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Three Greenhouse Gases Reached Record Highs Last Year

Cristen Hemingway Jaynes, EcoWatch



A coal-fired power station silhouetted at sunset, Pocerady, Czech Republic. (AdobeStock_192828957)

Levels of the three most important greenhouse gases — methane, carbon dioxide and nitrous oxide — in the atmosphere reached record highs again in 2023, according to research conducted by scientists with the National Oceanic and Atmospheric Administration (NOAA)'s Global Monitoring Laboratory (GML).

Air samples taken by GML indicated that levels of the heat-trapping gases did not rise as fast as the record leaps of recent years, but were still in accordance with sharp increases recorded in the past decade, a press release from NOAA said.

"NOAA's long-term air sampling program is essential for tracking causes of climate change and for supporting the U.S. efforts to establish an integrated national greenhouse gas measuring, monitoring and information system," said Vanda Grubišić, GML's director, in the press release. "As these numbers show, we still have a lot of work to do to make meaningful progress in reducing the amount of greenhouse gases accumulating in the atmosphere."

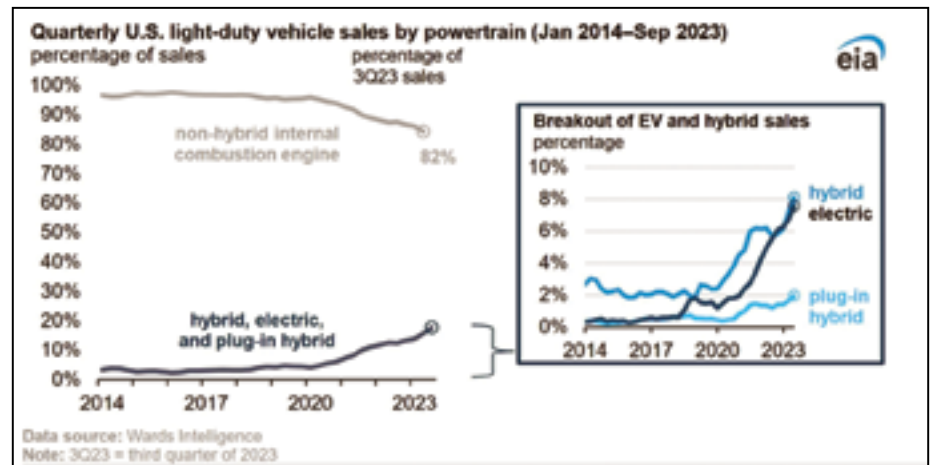
Earth's average surface carbon dioxide concentration for all of

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Gas-powered Cars are Losing Market Share to EVs and Hybrids

Dan McCarthy

Electric vehicle sales hit record heights last year. Sales of hybrids also soared. The trend is eating away at the market share of conventional cars.



CanaryMedia_CarMarketShare

It's been a messy few months for the U.S. electric vehicle market, but take a step back and the trend is crystal clear: conventional gas-burning vehicles are on their way out.

Last year, internal-combustion vehicles accounted for 84 percent of total passenger vehicle sales in the U.S. — their lowest-ever share of sales. Meanwhile, sales of fully electric vehicles and hybrids are rising to new heights.

Conventional gas-powered cars still dominate the U.S. market for now, but the downward trend is a major shift nonetheless.

The change is driven in part by a surge in sales for hybrid vehicles with a gas-powered engine and an onboard battery but no plug, which together with plug-in hybrids made up nearly 10 percent of new car sales last year, according to the U.S. Energy Information Administration. But although hybrids burn less gas than a conventional car, they don't offer a pathway to eliminating carbon pollution from vehicles.

Battery-electric vehicles, on the other hand, do. And it's good news that sales of 100 percent electric vehicles are also on a tear. Last year, despite

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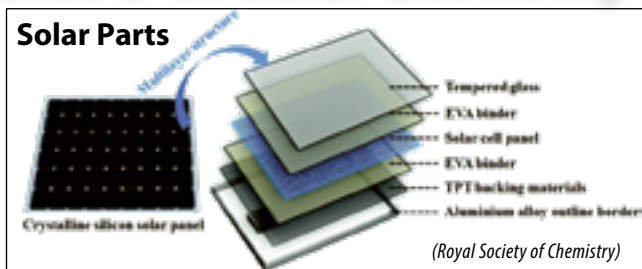
Recycling Creates a Circular Economy for Solar Panels

Michael J. Daley

With the expansion of its Yuma, Arizona processing facility, We Recycle Solar (WRS) is doing its part to help stave off a major rise of solar panel waste headed for landfilling or incineration as the first generation of large-scale solar projects face decommissioning.

According to the International Renewable Energy Agency, the world could be saddled with 78 million tons of solar panel waste by 2050.

In a September 15, 2021 website post, the National Renewable Energy Laboratory (NREL) cited a study that projects "From 2020 to 2050 in the modeled baseline conditions, approximately 80% of modules are landfilled (emphasis added), 1% are reused, and 10% are recycled."



This is not exactly the destiny or image most renewable energy advocates envisioned for our beloved green technology.

Julien Walzberg, lead author in the NREL study and of a new article titled "Role of Social Factors in Success of Solar Photovoltaic Reuse and Recycle Programs" in Nature Energy, makes this observation. "With today's technology, PV

(photovoltaic) modules are difficult to separate, and the process recovers mostly low-value materials. Because of this, there currently isn't enough revenue from recycling to offset the high costs, and therefore very little mass is recycled. Our model shows this could lead to a major waste problem by 2050."

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Concentration of CO2 in the Atmosphere

427.35
parts per million (ppm)
April 10, 2024

Learn more at www.CO2.earth.

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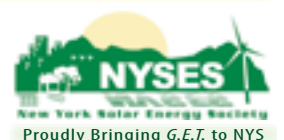
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Ad Design/Layout PJ Fischer / NR Mallery

Printing Quebecor Media Printing using recycled-content paper as available and plant-based, environmentally safe inks.

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

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Green Energy Times would like to thank everyone who has submitted articles or helped in any way to make this all a reality. We want to also thank our advertisers & ask that you support them. Say that you saw them in Green Energy Times. Now let's all G.E.T. moving ahead towards a clean, renewable future – one where our children & grandchildren will be able to breathe & grow, live & love on this beautiful planet where we live.

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

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Letter from the publisher

CELEBRATING 15 YEARS OF GREEN ENERGY TIMES!

What crazy times we continue to experience! The winter was probably the strangest one ever for most of us.

It may go without saying that Green Energy Times (G.E.T.) is more important than ever, as we endeavor to bring solutions to our ever-growing number of readers. **Solutions are what G.E.T. is all about.**

While Earth Day will be celebrated while you are likely reading this edition, we want to remind you and hope you will follow our mantra, that Earth Day is every day! Every day we can each do more to help reduce our own footprints on this earth. It all starts with you!

This edition, like all before it, is full of the topics that we hope will be helpful to you as we experience springtime and all the beauty and hope it can bring to us all. Instead of my regular letter telling you what is in this edition, I would like to appeal to all our readers at this time.

It is not hard for the staff of G.E.T. to realize that this edition marks 15 years of hard work to bring our free publication to you. G.E.T.'s future is totally dependent on our advertising and sponsorship dollars as well as any support from our readers. We will be running a campaign for support that will run from April 17 through June 16. I trust you will respond to our campaign appeal and help us out!

Dear Friends and Supporters,

Fifteen years ago, on May 4th, 2009, we embarked on a journey with a mission: to advocate for a greener, more sustainable future. Today, as we celebrate our 15th anniversary, we reflect on the incredible strides we have made together, and the vital role you have played in our success.

Green Energy Times has been at the forefront of the environmental movement, providing invaluable resources and insights into the world of renewable energy, sustainable living, and climate action. From solar solutions to sustainable agriculture, from energy efficiency to green transportation, we have covered it all in our bi-monthly publication, reaching over 100,000 readers in print and over 2,000 online readers every week.

But our work is far from over. As the challenges facing our planet grow more urgent, our commitment to making a difference has never been stronger. That is why we are turning to you, our readers and supporters, for help.

Your contributions, whether big or small, make a world of difference. Your support enables us to continue our efforts to educate, inspire, and advocate for a cleaner, greener future. Whether you can spare a one-time contribution or commit to a monthly contribution, every dollar counts.

You can send your contribution to Green Energy Times or conveniently donate through our website's "Advertising Info" page (follow donation instructions). Send questions to nancy@greenenergytimes.org.

Thank you for being part of the Green Energy Times community. Together, we can create a brighter, more sustainable tomorrow for generations to come. Let's continue to make a difference, one green step at a time.

Happy spring! We wish you much sunshine and blue skies. Be well, find happiness as you achieve your goals and know there is hope IF we make the changes for a sustainable future for us all.

With gratitude,

– Nancy Rae Mallery and our team at Green Energy Times. ♻️



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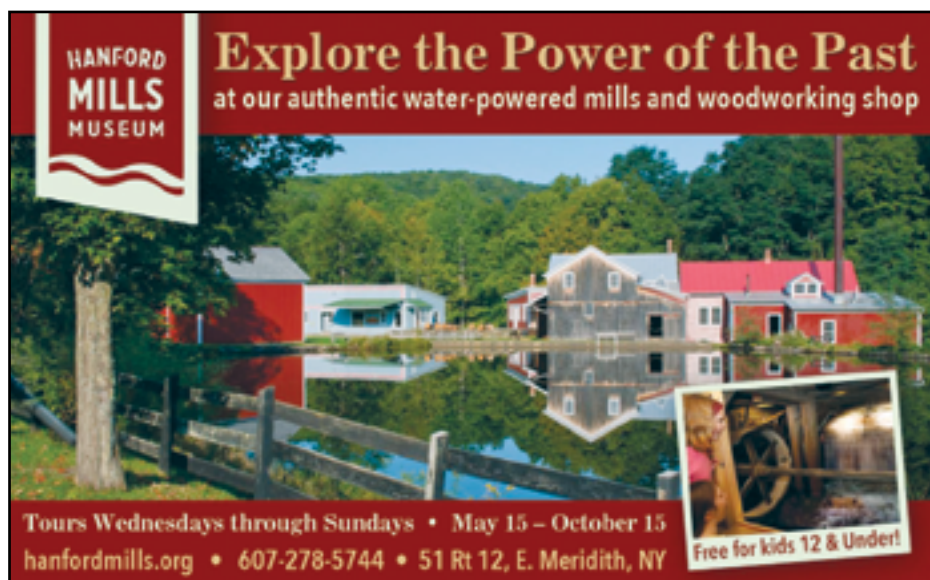
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Deepening Climate Crisis Galvanizes Transformative Energy Bill

Jonathan Dowds

After a year of record-breaking expensive winter storms and devastating flooding that crystalized how much Vermont is already suffering from the climate crisis, the Vermont House voted overwhelmingly in favor of updating the state's Renewable Energy Standard. For more than a year, Vermont environmentalists, utilities, and political leaders have been sitting down together to hammer out an agreement on a Renewable Energy Standard reform bill that is both pragmatic and visionary. Under the bill's provisions, which now moves to the Senate, Vermont would get 100% of its power from renewable sources by 2035, sooner than any New England state outside of Rhode Island.

Crucially, this would include getting 35% - 40% of our power from new renewable sources. This is crucial because more renewable energy is urgently needed to phase out power generation from our region's many remaining natural gas plants even as our demand for electricity grows. By 2035, Vermont's utilities would be purchasing four times more new renewable energy than they would under the status quo. And that's a big deal from a climate perspective - the equivalent of taking 160,000 vehicles off the road.

Renewable Energy Vermont, where I work, and a broad coalition of environmental and social justice organizations including VPIRG, VNRC, 350VT, the Conservation Law Foundation, the Vermont Chapter of the Sierra Club, and Vermont Businesses for Social Responsibility have been making the case for a rapid transition to 100% renewable energy that emphasized the role of new renewables. House Speaker Jill Krowinski's leadership helped put updating the Renewable Energy Standard front and center.

Vermont's utilities are highly responsive to their ratepayers and wary of increasing rates unnecessarily, and they embraced many of the goals that the House Environment and Energy Committee advocated for. The result was a consensus proposal



The 2.2 MW Lawrence Brook Solar project is providing low-cost renewable energy to Morrisville Water and Light customers. (Encore Renewable Energy)

that quadruples the amount of new renewable energy we use and that allows utilities to be confident that they can keep the lights on and rates affordable for their customers. It is not as ambitious as our initial proposal but is a very good deal.

Absent from these efforts in a meaningful way? The Scott Administration which missed another opportunity to engage productively on climate issues in favor of fearmongering on cost. Scott's Public Service Department (PSD) initially suggested that the transformative bill would cost a billion dollars over ten years -- a number that is two to three times what the bill will likely cost.

Despite its technical expertise, PSD failed to provide a vision of how we can take advantage of rapidly growing load flexibility, improving storage technologies, and other advances to achieve these goals at the lowest cost. For example, VELCO, the entity that manages the state's transmission system, estimated that if we are strategic about where we build it, we could get to 85% of the in-state solar capacity needed under

the bill (about 1000 MW) without hitting any transmission constraints at all. Thereafter more solar would necessitate either building new transmission capacity (some of which will be required to support the transition to EVs and heat pumps), or a combination of incentivizing electricity use when renewable generation is highest (something that we should be moving towards) and reducing solar output during select periods. Those periods

are when we are producing more energy than we can use or safely export to our neighbors.

Instead of providing a roadmap on how Vermont could most cost-effectively balance these strategies, the Department started with VELCO's worst-case, transmission-only scenario to assign the RES bill responsibility for \$500 million in transmission upgrades. PSD added on another \$500 million in additional power purchase costs but neither of these numbers was supported by actual modeling of the bill. When the non-partisan Joint Fiscal Office looked at the specifics of H.289, it con-

cluded that the total cost of the bill would be \$150 million and \$450 million over ten years, far below the Department's estimate and a small fraction of the \$14 billion that will be spent on electricity over that timespan. The Administration seemed to be answering the question "What is the cost of reforming the Renewable Energy Standard if we do it in the least thoughtful way possible?" rather than "How do we update the Renewable Energy Standard in the way that provides the greatest benefit to Vermont?"

Despite the lack of Administration support, the bill is moving forward. It passed the House on a 99 to 39 vote, with four strong supporters absent - meaning it has more than the 100 votes it would need to override a veto. As it should. It is not perfect - no bill is - but it is a significant step in the right direction.

A few critical issues will need to be picked up in the next Legislative session, designing the right procurement programs that spur development and provide equitable access to renewables, and permitting reforms to make the process more straightforward and predictable. But the update to the Renewable Energy Standard is the first step and sets us on the trajectory for success.

Jonathan Dowds is the Deputy Director of Renewable Energy Vermont. ☺



\$3.5 MILLION AVAILABLE TO DEVELOP GRID IMPROVEMENTS IN NYS

Grants for municipal electric utilities and rural cooperative businesses upgrades support the transition to 100% zero-emission electricity by 2040 in the state.

\$3.5 million in technical assistance funding is now available to support the development of electric grid modernization project proposals through the state's Grid Modernization Program. This funding is available to interested municipal electric utilities and rural electric cooperatives in developing a reliable grid infrastructure and access to affordable clean energy. The April 5 announcement supports the NY Climate Leadership and Community Protection Act goals to transition to 100% zero-emission electricity by 2040.

The announcement represents the pre-development step to help municipal electric utilities (MUNIs) and rural cooperatives (COOPs) plan for an upcoming \$24 million funding opportunity made possible through a U.S. Department of Energy (DOE) award to NYS last fall. The \$24 million, expected to be made available this summer, will be administered by the New York State Energy Research and Development Authority (NYSERDA) over a two-year period through a competitive solicitation process to select grid modernization projects.

New York State MUNIs and rural COOPs may now apply at <https://on.ny.gov/43TtGV3> on a first come, first served basis until 3:00 p.m. on December 1, 2027 for a one-time maximum technical assistance award of up to \$200,000 per applicant. This assistance can be used to support the technical analyses needed to evaluate potential projects, grant writing assistance for implementation funding, and development of a metrics reporting system to evaluate project success.

Doreen M. Harris, President and CEO of NYSERDA said, "NYSERDA is pleased to offer technical assistance support for municipal utilities and rural COOPs to plan for neces-



Funding is now available to support the development of electric grid modernization project proposals through the state's Grid Modernization Program. Shown are power lines that cross New Scotland So. Rd., Delmar, NY. (N.R. Mallery)

sary improvements and upgrades to the resiliency of their community's grid infrastructure. By providing this up-front support, we are ensuring future proposals submitted for consideration represent projects that will advance a just transition to a zero-emission electric grid while increasing access to clean energy for New Yorkers."

MUNIs and rural COOPs that do not have technical assistance needs may propose smaller implementation projects that fall within the allowable maximum award amount for projects which will strengthen the capacity of New York State's grid systems and communities to prepare for current and future climate-related risks.

New York was one of nine states and five tribal nations that were awarded a combined total of \$125 million last September as the seventh cohort of Grid Resilience State and Tribal Formula Grants. The \$3.5 million is part of New York's 15% matching funds required by DOE and sourced through the Regional Greenhouse Gas Initiative. To learn more, visit NYSERDA's website (<https://bit.ly/GridMod-Program>) and the Grid Deployment Office's website (<https://bit.ly/GridDepOffice>).

Priority is given to projects that generate the greatest community benefit providing clean, affordable, and reliable energy. ☺

OP-ED

Doctor Advocates Passage of New VT Energy Standard

Michael Latreille

As a primary care physician, I am reminded with startling frequency that the climate crisis, and its growing impact on our health, is no longer a concern of the future. The World Health Organization declared climate change the "single biggest health threat facing humanity," a sentiment shared in a joint statement by more than 250 highly respected medical societies.

My practice in Burlington offers a macabre front-row seat to this fact. It takes little effort to recall an inventory of informative recent encounters- the disabled patient with severe anxiety who has completely fallen apart after floods forced him out of his home and into his mother's; the elderly woman with COPD who cannot breathe in the summer because of wildfire smoke, 90+ degree temperatures, increased pollen counts, or some combination of these; or the huge, rising number of patients with tick-borne illnesses and their complications, unheard of several decades ago. These stories are real, steadily growing, and disproportionately hail from vulnerable pockets of Vermont -- the elderly, low-income communities, racial and ethnic minorities. They also represent merely the tip of the melting proverbial iceberg.

On March 21, however, the Vermont House brought us one step closer to an

exciting climate victory, with a 99-39 vote in favor of overhauling our Renewable Energy Standard (RES). The Vermont Senate will soon take up H.289, which represents a remarkable collaborative effort by a group of legislators, utilities, and other stakeholders, to modernize the existing Standard, last passed in 2015. The new Standard would quadruple the amount of new renewable energy Vermont electric utilities deliver to their customers in the next decade, equivalent to taking approximately 160,000-250,000 gas-burning cars off the road, permanently. As good as this sounds, the bill is at risk of being vetoed and urgently needs the support of Vermonters to pass.

The RES presently in effect for Vermont was an important step forward when it was passed in 2015, requiring Vermont electric utilities to provide 75% renewable electricity to their customers by 2032, of which 10% was required to come from smaller, new renewable sources built in Vermont. Nearly a decade later, Vermont still produces only a fraction of the energy it uses, much of the rest coming from combustion of fossil fuels outsourced to vulnerable communities in the region. The existing Standard is now the oldest and, with respect to new renewables, least

Cont'd on p.7

Electric Vehicle Charging: A Slippery Road Ahead for Gas Station Operators

Commentary by Morningstar DBRS.

The dramatic sales growth of full electric or plug-in hybrid vehicles, though from a relatively small base, is necessitating rapid growth in fast and reliable electric vehicle (EV) charging infrastructure and is consequently compelling gas station operators everywhere to adapt and future-proof their retail business.

Opportunities and Challenges for Gas Station Operators

While considerable uncertainties around the pace of transition to EVs remains, we believe this transition is unlikely to have a major negative effect on the credit-risk profiles of most gas station operators, over the near-to-medium term, especially for those with more diverse site locations. That said, to integrate reliable electric vehicle charging infrastructure into their service offerings and adapt other aspects of their business, we do expect gas station operators to be subject to higher capital investment requirements going forward. Furthermore, over the longer term, operators would need to evolve and address challenges around intensifying competition, their changing business and operating model as well as infrastructure concerns, to be able to maintain market share, profitability, and relatively stable credit-risk profiles. Conversely, the transition also provides a growth opportunity for those gas station operators that address these challenges and execute a successful transition.

Rapid Acceleration in EV Sales

As shown in Exhibit 1, the total number of EV sales worldwide increased substantially by 55% year-over-year in 2022 with over 10.5 million EVs sold. Furthermore, EVs accounted for approximately 13% of global passenger vehicle sales in 2022, growing from 8.3% in 2021. Similarly, electric light commercial vehicle (LCV) sales worldwide increased by more than 90% in 2022 as well.

EV Sales Fueled by a Global Drive for Zero Emission Vehicles

Consumer acceptance aside, the growth in EV sales is in large part driven by government legislation, electrification targets across the world (as highlighted in Exhibit 2), and incentives to build supporting infrastructure. As an example, the European Union has approved a ban on sales of new petrol and diesel cars from 2035 onwards, along with more stringent new emission standards for cars and vans that are aligned with the goals set out in its "Fit for 55" package. The U.S. Inflation Reduction Act of 2022, combined with the adoption of California's Advanced Clean Cars II rule by several states, could result in a substantial increase in EV market share in the U.S., broadly in line with the national target of 50% of vehicles sales being EVs by 2030.¹ Similarly for electric LCVs, a total of 27 countries, including the United States and a number of European nations, have pledged to achieve 100% zero emission vehicles bus and truck sales by 2040.

Charging Infrastructure Key to Supercharging EV Adoption

One of the main challenges to EV adoption is the lack of easily accessible, fast, and reliable electric vehicle charging infrastructure. As per a report from IEA, there were 2.7 million public charging points worldwide at the end of 2022, a 55% increase on 2021 stock, and this is expected to grow by another 35% in 2023. In addition to China, countries in

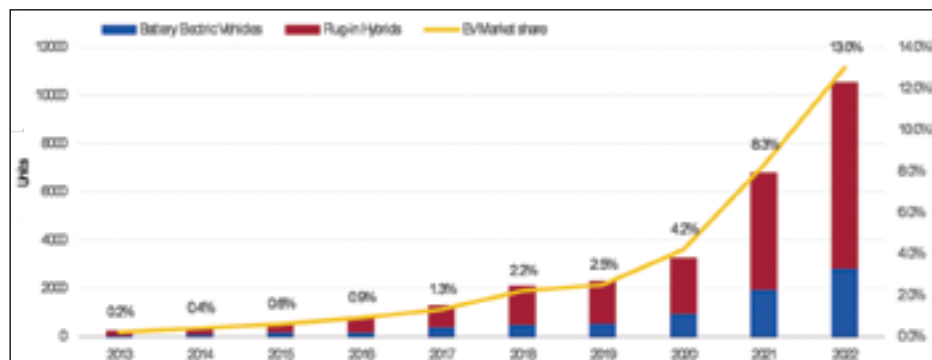


Exhibit 1

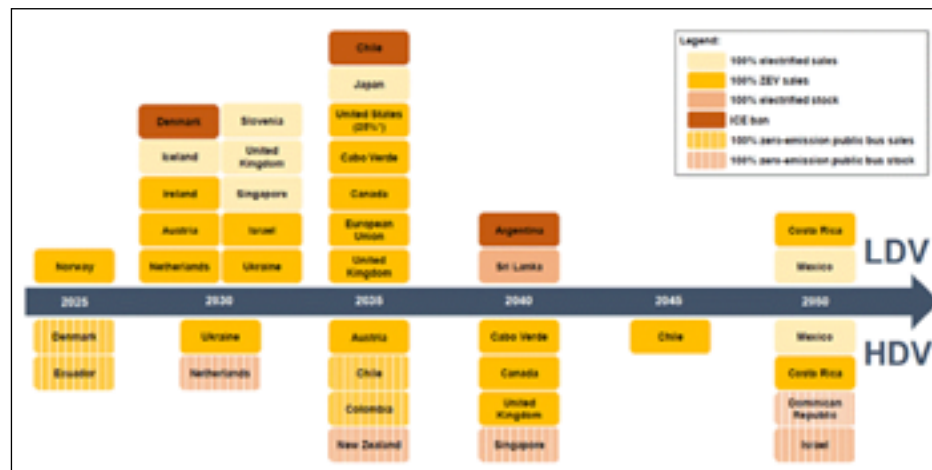


Exhibit 2

Europe and North America continue to invest heavily in rolling out EV charging infrastructure. As an example, in North America, major EV and battery makers have announced cumulative investments of over USD 52 billion in the last year or so, including Canada's deals with carmakers Stellantis and Volkswagen to build EV battery manufacturing plants in Ontario, which involves billions of dollars in government subsidies. The infrastructure bill passed by the Biden Administration in November 2021 provides for \$7.5 billion investment in electric vehicle charging infrastructure and over \$7 billion in EV battery components.

