Home You'll Want to Live in Forever. ♻

President Carter dedicates solar installation at the White House in Washington, D.C. June 20, 1979. (Energy.gov)

Air Source Heat Pumps: Ensuring Promise – Avoiding Perils

By Steven Wisbaum

Contributors Kate Stephenson, HELM Construction Solutions and Jeff Forward, Forward Thinking Consultants

In buildings that are well insulated, ductless air-source heat pumps (aka "mini-splits") are becoming increasingly popular as a cost-effective and energy-saving alternative to heating systems that use oil and natural gas. And they can also be operated for both cooling and dehumidifying, often at a lower cost than conventional air conditioners and dehumidifiers.

However, while most people are aware of the importance of properly cleaning and maintaining wood stoves, dryer vents, and oil and gas boilers and furnaces, because mini-splits are relatively new, there's increased risk of improper operation and maintenance, which not only reduces efficiency, but increases the risk of expensive repairs, and the spread of mold.

Mini-splits have two main components — an outdoor compressor-condenser and an indoor air-handling unit. A conduit containing the power cable, refrigerant tubing, and a condensate drain links the outdoor and indoor units. The air handler contains an air filter, and both the air handler and the outdoor unit contain a fan and heat exchanger coils. It is important to understand that mini-splits circulate indoor air, rather than heat or cool outdoor air that's then released into the building.

Cleaning for mold prevention and optimum operational efficiency

The fans push air through the coils, which means the coils and air filters collect the dust, pollen, pet dander, cooking grease, and other debris in the air. If not cleaned regularly, this debris reduces operating efficiency, which in turn increases energy consumption and operating costs. This also increases the likelihood of premature equipment failure. This debris can also hold moisture which can then grow and spread mold spores throughout a building.

Another way mold can be a problem is when a mini-split is left idle for multiple days (i.e., it is not used for either cooling, drying, or heating), and the moisture that condenses on the coils when operated in the 'cool' or 'dry' mode does not dry out. To dry out this moisture, operating manuals contain instructions to operate the system in a way that only the fan will be running without the system doing any heating, cooling or dehumidifying.

Depending on the use conditions, the air filters typically need to be cleaned every two to four months, which is relatively easy to do, assuming the air handler is within easy reach, but trickier if a tall ladder is needed. However, cleaning the fans, coils, and drain/base pan, flushing the drain line, and cleaning the outdoor unit requires a "deep clean" by a technician using a specialized pressure washer and a wash-water collection system. This deep cleaning should also include a service inspection to check internal components and wiring for damage or loose connections, testing the thermostat and controls, and inspecting the outdoor unit for mice nests. This deep clean and inspection process can cost between $200 and $300 for a system with one or two air handlers.

Dirty coils in an air-handler can cause the formation of mold. This also reduces operation efficiency. (Fresh Air Solutions)

There are several companies in *G.E.T.'s* distribution region that offer this service, including We Clean Heat Pumps; Fresh Air Solutions, ARC Mechanical, Energy Co-op of Vermont, Heat Pump Services, Mansfield Services, and Benoure Plumbing, Heating and Air Conditioning.

Proper installation

Because these appliances are still a relatively new technology in our region, and many builders and installers are still learning "best practices," it's critical that mini-splits are installed properly to avoid preventable repair issues, minimize the risk of mold growth in the air handlers, avoid creating rodent access points into a building, and to minimize the risk of damage to the outdoor unit from mice, snow and ice. Improper installation can also impede some important deep cleaning procedures. For example, air handlers should be installed perfectly level to ensure condensation drains properly into the drain pan and the condensate drain line. The condensate line also needs to be installed so that the exit end is accessible for vacuuming out any blockages. And if "hard plumbed," there should be a clean-out to facilitate this cleaning process. The holes drilled through perimeter walls also need to be properly sealed after installation of the refrigerant and condensate lines to prevent access to rodents. If a mini-split is to be used for heating, the outdoor unit should also be installed on a pedestal to avoid being impacted by snow, or the ice that forms

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Blustery Cold Weather Heat Pump Mis-Information War?

Martin Wahl

A favorite trope of the fossil-fuel industry is that heat pumps do not work well in cold weather. Heat pump technology has improved significantly, as we will see later, and heat pumps are selling so well nationwide, including in New England, that oil and gas interests are beefing up their campaigns to promote their products and doubling down on sowing doubts about heat pumps.

New technologies have increased heat pump effectiveness and efficiency providing benefits to cold-climate residents, and they can now operate with outdoor temperatures as low as -15ºF. (tristate.coop)

So, Who's Behind This?

The Energy and Policy Institute (EPI) maintains a list of fossil fuel industry's front groups who "advocate on behalf of utility and fossil fuel interests, often by amplifying misinformation about distributed, renewable energy or electrification, while masking or obscuring the utility's involvement." The messages often emphasize the elimination of "choices" proposed by renewable energy advocates and associated increased costs. EPI also documents the membership, advertising spending, and political activities of these groups, most of which are non-profit trade-related associations that contribute to politicians opposing clean-energy efforts.

With environmentally friendly-sounding names, e.g.: Natural Allies for a Clean Energy Future, some sites purport to help consumers select heating solutions, often including heat pumps in the list, usually with a caveat about their not being able to handle cold weather and, for example, requiring a "backup heating system to supplement a heat pump system during Maine's harsh winters." Most heat pump systems come with an electric resistance heating element for just such a purpose, so a supplemental system would not be required. Heating oil blended with 2% to 20% biodiesel as Bioheat® is often promoted as an environmentally sound solution, and 2 to 20% of a low fossil-sourced carbon fuel is better than none. However, claims of around 80% reduction in greenhouse gas (GHG) emissions are misleading; studies show that biodiesel blended fuel can reduce sulfur oxide by large amounts, but not GHGs.

Another common allegation concerning heat pumps is that they are only as environmentally beneficial as the source of the electricity to power them. A 2020 study by RMI found that replacing a gas furnace with a heat pump would reduce carbon emissions in all the lower 48 states given their sources of electric power, except for Wyoming and possibly Utah. Compared to heating oil, heat pumps are always a lower GHG-emitting solution.

How Do Heat Pumps Work in Cold Weather?

Heat pumps are more energy-efficient than gas or oil space heaters because they move heat from one place (outside air) to another (inside air) instead of creating heat by burning fuel. Like a refrigerator, heat pumps use electric power to transfer heat from a cool space to a warm space, making the cool space cooler and the warm space warmer.

Commercially available heat pump technology was originally developed early in the 20th century for refrigeration and air conditioning to cool spaces down, so it is not surprising that revising the technology to heat spaces up in cold climates took some time to achieve.

New technologies have increased heat pump effectiveness and efficiency providing benefits to cold-climate residents, and they can now operate with outdoor temperatures as low as -15ºF.

The new technologies include:

- Cold climate heat pumps typically use variable speed compressors, versus on-off types, so they adjust their energy use to meet varying heating requirements.
- Newer scroll compressors are more effective and efficient than piston type compressors and have reduced maintenance requirements.
- Refrigerants in newer cold weather heat pumps also have boiling points as low as -44ºF, allowing the extraction of heat from very cold ambient air.