Notwithstanding this rapid growth (from a small base), this transition away from the sale of fossil fuel-based products is unlikely to have a profound impact on the oil and gas sector in the near-to-medium term. This is largely due to the limited amount of oil likely to be displaced by EVs. (Per IEA estimates, road transport oil demand is expected to be 460 thousand barrels per day below 2019 levels of approximately 43 million barrels, by 2028.) Therefore, gas station operators should have time to take a balanced approach when it comes to adjusting their overall infrastructure and service offerings. Any structural changes to the business model and operations of gas station operators will need to align with the pace at which the fuel-sales mix transitions.

Considerable Challenges Pose Roadblocks for Gas Station Operators

While the trends around EVs and charging points represent opportunities for gas station operators, which have the advantage of an established network of stations as well as access to large spaces in prime locations, they are also faced with significant challenges. Gas station numbers have already seen a rapid decline across Europe and North America over the last two decades due to intense competition and lower margins, and the transition to EV charging is likely to result in further declines and consolidation in the sector. Exhibit 3 (shown on p.7) highlights the

decline in the number of gas stations in the U.S. In the UK, as well, gas stations have declined by over 35% during the 2000 to 2022 period. For gas station operators to remain relevant, they need to adapt and future-proof their business

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by addressing several key challenges, including significant capital investment requirements, intensifying competition, and a changing business and operating model as well as infrastructure concerns.

1. Significant Capital Investment Requirements

In response to the transition, large gas station operators, as well as the world's largest oil and gas companies, such as BP, Shell, Exxon, and Chevron, have all started to make considerable investments in EV charging infrastructure. While these investment requirements are significant, we note that gas station operators could benefit from government incentives and are likely to form partnerships with third-party service providers for installation, maintenance, and repair, which could reduce their capital investment burden. That said, finding the right partner for operational ease, technology upgrades, as well as scalability of operations will be critical.

Furthermore, we note that, while fuel sales are currently the key driver of traffic, a considerable portion of overall sales for gas station operators is already derived from more profitable ancillary products and services, such as convenience and food offerings as well as vehicle-related services such as car washes. Given longer time requirements for EV charging, combined with convenient locations, long opening hours, and easy parking, gas stations could increasingly

Cont'd on p.7



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CHARGE ME UP?

800-volt EVs and Charging Systems Promise Multiple Benefits

Should you wait for it?

Martin Wahl

Most electric vehicles (EVs) today are based on 400-volt battery platforms that require 20 minutes to add about 125 miles range. An 800-volt EV plugged in to an 800-volt charger accomplishes this in about half the time. Right now, only a few EVs have 800-volt architecture, although seven of the largest EV manufacturers are planning to adopt it.

Nothing is simple

It's a complex story that gets into the weeds quickly, in terms of both technology and marketing. More on the market later.



Hyundai's 800-volt 2024 Ioniq 5. (www.hyundaiusa.com)

800 Volts

800-volt vehicles require newer 800 volt charging stations (technically EVSEs, electric vehicle supply equipment) to use the higher voltage's speed. These vehicles sense whether the supply is 400 or 800 volt and adjust accordingly, without intervention from the operator.

800-volt architecture is likely the future for EVs. While currently more costly to manufacture, other things being equal, they run cooler than their 400-volt cousins, require less copper, produce less heat due to lower transmission losses and are lighter. (See technical box for discussion.) Most of all, the potential for fast charging at 800-volt stations is appealing.

800-volt EVs must do some additional processing to accept a charge from 400-volt chargers. They must use **inverters or other technology** to boost the incoming voltage to 800, thereby losing efficiency and slowing the charge time. In fact, Porsche Taycan (\$99,400 MSRP) provides an **optional DC to DC voltage boost converter** for \$460 to speed up charging from a 400-volt ESVE.

must use **inverters or other technology** to boost the

incoming voltage to 800, thereby losing efficiency and slowing the charge time. In fact, Porsche Taycan (\$99,400 MSRP) provides an **optional DC to DC voltage boost converter** for \$460 to speed up charging from a 400-volt ESVE.

Here's where things get technical

• Higher voltage allows thinner wires and lighter electronic components to provide the same power with less current (Remember: watts = volts x amps, where watts = power and amps = current) so vehicle weight can be reduced with 800-volt architecture. Lower current also reduces energy lost to heat, **thus increasing efficiency and battery life**, but higher voltages require increased insulation.

• Higher voltage batteries can provide greater power to the electric drive motor and achieve better regenerative braking, contributing to greater vehicle efficiency.

So where are these ultra-fast chargers?

There's the rub: Europe, mostly, for example in Germany with more than **7,500 800-volt ports at charging stations** (13% of the country's total) has trouble meeting demand. In the U.S. right now according to the U.S. Department of Energy, there are more than 62,000 level 2 and 3 charging stations with 165,600 ports, with unspecified output voltage. The Administration's plan to help establish 500,000 EV charging stations along highways and in communities does not specify voltage or connection characteristics.

Market Factors

Early adopters usually face technological challenges that subsequent customers can ignore. For example, early automobile adopters had to understand stoichiometric ratios, and **spark and throttle advance**.

Technological innovation is often a double-edged sword. In the case of encouraging the adoption of EVs, the urge to "future-proof" an EV purchase may encourage potential buyers to postpone buying one and wait for more affordable 800-volt versions and the implementation of more 800-volt chargers, meanwhile continuing to drive their greenhouse gas-emitting vehicles. So how much does the 800-volt difference make today?

"Range anxiety" and related concerns about public charging station availability and charging speed, are the most significant impediments to electric vehicle adoption, now that price parity is fast approaching. Tesla realized this early on and, leveraging its


Cont'd on p.6



A Nio battery swap station. (Wikipedia Commons)

To the Editor:

I saw another **e-bike article** in your Feb-April issue. In your June 2023 issue you had an article by Dave Cohen about e-bikes. I had been interested in getting an e-bike, but could not justify it as simply a fun bike. I live in an area of NH with a lot of hills around my house and I knew that, with the hills, I would not have much range. I borrowed a Radwagon Cargo e-bike to try out. The battery did not cover much range. Your article mentioned Lectric Xpedition as having two batteries for increased range. I checked it out online and bought one. I love it! With over 500 miles on it I have had no problems. The Lectric FB group members talk about problems with Lectric e-bikes and over 90% have to do with FedEx's handling of the boxes. The problems with the ebikes themselves have been taken care of by Lectric with everybody happy about the brand. I use the cargo e-bike to go grocery shopping and errands to nearby towns, a twenty mile plus round trip.

Thanks for the information you provided.
Lee Booker, Sutton, NH 

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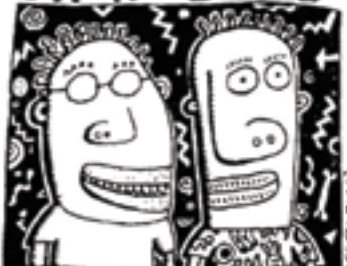
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COMMUTESMART NH AND COMMUTESMART SEACOAST COMMIT TO SUSTAINABLE TRANSPORTATION

Angela Cleveland (AICP), Vincent Pagano, Joyce Sawicki, and Michael Tardiff

What is CommuteSmart NH?

CommuteSmart NH is New Hampshire's (NH) Transportation Demand Management system (TDM) Trip Planner. TDM is defined as a set of planning processes, strategies, and policy decisions that are aimed at relieving congestion and improving efficiencies of transportation infrastructure. Trip planning is easy using CommuteSmart NH!

In NH, the software that powers the CommuteSmart NH trip planner is called AgileMile. Users of CommuteSmart NH's trip planner app can plan multi-modal trips with fixed route transit, demand response transit, micro transit, bike share, car share, park and ride lots and other transportation options. Users can find rides to match their type of transit mode, (e.g. carpool vanpool, bike, transit), organization, gender, language spoken, time, day of the week, and more!

CommuteSmart NH to host statewide May Spring Commuter Challenge

What is the May Spring Commuter Challenge? The Central New Hampshire Regional Planning Commission (CNHRPC) is hosting a special event to challenge NH residents to go green, get some exercise and have fun commuting! We encourage you, your employers, your coworkers, your family, and your school to find an alternative to driving alone to commute to work and school throughout the

month of May and track your trips using the CommuteSmart NH trip planner. CommuteSmart NH's challenge runs from May 1 through May 31 and also coincides with Bike to Work Week (May 13-19) and Bike to Work Day on May 17.

Where else is this happening?

The CommuteSmart NH May Spring Commuter Challenge is open to everyone who lives and works and plays in NH, but check online for commuter challenge events happening nationwide! If you or your company are located in the Seacoast of NH, you can compete in the CommuteSmart Seacoast B2B Challenge and have your commutes count in both!

Why should you participate?

You can have fun commuting to work and school! NH citizens can save money, reduce air pollution, get exercise, promote safe bicycling, and reduce stress during their work and school commute. You can save on the cost of gasoline as well. Decreasing the number of cars on the road also preserves the life of our existing roadways, reduces air pollution, minimizes time spent in traffic, and most importantly, keeps you healthier and happier.

Show me the metrics!

In May 2023, we accomplished much for the environment, our health, and our wallets, all through green commuting. During last year's challenge, collectively completing commuters reduced 9,648

car trips, drove a total of 71,075 miles less and prevented 60,674 pounds of CO2 discharged to the environment. Not to mention, we saved 3,096 gallons of gasoline from being bought. The savings at the pump and from wear and tear on our vehicles equaled a total of \$44,422 during our 2023 Spring challenge. Commuters collectively burned 486,667 calories by biking, walking, running, and scootering to work. It is amazing what 383 challenge participants can collectively do when they are committed to commuting smart to work and school!

How do you sign up for the challenge?

Registration using the CommuteSmart NH app and the desktop version is easy and safe. Follow these steps to join!

1. Type commutesmartnh.agilemile.com into your desktop browser, scan the QR code, or download the CommuteSmart NH mobile app (CSNH).
2. Create a free account.
3. Opt-in to the challenge and join a team. This can be found on the home page if you're on the desktop version or under the "more" tab in the mobile app. If you don't see your work or school, you can create a team yourself.
4. Start logging your trips! The leaderboard will appear on May 1 and will update at midnight every day. Gift card prizes are awarded to individuals every week.

The CommuteSmart NH algorithms automatically ensure the accuracy of the

data, prevent duplication, and protect users' privacy. All participants are eligible for great giveaways and coupons. CommuteSmart NH also seeks to educate employees and employers about the benefits of smart commuting and provides them with the resources they need to get started. CommuteSmart NH is a partnership between NH's planning commissions, state agencies and transit providers.

Have more questions? Contact CommuteSmart NH at 603-226-6020 or email vpagano@cnhrpc.org.

Angela Cleveland is a Principal Planner at the Strafford Regional Planning Commission. Vincent Pagano is a Regional Planner at the Central NH Regional Planning Commission (CNHRPC). Joyce Sawicki is a Project Planner at CNHRPC. Michael Tardiff is the Executive Director of the CNHRPC. ♻️



CHARGE ME UP? – Cont'd from p.5

enormous market capitalization, invested in proprietary charging stations (there are now more than 2,000 Supercharger station locations with more than 21,000 connection ports in the U.S.). In order to qualify for some of the 2021 Bipartisan Infrastructure law Tesla committed to opening 7,500 of its charging stations to non-Tesla vehicles by the end of 2024.

The Tesla Supercharger stations open to other EVs have a plug adapter, called the Magic Dock, to accommodate industry-standard NACS/CCS connectors. Currently Tesla claims there are more than 15,000 stalls open at their locations in the U.S. Tesla is planning to install Magic Docks at about 37% of its charging outlets, and claims it has a long-term goal of enabling non-Tesla charging at all its stations. Because Tesla charging stations have short cables (due to the location of charging ports on Teslas), some other EV drivers must do creative positioning to hook up. Right now (according to Tesla's app) models from these manufacturers may utilize Magic Dock-equipped chargers: Audi, BMW, Chevrolet, Ford, Hyundai, Kia, Lucid, Mercedes, Rivian, Nissan, Toyota, and Volkswagen.

So, what's a buyer to do?

Jesse Lore of Green Wave Electric Vehicles in North Hampton, NH, encourages prospective EV owners to consider their driving requirements, and helps customers assess their needs using online maps and EV charger database map providers like PlugShare to determine battery capacity requirements, noting that for most buyers today a Level 2 charger at home supplies sufficient juice for charging a 200+ mile range EV overnight. Installing an 800 volt charger or in fact any Level 3

DC charger at a home is infeasible in any case.

Tellingly, Tesla's cars and charging stations are all 400-volt based. Its new Cybertruck, which does have 800-volt architecture, incorporates split battery pack technology allowing it to charge at 400-volt stations. GMC's Hummer EV and the Chevy Silverado EV, also large, costly 800-volt vehicles, utilize split-pack technology as well.

And now for something completely different

Chinese EV auto manufacturer Nio has reached agreements with fellow Chinese auto makers Geely, Chery, JAC Group, and Changan on a standard for replaceable batteries, allowing drivers to swap an exhausted battery for a fully charged one in about five minutes. Especially popular for fleets and taxis, Nio has more than 2200 swap stations, most in China with a growing number in Europe, and now performs more than 60,000 swaps daily. Tesla toyed with the idea of swappable batteries for its Model S in 2013, but elected to pursue its Supercharger charging stations.

It appears that battery swapping is better suited to markets with shorter driving trip requirements than in the U.S., but the jury is out on its long-term success. Stellantis, manufacturer of Fiat and Chrysler automobiles, is partnering with California-based swap station developer Ample, to develop swapping stations in Europe.

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 CA and NH, he serves on Corte Madera, CA's Climate Action Committee and is a Newfound Lake Region Association member. ♻️

Earth Day EV Expo reflects trend toward electric vehicles

Hundreds of Upper Valley drivers and bike riders who are curious about switching to electric-powered vehicles will visit the second annual Earth Day Electric Vehicle (EV) Expo to talk with dozens of EV and e-bike owners and inspect their rides. The free event is part of the national Drive Electric Earth Month and is organized locally by the Lebanon (N.H.) Energy Advisory Committee and organizations from multiple Upper Valley towns.

- High public interest in the event reflects changes happening in the Upper Valley;
- The number of EVs registered in Lebanon increased 70% between 2022 and 2023, a 278% increase since 2016;
- Lebanon soon will issue a Request for Proposals to install public EV charging stations in the "charging desert" of downtown Lebanon;
- West Lebanon now has three fast-charging stations since the 2024 addition of chargers installed in the Shaw's parking lot (site of the EV Expo) by electric truck maker Rivian;
- Lebanon in 2024 will offer EV charging to its employees, and in 2023 the Lebanon City Council adopted a resolution thanking 18 other Upper Valley employers who do this;
- Lebanon adopted zoning regulations in 2023 requiring EV charging at all new developments.

When: Sunday, April 21, 12 noon to 3 p.m.

Where: Shaw's supermarket parking lot, 10 Benning Street, West Lebanon, N.H.

What: Displays of electric cars, trucks, and e-bikes adjacent to the newest of three fast-charging stations in West Lebanon, this one installed in 2024 by electric truck maker Rivian.

Who: EV and e-bike owners, wannabe owners, used-EV dealer Green Wave EVs, EV charging station installers, e-bike vendors, and three speaker sessions on \$\$ incentives, EV charging, and EVs in winter.

More info: For the Earth Day EV Expo see NHEV.org. For all of the Drive Electric Earth Month events see <https://driveelectricearthmonth.org>. Contact: Sherry Boschert, co-captain, Earth Day EV Expo; sherry.boschert@gmail.com; 415-730-9797.

Background: There are now more than 2.5 million EVs on the road in the United States and growing. The increased interest in EVs makes Drive Electric Earth Month events important for sharing experiences from one driver to another. -- the pros, the cons, and everything in between.

The Lebanon Energy Advisory Committee organized the Earth Day EV Expo along with Sustainable Lebanon and other New Hampshire and Vermont town energy committees. Green Wave EVs, Omer & Bob's Bikes, Cowbell Mobile Bike Shop, Vermont Bike & Brew, Bill Stearns, Norwich EV, and SolaflectEV financially supported this year's event.

Plug In America, the Electric Vehicle Association, the Sierra Club, EVHybridNoire and Drive Electric USAA teamed up to organize Drive Electric Earth Month nationally. ♻️

A Slippery Road

Cont'd from p.4

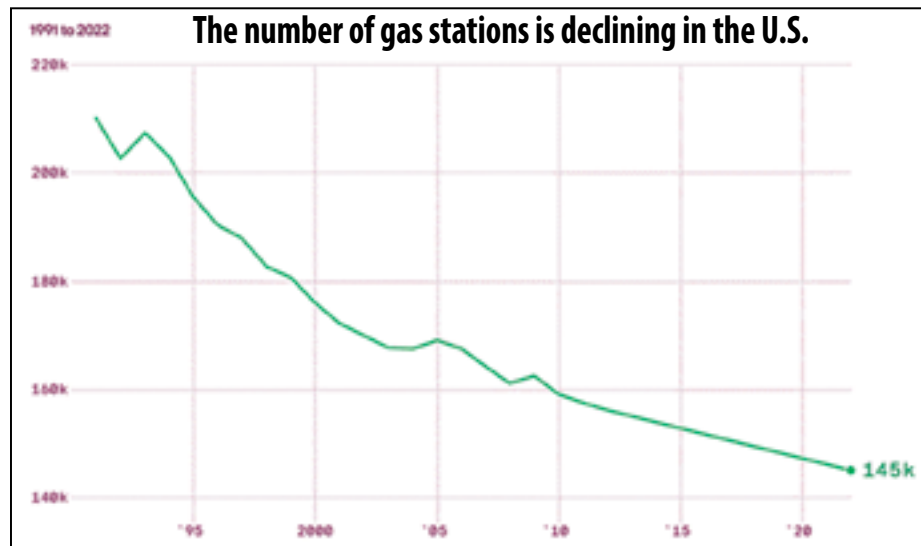


Exhibit 3

be well suited for selling a wider range of products, from ready-to-eat snacks and meals to larger grocery baskets. Consequently, to support future traffic flows, we expect value added service offerings to attract a relatively higher share of capital allocation going forward, as evidenced by Parkland Corporation's (rated BB, Stable) acquisition of the M&M food market business in 2022.

2. Intensifying Competition

As it relates to EV charging, gas station operators would not only be competing among themselves but potentially also with government-installed charging points, utility companies entering the space, as well as chargers located at retailer and other destination locations. For example, Walmart already hosts 1,300 EV fast-charging stations at 280 of its locations and is planning to install new EV fast-charging stations at thousands of Walmart stores across the U.S. Similarly, arrangements like Tesla's deal with other original equipment manufacturers (OEMs), including Ford, General Motors, Volvo, and Mercedes-Benz to allow access to over 12,000 Tesla charging stations in North America by 2024, intensify the competition in this space. All this incremen-

tal competition is in addition to home chargers, which meet approximately 70% of total EV charging needs today.

3. Changing Business and Operating Models: Urban versus Highway Stations

Depending on the evolution of the competitive landscape, gas stations may evolve differently depending on their location, ability to offer additional value or services, and the profile of their customer base. Due to their high volume and limited nearby alternatives, highway gas stations are more likely to be suitable for the roll out of EV charging infrastructure, and governments are more likely to consider public-private partnership models for developing or expanding charging infrastructure at these locations. Urban gas stations, especially those with limited space and no other value or service offering, are more vulnerable to alternative charging service providers, including the "in-house" option available to households with personal charging units.

¹Global EV Outlook 2023 by International Energy Agency (IEA).

Originally posted August 10, 2023 at <https://dbrs.morningstar.com/EV-GasStations>. ♻️

Market Share to EVs

Cont'd from p.1



2024 Nissan Ariya, Mid-size All-Electric SUV (Nissan)

In recent months, EV sales have started to show signs of weakness in the U.S., especially among the country's Big Three automakers, Ford, GM and Stellantis (formerly Chrysler). The turbulence has led some analysts to forecast that the market will grow at a slower pace this year, following a record-breaking 2023.

At least one analyst predicts sales will decline this year.

But a February report from Clean Investment Monitor, a joint project between Rhodium Group and the Massachusetts Institute of Technology's Center for Energy and Environmental Policy Research, found that electric vehicle sales are on track for the U.S. to meet its climate goals — in spite of the industry's current growing pains.

Dan McCarthy is news editor at Canary Media.

Reprinted with permission from Canary Media's March 1, 2024 blog at https://bit.ly/CanaryMedia_CarMarketShare. ♻️

some market difficulties, they accounted for seven percent of new vehicle sales.

All told, electric and hybrid vehicles made up 16 percent of new car sales in the U.S. last year.

The figures represent meaningful progress in the bid to clean up the transportation sector, which accounts for over a quarter of the nation's greenhouse gas emissions. There may be more effective ways to deal with this problem — such as boosting funding for public transit or making car-free living easier — but in lieu of meaningful progress toward those solutions, higher EV adoption is critical to meeting U.S. emissions goals.

New VT Energy Standard Op-ed

Cont'd from p.3



ambitious of its kind in New England.

In contrast, H.289 looks to the future, aiming for the ambitious goal of 100% renewable electricity in Vermont by 2035, faster than any other State in the region except Rhode Island. It would double the amount of energy coming from new renewable sources in Vermont, increase the provision of new renewable energy from regional sources, mostly in New England, and would require all Vermont utilities to provide 100% renewable electricity to their customers in the next 11 years-- by 2030 for Green Mountain Power and Vermont Electric Coop, and by 2035 for other utilities. The bill would also shift away from using biomass and large, potentially ecosystem-damaging, hydroelectric projects to truly renewable wind and solar. This would be the largest single move away from fossil-fueled power by the State of Vermont ever, by a wide margin.

Initial cost estimates, which scared away some supporters with a figure approaching \$1 billion, were grossly overestimated. The Joint Fiscal Office now estimates the proposed changes to cost between \$150 - \$450 million over 10 years. It is also important to note that the Standard would advance affordability and resilience of the electric system for consumers, reducing reliance on energy from outside Vermont and insulating ratepayers from the historically volatile fossil fuel market. Its broad support among utilities and climate advocacy groups alike is a testament to painstaking efforts made to balance cost-effectiveness and climate impact.

Merits and clear support of H.289 notwithstanding, the Scott administration's woeful track record on climate legislation would suggest that a veto from the Governor's office is all but certain. However, such a move does not have to mean the end of this bill. The Senate can, and should, override an anticipated veto. For our part as constituent Vermonters, we can steel our senators' resolve by letting them know how strongly we support it.

Vermonters have stepped up to the climate crisis in large numbers- solar panels materialize on our neighbors' rooftops; heat

pumps, EVs and charging stations proliferate at dizzying speeds. We, in turn, owe it to each other ensure that all our electricity comes from clean, renewable sources, not from those that pay for present energy needs with future calamity. My two-year-old son Theo sleeps soundly next to me as I write these final words, himself a call to action, a reminder of what is at stake. Our Senators have an opportunity to do their part in protecting the health of Theo's generation and those that come after. Please help them do the right thing. Find your representatives [here](#) and tell them how much this bill means, for the Vermont of today and for a healthier, cleaner future.

Michael Latreille, MD FACP is an Assistant Professor of Medicine at the University of Vermont Larner College of Medicine. ♻️

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Microgrid Secures Power for Rochester-Brandon, VT Mountain Zone

George Harvey

We have had grid outages since the grid began. Fortunately, most outages have not lasted very long, and it has been very unusual to have one that lasted as long as a full day. But it does happen, and the frequency and duration of long outages are getting worse.

The biggest culprit for worsening outages may be climate change. Storms are getting worse. They are getting more powerful and last longer. They dump more rain and snow, and they bring down power lines. They block roads. In some cases, they destroy bridges and tear up the roads themselves.

This has been a concern to Green Mountain Power (GMP) for some time, and its engineers have been designing "resilience zones." These are areas designed as microgrids to have power when the greater grid is down. They normally have emergency centers in them, where people can take shelter in extended outages. GMP said it intends to put up three such zones every year.

One of the GMP zones is the Rochester Brandon Mountain (RBM) Resilience Zone in Rochester, Vermont. The town was chosen for a resilience zone based on its experiences with extended outages in the past, the worst of which was the one caused by Tropical Storm Irene in 2011. A competitive bid request was put out in 2023, and this was won by Norwich Solar. The microgrid that will be



Solar farms and agriculture with cows (or sheep) grazing between solar panels make farming land more productive in community solar farms and microgrid sites with battery storage. They can be valuable to ensure power in rural areas when the grid goes down. (AdobeStock_749830168)

built as the core of the RBM zone will be Norwich Solar's first microgrid. (Norwich Solar is a subsidiary of Norwich Technologies, a certified B Corporation.)

The design specifications for the RBM zone include a 1,000 kilowatt (kW) solar array with a 2,000-kW battery. The battery will be able to store enough energy to discharge for four hours at full power, so its energy storage is 8,000 kilowatt-hours (kWh). The design was presented to the Vermont Public Utility Commission in 2023, and Norwich Solar announced that it had received its Certificate of Public Good from the commission in January 2024.

Obviously, part of the reason for creating resilience zones is to increase local resilience. However, there are other reasons to have such zones. One is to reduce the cost of electricity. This happens partly because the cost

of transmitting electricity on the grid is dependent to a degree on the peak demand during a period. GMP can draw from the zone's battery during peak demand periods to keep its own peak load down, and this reduces costs for all customers. This also reduces any chance that GMP will have to buy electricity generated at plants powered by fossil fuels, which is more expensive than electricity from renewable resources.

Norwich Solar has started developing the RBM zone, but it still has some designing to do before the actual installation begins. Specific details of the array must be developed, and that includes determining what equipment will be used. So, it is too early to report what solar panels, batteries, charge controllers, and other equipment will be used. We understand that the system will probably have lithium-ion batteries, but even that could conceivably change. On the other hand, we can be sure that construction of the array will begin during the summer or, at latest, the fall.

The site chosen for the array is very interesting on its own account. We often hear about agrivoltaics, so it should be no surprise that the installation would be on a farm, and that it will continue to engage in farming on the same land. What is surprising is the type of farming that will be done. In this case, the land is part of North Hollow Farm, which specializes in 100% grass fed, naturally raised beef.

Norwich Solar is designing the array to stand up to cattle grazing beneath the panels, though some of the solar array will be on an old sand pit. The batteries will be on a piece of land adjacent to the site of the array.


Kevin Davis, Norwich Solar's Vice President of Sales, said his company is very excited about this project as the first of possibly many. "We want to do more projects like this. This is where we see the future of solar power and the grid." He also commented on the way solar projects are developing, "Five years ago, we weren't actively looking for sites that could host both solar and a battery, but now we are." The market is changing, and the types of sites that should be built change with it.

Mari McClure, president and CEO of GMP, said, "We are motivated to do all we can to combat climate change and create a Vermont that is sustainable and affordable, but we must move faster. Together with our customers, regulators, our communities, and that Vermont spirit that manages to innovate despite all odds, we have all we need to revolutionize the energy system and ensure a stronger, more affordable Vermont."

Learn more about Norwich Solar on their website: norwichsolar.com.



Sheep grazing along with solar panels is a more commonly seen practice for agrivoltaics. (Merrill Smith, US DOE)



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Meet Your Solar Installer: SunCommon (VT & NY)

George Harvey

SunCommon has appeared often enough in the pages of *Green Energy Times* that it feels like a well-known organization. It seems, however, that while we have mentioned SunCommon several times, we never properly presented SunCommon as the subject of an article. That said, there is no time like the present, because SunCommon is a very interesting company with a fascinating, rich history.

The original founders of SunCommon had already been active before its founding, and one thing they did was to lead a campaign to shut down Vermont Yankee. SunCommon was founded in December of 2012 as a Public Benefit Corporation and Certified B Corp, in Waterbury, Vermont. It had two founders, Duane Peterson and James Moore, though it also started with fourteen original employees. Over the following years, SunCommon built solar systems for 4,500 Vermont families and 25 community solar arrays. With all that work, it grew rather quickly, to the point that it had a hundred employees in 2018.

At that point, the company suddenly grew, taking on thirty more employees and a much larger territory as the result of a merger with Hudson Solar, a company founded in late 2002 and originally based in Rheinbeck, New York. In addition to thirty new employees, SunCommon took on fifteen years of experience from building 1,700 solar systems. The Hudson Valley branch of SunCommon now has its office in Kingston, New York, serving

excellent service and products, which arise from its dedication to the principles of a B Corp, with a triple bottom line supporting people, planet, and profit, equally.

The effects of its triple bottom line are clear. The employees voted SunCommon one of the best places to work. It is clear that the company's commitments have spilled over into the attitudes of its workers. They have been active in their communities as individuals.

Jake C., a crew lead, explained what it is like to work with the other employees, saying, "The thing I like most about working at SunCommon [is] the people. When I go to work each day, it's like hanging out with my buddies. It's something you really can't put a price tag on."

Zoila S., a senior solar advisor, explained the attitude toward customers. "Engaging with customers gives me the joy of sharing our mutual passion for green energy, illustrating how easy and impactful the transition can be. Each conversation is an opportunity to build a community committed to a sustainable and greener future. It's about more than business, it's about taking meaningful steps together towards a cleaner planet."

SunCommon speaks of its original intentions, principles from which it has not wavered, on a page of its web site, "Advocacy & Activism." (<https://suncommon.com/advocacy-activism/>) It says, "SunCommon was founded to address the climate crisis, and built on the pillars of community organizing and activism. It's our mission to break down the barriers to renewable energy, but we know that our role goes beyond just installing solar panels. Creating a brighter future demands collective advocacy and action."

We might ask an interested reader to imagine the implications of such dedication. The B Corp triple bottom line



SunCommon customer and his dog in front of their newly solarized home in Waterbury, Vermont.

and Hudson Valley of New York. It provides services as a developer and contractor, along with engineering, procurement, and construction. Its customers are residential, farm, and commercial, along with municipal and non-profit.

The types of systems SunCommon can install include most of what people want, including ground-mounted, rooftop, and canopy installations. SunCommon can install battery back with systems, though it does not develop off-grid systems. With atten-

tion to the needs of individual customers, SunCommon can advise on incentives from the states of New York and Vermont, along with federal incentives.

SunCommon serves its customers in many ways. On its website, it says, "We take pride in tearing down the barriers to going solar by offering affordable solar financing with no upfront cost and low monthly payments."

SunCommon's ideals have led to numerous awards. In fact, it is one of only five solar companies to be designated "NYSERDA Platinum Quality Installer."

Learn more about SunCommon on their website at suncommon.com.

puts three values on equal footing. These are people, planet, and profit. This has a meaning that some customers might do well to think about. For one thing, it puts the customer at the same level of importance as profit.

Think of that! What would happen if all corporations were B-Corps? What would life be like if the fossil fuel interests put people and the environment at the same level of importance as profit? We might think it would benefit them as well as everyone else, because the path they are on is not sustainable.

SunCommon's territory covers the majority of Vermont and the Capital District



the New York Capital District and Hudson Valley.

SunCommon found new customers primarily through word-of-mouth. From the time of the merger, the number of employees grew to about 200 in just five years. SunCommon credits its growth to its efforts to provide



Close up of a SunCommon solar canopy with its bifacial solar panels and handcrafted timber frame. (Photos courtesy of SunCommon)



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ReVision Solar Projects Benefit Local Communities

George Harvey

ReVision Energy recently let us know about two community solar projects they have been working on. One was commissioned in February, and the other is in an early stage of development.

It might be a good idea to explain what a community solar project is. Many people would like to have their own solar array, but they have no place to put panels. Some of these people live in apartments or rent a home where solar panels would not be allowed. Others live in places where the sun really does not shine, such as on the north side of a steep mountain. Other people have other issues.

Whatever their reason for being unable to install a solar photovoltaic system where they live, some states allow people to participate in a shared solar system elsewhere, a community solar farm (CSF), and get credit for what the system produces.

Mark Zankel, director of community solar farms for ReVision Energy, summed this up saying, "In essence, a community solar farm is a large solar array that allows more than one electricity user to share the benefits of the energy that it generates," said Zankel. "CSFs are great, because they expand access to the benefits of solar energy by eliminating the need for at least some electricity customers to put panels on their own property."

Wishcamper Hampden Community Solar Farm

The Wishcamper Hampden Community Solar Farm was built by a partnership of ReVision Energy and Wishcamper Companies, a nationwide real estate developer. It was commissioned on February 29, 2024, in Hampden, Maine.

ReVision co-founder Phil Coupe explained a particular reason why community solar projects should be of interest in that state: "Because Maine is one of the most heavily forested states in the nation, meaning lots of shady rooftops and places where solar isn't viable, we need these large-scale, ground-mounted solar projects to help our communities and institutions move away from burning oil and gas." Stressing the economics of the Wishcamper Hampden community solar farm, he added, "Every time we build a clean energy project like this one, we keep our dollars right here at home in the local economy, creating good jobs, and giving us that energy independence and

resilience that we truly need."

Wishcamper Companies, is the investor and owner of the Wishcamper Hampden community solar farm. Charlie Duprey, the Vice President of Solar Development, addressed the benefit of partnering with ReVision Energy to develop the system. "This definitely wasn't an easy build. We ran into some bumps along the way, but ReVision's expertise and guidance mitigated those factors, and we were able to come online in our desired time frame."

The subscribers of the array include schools, the Isle au Haut Power Company, Bangor Water District, and the Town of Blue Hill and others. They receive energy credits, which are used to reduce their energy bills. College of the Atlantic President Dr. Darron Collins '92 commented on how important the solar farm is to his institution. "This project is a key ingredient in our commitment to eliminate the use of fossil fuels on campus by 2030," he said.

The Wishcamper Hampden community solar farm was built on the site of a closed gravel pit. It has 14,256 solar panels. Its energy production is estimated at 8,690 megawatt-hours, which is the equivalent to the energy use of 776 homes.

Jaffrey Community Solar

ReVision Energy also told us about another community solar project it is developing in New Hampshire. It will be built on a capped landfill in Jaffrey. Construction of the Jaffrey Community Solar (JCS) project is expected to start in the third or fourth quarter of 2024, and it should be operating in 2025. It will have a capacity of 1.4 megawatts (MW) DC and a nameplate capacity of 1.0 MW AC. Mark Zankel

said the JCS will be the largest solar array of its type in New Hampshire. This size of 1.0 MW is the result of an intentional limit on the part of the state's policy makers.

Ownership of shares in the array is limited to residents of the community of Jaffrey until the end of April, according to Megan Ulin, a project developer for ReVision Energy. At the beginning of May, any unsold shares may be purchased by Eversource customers in other communities in New Hampshire. Households, small businesses, and non-profits can buy shares in the JCS project.

Also, according to Zankel, current net-metering rules do not allow residents to receive the full value of their generated energy. So, the shareholders in CSFs get a somewhat reduced value from their investment. That, however, is also a policy matter, the result of the state government's attitude toward renewable energy.

Even so, there are some important benefits of buying a share of a community solar array. The owners of the share are entitled to a full federal tax credit for their shares of the system. Owners lock in the lowest cost of electricity, at a fixed price for a 25-year period. And the maintenance and support are covered by the purchase price. One other thing is that ReVision's lending partner can finance the cost of the share, above a base of \$1,000 which has to be covered by the buyer.

For the state of New Hampshire, the Jaffrey Community Solar project is definitely a step in the right direction, as the state gets only 1.4% of its electricity from solar power. We can hope that better things will come.

Learn much more about ReVision Energy's many projects and information at www.revisionenergy.com. 



Wishcamper Hampden community solar farm in Hampden, Maine will generate the equivalent to the energy use of 776 homes. (Images courtesy of ReVision Energy)



The Jaffrey Community Solar rendition which will be built in New Hampshire in 2024.

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GRAPPONE MAZDA GETS SOLAR ENERGY, CONTINUING THEIR LEGACY TO GO ABOVE AND BEYOND

George Harvey

Here at *Green Energy Times*, we have been watching Grappone Automotive Group as rather inspirational for about a dozen years. It was back in 2012 that we ran an article, "Grappone of Concord, NH Goes Above & Beyond," in which several steps Grappone had taken toward environmental stewardship were listed for its Toyota facility in Bow, NH (https://bit.ly/GET_Grappone_2012). Among them were recycling building components as the building was upgraded, use of geothermal heat pumps, care to prevent water loss, recycling materials so they can be reused, installing electric car chargers, and encouraging employees to use alternative transportation. The article ended by saying of Grappone Toyota, "The dealership was given Leadership in Energy and Environmental Design (LEED) certification by the US Green Building Council. The minimum score for certification is 40 points. Grappone got 49."



Grappone's Toyota LEED-certified facility in Bow, NH was given Leadership in Energy and Environmental Design (LEED) certification by the US Green Building Council. (Grappone)

If that makes Grappone sound like it is well ahead of its time, we should point out that there is a reason for this. It is because Grappone was well ahead of its time. And now, as we look at how the company is run, we see that Grappone is not keeping still and waiting for the rest of the world to catch up. It is still working on making its place in the environment the best that it can be.

The current owner of Grappone, Amanda Grappone Osmer, stands out on her own, as she contributes to the legacy of those of her family who preceded her. As the fourth-generation steward of the Grappone Group in New Hampshire, she was nominated for the 2024 TIME Dealer of the Year award, one of 49 dealer nominees from across the country who were honored at the 107th annual National Automobile Dealers Association Show in Las Vegas, Nevada. Osmer's great-grandparents, Rocco and Emanuela Grappone, were Italian



Grappone Mazda with its rooftop solar system installed by ReVision Energy. The 295 solar panels will generate over 160,000 kWh of electricity a year, offsetting more than 60% of their usage. (ReVision Energy)

immigrants to this country. They bought a gas station in Concord in 1924 to start their business. We could celebrate the fact that the business is 100 years old this year, but there is a lot more to celebrate in the company's history.

The Grappones expanded the gas station by adding an Oldsmobile dealership in 1925. Today, the Grappone Group includes Ford, Toyota, Mazda, Honda, and Hyundai dealerships. It also has the largest wholesale parts operations in northern New England. And of course, Osmer is keeping up a long family tradition as a member of the fourth generation.

Recently, Grappone made an investment in solar power at its Mazda facility. Osmer spoke of this as not just a financial investment in the company, but one in the health and well-being for the future of the family.

"In 1924, my Italian great-grandparents immigrated to Concord and started Grappone as a gas station. Since then, our family has committed to innovating and making sound decisions in line with the health of the company and the family," said Osmer. "Solar and renewable energy is undeniably the way of the future, and I'm proud to be leading Grappone into the next chapter of sustainability. It's a choice I know my grandparents would be proud of, and one I hope others in the automotive industry follow."

Grappone chose ReVision Energy to work on the solar installation. As a certified B Corp, the mission of ReVision seems to coincide with the vision of Grappone, as both seek to operate in ways that are

environmentally sustainable. ReVision has six offices, two each in Maine, New Hampshire, and Massachusetts. The office nearest Grappone Mazda is in Brentwood, N.H., about forty miles from Concord.

ReVision Energy installed 295 panels on the roof of the Grappone Mazda dealership building in 2023. The solar panels are

Q Cells, with inverters by SolarEdge. The racking is EcoFoot 2+ by UniRac. The solar system is operational and is expected to generate well over 160,000 kWh of electricity each year, offsetting more than 60% of the electricity Grappone Mazda uses.

We can easily share Osmer's hope that the rest of the automobile industry follows the lead set by her company. ♻️

RECYCLING SOLAR IN THE USA ACCELERATES THE CIRCULAR ECONOMY FOR RENEWABLES

Advanced technology will create 600 jobs and fill a gap in the country's supply chain

SOLARCYCLE, an advanced technology-based solar recycling company, will create more than 600 new full-time jobs in Polk County, Georgia, investing an estimated \$344 million in a solar glass manufacturing facility in Cedartown, GA. The facility will be the first-of-its-kind in the country to use recycled materials from retired solar panels to make new solar glass.

The company currently operates two solar panel recycling facilities in the U.S. Their advanced recycling technology allows it to extract up to 95% of the value from used solar panels. The proprietary technology allows it to extract 95% of the value of a solar panel's materials, such as silver, silicon, copper and aluminum, and to recycle or repurpose panels for new uses.

The new facility in Georgia will position the company as one of the first manufacturers of specialized glass for crystalline-silicon (c-Si) photovoltaics in the U.S., with the capacity to make five to six gigawatts worth of solar glass every year. The glass will be sold directly back to the domestic solar manufacturers and fill a critical gap in the country's supply chain to build more solar panels in America.

"There is no question that solar panel manufacturing is booming in the State of Georgia. We are thrilled to join the team and build our recycled solar glass plant in Cedartown, which will bring hundreds of good-paying jobs to Georgia and help the industry in its goals to build fully Amer-



SOLARCYCLE's CTO, Pablo Dias and COO, Rob Vinje, showing laminate after it has been cleanly separated from the glass to investors and partners. Laminate is where most of the value is contained in a panel, as in silver, silicon, and copper. (Solarcycle)


ican-made clean energy solutions," said Suvi Sharma, CEO and Co-Founder of SOLARCYCLE.

A new manufacturing facility located at Cedartown North Business Park is

a Georgia Ready for Accelerated Development (GRAD) certified site. Construction for the plant is scheduled

to begin in 2024 and will be operational in 2026. Full-time jobs in manufacturing, engineering, management, research and design, and support staff will also be created during this period. See updates and learn more at www.solarcycle.us/careers.

SOLARCYCLE provides a critical piece to the integrated solar supply chain for our country with many jobs in the innovative clean tech field. Solar installations are expected to continue to increase significantly as the country and world transition to a low-carbon clean energy future.

SOLARCYCLE is a technology-driven platform designed to maximize solar sustainability by offering solar asset owners a low-cost, eco-friendly, comprehensive process for recycling retiring solar panels and technologies and repurposing them for new uses. Experts in solar technology, recycling, and sustainability founded SOLARCYCLE in 2022 to accelerate the circular economy for solar and renewables. Learn more at www.SOLARCYCLE.us. 



Recycling Solar Panels – Cont'd from p.1

Except for countries in the European Union (EU), no country in the world has passed laws on solar waste recycling, a March 9, 2020 article in edobusiness.com by Tim Ha noted. In an extensive discussion with Vivek Chaturvedi, regional business director for solar in India, the Middle East and Africa at Royal DSM, a Dutch multinational that deals in health, nutrition and sustainable living, Chaturvedi said, "In the absence of clear regulations, there is much ambiguity around where responsibilities for recycling should lie."

WRS has not waited for government directives to undertake the task of keeping solar panel waste out of the trash. Founded in August 2019 by a team of infrastructure and environmental entrepreneurs, WRS has recycled or remarketed more than 500,000 end-of-life solar panels to date, diverting 23 million pounds of hazardous solar panel waste from landfills. They specialize in the highly-technical task of solar panel removal, decommissioning, recycling, and processing for reuse and is the nation's only solar recycler fully permitted by the federal EPA to handle hazardous secondary materials generated by solar panels.

With the addition of new lines of machinery and enhanced technology, WRS's utility scale, 75,000 sq. ft. recycling plant boasts the highest processing capacity in the nation, with the ability to process panels of every make and model, from any manufacturer, including those that are severely damaged, at a rate of up to ten panels per minute.

In a single day, WRS processes 7,500 modules, or 345,000 pounds, for recycling and reuse, and 69 million pounds in a single year, with plans to quadruple capacity to 522 million pounds by 2028.

WRS CEO Adam Saghei said, "We've not only increased processing speed and volume capacity enough to tackle roughly 25% of the current national need for recycling – we've also expanded our specialized solar handling teams, resulting in a breakage reduction of up to 30% at the time of decommissioning, which significantly increases the amount of PV panels we're able to repurpose for the resale market."

That ability to repurpose used modules is a critical part of waste management and points out the glaring inadequacy in current trends where NREL identified only 1% of panels being reused.

It is important to emphasize that except when damaged or defective, solar panels do not simply turn into pumpkins when they reach their currently warranted 30-year lifetimes. Output has faded to 80% of original capacity and while that may cause mega-projects to decommission them, the panels can continue to produce energy reliably at this reduced level for another 10 to 20 years.

"While it is possible to reuse a PV module, it doesn't have the same power efficiency and life expectancy the second time around, so there are limitations to focusing on reuse as the main PV circular economy strategy," Walzberg said. "Reuse and recycling strategies can be developed in concert. Understanding this interplay is important to move toward solutions that avoid landfilling while maximizing renewable energy generation."

And while NREL is conducting or sponsoring research into ways the ensure a circular economy develops for the solar industry, including reducing the toxicity of the solar cell materials used, current models are indicating even under best

scenarios, we may be moving toward a 23% reuse rate by 2050, and even less recycling!

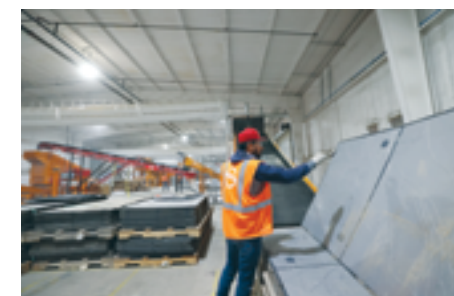
Few would disagree with this writer that this is simply not good enough.

So, what does a mature circular economy for a product look like? We only need to turn our attention upon the lead acid battery. It came into widespread use in the 1920s with the advent of electric starters in automobiles. Battery Council International (BCI), the leading trade association representing the global battery manufacturing and recycling industry, announced in July 2023 that the U.S. lead battery industry continues its outstanding recycling rate of 99% — the highest of any consumer product in the U.S. This keeps 160 million batteries out of landfills each year. BCI notes lead batteries are designed to be recycled. Its three main components (lead, plastic, acid) are 100% recyclable.