Just like fuel-burning heat sources, heat pumps do have to work harder in cold weather, losing efficiency because they must extract heat from colder air. Almost all heat pump systems have an electric resistance or a gas-fired backup if the system needs a boost.

Another benefit of heat pumps, of course, is that they double as air conditioners, now more in demand in northern latitudes as the planet warms.

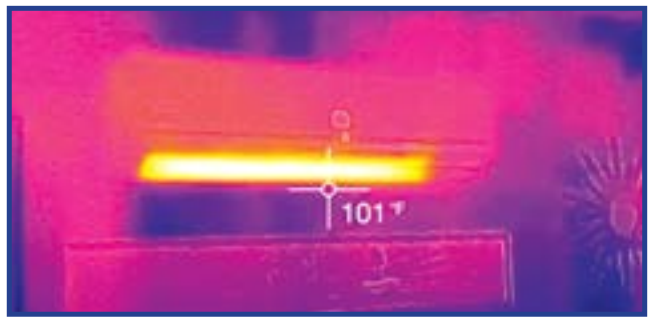
So, What to Do?

Whenever encountering a friendly-sounding source offering "facts" about fossil-fueled heating versus heat pumps, check out its background and funding to see whose interests are being promoted.

In the *Green Energy Times* readership area (ME, NH, VT, and NY) check out these sites for more helpful information:

- **New York:** NYSDA Heat Pump Program (NYS Clean Heat),
- **Vermont:** Department of Public Service Vermont Energy Saver, and Efficiency Vermont,
- **New Hampshire:** Clean Energy New Hampshire,
- **Maine:** Maine Housing Heat Pump Program.

After a career in data product management, Martin Wahl has worked in biofuels since 2006, currently with Lee Enterprises Consulting, a large bio-economy consulting group. Dividing his time between California and New Hampshire, he serves on Corte Madera, California's Climate Action Committee and is a Newfound Lake Region Association member. ♻



An entertaining YouTube thermal imaging video of a heat pump working in -27 degrees F at a home in Minneapolis can be viewed at https://www.youtube.com/watch-heat-pump. The yellow-white shows heat and blue-purple parts indicate colder surfaces. This image shows 101°Findoor heat pump output while it's -27° outside.

Biomass Boiler System at 310 Marlboro Street, Adds to Net-Zero Path for Keene, NH

Jim Van Valkenburgh

The last issue of *G.E.T.*, included an article titled, "The Path to Net-Zero in Keene, New Hampshire" about significant energy-focused renovations being done to an old factory building. The article described the new owner's long-term goals, and the multiple strategies they are using to ultimately get to net-zero. The project is called: 310 Marlboro Street and most of the renovations occurred in the summer of 2022. This article is focused on a new renewable fuel central heating system that now heats most of the old factory.

The 78,000 s.f. building consists of two main sections: a 66,000 s.f. all- masonry portion built in 1947 and a 12,000 square foot steel structure built in 1984. About 80% of the building was heated by a very large oil-fired steam boiler that they were advised was 60% larger than is actually required. This is the area that we will focus on in this article.

The 1961 vintage steam boiler had a maximum output of 2.4 million BTU per hour and consumed 19,415 gallons of oil per year (a four-year average) in a building that was only 30% occupied. Steam heat is rarely specified today, because it is not very efficient and is notoriously difficult to control: On a cold day some tenants would be too cold while others had to open their windows to cool off. The new owners knew that a new boiler system was needed!

Old buildings with solid masonry walls are difficult to insulate and 310 was no exception to this truism. Insulating on the inside would mean adding a layer of foam on all exterior walls and then refinishing them along with changes to the electrical services involved. Their tenants could not afford the downtime caused by this remodeling. Insulating on the outside would radically change the look and durability of the building's exterior and the cost of either approach was simply not in the budget. Only a few windows were replaced, but there are plans to do more. Since the flat roofs of the steam-heat sections of the building were in good shape, no new insulation will be added until roofs need to be replaced.

Above: A new high efficiency dried wood chip boiler was installed at 310 Marlboro Street in Keene, NH resulting in a 15% reduction in fuel use while the building occupancy rate went up 60%. The new boiler is a Schmid UTSK with 500 kW or 1.5 million BTUs/hour peak output. Left is the 1961 vintage steam boiler that was replaced. It had a maximum output of 2.4 million BTU per hour and consumed 19,415 gallons of oil per year. (Froling Energy)

Many new tenants have moved into 310 Marlboro Street, including a regional magnet school, a gym, two bakeries, and many small offices.

Goal #1 was to get rid of the use of fossil fuels. Goal #2 was to boost energy efficiency of the heating system. Both were accomplished by the installation of a new high efficiency dried-wood-chip boiler and a new forced hot water heating system to go along with it. The new Swiss-made boiler is a Schmid UTSK with 500 kW or 1.5 million BTU/hour peak output. This very low emissions, highly efficient boiler was the best choice for installation in an in-city building where a school and many businesses will be active.

A dry chip boiler must have a fairly large storage silo nearby. The owners of 310 decided to locate their silo in a large indoor space that had once operated as a kiln for drying wood. It was reconfigured and now holds 35 tons of precision-dried wood chips (PDCs) that are blown in through a six-inch pipe from a blower delivery truck.

The conversion from an old steam system to hot water heat distribution usually accounts for a 15% reduction in heating fuel use. Data indicates the new Schmid boiler is 10% to 15% more efficient than the old boiler. Further efficiency was added with a new room-by-room building control system that was installed to precisely manage room temperature needs to actual use. These are all significant changes that radically improved 310's energy picture.

Froling Energy predicts that the new heating fuel use for this winter for the old steam heated portion of the building will be about 233 tons of PDC dried wood chips in the new heating system, which is the equivalent of

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Why Everyone Who Cares About the Climate Should be Watching NYS

Matthew Desmarais

By the time this article is published, New York should have approved their annual budget. Tucked within it may be a major change to the building code that would prohibit all fossil fuel heating systems for residential new construction by 2025. Vermont, Massachusetts, and other New England states may not be far behind. For home builders or traditional heating contractors who are used to installing fossil fuels, switching to heat pumps may be an intimidating change. These laws, the All-Electric Building Act and NY Heat Act, both will give a huge advantage to heat pump technology and are a part of a sound climate policy that will slash carbon emissions.

First, let's start with the driving reason that heat pumps are at the center of climate policy: they produce at least 3 times less greenhouse gas emissions than the best fossil fuel sources, and their emissions can be further reduced as more renewable generation is added to the power grid. In the Northeast, geothermal heat pumps have the undisputed highest efficiency of any heating and cooling system, and that is where our focus will be today.

What makes the All-Electric Building Act a great policy? Currently, if a home is added to the natural gas pipeline, the homeowner does not pay any of the upfront costs, which could be in the tens of thousands of dollars. If they did, natural gas certainly would not be considered such a good deal. Instead, that cost is amortized over decades and paid by the collective ratepayers. Since the 2019 passage of New York's climate law, the state's gas utilities have spent $5 billion on infrastructure investments and identified $28 billion in pipeline replacement plans. That is a lot of investment in infrastructure that is already being phased out. The All-Electric Act solves this, starting with new construction and a similar bill, the NY HEAT Act redirects utilities to invest the $150 billion in neighborhood-scale building electrification over the next 20 years rather than squandering it on gas pipelines that are obsolete before they are even installed.

Heat pumps will help NY achieve the goal of prohibiting all fossil fuel heating systems for residential new construction by 2025 This double hybrid heat pump has a heating efficiency over 400%. (Energy Catalyst)

Here is a surprising fact- heat pumps can actually be better at heating than fossil fuels. For instance, Energy Catalyst's geothermal Double Hybrid can make heating hot water, domestic hot water and hot air at the same time and has more controllability than a boiler or furnace. This could be used in new construction to provide radiant floors in the bathrooms or basement while still using forced air as the primary heating and cooling. Who is going to argue with warm tile floors? For existing homes with hot water heating, the same heat pump could make hot water heat and air conditioning in the summer, and all at record efficiencies. A geothermal heat pump provides a variety of options that a boiler or furnace alone could never offer.

A question often comes up. What about extremely cold weather? A properly designed geothermal system will use the stable temperature of the earth and therefore is unaffected by air temperature changes. Earlier this year, there was a 24-hour period of weather that was between -15F to -30ºF throughout the Northeast. During this period, all our geothermal customers were warm, every heat pump was still working perfectly.

When building a new home with geothermal, it is easier than most builders think. A geothermal heat pump looks and is installed in a very similar fashion to a furnace. Instead of a single pipe coming through the basement wall to supply natural gas, a heat pump will have two water pipes that come from the outside borehole. A geothermal

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NHSAVES® PARTNERS Receive 10th ENERGY STAR® EXCELLENCE Award

NHSaves utility partners Eversource, Liberty, New Hampshire Electric Cooperative and Unitil have received the 2023 ENERGY STAR Partner of the Year—Sustained Excellence Award from the U.S. Environmental Protection Agency and the U.S. Department of Energy. Though always proud to receive such a prestigious award, this year's win is an exceptional honor for the NH utilities. It marks the tenth year in a row the partners have received the award, which is reserved for ENERGY STAR partners demonstrating outstanding leadership.

The Sustained Excellence Award is the highest honor bestowed by the ENERGY STAR program. The NHSaves utility partners are proud to be recognized for their long-term commitment to protecting the environment through energy efficiency. They are among the nation's leaders in driving value for the environment, the economy and New Hampshire.

Year after year, the NHSaves utility partners are proud to provide programs, rebates, and incentives to help make New Hampshire's homes, businesses, and towns more comfortable places to live and work, both now and in the future, and 2022 held no shortage of accomplishments for the program. In fact, in 2022, the NH utilities exceeded their savings goal of 36,143,248 lifetime kWhs and 579,809 lifetime MMBTUs.

Also, the utilities provided ENERGY STAR certification to over 760 homes in 2022, bringing their overall total to 10,900 homes since 2001. 514 homes were certified as Drive to ENERGY STAR, and ENERGY STAR certified homes were promoted to thousands of Home Show visitors and at Energy Code and ENERGY STAR Homes trainings. Perhaps most impressively, the NH ENERGY STAR Homes Program has grown from a 2% market share to 28–33% in recent years.

"The NHSaves utility partners are proud to be recognized for ten consecutive years of working toward a clean energy future," said Eversource Director of Energy Efficiency Kate Peters. "This Partner of the Year award is a testament to our work with stakeholders across NH, leading cost-effective energy efficiency initiatives and partnering with ENERGY STAR. We're proud of this accomplishment and appreciate the work of the NHSaves vendors and contractors, as well as local communities and partners throughout the state, who remain dedicated to mitigating the effects of climate change by reducing energy use."

Winners are selected from a network of thousands of ENERGY STAR partners. For a complete list of 2023 winners and more information, visit energystar.gov/award-winners. ♻

DIY Weatherization Tips: Simple Measures Save Big

Joanne Coons

Covid made us into homebodies focusing on esthetics, comfort, health and style of our habitable spaces. Some decorated and made home improvements because they had the money to do so. Others realize this is a great time to implement building efficiency to reduce our carbon use and put the brakes on climate change. (See "It's not just the thermostat" in the April 2021 issue of *Green Energy Times* at https://bit.ly/GET-thermal-comfort).

DIY weatherization training at SolarFest in Brandon, VT. This program trains local homeowners for basic installations which improve comfort and healthfulness, and to save energy. (Courtesy photo)

Comfort is more than just a feeling; comfort is an important goal in building science.

The first stop for many to building efficiency is to apply for state programs and get a home energy audit. This can be challenging (especially in New York). Navigating the process and securing an approved contractor can be daunting and take time. Most of us don't have the time or the energy to see this process through, but this does not mean that we can't do something about efficiency.

University at Albany's "Green Team" started training students in building efficiency basics and local homeowners for do-it-yourself (DIY) basic installation to improve comfort and health and to save energy. This program was modeled after Williams College's winter blitz program (see https://bit.ly/Williams-blitz). Williams College generously shares this model, which is simple and provides energy and cost savings. I was trained with the "Green Team" and brought it to SolarFest in Brandon, Vermont.

SolarFest, an organization that strives for change through education and the arts, partnered with Brandon's Energy Committee and sponsored Button Up Brandon to homeowners and multifamily building owners. This provided both knowledge and the supplies. Living in Clifton Park, NY, serving on the Town's GREEN committee, I did the same program for homeowners through grant money received through NYSERDA Clean Energy Communities and National Grid.

The program is simple and repeatable. We review the training manual with participants, set up demo stations for each task and encourage hands-on experience with each building efficiency measure for those just learning. We build their confidence by installing an insulating outlet covers, applying rope caulk, weather stripping, plastic window coverings, and more. Once the residents find out how easy these simple installations are, they are on their way to energy savings and comfort. Supplies are purchased with grant money to give trainees a kick start with the necessary building efficiency materials. The total supply cost is about $30 depending on the size of building. We also cover basic building efficiency and air sealing information, additional resources and new legislative initiatives. Feedback from homeowners included statements like, "I feel more comfortable now, and it was so easy."

The basic principle of building efficiency is that heat flows to cold. Fluid air movement moves heat the fastest, so the best way to stop heat loss (or gain in the summer) is to air seal, preventing air movement. Simple practical steps are locking all windows and dead bolting doors to air seal them. Any daylight that can be seen through a moving part (windows and doors) should be weather stripped. For non-moving parts, foam or caulk is applied for a permanent seal. Rope caulk is clay putty that can be pressed into leaky moving parts of windows that will be closed all winter. It can easily be removed when the window needs to be opened. Placing plastic window covering adds an additional air barrier to stop drafts. Outlet and switch cover plates can be removed and insulating device sealers are installed in both interior and exterior walls. Door sweeps and weather-stripping can seal the building's windows and doors. Almost anyone can do these simple home improvements. There are many excellent simple videos on YouTube that demonstrate installation of these products.

You can start on your own without waiting for a home energy audit or company. Let them do the heavy lifting with a blower door test to finish off the process of air sealing and insulation.