Designed for recycling is the key according to DSM's Chaturvedi, again speaking to edobusiness.com: "The focus of manufacturers, rightly, has been to reduce costs and ramp up efficiency to reach grid parity with fossil fuels. Now that this has been achieved in many parts of the world, considerations around waste are going to take a front seat globally in the coming years."

His group has already made a major contribution toward this goal by developing a back sheet for solar panels that is 100% recyclable. Just like lead acid batteries, almost all components of solar panels can technically be recycled — especially if that goal becomes a design priority.

Michael J. Daley is a life-long renewable energy educator and advocate, except



We Recycle Solar – B2B Solar Panel Recycling Services (<https://wecyclesolar.com/>)

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, powered by one repurposed solar panel. 

Long Wary of Batteries, New York is Now Poised to Go Big on Energy Storage

Can community-scale battery installations hit the sweet spot for the country's densest city? NineDot Energy has raised \$225 million more to take a crack at it.

Jeff St. John

A clean grid will need a lot of batteries to balance out the ups and downs of solar and wind power. Today, those batteries tend to come in two forms. The first is utility-scale battery farms that take up acres of land and cost up to hundreds of millions of dollars. The second is lots of little batteries tucked into garages and basements that can provide backup power when needed, plus share some of their stored energy with the grid at large.

Startup NineDot Energy is working on a third, medium-sized option, "community-scale battery storage" projects that can fit into less than an acre of open land or building space. The company's first target: the crowded urban landscape of New York City, where utility-scale batteries are hard to build and batteries inside buildings are hard to finance.

This month, NineDot Energy raised \$225 million in equity capital from new investor Manulife Investment Management and previous investor Carlyle, the private-equity firm that provided the startup with \$100 million in financing in early 2022. NineDot used that initial tranche of funding to build its first project, a 3-megawatt/12-megawatt-hour battery and solar installation built on a 7,500-square-foot former parking lot in the Pelham Gardens neighborhood of the Bronx.

Behind a fence decorated with a mural designed by students of a nearby elementary school, four Tesla Megapacks hum away. Their job is to store electricity from utility Con Edison's power grid when it is plentiful, usually overnight, and then discharge it when the utility needs it to meet peak customer demand or keep the grid running during extreme weather or other emergencies.

With its new funding in hand, along with \$85 million in construction debt financing from CIT and SMBC and a \$25 million credit facility from the New York state's NY Green Bank, NineDot has roughly \$400 million in capital. It has about 30 projects in planning or construction across New York City, including one now being built on Staten Island. The company hopes to have 400 megawatts, or 1.6 gigawatt-hours, of projects under development by 2026.

That exceeds the 322 megawatts of grid batteries deployed in New York state today, and it would bring the state closer to meeting the goal that Governor Kathy Hochul set in late 2022 of having 6,000 megawatts' of energy storage by 2030. That target is an important component of the state's landmark 2019 climate bill, which aims to reach 70 percent renewable energy by 2030.

So far, New York's large-scale battery market has failed to take off, however, with project developers unable to make the economics work under unfavorable utility contract terms. State policymakers have recently instituted a new Index Storage Credit structure for large-scale batteries that could provide more financial certainty to goose the deployment of 3 gigawatts, or 12 gigawatt-hours, of projects through 2030.

NineDot's community storage systems,



Inside the community battery project built by NineDot Energy in the Pelham Gardens neighborhood of the Bronx in New York City. (NineDot Energy)

by contrast, earn their money through a different structure that has provided a "bankable, consistent framework for valuing the energy put on the power grid," said Adam Cohen, NineDot's CTO and co-founder. That structure, known as "value of distributed energy resources" (VDER) incentives, "can define for a reasonable period of time how much money you're going to make, which makes financiers and investors comfortable that these projects will pencil out" economically.

New York's VDER structure has largely been used by the growing number of community solar projects in the state and, more recently, by community solar paired with batteries. In simple terms, VDER sets the price that project developers are paid by utilities for the energy they provide to the grid.

Then, those project developers sign up "subscribers" ranging from corporate and government energy buyers to individual households that purchase a share of the power those projects produce, typically at a lower price than what they can get from the utility. That is the standard approach in the 22 states (plus Washington, D.C.) that now have policies in place to support community solar.

But NineDot is one of a handful of companies — others include Summit Ridge Energy and Convergent Energy + Power — using VDER incentives for stand-alone battery projects. Other community-scale battery projects are being built by Con Edison, the utility serving New York City and Westchester County.

Batteries do not generate their own clean power, of course. Instead, they withdraw power from the grid at large at times when it's cheaper — and hopefully cleaner — and then discharge it to displace more expensive and dirtier grid power at other times, particularly when the grid is stressed by too much demand and not enough supply.

Cohen cited as an example the heat wave that hit New York City on September 7, the first day of the current school year — too many air conditioners running at once is a common cause of peak grid loads. "Overnight, when all the Bronx kids were getting their last tastes of summer break, the Pelham Garden system was charging up. When they got off their school buses, the system was fully charged, waiting for the afternoon peak," he said. "As they were getting home and the grid began experiencing its daily peak demand, the batteries discharged power back into the grid."

Getting batteries built in New York City

That distinct mode of operations has required some rejiggering of the structures designed for community solar projects, as well as for the decades-old rules and regulations for traditional energy infrastructure, Cohen noted. Fortunately for NineDot and other energy-storage providers, New York City "has really gotten behind energy storage inside the city to meet our renewable energy goals and to help shut down fossil fuel generators."

Cohen said that since NineDot started working on its first project, a couple of key policy changes have occurred that have made it easier to get community storage up and running in New York. In 2022, state regulators altered the rules on how battery projects are charged by utilities for the energy they withdraw and reinject into the grid, which battery developers complained were making it too expensive to build in many parts of the state.

And in December, the New York City Council approved a policy package dubbed the "City of Yes for Carbon Neutrality," designed to update decade-old zoning rules that have restricted everything from rooftop solar and electric vehicle chargers to building electrification and wastewater management retrofits. For batteries, the new zoning rules clarify "where you can install energy storage... and create a well-defined approval process for getting projects sited, permitted, built and operating," Cohen said.

Safety concerns about batteries had also held up the development of community storage until recently. For years, the New York City Fire Department blocked lithium-ion battery projects within city limits because of their fire risk — a very real problem, as the rash of battery fires inside and outside the state has proven. But the work that the fire department has put into certifying the safety of batteries now being installed in the city has "become the gold standard nationwide for how to look at this technology and how to approve it," Cohen said. "It may be slow, it may be complex — but it's done thoroughly and has established a high level of trust."

Building the value proposition for community storage

As more batteries get built in New York City, the opportunities to put them to use to help meet city and state climate goals start to multiply, Cohen said.

Today, the VDER tariffs that make up the bread-and-butter revenue for NineDot and other community solar and battery projects incorporate a "value stack" — a calculation of how each project can help provide lower-cost energy, alleviate the need for more expensive power plants to supply electricity at times of peak grid demand, reduce congestion on local grid circuits and lower overall carbon emissions of the grid at large.

If enough batteries are built within New York City, the power they store could replace that generated by fossil-fueled power plants still operating within the city's borders. Environmental justice activ-

ists have fought for years to shutter those power plants, which pollute communities and cause health problems, and state regulators have set a deadline for closing them. But late last year, state grid operator NYISO postponed the scheduled 2024 closure of four of those plants, saying they were needed to meet peak grid demand until new transmission lines bringing power from upstate New York and Canada are completed in 2026.

Transmission lines and far-off wind and solar farms are one way to relieve pressure on congested city grids. But locally sited community solar and storage projects are another, and they can be built a lot more quickly than transmission lines. Environmental justice groups in California are pushing state regulators to approve a community solar-battery program, in hopes that installations in densely populated sections of west Los Angeles County could prevent fossil-gas-fired power plants from staying open past their scheduled closure dates.

The demand for electricity in New York and other cities will only increase in the years to come under mandates to transition vehicles and building heating away from fossil fuels. Cohen noted that provisions in New York City's building decarbonization mandate, Local Law 97, allow properties that subscribe to community storage projects to count the electricity demand-shifting potential they provide in the same way they would if the batteries were located in their buildings. The biggest properties in the city can build their own batteries — the Javits Center convention hub in Manhattan has its own rooftop solar and indoor battery system, for instance — but "it's really hard to find a good spot for a battery" in most buildings, he said.


Cohen conceded that the full range of benefits that community storage could provide is still being hashed out. "If we're operating our batteries in 2034 the same way we're operating them in 2024, we are doing something wrong," he said. Eventually, distributed batteries could become integral to how utilities plan and operate their power grids, much as utility-scale batteries are today.

Gaining access to more of these "grid-services values" could also increase revenue for community storage projects, which in turn could allow them to provide cheaper energy to a greater number of lower-income and disadvantaged communities, he noted. New York's climate law directs 35% of clean energy and environmental spending to disadvantaged communities. The Biden administration's community solar programs also prioritize projects that can deliver low-cost energy to lower-income communities and communities of color.

But the economics of community solar and storage development also require deep-pocketed "anchor" subscribers willing to sign contracts for a portion of their energy. That includes customers like Starbucks, which is the first announced subscriber for NineDot's Pelham Gardens project.

NineDot is also seeking out subscribers in disadvantaged communities, though it hasn't made any announcements on that front yet. "We want the grid to be cleaner, and we want clean energy to get to those folks who need it the most," he said. "The first thing is to make sure you have a bankable project."

Jeff St. John is director of news and special projects at Canary Media. He covers innovative grid technologies, rooftop solar and batteries, clean hydrogen, EV charging and more.

Reprinted with permission from Canary Media's blog on January 22, 2024. The original posting is found at <https://bit.ly/CanaryMediaEnergyStorageNY>. 

A SECOND LIFE FOR WIND TURBINES

Wind turbines often contain huge magnets made with valuable elements like neodymium.

Scientists are exploring how to get a second life out of them. A new DOE program aims to keep them out of landfills.

Maddie Stone

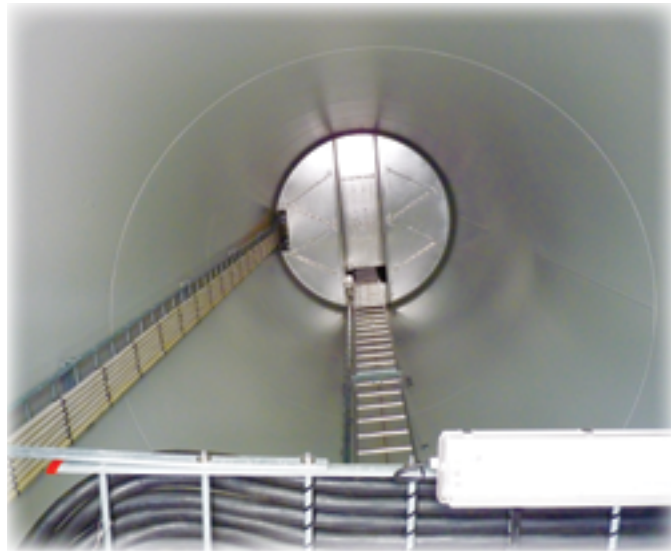
Every year, hundreds to thousands of megawatts worth of wind turbines across the United States get a facelift. These aging turbines have their rotors swapped out, their blades replaced, and key components like the generator upgraded in order to enhance the machines' ability to produce electricity from wind. This process is known as "repowering." Included among the components that sometimes get replaced are magnets made with rare-earth elements like neodymium and dysprosium, which also play essential roles inside smartphones, laptops, and electric car motors.

The wide range of applications for rare-earth minerals translates into a lot of potential ways to repurpose the ingredients from spent wind turbine magnets. But today, most of these magnets wind up in landfills. It's estimated that less than **one percent** of rare earths are recycled globally — from wind turbines, **hard drives**, and everything else.

The U.S. government, fearing a **future rare-earth supply crunch** that could hold back the energy transition, wants to change that. In January, the Department of Energy, or DOE, **announced 20 winners** of the first phase of its \$5.1 million "Wind Turbine Materials Recycling Prize." Funded by the 2021 bipartisan infrastructure law, the prize seeks to develop "a cost-effective and sustainable recycling industry" for wind turbine components that aren't being recycled commercially today, **including wind turbine blades** and the supersized magnets inside some generators. Each of the winning groups is receiving a \$75,000 cash prize to help advance its recycling idea. If a team's initial results are promising, it may go on to win an additional half a million dollars in cash, as well as a \$100,000 voucher for technical assistance from a DOE national laboratory.

The overall goal, said Tyler Christoffel, technology manager in the DOE's Wind Energy Technologies Office, is to bring promising recycling ideas closer to commercialization "on a timeline that would impact clean energy deployment and our decarbonization goals."

Rare-earth magnets are the strongest commercial magnets that exist today. They have a variety of uses, including electric vehicle motors and several types of wind turbine generators. Despite their



Inside a wind turbine at Westmill Co-op. (Ivana in York/Flickr)

importance for clean energy, mining and refining rare-earth elements is **anything but green**. Large volumes of earth must be moved in order to dig up these metals, and **harsh chemicals are needed** to concentrate and separate them. The environmental impacts of rare-earth mining, coupled with the expectation that **global demand for rare-earth minerals** will skyrocket in the coming decades, suggests we should be doing everything possible to recycle rare earths from old technology so they can be used again. Considering that the generators inside wind turbines can contain **hundreds of pounds** of rare-earth metals, it seems like a no-brainer for the wind industry to start recycling rare-earth magnets as soon as possible.

But that's not what's happening.

"Right now, to our understanding, essentially no rare-earth elements from wind are recycled," Christoffel told Grist, citing the immaturity of rare earth recycling technology, the economic challenges that come with scaling up new recycling processes, and the limited quantity of spent turbine magnets in need of recycling today. As the U.S. continues to expand its land-based wind fleet and move offshore, where **rare-earth-intensive generators are favored**, the dearth of magnet recycling options will "become a much more pressing issue," he said.

The DOE is hoping to get ahead of this problem through its new recycling prize.

Of the 20 teams that won an initial

tranche of prize money last month, four are explicitly focused on magnet recycling. Christoffel said these teams were chosen because their recycling solutions seemed novel and promising, and because they demonstrated they were "capable of advancing the technologies to commercialization." Additionally, most of these groups proposed cleaner and less energy-intensive alternatives to traditional metal recycling approaches.

"What this prize really helps to do is advance some of these recycling technologies that can offer a lower-emissions, lower-resource use [path] to a magnet," Christoffel said.

For instance, in one process for recycling rare-earth magnets

that's **previously been studied**, magnet scrap is placed in a furnace at elevated temperatures and exposed to hydrogen gas in order to extract the metals. If the scrap has become highly corroded, or **oxidized**, an additional, emissions-intensive step called **molten salt electrolysis** may be required to convert those elements back into a metallic form. A phase-one prize-winning team from the University of Utah is pioneering a novel approach that relies on chemical reactions involving both hydrogen and magnesium at elevated temperatures to separate neodymium from magnet scrap and turn it back into a high-purity metal. With this process, recyclers are able to bypass molten salt electrolysis, considerably reducing both carbon emissions and energy usage.

"We have demonstrated the reaction, the concept, works" at a very small scale, project lead **Zhigang Fang**, a metallurgist at the University of Utah, told Grist. Over the next six months, the team plans to "scale up to a bigger quantity so that we can demonstrate ... that this is a robust process that has the potential to be scaled up to a production scale."

In another popular metal-recycling approach, hydrometallurgy, recyclers often use strong acids to extract metals from scrap. Phase-one prize winner Critical Materials Recycling, Inc. is taking a greener twist on this approach with **acid-free dissolution recycling**, a method developed at Ames National Laboratory in which rare earths

are extracted from magnets using a water-based solution.

Critical Materials Recycling's parent company, TdVib, **signed a licensing agreement** for the tech in 2021 and is in the process of spinning up a pilot plant that uses it to recycle rare earths from electronic waste. With the DOE's support, Critical Materials Recycling will now explore the logistics and economics of setting up a domestic wind turbine magnet recycling industry. Eventually, with additional funding, the company hopes to actually start recycling magnets from turbines at a pilot scale using its technology.

Partnering with the wind industry "seemed like a natural fit" for Critical Materials Recycling, company CEO **Daniel Bina** told Grist. Bina noted that Iowa, where the company is headquartered, is the **second biggest wind producer** in the nation. "We should obviously be working with those people in our backyard to reclaim rare earths from materials that we have right here," he said.

With phase one of the competition over, teams are now working on their **phase-two submissions**, which include a prototype demonstration of their technology and a detailed plan to scale it up further. Up to six teams will be eligible to win \$500,000 phase-two prizes, which the DOE expects to announce in late summer or early fall, Christoffel said.

While the prize competition itself won't result in a brand-new recycling industry, the DOE hopes to produce a suite of technologies that could serve as the foundation for commercial rare-earth magnet recycling from wind turbines. Currently, there aren't a huge number of wind turbines that have reached the end of their estimated **30-year lifespan**. But that will change in the coming decades. In the meantime, there are some magnets that could be recycled from turbines following repowering, plus additional scrap being produced during magnet fabrication.

"Hopefully, this kind of competition will bring more attention" to the fact that there are ways to recycle rare-earth magnets from wind turbines," said Linda Wang, who's leading another prize-winning team at Purdue University that is developing a low-carbon, hydrogen-powered rare-earth recycling process. "We have the technology. ... The companies who own the wind turbines should do some long-term planning to collect them, instead of ship[ping] them to landfills."

Maddie Stone is a freelance science journalist based in Philadelphia.

Originally published by Grist on Feb 27, 2024. See https://bit.ly/Grist_RecycleWind-TurbineMagnets. 

The Quest for More Efficient Photovoltaics

George Harvey

Reports that a far more efficient solar cell has been developed is in the air.

Some of us may know of the "Shockley-Queisser" limit, regarding the efficiency limit of solar cells. It was named after the two scientists who first calculated the limits at the time. Its value, about 33.7%, means that theoretically, solar cells cannot convert more than 33.7% of the energy of the sunlight into electrical energy. The limit is "the maximum theoretical efficiency of a solar cell using a single p-n junction to collect power from the cell where the only loss mechanism is radiative recombination in the solar cell," according to the Wikipedia article, "Shockley-Queisser limit" (<https://bit.ly/SQlimit>).

I am sure that is not perfectly clear to

many of us, but we can still learn from it without knowing precisely what it means. First, the limit is theoretical, which means that there is a reason why it might be true, but it also might not be true. Next the limit only applies to a single "p-n junction." From a practical perspective, that means the Shockley-Queisser limit does not apply to all solar cells. The same can be said for the question of the only loss mechanism being "radiative recombination in the solar cell." The limit only applies to one, specific type of solar cell, and it is important because that type of solar cell is in widespread use.

An important implication is that the Shockley-Queisser limit will somehow govern the future of photovoltaics (PVs). But it is probably not correct, because


other types of solar cells might be developed, and they might have efficiencies greater than 33.7%.

Reports have been coming for some years about cells that actually do better. In 2022, the Fraunhofer Institute of Solar Energy Systems produced a solar cell that operated at a conversion rate of 47.6%, a pretty impressive improvement from 33.7%. How did they do this? They used an entirely different chemistry than the one the Shockley-Queisser limit applies to.

Now we find that things have been changed again. Researchers at Lehigh University reported in the journal *Science Advances* that they have achieved an "average photovoltaic absorption rate of 80% [efficiency]" in a prototype using a different chemistry and assembled in new ways.

The bottom line is that scientists believe that they may be able to produce far more efficient solar panels soon. And that means we will likely be able to produce far more electricity in the same amount of space.

We are still just starting our transition to renewable energy and addressing climate change. One thing we can bet on is that improvements will continue to move forward as our understanding of the science improves.

The technology can be compared with a Model T Ford. We have seen the prices of PVs decline sharply, in much the same way that the price of a Model T did, a hundred years ago. But the cars continued to improve for a long time after that car was developed. We can expect the same sort of improvement in renewable systems. 

The End of Coal-Burning Power Plants in New England is Here

George Harvey

Granite Shore Power (GSP), owner of the Schiller (Portsmouth, NH) and Merrimack (Bow, NH) coal-burning power plants made an agreement with the Environmental Protection Agency to close both plants. The Schiller plant will be officially closed in 2025, and the Merrimack plant will be shut down in June of 2028, at the latest. Both plants will be replaced by renewable energy parks, consisting of solar arrays and battery storage facilities at the sites of the power plants.

The Schiller and Merrimack plants are the last coal-burning plants in New England, so the entire area will be coal-free. It will be the second area of the United States to be coal-free, after the Pacific Northwest.

The announcement made by GSP was met by numerous groups as a vindication of their efforts. The Conservation Law Foundation and the Sierra Club had brought litigation against the plants, alleging violations of the Clean Water Act. Others had also made claims that the Merrimack plant was failing to operate



Burning coal at the Merrimack, NH power plant is over. (Granite Shore Power)

within environmental limits on emissions. The litigation is ending with the agreement.

Local organizations also took credit for their parts in bringing the plant closings about. The Climate Disobedience Center and 350 New Hampshire had joined forces to start a campaign, No Coal No Gas, in 2019. They have made clear that they are not quitting their work with this success. They will continue working to close gas-

burning power plants.

The demise of coal has been coming for a long time. GSP said it was motivated primarily by the fact that coal plants are not economical to run. While this statement might be intended to dampen the enthusiasm of environmental groups, there is probably at least some truth in it. The cost of producing electricity with coal has been increasing at just the same time that the cost of renewable energy from solar and wind power has declined to the point that it is the least expensive available.

The cost of batteries is also declining rapidly, new battery technologies are constantly being developed, and well-firmed renewable energy is expected to be as reliable than any more conventional form generating, at a much lower price, in the near future. We recommend NextEra Energy's [Investor Conference Report 2022](https://bit.ly/NextEra-report-2022), which it presented to its stockholders, as a more detailed source for this (<https://bit.ly/NextEra-report-2022>).

We should also make clear that the Schiller plant and the Merrimack plant are not operating as they once had been, blowing smoke and soot out of their chimneys full-time. The Schiller plant, in fact, has not operated at all for a couple of years, though it seems to be capable of going back into use. The Merrimack plant is operating, though only part-time. Like some other coal plants, it is only economical to run when demand is high, in winter and summer.

Plant operators have seen the demise of coal coming for a long time. There have been no large coal-burning power plants built in the United States in over ten years according to the Energy Information Administration (<https://bit.ly/RetiringCoal>).

The Sierra Club been working to close down coal plants for a long time and knows a bit about the subject. One of its graphics brings the issue into greater clarity, pointing out that 382 coal plants have closed or been scheduled to close in the near future, and there are only 148 left to go (<https://bit.ly/SierraCoalCampaign>).

We congratulate all involved in bringing about the agreement to close the Merrimack and Schiller plants. But we must continue to work on gas. ♻️

Many thanks to our sponsor:



NEW HAMPSHIRE'S COMMUNITY POWER MOVEMENT EXPANDS

Tom DeRosa

In a resounding testament to the growing momentum of community-driven energy initiatives, the Community Power Coalition of New Hampshire (CPCNH) has proudly announced twelve new towns that launched in March. This expansion brings local control, significant electricity cost savings, and enhanced energy choices to approximately 30,000 additional electric customers across the Granite State.

The surge in participation reflects a burgeoning trend, with the number of towns affiliating with CPCNH more than doubling in 2023 alone. Currently, the coalition boasts 56 member municipalities, representing over 30% of New Hampshire's population, and is swiftly becoming a cornerstone of local energy governance.