Recently Congress passed the Inflation Reduction Act (IRA), the government is supporting efforts to reduce carbon and put the brakes on climate change by encouraging building owners to implement building efficiencies and go electric. (With the back source of these electrons to come

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Watching NYS – Cont'd from p.27

heat pump will use approximately the same size electric breaker(s) and ductwork as a comparable central air AC unit. The Energy Catalyst heat pumps come as a kit that can be assembled in about an hour and uses the same labeling system for furnace thermostats and zone controls, so traditional contractors can easily adapt to the new system. The hardest part is the geothermal design, which does require special expertise and certifications, but some geothermal companies offer a properly sized geothermal design, boreholes, and heat pump(s) as a package so that a home builder can have access to geothermal without changing their HVAC contractor.

350 ft vertical geothermal heat exchanger being installed by Energy Catalyst. (Images courtesy of Energy Catalyst)

Above: Horizontal geothermal heat exchanger installation in progress. Energy Catalyst offers design and installation of an accompanying geothermal heat exchanger with their heat pumps.

The new laws may also bring new incentives to homeowners and businesses, which can be coupled with the funding from the implementation of the Inflation Reduction Act. In Upstate NY, a household who makes less than $112,000 may qualify for a $14,000 IRA incentive, $10,000 NYS tax credit, $4,500-$9,000 heat pump rebate and 30% Federal Investment Tax credit on the remaining cost. If your boiler or furnace barely made it through the last winter, there may not be a better time to switch to geothermal!

Matthew Desmarais is the founder of Energy Catalyst Technologies. ♻

310 Marlboro St., Keene, NH

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about 21,809 gallons of #2 fuel oil. Wait a minute—that's 2,394 gallons more than the prior year's oil use!

Yes, that is true, but today the building is 90% occupied. In the past it was less than 30% occupied. That means nearly 40,000 square feet of the steam portions of the building were only minimally heated and now they are fully heated to 70°F. With all of these changes considered, it looks like the building will only use 12% more fuel than in the past years.

However, the real cost of heating is a far more significant change—and for the better. Imagine if they had to pay over $4.50 a gallon for oil this past winter!

233 tons of dried wood chips is the equivalent of 21,810 gallons of oil. At $4.50 a gallon, that would cost $98,145. At $3.50/gallon, the cost is $76,335. At $2.50/gallon, it is $54,525.

If the prediction of 233 tons of PDC dried wood chips is accurate for a 90% occupied building, they will have a cost of $33,785. In New Hampshire these will generate at least $11,185 in NH Class 1 Thermal REC income which results in a net annual cost of heat of $22,600. That is the same as buying oil at $1.04/gallon (or $1.55/gallon in Vermont without T-RECs)!

So far, the remodeling and reuse of the building at 310 Marlboro Street has been a big success. Next, the owners plan to add 57 housing units to the property in new structures which will have their hot water supplied by the dry chip boiler system.

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

Using New Home Energy Rebates to Lower Utility Costs in All States

Lowell Ungar, Director of Federal Policy at ACEEE

Later this year, households across the country will begin tapping nearly $9 billion in new federal Home Energy Rebates to make energy-saving and electrification improvements. Low-income residents particularly stand to benefit from the lower utility bills. But states—charged with administering the rebate programs—need to ensure that low-income households can take advantage of the funding.

Congress created a broad structure for the rebates as part of the Inflation Reduction Act last year (along with providing other home efficiency funding), and the Department of Energy (DOE) is now preparing further guidance for state energy offices. If the rebates successfully support improvements in affordable housing, they could—aligned with the goals of the R2E2 initiative, which we co-lead "lower utility bills, reduce greenhouse gas emissions, improve residents' health, create good-paying local jobs, and help mitigate racial inequity."

Here are five steps the department can recommend and that states can take as they design their programs:

Set aside funds for affordable housing: Congress intended to focus the rebates especially for affordable housing by significantly increasing the benefits for households earning under 80% of the local area median income (which is, on average, income under about $72,000 for a family of four). Such households can potentially cover the full cost of electrification investments with rebates and receive double the incentive of other households for whole-home efficiency rebates. However, there is a risk that higher-income owners of single-family homes could use up the funds before apartment building owners can develop more complex projects and before states and others can conduct effective outreach encouraging low-income homeowners to use them. States should dedicate funding for these low-income households and should provide longer-term commitments and progress payments to individual large projects.

Ease income verification: One of the rebate requirements that worries states and other likely program implementers most is verifying household incomes. This must be made easy, and no one approach will work for all households, but it should not be the responsibility of building contractors. Homeowners, at least in low-income neighborhoods, should be able simply to attest that they are under the income caps, subject to audits and penalties if the attestation is false. Households that qualify for other income-limited programs, like energy or food assistance, should also automatically qualify for the rebates. But for some households there may need to be a way to submit tax returns or pay stubs, or ideally link to IRS data, as other income-qualified programs do today. New Jersey utilities have successfully used a similar multipronged approach for determining eligibility for low-income programs.

Apartment buildings with resident income limits for federal or local assistance programs also should automatically qualify. But owners of "naturally occurring" affordable rental housing will have no way to know the incomes of their tenants; they should be able to qualify if the rents are affordable to low-income households. California adopts similar options for its Low-Income Weatherization Program.

Protect low-income renters: Landlords should not be able to take money that is intended to benefit lower-income households, improve the apartments, and then jack up rents, forcing the low-income tenants out. But if rent restrictions feel onerous, owners simply won't use the rebates, and the buildings that most need improvements will continue to waste energy. We suggest tying the affordability requirements to the way owners qualified for the program. As in the California program, if a building qualified because the apartments have income limits, those limits should continue, and if they qualified because of low rents, then rents should continue to be affordable. The length of time for the requirements could be calibrated to the amount of funds.

Ensure residents get lower energy bills: In some colder regions, switching inefficient homes from natural gas furnaces or boilers to heat pumps could result in higher total energy bills. States should seek to avoid this by pairing electrification with better insulation, air sealing, and other efficiency measures that reduce energy use and spending regardless of fuel source. Whole-home retrofits are designed to combine different kinds of measures. But the electrification rebates also include rebates for insulation and air sealing, or they can be paired with other incentives.

States should also consider leveraging additional energy assistance funding to ensure—through additional efficiency measures if possible—that no low-income household that shifts to electric heat pays more than 6% of its income on electricity. Virginia is preparing to implement its Percentage of Income Payment Program to provide a similar kind of protection for low-income households.

Embed efficiency upgrades in other home improvements: Even $9 billion will only reach a small fraction of homes. To have a lasting impact, the rebate programs should help make energy efficiency a regular part of the home improvement market. Owners of affordable multifamily buildings have a key opportunity during project refinancing and capital needs assessments that typically are done after a decade or two. The state energy offices should work with state housing finance agencies to incorporate the energy upgrades and rebates (perhaps in the form of loans rather than grants to be compatible with the Low-Income Housing Tax Credit) into the broader projects. For single-family homes, the time of purchase, refinancing, and other home renovation projects all should incorporate energy upgrades. And states should coordinate the rebates with existing utility and state efficiency programs, which should continue after federal funds are gone.