CEO Brian Callnan expressed his enthusiasm for the coalition's growth noting, "CPCNH now operates Community Power programs in twenty-eight municipalities, and by the end of March, we will be delivering savings and expanding local energy choices to an expected 120,000 customers." Callnan emphasized the tangible impact of CPCNH's efforts, citing over \$9 million in customer savings accrued over the past calendar year.

The new towns set to benefit from Community Power savings include Durham, Hudson, New London, Newmarket, Pembroke, Stratham, Warner, Webster, and Westmoreland. Additionally, three more towns – Chesterfield, Roxbury, and Winchester – are joining the Cheshire



Stratham, NH unanimously voted yes to community power at the town meeting.

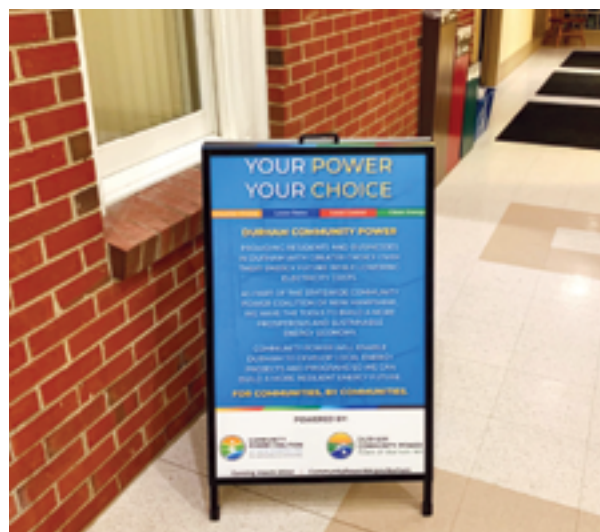
County Community Power initiative, marking a significant step forward for regional energy autonomy.

During New Hampshire's March Town Meeting days, a hallmark event in New Hampshire's civic calendar, 22 CPCNH Members voted to adopt community power, further solidifying the grassroots support for local energy governance. Furthermore, the Somersworth City Council made the pivotal decision to embrace Community Power.

The momentum doesn't stop there. Merrimack County, following a unanimous vote by its delegation on March 8, has approved the state's second County Community Power program. This decision not only under-

scores the broader commitment to local energy governance but also paves the way for many towns which have expressed interest in joining this program.

Furthermore, Concord City Council unanimously voted on March 11 to join CPCNH, adding another major city to the coalition. With Concord's inclusion, three of New Hampshire's five largest cities – the others being Nashua and Dover – are now proud members of CPCNH. Community Power has been offering municipalities the opportunity to secure lower electricity rates. CPCNH continues to offer lower rates than those provided by New Hampshire's four distribution utilities.



Board at Durham, NH public information session. (Courtesy photos)

The significance of these developments extends beyond immediate cost savings. By embracing Community Power, communities across New Hampshire are cultivating resilience, sustainability, and localized decision-making in their energy landscapes. With more communities actively engaged in the process of launching their own Community Power programs, the movement shows no signs of slowing down.

As New Hampshire continues to embrace the principles of community-driven energy governance, CPCNH stands at the vanguard, championing a future where power truly resides in the hands of the people.

Tom DeRosa is a principal at b-fresh consulting. ♻️

Many thanks to our sponsor:



The Potency of Food Recovery and the Climate

Jessie Haas

Willing Hands, the fresh food recovery nonprofit located in Norwich, VT., has three missions: ending hunger, improving health, and reducing waste. But as they note in their new Climate Action Plan, reducing food waste is more than just a value. It is a way to address climate change on a community level, where individual actions can have an outsized impact.

Reducing food waste makes ten times the impact of switching to an electric vehicle and is Solution #3 in Project Drawdown's list (electric vehicles is #26). Simply by following its main mission, Willing Hands is avoiding one million pounds of carbon-dioxide-equivalent (CO₂e) emissions every year. They plan to double this negative carbon footprint by 2026. Not surprisingly, the most effective strategy for doing this is to do more of what they are already doing—fresh food recovery.

Why is food recovery such a big deal? In climate terms, there are two main reasons. If food is not eaten, all the CO₂ used to produce, package, and ship it is wasted. The emissions rise into the atmosphere without having provided any benefit to people or the planet. Then it gets worse. If food goes into a landfill, it decomposes and produces methane, an extremely powerful greenhouse gas (GHG), up to 34 times more powerful than CO₂. One quarter of human-caused climate change can be attributed to methane.

The basics of the Willing Hands' plan are simple: Get 600,000 pounds more food from new and current local sources, and create a regional food recovery network to provide the remaining 300,000 pounds of food. Each pound of recovered food avoids 1.6 pounds CO₂e; gleaned food from farm fields provides one pound of CO₂e, and each pound of composted food avoids roughly 0.75 pounds. Tons more food for the community, tons less pollution in the atmosphere; a simple and elegant solution.



(Photos courtesy of Willing Hands)

But nothing is ever that simple. Willing Hands has several trucks on the road, and a refrigerated warehouse, bringing it smack up against Project Drawdown's Number One Solution—Refrigerant Management. The chemicals used widely to refrigerate food, along with other substances, for decades contributed to causing a hole in the ozone. The Montreal Protocol forced a transition to different gases, which are benign for the ozone layer but are extremely potent GHGs. Willing Hands' Executive Director, Gabe Zoerheide, notes that the combination of older refrigerated trucks and rough Upper Valley roads has been a bad combination. Frequent refrigerant leaks have made up a large proportion of Willing Hands's direct carbon impact. The units have no gauge to tell an operator of a leakage, and there is a shortage of refrigerant technicians in the Upper Valley region. Willing Hands is working with an Efficiency Vermont consultant and expect a 56,000-pound reduction in CO₂e. Switching the office from propane-powered baseboard heat to a heat-pump should reduce emissions by another 9,000 pounds.

Willing Hands' trucks log 40,000 miles annually. By mapping out efficient routes and committing to using the smallest

vehicle available for nonregular routes, Willing Hands plans to avert another 6,500 pounds of emissions. Purchasing an electric gleaning van would reduce emissions by another 5,000 pounds.

Other strategies for Phase One include replacing a propane water heater with an on-demand tankless electric heater, replacing one box truck with a delivery van, fostering a culture of efficiency with an emphasis on carpooling.

Phase Two involves writing a vehicle replacement plan, exploring the possibility of retrofitting



ing, food waste, and food equity; turn the Willing Hands facility at 198 Church St. into a community hub. Land management will also be important. Willing Hands owns ten acres of garden, orchard, and a composting facility, and grows food on four more sites. They already follow many regenerative practices but plan to improve their composting and soil carbon sequestration, as well as plant a pollinator garden and see if anything can be done to improve the health of the wetland.

The Climate Action Plan is both ambitious and educational, illustrating the power of what most people still do not understand as a climate action; reducing food waste. Willing Hands only needs to keep doing what they are doing to improve the health of people, the community, and the planet.

The website offers clear paths to donate food, find food, and volunteer; individuals can Grow a Row in their own gardens, share a CSA share, or contribute wild game, as well as glean, work in the warehouse or office, or deliver food. For those of us who live too far away, Willing Hands is not looking to expand geographically, but would love to see sister organizations following the same model. Maybe there is room for one in your community.

Jessie Haas lives in a 450 square foot off-grid cabin in southern Vermont with husband Michael J. Daley. She is the author of 41 books for children and adults. ♻️



existing trucks with refrigeration systems that can use more benign refrigerants and tracking independent volunteer driver miles with a view to reducing their impact. With 600 volunteers, this impact is unknown, but likely high.

Outreach is also an important component of the plan. Willing Hands intends to create a replicable Climate Action Plan other organizations can use as a template; make climate and the environment a much more prominent part of the story they tell to the public, donors, and recipients of food; educate about garden-

EPA and DOE Name NHSaves® Utility Partners a 2024 ENERGY STAR® Partner of the Year Award Winner

Utility partners nationally recognized for Sustained Excellence for their New Home Construction program for 11th consecutive year

The NHSaves utility partners Eversource, Liberty, New Hampshire Electric Cooperative and Unitil are proud to receive the 2024 Partner of the Year Award for Sustained Excellence – from the U.S. Environmental Protection Agency and the U.S. Department of Energy. This marks the 11th consecutive time that the utility partners have been honored for their leadership delivering energy efficiency programs for New Hampshire customers.

"The NHSaves utility partners are extremely proud of the success of the ENERGY STAR Homes Program, connecting customers across New Hampshire with highly efficient new-build homes," said Eversource Director of Residential Energy Efficiency Kate Peters. "Every year we are able to help homebuilders construct more energy-efficient homes, reducing energy



use and mitigating the effects of climate change throughout the state. The Sustained Excellence award is the highest honor that ENERGY STAR can bestow, and it is a huge testament to the strength of our initiatives and partnerships throughout the state of New Hampshire."

The New Hampshire utilities are leaders in guiding residential, commercial, industrial and municipal gas and electric customers toward energy savings through incentive-based programs, including the New Hampshire ENERGY STAR Homes Program for new construction. In 2023 the partners surpassed their ambitious targets of 35,350,664 lifetime kWh and 559,252 lifetime MMBtu savings.

Last year, the utility partners also facilitated ENERGY STAR certification and provided incentives for more than 946

households, contributing to a cumulative total of 11,674 homes since 2001. At the same time, they grew the program's market penetration from two percent to a robust 28-33 percent. These outcomes reflect an increasing awareness of the benefits of program participation for customers, driving engagement and demand.

"President Biden's Investing in America agenda creates an unprecedented opportunity to build a clean energy economy, and private sector partners through programs like ENERGY STAR are leading the way," said EPA Administrator Michael S. Regan. "I congratulate this year's ENERGY STAR award winners for



their innovation and leadership, in delivering cost-effective energy efficient solutions that create jobs, address climate change, and contribute to a healthier environment for all."

In order to receive the ENERGY STAR Partner of the Year Sustained Excellence Award, partners must be named an ENERGY STAR Partner of the Year for two consecutive years.

A complete list of 2024 winners and more information about the ENERGY STAR awards program can be found at www.energystar.gov/awardwinners.

To learn more about all the NHSaves programs, go to: <https://nhsaves.com/>. ♻️

WHITE HOUSE AWARDS \$20 BILLION TO NATION'S FIRST 'GREEN BANK' NETWORK

At least 70% of the funds will go to disadvantaged communities while 20% will go to rural communities and more than 5% will go to tribal communities.

Kristoffer Tighe

On Thursday, April 4th, 2024 the nation's first "green bank" network, an historic \$20 billion investment aimed at making clean energy affordable to low-income and rural residents was announced by the Biden Administration.

The banks will provide low-or zero-interest loans "to fund tens of thousands of climate and clean energy projects across America, especially in communities historically left behind and overburdened by pollution," the White House said.

The "green bank" network upholds two of President Biden's key campaign promises: slowing climate change and advancing environmental justice.

Under the Environmental Protection Agency's Greenhouse Gas Reduction Fund—also known as [the country's first national green bank](#)—eight community development banks and nonprofit organizations will receive federal funding to go toward rooftop solar installations, energy efficiency upgrades and other projects that help reduce greenhouse gas emissions. The Inflation Reduction Act created the green bank in 2022 with an initial federal investment of \$27 billion.

Vice President Kamala Harris traveled to North Carolina on April 4th to publicize the announcement, appearing with EPA Administrator Michael Regan and North Carolina Gov. Roy Cooper at a press conference in Charlotte, where they named the eight recipients. The groups, which consist of Coalition for Green Capital, Power Forward Communities, Appalachian Community Capital, Climate United, Justice Climate Fund, Opportunity Finance Network, Inclusiv and Native CDFI Network, have committed to spend \$7 in private investment for every \$1 of government funding.

The White House said that the new initiative will generate about \$150 billion in clean energy and climate investments and help the nation avoid the release of 40 million metric tons of carbon pollution each year through 2031. At least 70% of those funds will go to low-income and disadvantaged communities, the administration said, while 20% will go to rural communities and more than 5% will go to tribal communities.

"The majority of this \$20 billion will go to communities that have historically been left out and left behind," Harris said at the Charlotte event. "For the first time in history, we are providing tens of billions of dollars directly to community lenders to finance local climate projects."

"Imagine a small business owner who can now take out a line of credit to buy a fleet of electric delivery vehicles, so he can stop paying for gas and reduce pollution at the same time," she added. "Imagine a house of worship that can now get a zero-interest loan, so they can install solar panels to generate clean energy electricity for the entire neighborhood."

Climate advocates largely celebrated the news, calling the move historic and saying it would jumpstart clean energy investments across the country. The Coalition for Green Capital, which received

\$5 billion, said it's looking forward to collaborating with hundreds of community organizations and commercial partners on their projects.

To date, the coalition and its partners have helped secure more than \$9 billion in public and private capital for clean energy projects in multiple states, including California, Colorado and New York. Some of the projects funded by the coalitions' partners include the installation of solar and battery storage systems at two recreation centers in Detroit, which reduced the facilities' energy bills by 35%, and [helping Black churches in Georgia](#) connect to clean-powered microgrids.

"The EPA's awards of \$20 billion compose the largest single capitalization of green banks in any country in the world," Reed Hundt, Coalition for Green Capital's CEO and co-founder, said in a press release. "The United States now can lead all nations in showing how public-private investment can deliver cheap clean power faster than anyone has predicted."

Biden has by far done the most of any president to advance climate policy. The Inflation Reduction Act, which Biden signed into law in 2022, dedicates around \$370 billion to climate efforts.

"These funds will be available for use in the next few months and will be put into action before November," said Carla Walker, director of environmental justice and equity for the World Resources Institute's U.S. branch. "That means low-income and disadvantaged communities across the country will soon start seeing a tangible difference in their lives, from greater access to clean energy technologies that lower their utility bills and clean their air to more job opportunities."

Specifically, the new funding helps to bolster the president's commitment, under the Justice40 initiative, to drastically reduce America's persistent economic and health gaps. That program sets the goal that 40% of the overall benefits from certain federal investments flow to disadvantaged communities that have been disproportionately impacted by underinvestment and overburdened by pollution. The \$20 billion going toward the new green bank network is covered by Justice40, the EPA said in an email.

That funding "is a crucial step toward addressing longstanding inequities and barriers to accessing much-needed capital for the communities that need it most," Walker said. "It will empower these communities to become active participants in America's clean energy transition."

Kristoffer Tighe is a staff writer for Inside Climate News, covering climate issues in the Midwest. He previously wrote the twice-weekly newsletter, Today's Climate, and helped lead ICN's national coverage on environmental justice. His work has been published in Reuters, Scientific American, Mother Jones, HuffPost and many more. Tighe holds a master's degree in journalism from the Missouri School of Journalism. Email him at kristoffer.tighe@insideclimatenews.org. Marianne Lavelle contributed to this report.

Efficiency Maine Green Bank Receives Grant to Bolster Clean Investment Loan Initiatives

The Efficiency Maine Green Bank proudly announces that it will receive approximately \$15 million to support energy loans through a grant from the U.S. EPA's National Clean Investment Fund (NCIF), an initiative of the Inflation Reduction Act's Greenhouse Gas Reduction Fund. Efficiency Maine is a sub-awardee under an application submitted by the Coalition for Green Capital (CGC), which is one of three winners of NCIF funds (<https://bit.ly/EPA-CleanEnergyGrants>).

Background: Since 2010, Efficiency Maine has offered loans as part of its portfolio of programs to support Maine consumers making energy efficiency improvements to their homes and businesses. In recent years, the Maine legislature has expanded the authority of the Efficiency Maine Green Bank to provide more financing support for the "rapid deployment of mature technologies and the commercialization and scaling of new technologies" that will help Maine consumers improve their energy efficiency and reduce their greenhouse gas emissions. With the promise of new capital from the U.S. EPA's Greenhouse Gas Reduction Fund, the Efficiency Maine Green Bank intends to expand its loan and lease offerings across a broader range of homeowners, small businesses, commercial properties, schools, and municipalities.

The CGC, doing business as the American Green Bank Consortium, is a 501(c)(3)

chartered specifically to reduce greenhouse gas emissions and other forms of air pollution and redress climate and energy-related environmental impacts. Green banks are a proven finance model that use public and philanthropic funds to stimulate private investment in renewable energy, energy efficiency, and other decarbonization technologies. Since 2011, the CGC has supported or created more than 40 green banks and has developed a pipeline of qualified projects in low-income and disadvantaged communities. For more information, visit <https://coalitionforgreen-capital.com>.

James Neal, Senior Manager for Finance Initiatives at Efficiency Maine said, "The Efficiency Maine Green Bank is grateful for and excited about the opportunities that this generous National Clean Investment Fund grant will provide. These funds will enable the Efficiency Maine Green Bank to offer loans for heat pump projects that will reduce Maine's dependence on imported fuels and lower heating bills in homes and businesses across the state. These loans will be strategically deployed to complement the pioneering rebate programs offered by Efficiency Maine to help Mainers maintain efficiency and reduce their carbon footprint while staying warm throughout cold Maine winters. The Greenhouse Gas Reduction Fund will have a real and tangible positive effect on the lives of Mainers." ♻️

Ship & Shore Environmental Solutions

Ship & Shore Environmental, Inc. is a Long Beach, California-based, woman-owned, certified business specializing in air pollution capture and control systems for industrial applications. Ship & Shore helps major manufacturers meet Volatile Organic Compound (VOC) abatement challenges by providing customized, energy efficient air pollution abatement systems for various industries, resulting in improved operational efficiency and tailored "green" solutions. Since 2000, Ship & Shore has been prepared to handle and advise on the full spectrum of environmental needs with its complete array of engineering and manufacturing capabilities and global offices around the U.S., Canada, Europe, India, Thailand, China, and more. The Ship & Shore Technical Engineering Team has custom designed tailored solutions for clients throughout the world.



The 10,000 SCFM Ship & Shore Environmental Regenerative Thermal Oxidizer (RTO). (Courtesy photo).

Clean Air Solutions Amidst Shifting Food Industry Dynamics in 2024

As the food industry faces unprecedented challenges and transitions in 2024, Ship & Shore Environmental, Inc. (S&SE) emerges as a guiding force, championing clean air solutions tailored to the evolving needs of food manufacturers and packagers. Against the backdrop of recent news highlighting declining stocks in fast food chains and the surge

in grocery store food sales, S&SE reaffirms its commitment to supporting the food industry's transition towards sustainability and compliance.

The rise of grocery store food sales underscores the need for innovative pollution abatement solutions, particularly in manufacturing and packaging. S&SE, with over

a dozen customers in the food industry, including food manufacturing and packaging, is at the forefront of providing tailored solutions to address the diverse challenges faced by manufacturers of food, frozen food, fried food, flavors added to foods, and odor control at facilities.

Local Efforts to Clean the Air

Many food facilities are located in California, S&SE's efforts there to clean the air have become increasingly pertinent. The company's most recent activity included the installation of a 10,000 SCFM Regenerative Thermal Oxidizer (RTO) for a food customer in California, further solidifying its commitment to environmental stewardship at a regional level.

Innovative Solutions: Coconut Husk as an Effective Oil Filter

Highlighting its dedication to product development, S&SE underscores the effectiveness of coconut

FEDERAL

FEDERAL INVESTMENT TAX CREDIT

- To learn more about federal tax credits for home owners, home builders, and commercial buildings, go to: 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 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 for:

Advanced Wood Heating

- Pellet 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.
- Replace coal stove, furnace, or boiler with a pellet stove, furnace, or boiler
- Adder is up to \$27,000 for commercial projects
- Can be combined with other incentives (<http://tax.vt.gov/exemptions>)
- Additional information on wood heating at: www.fpr.vermont.gov/woodenergy/rebates

Eligibility

- Residential Customers
- Installation must be in Windham County
- Customer must be Low or Moderate income earning to be eligible
- Adder is \$8,000 for Low Income customers, and \$6,000 for moderate income customers
- Advanced Wood Heating Installers must be members of Efficiency Vermont's Efficiency Excellence Network (EEN) Advanced Wood Heating trade group. Info. for the pellet system incentives and the low-income adders for Windham County are at www.RERC-VT.org
- For Residential: <https://bit.ly/424incent1>
- For School and Municipal: <https://bit.ly/424incent2>
- For Business Small Businesses: <https://bit.ly/424incent3>

Free Assessments for Small Businesses

- FPR, in partnership with VEIC, is offering free assessments for Vermont small businesses interested in switching from fossil fuels for their heating needs to Advanced Wood Heat (AWH). For more information, contact Adam Sherman at VEIC at asherman@veic.org.

Bio-diesel

- Eligible customers can receive funds for heating with bio-diesel. (www.erc-vt.org/heating-with-biodiesel)

Other Utilities Heating Offers

- Members of Washington Electric Co-op (WEC) can get a \$1000 rebate on approved pellet boilers and \$500 for pellet furnaces. This can be combined with the CEDF and Efficiency Vermont incentives for a total of \$7000; \$250 for qualifying pellet or wood stove installed by a qualified installer. This can be added to stove offers from CEDF and Efficiency Vermont.
- Members of the Vermont Electric Co-op can get a \$150 credit on the purchase of an approved pellet stove: www.vec/energy-programs.
- Stowe Electric Customers can get a \$150 rebate with the purchase of a pellet stove.

VT TAX CREDITS

- Vermont offers an investment tax credit for installations of renewable energy equipment on business properties 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.encyvermont.com/rebates.

Lighting

- 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 \$4,000.
- 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

- Combination washer/dryer rebate: \$400
- 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** – This loan offers income-eligible financing as low as 0% APR for 60 months. It is more accessible than traditional financing tools and can be used for small projects like a new pellet stove, or large projects like a weatherization project.
- Additional incentives may be available through your local electric utility provider. Contact your utility for more information.

- On-bill financing:** Pay for your weatherization project on your monthly utility bill. Restrictions apply.

- Renters can get free LEDs** (including dimmable and wifi-enabled), faucet aerators, and showerheads.

- Small business wood energy** incentives: <https://bit.ly/VTDepartmentofForests-ParksandRecreation>.

- Grants for working land:** <https://workinglands.vermont.gov/businessgrants>

Flood Recovery Rebates for Homeowners and Renters

To Homeowners and renters recovering from flood damage can get up to \$24,500 back on eligible products, appliances, and weatherization services. See encyvermont.com/floodrebate.

GMP Rebates Through 2024

Learn 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

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

Residential Solar/Wind Rebate Program 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_ResidentialWoodPellet 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**.

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.

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

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, EFL.

- 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 that 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 NYSEDA 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/>.

National Grid: To get the latest info go to: NGRID.com/Save.

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 municipal-ity 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>
- **National Grid High Priority Electrification:** https://bit.ly/CleanHeatNY_HeatPumpIncentives
- **National Grid High Priority Zip Codes** Qualifying customers in these areas are eligible for an additional 25% incentive on the installation of heat pumps (for conversion from gas to electric). <https://bit.ly/424incent6>
For Businesses, not for profits, schools and municipalities: <https://bit.ly/424incent4> <https://bit.ly/424incent5>
- **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

ReWire America Calculator.

<https://www.rewiringamerica.org/app/ira-calculator>

Read up on electrification at:

<https://homes.rewiringamerica.org/>

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. For more information go to <https://bit.ly/424incent9>. To find a vendor go here: <https://bit.ly/424incent10>.

Multifamily Insulation:

Efficiency Maine also offers incentives for multifamily insulation and air sealing. Multifamily buildings with three 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. Go to <https://www.efficiencymaine.com/insulation/>

Heat and Cooling:

Efficiency Maine offers rebates and financing for the installation of high-efficiency equipment. To find out more about heating solutions, for your home go to: <https://bit.ly/424incent11>.

For business heating and cooling solutions go to: <https://bit.ly/424incent12>. Homeowners can estimate their annual heating costs for different heating systems using the Compare Home Heating Costs calculator here: <https://bit.ly/424incent13>. To find a residential vendor go here: <https://bit.ly/424incent14>. To find a qualified partner for business solutions, go here: <https://bit.ly/424incent15>.

Heat Pumps:

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

Businesses, municipalities, schools, and other non-residential facilities are eligible for commercial incentives. Learn more at the Efficiency Maine heat pump website hub at <https://bit.ly/424incent16>.

Many thanks to our sponsor:



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 <https://bit.ly/424incent17>. Use the Compare Water Heating Costs calculator to estimate savings: <https://bit.ly/424incent18>.

Efficiency Maine also offers commercial incentives to qualifying building types for heat pump water heaters with 80-gallon storage tanks, 120-gallon storage tanks, and split-system heat pump water heaters with a minimum of 80-gallon storage tanks. Learn more at <https://bit.ly/424incent19>.

Electric Vehicles (EVs):

Efficiency Maine offers rebates between \$1,000 and \$7,500 for eligible electric vehicles. These rebates are available to individuals, businesses, nonprofits, and governmental entities.

Vehicles must have a sticker price below \$50,000, except pickup trucks and commercial vans, and must be purchased from a dealership in Maine or directly from a manufacturer.

Visit efficiencymaine.com for a list of rebate-eligible vehicles, an EV dealer locator tool, and more.

Electric Vehicle Charging Solutions:

Charging in a single-family home, typically in a garage, is convenient and inexpensive. For those reasons, most EV drivers charge at home (<https://bit.ly/424incent20>) using either a Level 1 charger or a faster Level 2 charger.

For public sites like businesses, municipalities, or multi-family residential complexes, installing an electric vehicle charging station 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://bit.ly/424incent21>.

Commercial:

Efficiency Maine has programs for businesses of all sizes, including multifamily buildings with three or more units and Maine's largest energy customers.

Examples of eligible organizations include businesses, for profit or nonprofit; municipalities; schools and higher education facilities; manufacturing and other industrial facilities; other non-residential facilities; mixed-use buildings, and multifamily buildings with three or more units.

To learn more about Efficiency Maine's incentives for the commercial and industrial sector, commercial energy efficiency solutions, how to get started, and program details, visit <https://bit.ly/424incent22>.

To find contractor participating in Efficiency Maine programs as a Qualified Partner go here: <https://bit.ly/424incent15>.

Appliances: \$50 rebates available for ENERGY STAR® certified clothes washers: <https://bit.ly/424incent23>

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.

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

LET'S GET TO THE HEART OF THE MATTER

What impact do microplastics and PFASs have on human health, and what can we do about it?

Janis Petzel, MD

PLASTICS

Let's get to the heart of the matter: plastic pollutants are not good for your heart. Or your brain. Or your immune system, your reproductive organs, your liver, kidneys, blood vessels or hormone systems. Their presence all over the human body—both chemical and actual bits of plastic—sets off alarm bells for the body's immune system and increases health risks for inflammation, cancer, and autoimmune problems.

Plastics are made from petroleum and tens of thousands of chemicals. They last almost forever. Plastic objects break into smaller and smaller pieces in a short period of time with use, abrasion, or exposure to sun. Plastic manufacturers and the fossil fuel industry (which are often one and the same, Exxon Mobil a prime example) pushed hard to promote single use plastics starting in the 1950s as a way to increase sales of their petrochemicals, all the while knowing these plastics could not be recycled.

So, now, Earth's air, soil, water, and food chains are contaminated by these bits that range in size from nanoparticles the size of viruses (which you need an electron microscope to see), to microplastic particles visible to the eye or under a regular microscope (up to the size of a sesame seed). They get into our bodies by ingestion and inhalation. We eat them, drink them, and breathe them. In a 2024 study in *PNAS*, the authors note that for drinking water, "plastic contamination is confirmed in every step from the well to the bottle."

We can't eliminate plastics from water using plastic. For example, per *PNAS*, polyamide is "the most popular membrane material used in reverse osmosis," and "polystyrene is the backbone material for ion exchange resins in water purification." It's ironic, but water filters themselves are known to release nanoparticles of these major contaminants in bottled water (but aren't the only sources).

Nanoplastics are absorbed into the blood stream, where they are taken up by tissues all over the body. They are linked to diseases like diabetes and Parkinson's Disease. We now know that microplastic pieces can also infiltrate the tissues and fluids in our bodies—blood, breast milk, feces, the liver, lungs, testes, and placenta.

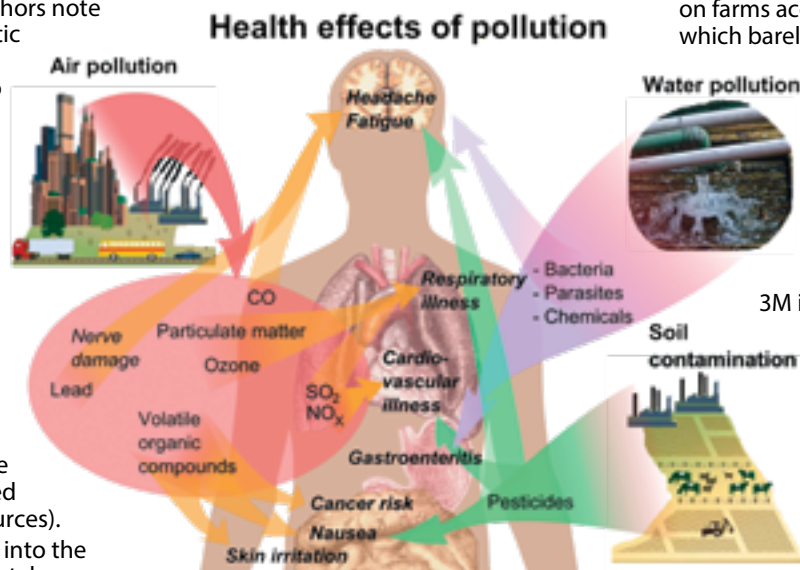
Microplastics are now linked to bad outcomes from heart disease. According to a 2024 study in *New England Journal of Medicine*, people who have microplastic in their plaques (the gunk in the hardening of the arteries) are four to five times more likely to have heart attacks, strokes or to die than people who don't have the plastic bits. The presence of microplastics in tissue correlates with an increase in inflammation, and with an intense response from immune cells, both of which increases risk for pathology and disease.



Beach plastic trash at Freedom Island in the Philippines. (Greenpeace Philippines)

Microplastic pieces carry chemical toxins into our bodies. A sobering report from the Norwegian Research Council showed that there are at least 16,000 different chemicals in various plastics (3000 more than had previously been recognized), only 6% of which are monitored, but 25% of which are known to be hazardous to human health. (Particular types of plastic may be made from up to 1000 chemicals).

Each plastic type has a different recipe, which is why it is so difficult to recycle them, just as you can't recycle a chocolate cake back to eggs, flour, and sugar. Once the plastic mixture has hardened, it takes heavy chemicals and high heat to separate it back to its original components, if it can be done at all. Almost no plastics are recyclable on any safe or practical level. (see the MCV YouTube on the Fraud of Plastic Recycling).



Health effects of common types of pollution. (Wikipedia Creative Commons CC0 1.0 Universal Public Domain Dedication)

PFASs: PFASs (poly- and per-fluoroalkyl substances) are prime examples of chemical toxins that travel with plastics. According to a 2023 article in *npj Clean Water*, PFASs are "intricately connected to the global issue of plastic pollution as they co-occur with microplastics and other additives" such as phthalates and plasticizers that also raise concerns for human health risks.

PFASs are a family of thousands of different molecules used as flame retardants, fabric, paper coatings, surfactants, and non-stick coatings for kitchen pans and industrial machinery—which may be how toilet paper even from "green" companies gets contaminated with these chemicals.

According to a review of medical literature by the National Academies of Science, Engineering and Mathematics, there is definite evidence for PFASs causing a decreased antibody response to vaccines; dyslipidemias like high cholesterol; decreased infant and child growth; and risk of kidney cancer. Limited data also showed an increased risk of breast cancer, pregnancy-induced hypertension and preeclampsia, ulcerative colitis, testicular cancer, and liver function alterations.

Ironically, it looks like the use of PFASs increased when older flame retardants were phased out due to public concerns, which demonstrates the whack-a-mole problem with plastics and PFASs. There are so many varieties, and such little incentive for corporations to be forthcoming with safety data, that it's difficult for regulators or public health systems to track them.

Water and sewage treatment plants are not equipped at present to remove PFASs from wastewater. In fact, levels may be higher after treatment with chlorine, because some PFASs convert to even more stable forms that may last almost forever. There is a type of filter under development called MOF (metal-organic frameworks) that appears to be effective and scalable for city water systems, so fingers crossed, that will be available soon.

As of January 2024, New England states have spent \$355 million to investigate, identify and mitigate PFAS in water and on farms according to *saferstates.org*, which barely scratches the surface for the damage done to people's lives and health.

After the 3M Company decided to phase out manufacturing of PFASs in 2022 (with plans to stop completely by 2025), levels of PFASs in the environment went down to some extent.

3M is still in business, proving corporations can survive when they do the right thing.

To sum things up, the general use of plastics and ated chemicals has to stop, but how? Individuals can take some steps to avoid plastics (see article on "What Can You Do" on p.20 in this edition of GET), but this is an expensive global problem that won't go away without hard work and consensus. Manufacturers of plastics and toxic chemicals

need to be held accountable, a gargantuan task fraught with politics, corporate resistance, and outright greenwashing, just like what we have seen with tobacco, opioids, petroleum and climate change. But legal remedies held corporations accountable before. We have to stay strong and do it again for plastics.

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

WHAT CAN YOU DO TO CUT DOWN ON PLASTIC EXPOSURE AND POLLUTION?

Janis Petzel, MD

Stop drinking water from plastic bottles

A recent analysis of commercially available bottled water published in the "Proceedings of the National Academy of Science" showed a quarter of a million tiny plastic fragments in each liter of water, the bulk of which were nanoparticles (90%), much higher contamination than previously realized. Plastic particles easily infiltrate the human blood stream. Bottled water also contains plastic-related chemicals such as polyethylene terephthalate (PET). Some of the plastic contaminants (like polyamide or polystyrene), may have come from the filters used to "purify" the water.

Avoid microwaving food, baby food or water for formula in plastic containers or pouches

A 2023 paper from *Environmental and Science Technology* reported that "some containers could release as many as 4.22 million microplastic and 2.11 billion nanoplastic particles from only one square centimeter of plastic area within three minutes of microwave heating."

Do your best to keep plastics and PFASs from touching your food.

Avoid non-stick pans that have plastic-based coatings, because these types release PFASs into the air and the food when heated.

Food packaging is loaded with PFASs—at least 68 types of paper, plastic, and coated metal packaging—according to Switzerland's Food Packaging Forum Foundation, as reported in *Ecowatch*. Storing food in plastic and even cutting food on plastic cutting boards leads to significant plastic particles of nano- and micro-particle sizes in the food. Glass may be the only safe alternative for food storage.

Avoid chemicals on your skin.

Let the buyer beware. Cosmetics, sunblock, coated dental floss and even toilet paper may contain PFASs. Bidets are relatively inexpensive, easy enough to install or retrofit to your toilet, and help cut down on paper in the waste stream.

Removing PFASs and plastics from drinking water

Good news: Many pitcher-type water purifiers seem to work pretty well, according to both the National Academies of Sciences' 2022 report, and from *ewg.org*, the non-profit group that publishes Dirty Dozen reports on fruits and vegetables. There is a potential issue with plastics from the filters getting in to the water (similar to the issue in bottled water). I have a glass Life Straw pitcher which I got as a gift from my daughter. Their specification sheets say it works, and my coffee tastes better. I have not had my water tested to be sure.

There are lots of filter systems out there, from under \$50 to thousands of dollars that claim to remove PFASs, plastics and other substances. Some seem to work; some don't based on my internet searches (but none remove 100% of PFASs). There is almost no data on effective use in the real world outside a test lab. Taking

Cont'd on p.21

OH BUOY! MUSHROOMS TO THE RESCUE

Janis Petzel, MD

Even if they were not dangerous to human health (which they are), plastics are almost impossible to get rid of, cannot easily be recycled, and create ugliness and pollution. Most of us want to cut back or eliminate plastics from our lives. But finding alternatives is not easy.

That is why material science research into the use of fungi to replace plastic is so exciting. Mushrooms are the fruiting bodies of fungi. They grow out of thread-like mycelia, which infiltrate organic matter to break it down. The mycelia are thin but mighty. You can see this in a dead tree which has decomposed but still holds its shape thanks to a mycelial network.

Mycelia can be grown in molds with plant waste to create a natural bio-composite for fire retardant insulation, packaging material, or alternatives to expanded polystyrene for floats and buoys in the aquaculture industry.

Sue Van Hook, CEO and founder of start-up company, MycoBuoy, is one of the pioneers in mycelium research for aquatics. She draws inspiration from Paul Stamets' book *Mushrooms Can Help Save the World*. She is doing more in retirement than many people do in their careers, and describes a "fungal revolution" in progress.

Van Hook said, "Fungi have so much to teach us. They have been around for 1.7 billion years and have learned to adapt. They have a suite of enzymes to digest carbohydrates and are symbiotic with so many living systems."

She served as a mycological consultant from 2007-2010, when she left her full-time job at Skidmore College in New York to join a mycelia start up called Ecovative Design, becoming the company's chief mycologist. She spent the first six years isolating wood rot species from the wild to test their structural properties as a new bio-composite material.



MycoBuoy's being prepared for deployment on the Hurricane Island experimental aquaculture farm in June 2023. (Madison Maier, Aquaculture Manager at Hurricane Island)

Having spent childhood summers at her grandparents' home on North Haven, an island in Penobscot Bay in Maine, Van Hook was intrigued by the idea of mycelia buoys. She grew lobster buoy prototypes in three-liter soda bottles to give them the right shape, then got feedback from Maine lobstermen. Over a decade later, friends in oyster aquaculture asked for her help getting plastic out of their operations.

The buoys are made from mycelia and hemp, a traditional material used for sails, lines, and caulk in sloops. Van Hook uses solar energy to dry the buoys before they go into the ocean. The buoys are much less energy-intensive to make than plastic buoys. (View <https://bit.ly/TheFuturePlastic> to see a video from University of Utrecht in Netherlands, where they dry 3-D printed fungal furniture in an oven, as you would loaves of bread).

The natural, uncoated buoys, which have the look and feel of Styrofoam, last five months in the water, which is perfect

timing for Northern oyster aquaculture (the oyster bins are sunk to the bottom of the bay to overwinter). The buoys and the algae they pick up (called biofouling) can be composted and reused as a soil amendment for a true circular economy.

Now, thanks to grants from NE SARE and SOAR, an oyster mariculture grant from The Nature Conservancy, Van Hook is testing the buoys with various plant-based coatings to see if they can last even longer in the water. She is collaborating with Abigail Barrows, microplastic researcher, oyster grower and owner of Deer Isle Oyster Company as well as 14 other oyster farmers from Beals, Maine to New York Harbor to test buoys this season. Van Hook has a couple of companies interested in making these buoys when the time comes to scale up production.

Madison Maier, Aquaculture Manager at Hurricane Island, estimates a mycelium buoy would cost about \$65, while a standard plastic model, which lasts about three years before the plastic erodes in the sun, costs about \$45. The cost of the mycelia buoys should come down with mass production, and Van Hook says the compost from the buoys could be sold to recoup costs. ♻️



Mushrooms can provide just one of many solutions to the predicted effects of plastic on the environment. (Courtesy photo)



Mushroom painting by a talented 4th grader. (Courtesy image)

VT VOTES YES TO PROTECT HEALTH & THE ENVIRONMENT

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

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.

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

WHAT CAN YOU DO? – Cont'd from p.20

care to maintain your system and to use fresh filters is important.

Avoid single use plastics and household items in plastic bottles.

There are companies that provide household items that are not stored in plastic. For example, Ancestral French Soaps, a small business in Maine, makes laundry and personal use soaps from olive oil which are minimally wrapped (in paper) and there are no weird chemicals in the soaps. Owner Nancy Durand Larson said that in 2023, she estimates her customers saved 47,000-plus plastic bottles of shampoo, dish soap and body wash from entering the waste stream.

Choose clothing, furniture, carpets, etc. made from natural fabrics

Synthetic fabrics are notorious for shedding microplastic fibers. Even natural fibers may be coated or treated with waterproofing, stain resistance chemicals or fire retardants. It can be difficult

to know what you're getting. Read labels. Go to manufacturers' websites. Ask questions.

Stop microfibers from your laundry from entering the water stream (maybe)

A few small companies make filters for washing machines. *The New York Times* reviewed some of them in its *Wirecutter* blog. Some of the companies have third-party independent labs verify their claims. Consumers are still pretty much on their own to decide if these filters work (https://bit.ly/Wirecutter_LaundryMicrofibers).

You cannot depend on recycling to get rid of plastics



Volodymyr Hryshchenko on Unsplash

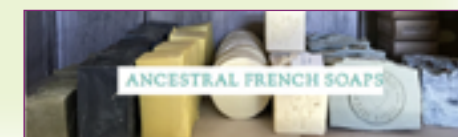
Those little triangles with the numbers? The system was developed by the fossil fuel industry as a way to greenwash the fact that recycling plastics is economically and technically unfeasible, according to the Maine Conservation Voters excellent Lunch and Learn on the topic at: <https://www.youtube.com/recycling>.

Likewise, the concept of "Advanced Recycling" is not recycling. It's chemical degradation with toxic chemicals or incineration. Don't let it happen in your state. See the Center for Climate Integrity's report, the Fraud of Plastic Recycling (<https://climateintegrity.org/plastics-fraud>).

Vote Wisely

Plastic and chemical pollution are systemic problems that need an all-hands-on-deck approach to solve. We need leaders at all levels of government who take this problem seriously. ♻️

Many thanks to our sponsor:



Audits Help Efforts to Reduce Energy Costs – NY, VT, NH, ME

Links available in the online edition of Green Energy Times.

NEW YORK

Residential Energy Audits for No Cost

Take control of your energy bill and live more comfortably in your home. It all starts with a no-cost home energy assessment conducted by participating residential auditors. The assessment, also referred to as an energy audit, provides you with a top-to-bottom look at where your home is wasting energy and flags any potential health or safety issues.

All New York homeowners of one- to four- family homes can get a no-cost energy assessment.

Getting an energy assessment can uncover the underlying problems and put you on the path to lasting savings and comfort.

It's also important to complete an assessment prior to making efficiency upgrades or installing clean energy technologies, such as heat pumps or solar panels to ensure the system is correctly sized. By properly sealing and insulating a home after an assessment, you may be able to install a smaller heating or solar system, resulting in additional savings.

Learn more about what to expect from an assessment in our complete guide to home energy assessments (<https://bit.ly/424audits1>).

Get a No-Cost Home Energy Assessment (Audit)

Connect with a contractor in your area through:

1. Residential Energy Assessment Program to complete an assessment or
2. EmPower+ to apply if income-eligible to receive discounts on energy efficiency upgrades following the assessment.

Residential Energy Assessment

All owners of one-to-four family homes in New York State are eligible to receive a no-cost energy assessment. Find a Contractor at <https://bit.ly/424audits2>.

EmPower+

Income-eligible renters and homeowners can get a no-cost energy assessment and support with energy efficiency upgrades to save energy and create healthier, more comfortable living spaces. Learn more at <https://bit.ly/424audits3>.

Additional Resources

In addition to discounts by NYSERDA, there may be other financial incentives and offerings available through utilities and local community-based organizations.

Regional Clean Energy Hubs.

Households are encouraged to work with their Regional Clean Energy Hub (<https://bit.ly/424audits4>) for information about the benefits of the clean energy, ways to reduce energy use and costs, and how to make more informed energy decisions.

Capital Region. The capital region hub serves Albany, Columbia, Greene, Rensselaer, Saratoga, Schenectady, Warren and Washington counties. Contact: Susan Cotner, (518) 275-4805, energy@ahphome.org; www.cleanenergycapital-region.org/.

NYS Clean Heat:

Heat pump info, rebates and financing <https://cleanheat.ny.gov/>.

Solar Panels for your home or community solar info:

How to go solar, how to pay for it, FAQs and resources <https://bit.ly/424audits5>.

VERMONT

Home Energy Assessments

The first step in saving energy is understanding how much you use and which products or systems use the most.

An energy assessment helps you understand where your home is losing heat or wasting electricity, and how you can address it. You can do a basic assessment on your own with some help from Efficiency Vermont, or you can have a professional contractor do an assessment for you. We manage a network of qualified contractors who have knowledge of building science, and experience with a range of building types.

1. No Cost Over-the-Phone Consultation

Efficiency Vermont's customer support team will ask some questions about your home's heating and cooling systems, insulation, lighting, and appliances. This gives us a better picture of where your home may be using more energy than necessary. Find out what your options are, including equipment or weatherization upgrades, rebates and next steps.

2. Virtual Home Energy Visit

Are you ready to embark on a home efficiency project, but aren't exactly sure how to start? When you schedule a free

virtual visit (<https://bit.ly/424audits6>), an energy experts will assess your home via video chat. They will answer your questions and look for places where your home may be losing energy. The visit takes about an hour and a half. It is a convenient way to access a home energy expert and to receive guidance on your home's specific issues or areas for improvement, and a personalized list of next steps.

Professional On-Site Assessments

An on-site energy assessment is a comprehensive way to understand your home's energy use. You can choose a standard home energy assessment, or a healthy home energy assessment.

Standard Home Energy Assessment.

An Efficiency Excellence Network weatherization contractor (EEN) can inspect your home for energy saving opportunities and common health and safety improvements. This includes insulation, air-sealing, heating, and ventilation systems. The contractor then suggests improvements that are cost-effective.

Healthy Home Energy Assessment

Households with chronic illness or health risks, such as asthma, should consider a healthy home energy assessment. There is potential to address health hazards like poor indoor air quality, mold, or pests with proper air sealing, insulation, and ventilation.

Learn more about home energy assessments in Vermont at <https://bit.ly/424audits7> or call them at 888.921.5990.

Maine & NH Audit info cont'd on p.23

Resolve to Save Energy and Money in 2024

New Hampshire Electric Co-op and the NH Saves® utility partners offer programs and incentives that will help you achieve your energy goals at home or work. See the full range of programs below and call or click to learn more: www.nhec.com; 1-800-698-2007.

ENERGY SOLUTIONS FOR HOME

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Offers incentives for building to ENERGY STAR efficiency standards. Third party efficiency verification and Home Energy Rater Services included.

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Home Energy Assistance

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Electric Vehicle Charging Stations

Rebates for installation of Level 2 EV charging stations.

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- Refrigerator \$40-\$50
- Room Air Conditioner \$20
- Room Air Purifier \$40
- Variable Speed Pool Pump \$350
- Advanced Power Strips \$8-\$40
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MAINE:

Home Energy Assessments

To get a [home energy assessment](#) in Maine, you can either visit [MaineHousing](#) or call 800.452.4668 to get a list of certified energy auditors. The [energy assessment process](#) takes about three to four hours and starts with a homeowner interview to discuss your priorities and plans for the house. The [auditors will then perform an interior and exterior inspection](#) of your home.

Maine Home Energy Audit - First Step to Energy Efficiency

An energy audit can be a logical first step toward reducing energy waste. Energy advisors perform various tests to determine the best energy savings opportunities and provide suggestions on projects that can address potential health and safety issues including moisture, mold, and radon. Energy audits can include a walk-through of the entire home and tests using a blower door, combustion safety equipment, and a thermal camera (<https://bit.ly/MEEnergyAudit>).