To help make efficiency upgrades common practice, states should also reinforce the rebates with complementary policies. For example, widespread energy ratings and other consumer information on home efficiency, such as required heating bill disclosure to prospective renters in Chicago, IL, and energy scores in homes for sale in Portland, OR, and Minneapolis, MN, can build owner interest. And building energy and climate performance standards for multifamily buildings ensure all are efficient.

The DOE and the states have many decisions ahead. But by paying attention to the needs of affordable housing, they can make millions of affordable housing units throughout the country more efficient, lower cost, healthier, and better for the climate.

Additional discussion of these topics can be found in ACEEE comments and joint comments led by National Housing Trust, both submitted in response to a DOE Request for Information to inform its upcoming guidance for states. ♻

Does it pay to insulate your home to decrease your energy loses and utility bills? (My Next Move)

The Vermont Efficiency Excellence Network's(EEN)

Best of the Best Awards

Efficiency Vermont

During April's Better Buildings by Design conference, two businesses were recognized for Efficiency Vermont's Best of the Best (BOB) awards from the Efficiency Excellence Network (EEN). Vermont Foam Insulation was recognized as the EEN Partner of the Year. Al Jeffers and Sons Heating and Cooling was recognized with EEN's Leadership Award.

The EEN Partner of the Year Award recognizes a firm or individual in the Efficiency Excellence Network that has demonstrated commitment as an Efficiency Vermont partner. Congratulations to Vermont Foam Insulation, this year's award winner.

When it comes to the Home Performance with Energy Star (HPwES) program, Vermont Foam Insulation (VFI) is one of Efficiency Vermont's most supportive contributors. More than just "thought partners" on program design and market needs, VFI is a loyal and valuable partner dating back to the program's very inception. The organization consistently champions Efficiency Vermont to VFI customers, driving increased HPwES awareness and participation.

As reported in *Analyzing Energy*, year-over-year, VFI is one of the largest-volume producers of projects reported in the HPwES program. Learn more at www.vermontfoaminsulation.com.

The EEN Leadership Award recognizes a firm or individual in the Efficiency Excellence Network who has demonstrated innovation, influence, and commitment to the energy efficiency industry. Congratulations to Al Jeffers and Sons Heating and Cooling, this year's award winner.

Tim Jeffers is a leader by example and by practice for the approach he takes to his trade and for the projects his company produces. Jeffers and Sons installs a lot of heat pumps. But they only install heat pumps when it is the right equipment for the application – and when the proper steps have been taken to evaluate the application and design the system. His company focus is on quality outcomes, not quantity.

Jeffers approaches his work with sound, old-school HVAC principles and methods as a foundation, while keeping up with, and making use of, the most modern, state-of-the-art heat pump and mechanical equipment on the market. Tim was a very early adopter of air-to-water heat pump technology and is a huge proponent of the equipment, regularly specifying and installing it on any job where he sees it will make sense. He is an expert in hydronic design and installations.

Jeffers has also been installing geothermal heat pump systems since the 1990s. He understands the process and equipment, always finding the best, most practical system match for the building and site conditions. His ability to see all the applications for heat pump equipment (ductless, ducted, air-to-water, geothermal) makes him uniquely able to findthe best solution for any project.

Learn more at www. jeffersheatingandcooling.com. ♻

During the BBD conference on April 5, Steve Spatz, Efficiency Vermont's account manager (left), presents Will Reed, Vermont Foam Insulation's general manager with the EEN partner of the year award. (Homer Horowitz Photography)

During the BBD conference on April 5, Steve Spatz, Efficiency Vermont's account manager (left), presents Tim Jeffers, president of Al Jeffers and Sons Heating and Cooling with the EEN leadership award. (Homer Horowitz Photography)

Fertilizers Are Greenhouse Gas Emitters, but Their Impact Can Be Cut

Olivia Rosane

When we think of greenhouse gas emissions, we typically think of coal-burning power plants, vehicle exhaust or maybe forests being cleared to make way for methane-belching cows.

However, there is another important agricultural source of climate pollution: nitrogen-based fertilizers. A new study from University of Cambridge-based researchers has calculated these fertilizers' total contribution to the climate crisis for the first time, but also revealed how that contribution could be reduced to around a fifth of current levels by 2050.

Organic and synthetic fertilizers pollute more than global shipping and aviation combined, around 2.6 gigatonnes of carbon each year. (Bill Meir/Flickr)

"Our work gives us a good idea of what's technically possible, what's big, and where interventions would be meaningful — it's important that we aim interventions at what matters the most, in order to make fast and meaningful progress in reducing emissions," said study co-author Dr. André Cabrera Serrenho from Cambridge's Department of Engineering said in a press release. Nitrogen fertilizers can be either organic — coming largely from plant or animal waste — or synthetically made using chemical processes, according to Carbon Brief. Both have been important for boosting food production worldwide. Environmental scientist professor Vaclav Smil called them "the most important invention of the 20th century."

However, they are causing environmental problems in the 21st. When they are sprayed onto a field of crops, they can acidify the soil, run off into nearby waterways and feed deadly algal blooms or interact with soil microbes to form nitrous oxide (N2O), which is a greenhouse gas almost 300 times as potent as carbon dioxide.

Their production also burns emissions and, together with plastics, synthetic fertilizers make up as much as 74% of the products of the petrochemical industry, according to the press release. Despite this, a full life cycle assessment of fertilizer emissions had not been conducted before the new research published in Nature Food Thursday. What the study found was that nitrogen fertilizers contribute around five % of global greenhouse gas emissions. Organic and synthetic fertilizers emit more than global shipping and aviation put together at around 2.6 gigatons of carbon each year, according to the press release.

The researchers further discovered that around two-thirds of these emissions occurred after the fertilizers had been spread over crops.

"It was surprising that this was the major source of emissions," Serrenho said in the press release. "But only after quantifying all emissions, at every point of the lifecycle, can we then start looking at different mitigation methods to reduce emissions without a loss of productivity."

The researchers assessed what would happen if various already-available methods to reduce fertilizer emissions were put in place. For example, fertilizer production could be powered with renewable or nuclear energy. Nitrification inhibitors could also be added to block the formation of nitrous oxide. However, the most important intervention would be to prevent fertilizers from being over-applied.

"Increasing nitrogen-use efficiency is the single most effective strategy to reduce emissions," the study authors wrote in their abstract.

Currently, only 42% of the nitrogen applied to a field is actually absorbed by the crops, Carbon Brief explained. If that were increased to 67%, demand for fertilizers could fall by 48% by 2050. If farmers worldwide applied all of the strategies outlined in the report, nitrogen emissions could fall by 84%.

Professor Mark Sutton, an environmental physicist at the UK Centre for Ecology and Hydrology, applauded the study for showing a way forward. He also said it came at an opportune time, because the participants at the COP15 biodiversity summit in Montreal in December of 2022 agreed to cut nutrient loss in half by 2030.

"I think what is really new [in the study] is this very high level of saying 'we can do it,' and that's why it's a challenge to the community, for people who say we can't go quite as far as this," he told Carbon Brief. "I've not seen the whole set of emissions from all sources combined showing that level of ambition."