Insulation Incentives are up to \$9,200

Improving insulation can make your home more comfortable, lower your heating bills, and prevent ice dams, frozen pipes, and cold drafts. [Insulation-Rebates-Brochure.pdf](#) (<https://bit.ly/MEInsulation-Rebates>)

NEW HAMPSHIRE Home Energy Assessments

Whether you want to improve the comfort of your home, reduce the impact it has on the planet or learn about the long-term costs associated with your energy usage, your NHSaves® utility partners have the resources to help calculate the efficiency of your home. The Home Heating Index Tool available on NHSaves.com is an easy, online calculator that can help you evaluate the current efficiency of your home. The Home Heating Index Tool can be found at <https://bit.ly/NHHomeEfficiency>.

Energy Audits and Weatherization

Another way to examine the efficiency of your home is to use the home efficiency calculator at the web page, "Energy Audits & Weatherization." It offers a series of steps, Test Your Home, and addresses some of the options for financing. The web page is found at <https://bit.ly/NHWeatherization>. ♻️

IGSHPA and GeoExchange Designate April 2024 as National Geothermal Month!

On March 20, the International Ground Source Heat Pump Association (IGSHPA) and Geothermal Exchange Organization (GeoExchange) announced the designation of April 2024 as National Geothermal Month. In collaboration with state-level geothermal heat pump (GHP) organizations, electric and gas utilities, GHP manufacturers and market stakeholders, National Geothermal Month will be a multi-faceted public awareness and public outreach effort intended to build momentum for the widespread application of the most efficient HVAC technology available today, the geothermal heat pump.

From single-family homes to entire housing developments to community-scale thermal energy networks, today's GHP technology constitutes one of the most high-impact and scalable beneficial electrification opportunities available. As the nation moves to decarbonize both new and existing buildings, GHP technology is uniquely positioned as the most efficient and effective infrastructure choice for all-electric space conditioning and water heating. Electric and gas utilities, whether member-owned, publicly-owned, or investor-owned, are embracing this opportunity to build out the country's electric HVAC infrastructure for the sustainable clean-energy future.

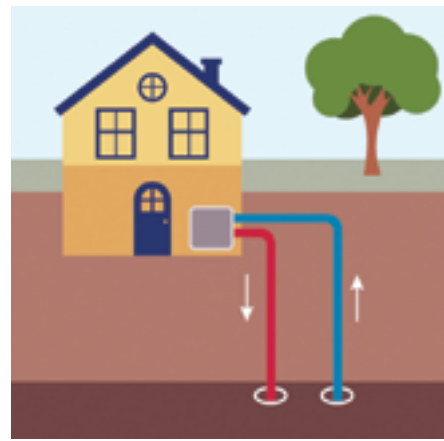
The U.S. Department of Energy, in its December 2023 grid impact study, stated that the widespread application of GHP technology would result in:

- 12% cheaper wholesale electricity
- 7.34 GIGATONS CO2e SAVED
- 33% fewer miles of transmission
- 47% cheaper grid decarbonization
- \$19 billion/year fuel cost savings
- Cumulative savings more than \$1 trillion

"IGSHPA is proud to work with the Advocacy and Communications Task Force and many other industry stakeholders, including local and national/international geothermal organizations to promote National Geothermal Month for the first time in April 2024 in celebration of Earth Day (April 22)," said Jeff Hammond, Executive Director of IGSHPA.

"Now is the time to spread the word about how geothermal technology can reduce demand on the electric grid, decrease the use of fossil fuels, and at the same, lower operating costs for building owners and homeowners. We want to celebrate and acknowledge geothermal technology as a solution to many of the goals associated with decarbonization and beneficial electrification!"

"2024 is shaping up to be a banner year for the geothermal heating and cooling industry," said Ryan Dougherty, President of GeoExchange. "There is an unprecedented level of attention our technology is getting, much of it due to the Inflation Reduction Act and evolving state energy policies. Stakeholders and consumers are realizing that there is a cleaner, more comfortable, and cost-effective way to heat, cool, and produce hot water. It's



NJ Department of Environmental Protection



NATIONAL GEOTHERMAL MONTH

time to strike while the iron is hot and get the word out even more broadly.

National Geothermal Month is our industry's call to action to increase the visibility of and support for GHPs."

IGSHPA and GeoExchange are working collaboratively to engage stakeholders and market participants in a long-term vision to accelerate the adoption of GHP technology, in North America and around the world. If you would like to receive more information, please send a request to info@igshpa.org to learn more. ♻️

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CONTRACTOR SPOTLIGHT: Sisler Builders

INTERVIEW WITH STEVE SISLER, FOUNDER AND CEO, STOWE, VERMONT

Interview by Michael J. Daley

Steve Sisler began his company in 1983 after earning his degree in industrial economics from Union College in Schenectady, NY. For the past 40 years, he and his crews and teams of subcontractors have been building high quality custom homes and remodels in the north-central Vermont ski country where there is a vigorous market for second homes. Sisler employs 30 people, including his son, Luke. We will learn what his other son is up to in the following interview.



The Sisler Builders team. Right: A Sisler Builders' project showcasing economic use of space with well-crafted details. Sisler custom-made the cabinetry to utilize the available area. The design includes efficient radiant heat and passive and active solar with rooftop solar panels. (Courtesy photos)

How do the elements of your business divide out?

It fluctuates year to year, naturally, but currently we are about 10% energy division, 8% custom woodworking, 7% small projects/handyman, 45% new homes and 30% remodels.

Your clients are primarily financially successful people. The projects showcased in your portfolio are stunning houses straight out of the pages of House Beautiful and Fine Homebuilding. Do you find that clientele interested in energy efficiency?

It's really only in the last few years that I'm seeing a change in people's conscious-

ness. Almost everyone is interested in heat pumps whether air source or geothermal. We have not built a recent project with a fossil fueled primary heating system.

As for energy efficiency, you have to ask where are the savings? The answer is the more you spend up front on good design, quality materials and workmanship and a tight envelope then the operational savings are enormous. That also means simple things like choosing materials that don't need to be repainted every two years.

But it's not a matter of throwing R100 insulation everywhere like some people think. Perhaps it's my industrial economics background, but I'm interested in the optimal balance between cost and results. My son, Nick, and I collaborated on the research. He's head of engineering at Ekotrope, a company that evaluates energy efficient design. We found that R55 for ceilings and R33 for walls is the sweet spot for us.

Are your clients making design choices that reflect the increasing severity of climate disruptions?



Definitely we do more planning with extreme weather events in mind. There's more thought given to ancillary systems like power walls or generators. 100% of our projects use those now. Water management is always an active discus-

sion with more attention to guttering and basement protection.

Mike D'Muhala, head of your energy division, considers a tight envelope the single most important element in home comfort and efficiency. Do you agree?

Yes, I'm very proud of our focus on a tight envelope. In the past ten years we have not had an ACH50 blower door test rating over one air change per hour, and often less for our new homes. The national standard is three. We achieve our results by testing three times during construction. First when all the mechanicals are in but before the interior paneling, so we can more easily fix any issues that show up. Second after the drywall, appliances and fireplaces are in. Third at the finish, so we can give our customers the certificate and bragging rights to their friends.

You've said "Professional relationships are about good communication without stepping on anyone's toes." You take pride in building harmonious relationships between clients, architects, designers and the many other subcontractors critical to a project's success. Is that a talent that came naturally to you, or did that skill evolve over time?

I think it's always evolving. I went from a college with 2,300 students to Stowe with 3,000 people. So, I learned quickly how vital a good reputation is for working with people. I'm trying to pass along that skill to my sons, giving them details about how to work with people to ensure they will want to keep working with you into the future.

Cont'd on p.28



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Cheshire County, NH Benefit from Building Energy Improvements and a Switch to Renewables for Heating

Martin Wahl

Energy Efficient Investments of Merrimack, NH (EEI) was first introduced to Cheshire County NH in 2019. At the time the County had significant problems - their plan to renovate the Maplewood Nursing Home in Westmoreland, NH had priced out significantly over budget. The 45-year-old nursing home used steam heat from 1970's oil boilers that were consuming more than 100,000 gallons of fuel per year and in dire need of improvement. The lead project architect, Ingrid Moulton Nichols of Banwell Architects, Lebanon, NH, suggested employing an energy performance contract. Under an [energy performance contract](#), the facility owner engages the energy services company (EEI) to develop an energy savings plan and guarantee that the project's energy conservation measures would provide at least a specified annual energy savings as a creative way to support the lease funding the project. If the savings fall below the specified amount, the contractor must pay the difference to the owner. EEI was selected and worked with the design team to incorporate a dry wood chip-fired system from Froling Energy of Keene, NH supplemented by in-room heat pumps. The project came in under budget and yielded more than \$171,000 per year in energy savings. The team also obtained a \$395,000 grant from New Hampshire's Public Utility Commission.



EEI worked with the design team to incorporate a dry wood chip-fired system from Froling Energy of Keene, NH supplemented by in-room heat pumps for Maplewood Nursing Home in Westmoreland, New Hampshire. (Courtesy image)

Following the success of the Maplewood project, Cheshire County requested that EEI create a sustainability action plan to improve the efficiency of its other buildings and help the County transition off fossil fuels as its primary heating source.

What they did

Over the next three years EEI developed a plan tailored to each site ranging from the rural nursing home to downtown city courthouses. Here are the buildings and systems along with some of the issues they had, and the upgrades made:

- Administration Building: Replace old lighting fixtures with LED lighting throughout. Replace inefficient, 1970s vintage gas boiler heating system and separate chiller unit with roof-mounted variable refrigerant volume (VRV) heat pumps that allow independent temperature settings at different locations in the building.
- Maplewood Nursing Home: Replace the 25-year-old air conditioning system with an updated version. The old system used R-22 refrigerant that is no longer available and was at end of life.
- New Courthouse: Replace lighting with LED units. All the buildings used different control systems, some almost 50 years old, so the New Courthouse's Schneider Electric control system was expanded by ENE Systems of Bow, NH to cover all the buildings, simplifying energy system management significantly.
- County Hall/Old Court House: This [historic building](#) dating from the 1850s had received many upgrades over time, and now needed a new heating and air conditioning system as well as lighting upgrades. Based on the success at the Maplewood facility, the County opted to have a Froling Energy dried wood chip-fired boiler installed with city gas backup. A sprinkler system and LED lighting were also installed, incorporating new ceiling tiles.
- Department of Corrections: Perhaps the most intriguing project of the five, the building already had a geothermal heat pump, relying on underground temperatures to cool the building in summer. This heated up the ground so that later on in the summer, the heat transfer became

less efficient, stressing the heat pump system. EEI recommended upgrading the system to utilize the heat stored in the ground over the summer to supplement the heating system in the winter. Upgrades included adding a heat exchanger for supplementing domestic water heating and a cooling tower to manage higher temperatures in the summer if needed.

Show us the money

The total project cost for the five-building upgrades was little over \$4.7 million. Half of the cost was offset with the County's portion of Federal American Rescue Plan Act funding [provided by New Hampshire](#), along with the Public Utility Commission's \$395,000 grant. EEI guarantees \$100,000 of the payment through the performance contracting bond, based on projected annual energy and operational savings. Additionally, the County generates Thermal Renewable Energy Credits (see box for T-RECs discussion) that can generate revenue for the County.



So, how's it going?

So far, project savings have exceeded the EEI guarantee limit, most recently \$115,000, funding a large portion of the project payments for the County. The County enjoyed T-REC revenue of \$4,000 last year, as well. The chart above shows the source of project's verified energy measurement savings, including \$225,000 from the original Maplewood Nursing Home project.

Cont'd on p.27



Old Cheshire County Courthouse (www.courthouses.co/nh/cheshire-cty/) opted to have a Froling Energy dried wood chip-fired boiler installed with city gas backup. (Boiler images: Froling Energy)



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COLD CASH: ENERGY EFFICIENCY PAYS OFF FOR PATCH'S MARKET

New Hampshire Electric Co-op

Ron Patch knows all about the cost of doing business these days. As the owner of Patch's Market & Deli in Glen, NH, he's seen his costs go up on everything from the gas at the pumps to the meat in the subs. So, when the cost of power went up too, he turned to New Hampshire Electric Co-op (NHEC) and the NHSaves energy efficiency programs for help. "We're all stuck in it together, especially with the increases in the cost of energy," Patch said. "So, to have these programs really helps out."

With financial incentives from NHEC totaling 50% of the project cost, and the NHEC on-bill financing program, Patch was able to invest in the energy efficiency of his business with no up-front out-of-pocket expense! The result: over 71,000 kilowatt-hours of electricity savings per year. That is more than \$14,000 a year!

Like the many other small markets dotted across NHEC service area, the biggest energy savings opportunities are the general interior and exterior lighting and the coolers with the beer and soda. At Patch's, that meant replacing fan motors that ran 24 hours a day with electrically commutating (EC) motors that operate only when needed. On a busy summer day, a steady stream of customers is in and out of the walk-in



Ron Patch, owner of Patch's Market & Deli. (NHEC)

cooler, buying an estimated 300 cases of beverages a day.

"The main cooler is so much more efficient now," Patch said. "I used to have trouble keeping it defrosted but had no problem whatsoever with it this summer,

which was the hottest we've had in years."

He also swapped out older fluorescent lights in the 40-foot by 16-foot cooler with highly efficient LEDs, a change that Patch said elicited hundreds of comments from customers.

"The product just sparkles now and they really notice it," he said. Other efficiency measures included the installation of anti-sweat heater controls in the cooler doors. All told, Patch's Market can expect to save more than \$6,000 a year in electric costs from the cooler-retrofit measures (based on current rates).

For the interior general store lighting, Patch replaced all 52 of the old fluorescent lights with new LED fixtures which reduced the energy consumption by over 1/2 while greatly improving the light quality and aesthetics of the fixtures. For the exterior lighting, Patch replaced 37 old mercury-containing metal halide lamp fixtures with new LED lights that use only one-third the energy of the old lights while lasting up to 20 years! The interior and exterior lighting improvements are anticipated to save Patch's Market around \$8,000 annually!

For all of these projects, Patch was able to use NHEC's on-bill financing program which allows commercial members to finance the portion of

the project not covered by the incentive directly on the electric bill. This program offers interest-free financing with a term of up to four years to help remove any hurdles for businesses to implement energy efficiency projects.

"It's been a very successful conversion for me," Patch said. "I came away thinking this was a win-win situation for everyone." ♻️

Cheshire County, NH - Cont'd from p.26

Note to the chart. Cooling system savings for the Corrections and Administrative buildings estimated at \$7,000 could not be separated from the rest of the project, and total savings to the County from all the EEI projects is over \$325,000.

EI reports that the reduction in fuel oil consumption in the City Hall/Old Courthouse building has been 15,000 gallons per year, so, using the [New England average](#) of 6.7 pounds of CO2 equivalent emissions per gallon, has saved 50 tons of greenhouse gas emissions annually in addition to the 336 tons avoided from the earlier Nursing Home project.

It is important to note that Cheshire County is very pleased with the results. County Administrator Chris Coates said, "Cheshire County is consistently searching for creative solutions to pressing issues. The partnership between EEI and Cheshire County has been invaluable to ensure the County is finding new innovative ways to promote clean energy, prevent additional tax burdens on residents, and to ensure that all of our campuses are running as efficiently as possible. With the support of EEI, we have been able to achieve this goal, with a monumental reduction of 50 tons of greenhouse gas emissions annually."

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 CA and NH, he serves on Corte Madera, CA's Climate Action Committee and is a Newfound Lake Region Association member. ♻️

HOW T-RECS HELP TO REPLACE FOSSIL FUELS



T-rex: Wikipedia

With apologies to paleontologists, T-RECs are Thermal Renewable Energy Credits, now adopted by many states, first [launched in New Hampshire in 2012](#). Traditional RECs are generated by electricity producers that use renewable energy for non-renewable producers to acquire in order to meet their renewable energy portfolio requirements. [Thermal RECs](#) are generated when biomass, solar or geothermal sources are used to replace fossil fuel-sourced heating, chiefly for buildings. [New Hampshire's T-RECs](#) are awarded based on an equivalence of 3.4 million BTUs to one megawatt hour of electric energy. The aim of the program is to keep money spent on heating in the state, instead of providing revenue to out-of-state fossil fuel producers as well as to help reduce fossil-sourced greenhouse gas emissions. ♻️

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Sisler Builders – Cont'd from p.25

What is your own home like?

When my wife, Sharon, and I came to the area, we found a burnt out 1805 farmhouse in Waterbury Center. The house was derelict, but I saw the potential for salvage and in the property. The trim was American chestnut. I saved all that. I was reclaiming materials before that became a catchword. We were on a shoestring budget so we actually turned the horse barn into our house. Today, the house is net zero with heat pumps, an electric boiler, and solar powered including charging my EV.

Is there an aspect of the home building process that most gets your motor going?

I really enjoy relationship building with a new customer and leveraging that trust to give suggestions for finish details that look great but don't cost a lot. My grandfather, a depression era fine woodworker himself, used to save and unbend old nails. That's in my heritage, and I'm occasionally caught off guard by people who haven't worked in the field with hammer and nail who seem to have the attitude that cost isn't even a variable. It always is for me, and for my clients, however wealthy. Beauty is doing something really stunning but at a reasonable cost that I and the homeowner can appreciate. That's what excites me.

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. 

Protecting Affordable Housing While Lowering Energy Bills

American Council for an Energy-Efficient Economy (ACEEE)

ACEEE's Energy Equity for Renters initiative is providing ten local governments and community-based organizations with no-cost technical assistance to improve energy efficiency in rental homes while also preserving or expanding affordable housing.

Energy Equity for Renters will work with these jurisdictions to create and implement programs for rental efficiency upgrades. The initiative also tracks policy developments across the country that support residential efficiency and affordability efforts.

ACEEE will work with 10 communities on programs to address home weatherization, renter energy burdens, residential building electrification, and other rental housing needs. Burlington, Vermont is among the 10 communities that will receive assistance from initiative:




Multi-unit apartment house in Burlington, VT (Don Shall/Flickr)

Burlington, Vermont: The City of Burlington has a rental weatherization ordinance requiring multi-unit dwellings over a certain energy use threshold to weatherize their buildings to reduce thermal energy use, reducing carbon emissions and keeping tenants warm in winter and cool in summer. As the city works to implement the ordinance, it will partner with community-based organizations to determine how to best communi-

cate about the law with tenants, property owners, and others.

Last year, Energy Equity for Renters announced its first round of technical assistance to five jurisdictions and CBOs in the San Francisco Bay Area; Cambridge, Massachusetts; Duluth, Minnesota; Portland, Oregon; and Tacoma, Washington.

Full announcement including all 10 communities is available online at <https://www2.aceee.org/afford-housing>. 



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INNOVATIVE BUILDINGS FROM VERMONT

Boston Hosts the World's Tallest Passive House

What lessons can your home design take from the Winthrop Center?

Greg and Barb Whitchurch

The Winthrop Center in Boston (www.WinthropCenter.com/) is the tallest and largest office building in the world to earn Passive House certification. Located near Faneuil Hall in Boston's historic district, it also meets the LEED Platinum standard (www.bit.ly/usgbc-leed) set by the U.S. Green Building Council and has been WELL Gold certified (www.bit.ly/well-cert).

Passive House (PH) is a pretty basic energy, comfort and health standard, which is no longer difficult or costly to meet (~2.5%). LEED includes sustainability of design and materials, as well as effects upon the surrounding community, while WELL focuses on human wellness and comfort. (PH includes many of the particulars of LEED and WELL.)

This project is different from the usual approach, in that the owners were willing to assemble a design team which put the interests of the owners at the forefront by allowing internationally recognized institutes to approve their design and then certify their product.

Handel Architects (www.bit.ly/handel-winthrop) in collaboration with Steven Winters and Associates (www.bit.ly/swinter-winthrop) were the designers, assisted by a group of MIT professors led by John Fernandez, director of the MIT Environmental Solutions Initiative (www.bit.ly/archpaper-winthrop). Together with the Passive House Institute (www.passivehouse.com/), they achieved the goal of incorporating PH design in the office portion of this 62-story mixed-use building. (PH for residential is addressed in the "Housing 2.0" article in this issue on p.31.)



Winthrop Center, on right. (Winthrop Center)

But What About Me and My Home?

This article, www.bit.ly/ct-winthrop, is well worth four minutes of your time; and we won't waste our space here by repeating its contents. The principles and techniques addressed in that article apply to one's private residence as well -- PH is mostly about focus and care -- not style, size or purpose. The rest of our article is meant to supply context and perspective to what the longer piece, above, presents: a holistic design strategy for buildings that addresses health, comfort, safety and resiliency; boosts happiness and productivity; and better protects the occupants and our environment.

The Passive House standard has been misunderstood in the U.S. for a couple of decades now. First of all, "House" in "Passive House" is a rather unfortunate word. PH actually refers to any kind of building: office towers, homes, hospitals, universities, resorts, ice rinks, you name it -- tens of thousands of these buildings are currently in existence, and the rate of adoption continues to accelerate.

Second, PH has been thought of as the Gold Standard, or the highest-end, most effective design. Nope, it's only a gold standard in that it provides the best bang for one's buck (www.bit.ly/ph-90). It soon returns monetary savings far in excess of any slightly increased front-end cost. One can get far pickier about energy savings, comfort and sustainability than PH, if one has the money and the desire.

As we continue to treat our air as an open sewer, we're experiencing increasing extremes of unstable weather (heat, storms, floods) and air pollution (vehicle exhaust, chimneys, forest fires). PH helps us to achieve security from the accelerating pace of our changing climate by giving us more control over our indoor environment with far less effort and expense than ever before.

The common, old-timey building styles and codes we have become used to are long out of date. Medicine, vehicles, home building and advertising were all art forms at one time -- they are all sciences now. Building science, engineering and new materials finally allow us to construct buildings that are increasingly healthful for the occupants (using highly-filtered, balanced ventilation to ensure fresh air), far less energy-intensive (all-electric homes), lower maintenance, a much more valuable investment, and far less dependent upon external sources of energy.

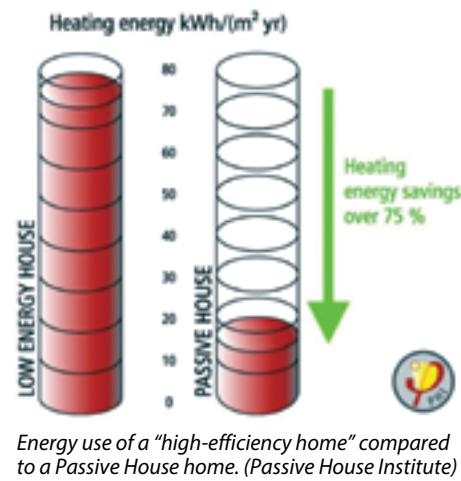
Unfortunately, most designers and builders are still stuck in their past and are not willing to take the time to catch up -- so they denigrate PH and threaten owners with false claims about imagined high prices and difficult

Cont'd on p.30

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Tallest Passive House

Cont'd from p.29

techniques. Some of these builders do not want an owner's representative checking up on them. However, finding someone who can and has built a PH is less and less difficult as time goes by. PH is designed to be a base building code standard; it's NOT a heavy lift, even for newbie builders (as our own personal PH residence attests -- see our bio below).

Certification

Much like Underwriters Laboratories (UL listing), NHTSA (for our cars), and other certifications around the world, PH is meant to avoid shoddiness, guesswork, inexperience, rules-of-thumb, and covering up mistakes. Having an owner's representative verify the design, keep tabs

on the construction, and then check it all out in the end is worth the small extra cost to many people. They are investing the largest sum they will ever spend for a home in which they will spend most of their time. And they will pass it along as legacy, or convert it into value as they move on to their next destination. Buyers and their lenders have representatives for home inspections and for their real estate purchases. Why give that up for the house itself?