Olivia Rosane is a freelance writer and reporter with a decade's experience. She has been contributing to EcoWatch daily since 2018 and has also covered environmental themes for Treehugger, The Trouble, YES! Magazine and Real Life. *She holds a Ph.D. in English literature from the University of Cambridge and a master's in art and politics from Goldsmiths, University of London.*

Reprinted with permission from the February 10, 2023 EcoWatch blog at https://bit.ly/ecowatch-fertilizer-greenhouse-gas-emissions. ♻

DIY Weatherization Tips

Cont'd from p. 30

from renewable energy). This is the first step to a fossil-fuel free future. We are in transition and change can be difficult, but the IRA provides some encouragement (Approximately $14,000 per house hold, see https://bit.ly/IRA-calculator. An electric service panel can also be upgraded to accept an EV home charging station. The IRA will provide up to $4000 for such an upgrade.)

Our training sessions are fun, we meet the nicest people, and, we hope, they pass their knowledge and enthusiasm on to friends. Don't wait! Buddy-up with a friend and DIY, start small and save big.

Joanne Coons is an adjunct professor at Hudson Valley Community College, TEC-SMART facility teaching photovoltaic theory and design, maintenance and installation. She is an active member for SolarFest in Brandon VT, advocates for sustainability, building science and is a member of the Town of Clifton Park's GREEN (Government Re-Thinking Energy & Environment Now) and is a NY-GEO advisory board member. Prior to her current endeavors, she taught high school biology, earth science and environmental science for 28 years. Her husband Paul is the silent partner but the brains and brawn of the team. ♻

ASHP: Avoiding Perils

Cont'd from p. 24

from condensation dripping off the coils. A pedestal also reduces the potential for access by mice, and for leaves and other debris being pulled in by the fan. A roof or cover may also be needed to protect the outdoor unit from falling icicles and snow dumps.

Protecting outdoor units from mice damage

Preventative strategies should be employed to help reduce the likelihood for expensive repairs due to mice nesting in the outdoor compressor/condenser and damaging its wiring and circuitry. These strategies include placing the unit on a pedestal, using steel wool to fill any access points in the protective metal casing, such as cut-outs for extra refrigerant lines (but NOT anywhere close to the circuit board), inspecting the interior of the unit during the yearly maintenance check, and if needed, using a rodent deterrent product.

Considering the need for a back-up heating source

Although cold climate heat pumps are designed to produce heat in cold temperatures, their efficiency decreases as the temperature decreases. Some newer models can generate heat at temperatures of -200 F and contain an internal back-up heating element, but this is not always the case. Therefore, proper consideration should be given for the installation of a back-up heating source to ensure occupant safety and protect plumbing infrastructure for deep freeze events, and when a mini-split becomes temporarily inoperable.

To summarize, installing air source heat pumps in buildings that are properly weatherized/insulated is critical to reduce greenhouse gas emissions associated with fossil-fueled heating systems, and to save consumers money. However, to ensure these goals are achieved, and to avoid the serious health problems associated with mold, these systems need to be properly installed, maintained and cleaned. Proper consideration should be given for the need for, and type of back-up heating source to install.

Steven Wisbaum has been advocating for and working to reduce fossil fuel use for almost fifty years. In 2016, he founded the Mow Electric! *Campaign (www.mowelectric.org) to advocate for and support the transition to electric lawn equipment within both the private and public sectors.* ♻

Elmore Roots' Permaculture Know-How

Keeping Local Pollinators Around

David Fried

A flower's main job is to attract pollinators. There are millions of flowers on native American plum trees and wildlife apple seedlings each spring. This gets the bees and wasps and moths and butterflies and so many others out each spring and early summer and keeps them busy and well-nourished. They come back to their nests with the nectar from the blossoms, and the trees get cross-pollinated so they will make a lot of fruit and feed the wildlife and the people fortunate enough to know a good thing.

Courtesy photo of this beautiful peacock: Joyce Dutka.

Even though the black walnut is mostly wind-pollinated, it is a host plant for over 100 species of butterflies and moths including the Luna moth, regal moth, imperial moth, walnut sphinx moth, walnut caloptilia, pecan leafminer moth, monkey slug moth, and more! The walnut it produces is edible and very tasty. Wildlife like flying squirrels will enjoy the delicious nut. Red squirrels may appear to become flying squirrels when the nuts are ready to harvest. The high concentration of fatty acids in the walnut makes it an excellent fall food to gear up for winter.

The reason a flower is so attractive is so that it will be beautiful and tasty to the flying creatures who fly from flower to flower. The male peacock and the male cardinal are two birds that are so stunningly beautiful they attract the female who will "pollinate" with it and keep their local bird population strong and energized. If you were a female grayish bluebird, wouldn't you want to hang out around a male buffed- up- blue eastern blue bird?

Fruit has a range of colors that call attention to them, so they will be eaten and their seeds will be spread far and wide. A persimmon is bright orange, a quince bright yellow, grapes light green or dark purple, and we all know the spectrum of colors in apples. Before a fruit is ripe and ready to make more of itself through its seeds, it is usually a dull green or tan. Only when mature does it have the ability to pass on its splendor to the next generation- it finally turn its full color!

There is a line in a Grateful Dead song that says, "Don't shake the tree if the fruit ain't ripe." One of the pleasures of living in Vermont and having a backyard fruit grove is that we get to taste our fruit when it is actually ready to be eaten. It has developed its full color, its full fragrance and its best flavor. If we had to ship it across the country or had to store it for months on end, we would have to harvest the fruit before it was ripe. But it would be removing the essence of why fruit ripens and colors up- so it can live on for many generations through its seedlings. Each seedling will have new characteristics never before seen in its parents. Some will be hardier, tastier, more disease resistant. Some will be yellow, red, striped, russet. Some will be small and hard. A few may be spectacular new examples of how the world keeps working to get better, behind the scenes and up in the treetops.

Keep planting. Keep the vision of a beautiful world in harmony alive in everything you do. The pollinators will thank you. The wildlife will be grateful. And your grandchildren or the kid next door may even think of you as a local hero and be inspired to plant more native flowering trees and shrubs like you did.

David Fried is a writer and propagator of hardy native trees and shrubs at Elmore Roots Nursery in northern Vermont. ♻

Team *G.E.T.* Saves the Planet

Cont'd from p. 2

Everything had built in switches which were kept off when not in use. The soft-start well pump went to an over-sized pressure tank so it would come on less often. Rain water collection fed the gardens.

Being frugal with energy does not mean giving all that much up. She used a typical Energy Star Amana refrigerator with ice-maker and up to two Energy Star freezers were needed because she grew about 90% of her own food, which she froze and canned or stored in a root cellar. The permaculture landscaping included fruit and nut trees, including blueberries, to hazel nuts, apples, pears, cherries, raspberries, peaches, currents, hardy kiwis and more.

After finding that people were amazed to see how off-grid living could work, in 2009 it was time to share the successful lifestyle experiences with more interested people to give everyone access to the information needed to do it themselves. *Green Energy Times* was born and has grown way faster and further than ever anticipated.

While Mallery currently drives a Prius Hybrid, her next vehicle will be an all-electric small pickup truck which she hopes will be in the near future.

Recently, she sold her homestead in Vermont to be near her family in New York state. Interestingly, the solar system that had served her so well was still operating pretty much the way they did when it was installed. Her new property will go beyond her Vermont low-carbon lifestyle. The new place has a pond-loop geothermal system in place for heating and cooling and swimming, along with solar, organic gardens, apple orchards and is a cross country skier's paradise of trails that will also accommodate hiking, foraging, sugaring and more. Mallery plans to re-create another sustainable lifestyle to meet the future with no fossil fuels. ♻

RESOURCES

350-Vermont: General group that coordinates a variety of statewide actions. **www.350vermont.org**

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

American Solar Energy Society (ASES): www.ases.org

Backwoods Solar: Specialty: solar, off-grid - **www.backwoodssolar.com**

Carbon Tax: carbontax.org

Clean Energy NH: www.cleanenergynh.org/

CO2.Earth: See emissions harms, scientific advice, and pathways to follow. www.co2.earth

Consumer Guide to Home Energy Savings, Heating, Appliances, Refrigerator Guide, Building Envelope, Driving: http://aceee.org/consumer

Dept. Public Svc. (CEDF): publicservice.VT.gov/energy/ee_cleanenergyfund.html

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

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

Energy Efficiency & Renewable Energy Clearinghouse (EREC): eetd.lbl.gov

Energy Guide: Unbiased advice about today's energy choices. Find ways to save, lower your bills & help the earth's environment - **www.energyguide.com**

Energy Star Federal Tax Credits: www.energystar.gov/about/federal_tax_credits.

Federal Energy Regulatory Commission (FERC): www.ferc.gov

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 lot of great information! - **hes.lbl.gov**

IREC/ Interstate Renewable Energy Council: RE educational info. **www.irecusa.org**

NABCEP/ North American Board of Certified Energy Practitioners: This organization that tests & certifies PV system installers. Individuals are Certified, companies are not. **www.nabcep.org**

NESEA/ Northeast Sustainable Energy Assoc.: www.nesea.org

National Association of Energy Service Co. (NAESCO): www.naesco.org

National Renewable Energy Laboratory (NREL): www.nrel.gov

NeighborWorks® Alliance of Vermont: Low-cost energy loans - **www.vthomeownership.org**

New York Solar Energy Industries Association/NYSEIA www.nyseia.org

New York Solar Energy Society (NYSES): www. nyses.org

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

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

Renewable Energy World: www.renewableenergyworld.com

Renewable Energy Vermont: www.revermont.org

SEIA/ Solar Energy Industries Association: The SEIA Tax Manual to answer your solar related tax questions. **www.seia.org**

SmartPower: www.smartpower.org

Solar Components: www.solar-components.com

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

Solar 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.vpirg.org/cleanenergyguide**

VT Energy Investment Corporation (VEIC): nonprofit organization that issues home energy ratings for new & existing homes. 800-639-6069 - **www.veic.org**

Vermont Passive House: www.vermontpassivehouse.org/Resources/

Weatherization, Energy Star & Refrigerator Guide: www.waptac.org

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WORDS OF LIFE FOR THE HEALTH OF SOUL AND BODY
Based on an earlier publication: "Cause and Development of All Illness." What effect does our destructive behavior have on nature, on the animals, and not least, on our own health? www.gabriele-publishing-house.com (also on Amazon.com and Alibris!) Toll-Free 844-576-0937).

BOOKS: 'A ZERO WASTE LIFE'

A practical guide to improving your life and your impact on the world in just one month by radically reducing waste while improving lifestyle. Incorporating thirty simple rules one day at a time, this manageable guide helps you form a more conscientious, intentional life. Stop wasting and start living. (apollopublishers.com)
* *Please read* Zero Waste Life *book review on p. 20.**

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Larry Plesent

Ingredient of the Month

Wellness is Balance

Wellness is about balance. Work and play. Action and rest. Tension and relaxation. To and fro goes the way.

Eating and exercise fads come and go with the decades. Eggs were out. Now they're a superfood. Saturated fats supposedly made us sick and led to an early death. Now they are once again considered essential nutrients. We were told not to eat beef. Now its OK. Nobody likes to be made the fool. What is real? What is BS? Here is my take on it.

Our ancestors ate the planet. Anything that walked, crawled, swam or reproduces was fair game. Leaves, roots, bark, fruit and seeds, fungi, insects and their larvae, slugs, bugs and animals large and small were consumed. Each had a season and a time for harvest. Presumably even cannibalism was ritually condoned at some time in nearly every culture on the planet.

Our ancestors were not typically wanderers eternally moving on to new pastures. They were more likely to make seasonal camps to vary their diet and to let the land recover from their presence on it. They often brought back fruits and berries to share with their loved ones. There they would be, your ancestors and mine, swinging in their hammocks in the shade. Eating fruit and berries and spitting out the sides. Soon food plants appear as if by magic right where they live and eat and hang out.

At the same time, poisonous plants, anything with thorns or prickers were dug up and moved to the perimeter to form a dense fence of thickets and poisonous plants. The tribe knew the way through. Invaders did not.

More than just opportunivore's, our hunter, gatherer, wild cultivating ancestors ate and altered the world. They obtained the nutrition they needed through variety and seasonality.

How different this is from the easy calorie diet most of us enjoy today! Beef, pork or chicken? An occasional meal of fish or shellfish? Corn, wheat, rice or barley (beer)? How many varieties of vegetables and fungi do you eat in a year? A dozen? Half a dozen? How much of your family's diet is little more than sugars, colors, flavors and preservatives in liquid, solid and gelled mediums?

Stay healthy by eating a variety of foods. (Australian Nutrition Foundation)

These questions inevitably lead us to conclude that whatever diet of our ancestors had at any given time, eating petrochemicals was not a normal part of the program. After eating from the earth for millions of years we now eat from our oil wells and coal slag piles. Fake colors, fake scents and flavors (they are basically the same thing), herbicides and pesticides and off-gassing hormone mimicking plastic. Will this mad rush to live in an artificial and virtual world ever end?

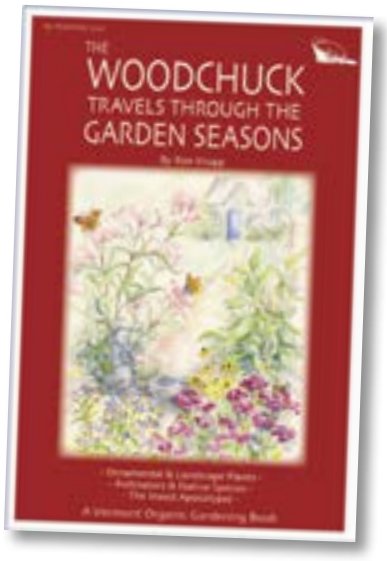
We did not descend from mono diet ancestors. We descended from people that ate a diet that varied daily, weekly, and seasonally. We would be wiser and healthier if we were to move closer to our roots and ate a wider range of animal, vegetable, fungal and insect foodstuffs (there are over 500 species of edible insects in Africa alone), all fresh and in season. OK, so maybe we could go easy on the insects.

Larry Plesent is a writer and a mostly retired natural-products formulator living and working in the Green Mountains of Vermont. ♻

The Woodchuck Travels Through the Garden Seasons

By Ron Krupp, Onion River Press, 2021, 186 pages, $20

Book review by N. R. Mallery



If you are a gardener in Vermont, you have likely heard of or read at least one of the Woodchuck Gardening books. The author, Ron Krupp has years of experience with gardening which started in Kentucky and his many years in Vermont. Krupp was a commentator on *VPR* for twenty years and also published *The Green Mountain Farmer* newspaper during that time period.

The latest edition of this book was in 2022 and holds exceptional information that gardeners everywhere in the northeast will learn from and be able to use. Krupp is a storyteller as well as a master gardener.

The inclusion of climate change notes and concerns about global warming make it especially valuable as we deal with many issues including pests and how to control them, composting and attracting pollinators. For instance, the introduction notes the impacts from extreme heat on birds, stating "Birds are telling us in the clearest way possible that we must act urgently to address climate change." He points out that "fossil fuel usage is driving this climate chaos and that we need to cut off the money to Big Oil, who knew the dangers of climate change for decades and chose not to act, valuing profits over the future of life on Earth." Page ten discusses the U.S. Climate Report for 2020-2021 for Vermont.

The book is a seasonal journal which travels back to 2013 continuing through to 2021. It has a clear focus on flowers and native plants portraying his passion for environmentally safe gardening practices. The "Fall Garden Chores" section has a thorough description about soil, composting and its many benefits and how he creates the compost for his own gardening needs.

Medicinal healing plants are included with detailed information on them, interspersed throughout the book. I found the need to dog-page so many of these tips that I plan to refer to in my own gardening adventures. There are tips for native plants that support wildlife, examples of native plants, what to do about the heat and heavy rains or lack of, weeds and invasive, insects, watering, rain barrels, toxicity in hoses, and much more. You should read the book. It is one you will keep as a reference book for each season.

I personally enjoyed the pictures and mention of the Newfoundland dog, Herk, because I am also a Newfie enthusiast, having one sitting right next to me as I write this review.

A copy of the book can be ordered by contacting Ron Krupp at woodchuck37@hotmail.com or 802-658-9974.

N. R. Mallery is the editor of G.E.T. ♻

Tick Season 2023 is Here!

Nancy Rae Mallery


Photo courtesy of California Department of Public Health

Ticks are small blood-sucking parasites that are commonly found in the northeastern United States. They can carry and transmit diseases such as Lyme disease, Rocky Mountain spotted fever, and Anaplasmosis, making it important for people to take steps to protect themselves from tick bites.

There are several factors that can affect the tick population in the Northeast. The most important of these is temperature, as ticks are highly sensitive to changes in weather patterns. Warmer temperatures can increase the tick population, while cooler temperatures can reduce it. Additionally, the presence of host species, such as deer and small mammals, can also affect the tick population, as these species provide food for the ticks. Finally, precipitation levels can also play a role, as dry conditions can reduce the number of ticks, while wet conditions can increase it.

To protect yourself and your pets from ticks, it is important to take several precautions. First, when spending time outdoors, especially in wooded or grassy areas, it is important to wear long pants and sleeves, and to use alternative insect repellents like lemon eucalyptus oil or permethrin-treated clothing. Also, it is important to regularly check yourself and your pets for ticks, and to remove any ticks you find as soon as possible. Mainejane's Tacklers can also be used as a preventative measure against tick bites.

There are also new tools and technologies that have been developed to help protect against tick bites. For example, tick-repellent clothing and gear can be treated with insecticides to provide long-lasting protection. There are also new types of tick collars for pets that contain insecticides, and there are even some tick-repellent sprays that can be applied directly to skin. (Read the directions about any precautions to protect yourself from the insecticides when petting your furry friends).

It is also a good idea to keep your yard tick-free by removing tall grass and weeds, and by keeping your lawn mowed, (hopefully with an electric mower). You can also use tick tubes, which are small cardboard tubes filled with treated cotton that can be placed around the yard to kill ticks before they reach you or your pets.

Nancy Rae Mallery is the editor of G.E.T. ♻

Switching to the E-lawn Care Solution is Easier and is more important than ever

Steven Wisbaum

While the annoying wail of conventional lawn mowers has long been associated with summer, that sound is thankfully becoming a lot less common with the growing popularity of battery electric lawn equipment.

There are a lot of reasons why so many people are switching to e-lawn equipment. For starters, due to advancements in lithium-ion battery technology, there's now over 25 manufacturers, including at least nine offering residential riding mowers.

Author on a commercial battery-powered, zero-turn riding mower. (Courtesy photo)

And in Vermont, all the electric utilities offer rebates, which makes e-lawn equipment (purchased or picked-up in Vermont) even more affordable.

Operating cost savings and convenience is also a huge motivating factor. E-lawn equipment eliminates the need to buy, transport, and handle gasoline, doesn't require oil changes and tune-ups, and will typically run for decades without needing any repairs. And without any oil or gas to spill out, most walk-behind e-mowers are designed to stand upright for easy storage. Equally important, e-lawn equipment is quiet and emission-free.

With ever-mounting evidence of the existential impacts of human-caused climate change, many people are trying to shrink their personal carbon footprint, either by driving electric cars, weatherizing their homes, flying less, installing solar PV systems and air and ground source heat pumps, and switching to e-lawn equipment.

While a single residential conventional mower or "chore tool" does not burn nearly as much fuel as a car or home furnace, the collective impact of all this lawn equipment is huge. In fact, a recent DOT- Federal Highway Administration analysis (https://bit.ly/USDOT_GasolineUseage) estimated that in Vermont alone, over five million gallons of gasoline are burned annually by lawn care equipment, which generates over 5,000 tons of CO2. And this does not even include the millions of gallons of diesel fuel consumed by diesel-powered lawn mowers operated by contractors, local and state public works departments, golf courses, and schools. schools, colleges, and universities.

Cordless and rechargeable rotary lawn mower, in mulch mode, removable battery located above rear wheels. (Wikipedia)

So, if your gas-powered lawn equipment is at or nearing retirement, and you are considering making the switch, here are some things to keep in mind.

How to choose: Since there are lots of manufacturers and quality is relatively consistent, choice will largely depend on the different features available. Ask your friends and neighbors about their equipment and try it out. The Mow Electric website has links to some of the popular video product reviews and websites.

Stick with one manufacturer: If you are buying multiple items (e.g., mower and chore tools), stick with one manufacturer since batteries and chargers are not interchangeable among all manufacturers.

Battery capacity and run-time: For larger yards, it is a good idea to buy the higher capacity and longer-run-time battery options.

Buy local: Last, while e-lawn equipment can be purchased on-line and at big-box stores, most hardware, building supply, and lawn equipment stores now sell e-lawn equipment.

Steven Wisbaum is the founder of the Mow Electric! campaign and website that contains a list of available equipment, links to equipment reviews and comparison videos, a directory for contractors in Vermont offering e-mowing services and links to utility rebates. Learn much more at www.mowelectric.org. ♻