Boston and the surrounding five cities have adopted PH as a building standard that provides a shortcut through the usual permit process and inspections -- saving the city and builder time and money, as well as emergency planning -- since the resilience and stability of PH mean that emergency services are less

taxed during disasters. These are some of the reasons PH is now becoming the base building code for most buildings. New York City and many more cities across the U.S. are also following this path.

PH is a win-win-win: for the owners, occupants and the environment. Avoiding a "legacy, retro" home design in favor of a "future-proof" design is just common sense. The impediments are not the cost or difficulty, rather they are the emotional risk of adopting the unknown and hesitation to make the effort to change.

The Whitchurches live in a net-zero Passive House (www.bit.ly/vtph-ph) in Middlesex, Vermont. Their solar PV also provides grid backup, and powers their Bolt and Niro EVs, lawn, garden and chainsaw tools. ♻️

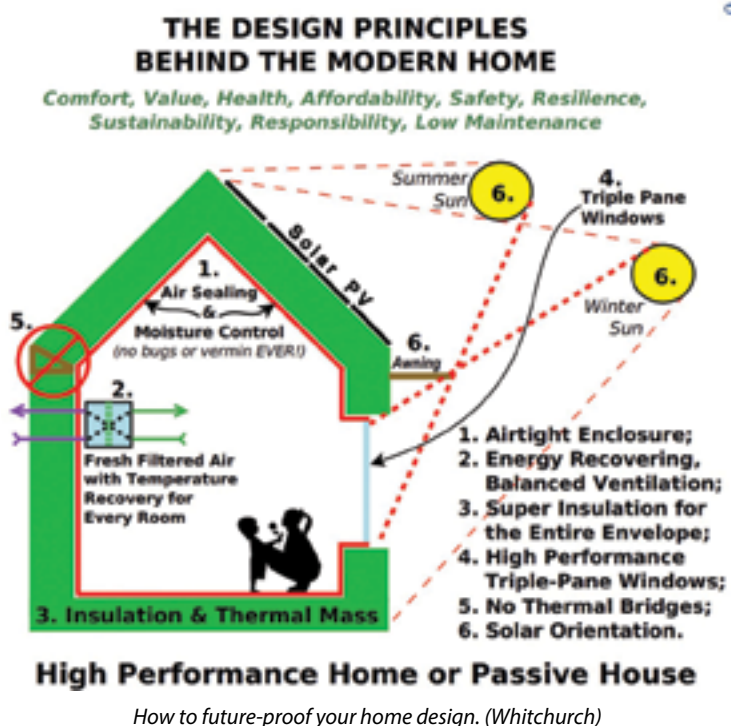
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OTHER BENEFITS OF PH DESIGN PRINCIPLES

A. Occupant Health: Indoor Air Quality (IAQ):

- NO fossil fuel use.
- NO off-gassing foam materials (XPS, polyiso, spray urethane and such)
- Avoid furniture, rugs, and paints containing volatile organic compounds (VOCs).

B. Safety:

- NO combustion appliances (hot water, furnace, etc.). Use air and ground source heat pumps.
- NO fossil fuel storage.

C. Cost Savings:

- NO kitchen or bath vent fans (#2 in

diagram: ventilation does all that better and cheaper than vent fans).

- NO vented clothes dryer (use heat pump or condensing).
- Induction cooking range (faster, cheaper, cooler and less polluting inside and outside than gas or electric).

D. Environment:

- Electrify everything.
- Sequester carbon.
- Avoid cement, steel and VOC adhesives and glues.

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HOUSING 2.0 - STEPS IN THE RIGHT DIRECTION

Greg Whitchurch

The Problem: The majority of new homes are still built in the old ways, to outdated building code standards at best, and using "same-old, same-old" materials and techniques. How can we entice designers and builders to "up their game" and approach better efficiency standards without scaring them away with expensive and time-consuming trainings?

However, these people are doing just fine, thank you very much with the old techniques. LEED, Energy Star, BPI, Passive House and even Pretty Good House and others offer much better results for the owners, the occupants and the environment.

Green Builder Media boldly steps up to this challenge with a webinar featuring Sam Rashkin, an expert's expert with a long tenure at the U.S. Department of Energy – working on, among other things, bringing home design and construction into modern times. And he can teach!

In his book, *Housing 2.0 - A Disruption Survival Guide*, Mr. Rashkin presents a path forward for the designer wishing to catch up with the times. He gently guides the reader with carefully selected photos, well-defined terms, easy-to-understand graphs, and clear-as-glass narration. (Go to www.bit.ly/rashkin-housing20 and check out the generous preview offered there!) **[graphic 1]**

The webinar I attended was a valuable introduction for any designer who's willing to dip their toes into the future of their industry, and into responsible building in particular. Rashkin also addresses many broader operating challenges facing construction

business owners these days. And he realizes, as we all do, that builders are often handed a set of plans with little wiggle room for efficiency improvements. The webinar is archived at www.bit.ly/gbm-rashkin.

Rashkin examines the gradual improvements of our national building energy code over the past 50 years. He presents examples of the incentives now available for better building practices. He points out the advantages of joining the high-performance home community of builders who are achieving "ultra-low energy bills; ultra comfortable; ultra convenient; ultra-low maintenance; ultra safe; superior health protection; superior resilience." (This is missing only the ultra-high value of the finished home, in my view.)

In the video, Rashkin explains the why and how to build tighter and better-insulated enclosures, while solving the new issues that such improvements present to the designer and builder. For example, common practice allows so much air and heat to flow thru envelope assemblies that moisture-handling principles can remain ignored and seldom result in problems. In this video, we get the solutions needed to safely implement higher standards.

Cost is not the problem. As Mr. Rashkin points out, building to a higher standard can be cheaper than current practice. One reason for this is that a better envelope requires far smaller HVAC machinery; and energy modeling removes the imprecise formulae and just-in-case over-sizing of HVAC, so common for so long. This same benefit is even greater in the Passive House standard.

Most builders do want to improve their

product, but without straying too far from their comfort zones – hence Rashkin's book. He makes the path toward certifiable standards wide and clear. (See article on the Winthrop Center on p29 in this issue, www.bit.ly/get-winthrop.)

The certification plaques displayed outside a home on page 35 of his book are "Zero Energy

Ready Home," "EPA Indoor Air Plus," "Energy Star," and "Home Innovation NGBS Green Certified." The first three of these are included within the Passive House certification. As Rashkin points out: "Home buyers will know certified performance vs. 'Trust me.'"

Rashkin recommends an airtightness goal of 1.5 ACH@50P -- where lower numbers are better. This number is almost three times higher than the old Passive House 0.6 ACH@50P requirement, and some homes these days come in at less than 0.3. Please note, though, that even 1.5 turns out to be much better than current run-of-the-mill practice! **[graphic 2]**

Rashkin has picked an airtightness target that's easy to hit, and makes a big difference when compared to the usual, costs insignificantly more, and provides a big boost to affordability and occupant health. Just getting builders to run a blower door test at all is a big step forward.

For the skilled but somewhat-behind-the-times designers and builders who are the target audience of this webinar, Rashkin provides a panoply of real-world solutions for critical design problems which work "right out of the box." It is important that those solutions be implemented as presented, without uninformed improvements. Without understanding the methodical basis of the design, changes might result in assembly failures, with rot and mold resulting.

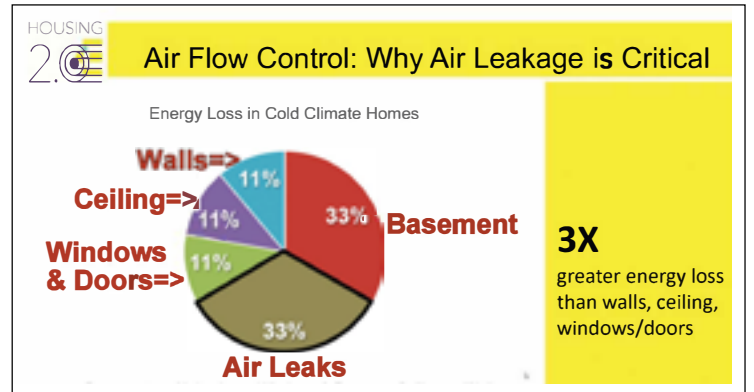
Passive House -- which is a cheap, easy and basic efficiency standard -- provides improvements and guardrails which encompass this presentation. And even broader standards exist, such as LEED and Living Building Challenge. But for such standards the designer must have some specialized training in building science.

The importance of Rashkin's presentation is this: when faced with the Full Monty of the actual necessary changes required of us, we

tend to reject it simply because it looks like way too heavy a lift. Getting going is better than staying stuck.

I have seen several presentations on this topic. I highly recommend this webinar video as well as the book upon which it is based. Plus, even the common homeowner can understand most of the basics. Give the video a chance – it is free, and you won't be sorry.

Greg Whitchurch lives in Middlesex, Vermont. Read more of his work at www.bit.ly/get-kudos, www.bit.ly/get-w-build, www.bit.ly/get-w-ev. ♻️



[2] The importance of air sealing the envelope. ("Housing 2.0" webinar on Green Builder Media, and ecohome: 10/5/20)



[1] The importance of small details and how to avoid future problems. ("Housing 2.0" webinar on Green Builder Media)

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A Review of Global Climate Management



Dr. Alan K. Betts

The global climate situation has become very challenging as Mother Nature has taken over to save life on Earth in the face of the planned criminal destruction by the fossil fuel industry to

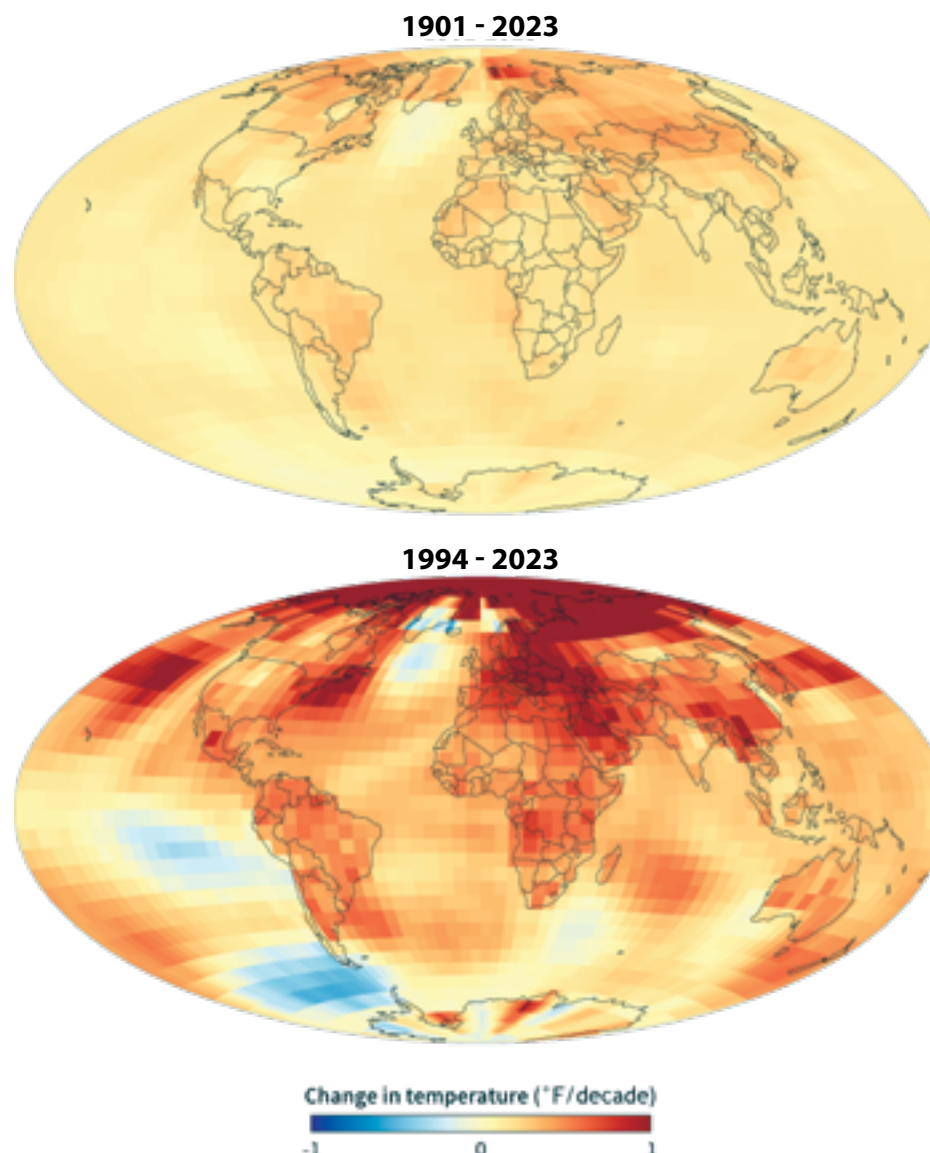
maximize its profits. I have discussed this in earlier articles.

Last year and this past winter, there have been new record temperatures both globally and in the U.S. In our G.E.T. region, we have had very little snow in Vermont except in the mountains, but as I write on March 11, it has been snowing all night, and it is hard to shovel the four inches off my road, so I am just watching out my window!

There has been a stunning change at the World Meteorological Organization (WMO) international level that was a delightful and exciting surprise to me. The WMO has appointed Dr. Gianpaolo Balsamo as the director of the WMO Global Greenhouse Gas Watch (G3W). I know Gianpaolo very well as for many years he has been the Director of the European Weather Center for Medium-Range Weather Forecasts (ECMWF) in the UK, our finest global modeling center. We worked together on improving the ECMWF model by comparing it with detailed diurnal and seasonal analyses of 50 years of calibrated hourly Canadian Prairie data. The appointment of an expert scientist in coupled processes in Earth System Modelling will provide a solid scientific basis to assess mitigation actions taken under the Paris Agreement on climate change. He commented as follows.

"The year 2023 was the warmest year on record, with super-charged extreme weather events. Finding climate change solutions is the defining challenge of our time, and this includes the need for better information on greenhouse gases – the root cause," said Dr Gianpaolo Balsamo, the new director of the Global Greenhouse Gas Watch (G3W). [The 2024-2027 G3W draft implementation plan](#) lays down the foundational blocks for building an integrated, operational framework which brings under one roof all space-

WARMING OVER PAST 30 YEARS IS MUCH FASTER THAN LONG-TERM TREND



Trends in annual surface temperature in the past few decades (1994-2023, bottom) compared to the trend since the start of the 20th century (1901-2023, top). Recent warming is much faster than the longer-term average, with some locations warming by 1°F or more per decade. Differences are most dramatic in the Arctic, where the loss of reflective ice and snow amplifies the rate of warming. (NOAA Climate.gov, based on data provided by NOAA National Centers for Environmental Information)

based and surface-based observing systems, as well as modelling and data assimilation capabilities. The G3W plan will monitor carbon dioxide, which has a long lifetime and accounts for nearly

two thirds of the warming effect of long-lived greenhouse gases; methane, which is a potent climate change agent but has a lifespan of only about one decade, and nitrous oxide which is an extremely

potent climate change and ozone depleting agent."

This is a flagship initiative to boost climate action at the global level as it will improve global scientific collaboration. For contrast, scientific reports to the recent COP28 meeting made it clear that the globe is still heading in the wrong direction but with more than 500 fossil fuel lobbyists present, they could be ignored.

The statistics for 2023 remove any doubt as to where we are headed. 2023 was the warmest year on record, because of long-term climate change and the effect of the 2023 and 2024 El Niño episode. Globally, all the months from July to December were the warmest on record by stunning margins above 0.3°C. All the years since 1976 have been warmer than the 20th century average. In addition, 2023 was also a year when Antarctic Sea ice coverage hit a record low.

Global sea level increased to a new high in 2023. Since the beginning of the satellite altimetry measurement in 1993, sea level has increased by 110mm (4.3 in). The oceans absorb more than 90% of anthropogenic heat in the Earth system, so they play a role in moderating global atmospheric warming. The heat content of the oceans has been increasing steadily for several decades. Measurements have become much more precise since the Argo float program was introduced in 2005, so we can see that recent ocean warming is at a steadily increasing rate.

The threshold outlined in the 2015 Paris Agreement of keeping the temperature rise to 1.5°C (above Industrial Revolution temperatures) has essentially been reached and warmer temperatures lie ahead. The key reason, of course, is that politicians in the U.S. have been heavily influenced by the fossil fuel industry since 1978 not to bring the climate catastrophe under control.

Readers understand the many things we can do locally to improve our resilience to accelerating climate change. My expectation is that this shift at the WMO will give us a responsible global grasp that is outside political interference.

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

Ponds, Lakes and Rivers: Other Casualties of Climate Change

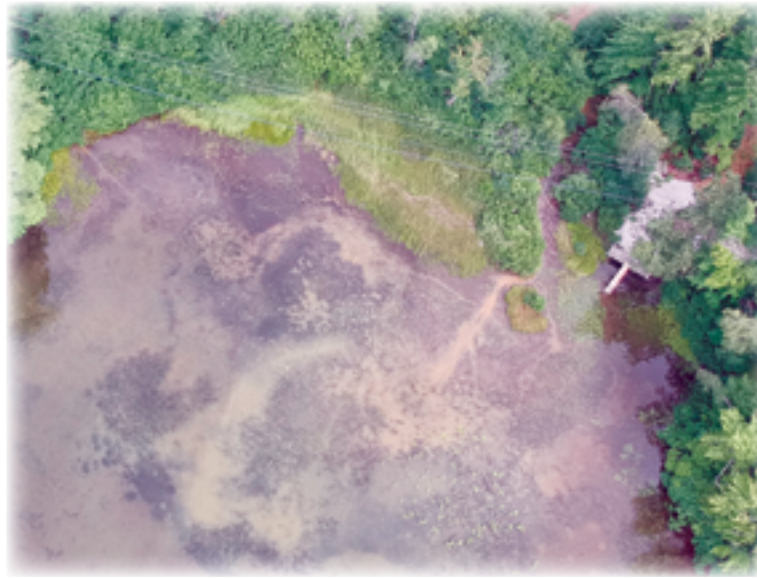
Russ Lanoie

One of the biggest environment threats to ponds, lakes and rivers comes from erosion of natural soils in developed areas. Unpaved roads, road shoulders, driveways, roof drip lines, construction and logging areas are subject to the erosive power of rain. As the late Tin Mountain Executive Director and forest ecologist Dr. Michael Cline in Albany, New Hampshire often pointed out, "All that soil-laden water ends up somewhere; too often it silts streams destroying fish breeding beds and adding phosphorus into nearby lakes contributing to algal blooms."

Our recent rain events seem to be more intense on a regular basis regardless of whether you blame global climate change or not. There have been several events just this past year that have caused damage that is still being repaired. But the soil that has been washed away is just beginning to cause problems that will be even harder to repair than the obvious washouts left

behind. There are increased reports of swimming areas being jeopardized with dangerous contaminants, and sometimes the threat is even visible to the naked eye, as in the photo of a pond near my home in Madison, NH.

This is the pond where I used to swim with my kids, and where I now often launch my kayak. For the last ten years, I have had the dubious task of trying to maintain the very basic unpaved roads in the burgeoning housing development included in the watershed uphill from the pond that drains directly into it. Fortunately, the pond is still mostly clear in spite of this siltation, so local residents have formed an



A pond near the author's home shows signs of siltation but is still mostly clear due to a stormwater migration program. (Bob Christiansen)

association to protect it from further degradation. I am pleased to be a consultant to the association, offering what I have learned in the last sixty years of driveway and road maintenance. In addition to providing proper ongoing maintenance, their upcoming stormwater migration program will likely involve stone lining ditches and installing check dams and settling ponds, in part just to deal with the excessive amount of winter traction sand spread on the development's steep roads.

While it will never be possible to control the weather in New England, it is possible to stabilize roads Cont'd on p. 34

DO ENVIRONMENTALISTS REALLY CARE ABOUT THE ENVIRONMENT?

Bob and Suzannah Ciernia

Readers of *Green Energy Times (G.E.T.)* are among the nation's most knowledgeable supporters of renewable energy. If you want to know about solar, wind, electric vehicles, batteries, and a host of cutting-edge developments, the companies and columnists who appear in *G.E.T.* inform, instruct, and promote alternatives that will fuel the transition from carbon-based energy to a greener, healthier society.

So, you probably think that your fellow *G.E.T.* readers and other environmentalists are among the most likely to do the one thing that can have a nationwide impact on climate change: vote. Unfortunately, that's wrong.

It seems counterintuitive, but research by the Environmental Voter Project (EVP) shows that large numbers of people who list climate change or other environmental issues as their top one or two priorities do not put that conviction into action by voting. How many people are we talking about?

EVP estimates that over 8 million environmentalists did not vote in the 2020 presidential election and over 13 million skipped the 2022 midterms.

Many Federal elections are determined by a few thousand votes – out of a million or more cast! If a fraction of those 13 million non-voting environmentalists had voted, several swing states would have had different outcomes. If a good percentage of those non-voting environmentalists weighed in at election time, we would be talking about a changed legislative landscape.

So, what can you do to make sure that environmentalists vote? Talking to like-minded family and friends is a start,



What can you do about the climate emergency? (Created by CCL Chapter member Jennifer Durgin)

but here is another idea: work with an organization whose sole purpose is to turn out environmentalists for local, state, and federal elections. That is how we in the Northeast can have a bigger impact nationally.

That is what Citizens' Climate Lobby, a nonpartisan organization, is doing—encouraging its members to volunteer with EVP.

Environmentalists, the people most concerned about climate change, are often no-shows at the polls, according to Nathaniel Stinnett, Executive Director of EVP. "In a nutshell, the Environmental Voter Project is a nonpartisan nonprofit that identifies environmentalists who

don't vote, and then we turn them into consistent voters," says Stinnett. EVP research shows that, in many states, unlikely voters are twice as likely to list climate change as a top priority as compared to likely voters. Think about that.

When environmentalists show up at the voting booth, climate change moves higher on the agenda of all the members of Congress, regardless of party. Writing and calling senators and representatives is important, but, ultimately, votes are more important. Unless environmentally-minded constituents consistently vote — and that information becomes public record — their opinions are not taken seriously. It is only when lawmakers see

that climate advocates are also voters that the issue becomes important to them, too. It does not matter which party we are talking about, this cannot be said too often: our elected officials are moved by voters, not by the volume or frequency of a small number of callers.

"Nothing motivates a politician more than the prospect of winning or losing an election," says Stinnett. "It's crucially important for climate voters to continue building our political power and flood the polls in local and state elections."

EVP has a track record of converting infrequent voters to becoming consistent voters – and that is what it is going to take to get legislators' attention.

To volunteer with EVP, visit <https://www.environmentalvoter.org/get-involved>. You will find opportunities to phone-bank, canvass, and send postcards. Training is provided, and you will be participating in actions that have proven to be impactful.

Will it be worth your time? EVP tracks its impact over time – using the aforementioned public voting records – and reports that of the 9,542,183 low propensity voters they have mobilized since 2015, 1,487,733 are now consistent voters.

For more information about EVP, the studies they have conducted, and the results they have achieved, visit <https://www.environmentalvoter.org>.

It is time environmentalists do more than buy electric vehicles and put solar panels on their roofs; we need to vote.

Bob and Suzannah Ciernia are co-leaders of the Vermont Citizens' Climate Lobby Chapter. ☺

GHGs Record Highs - Cont'd from p.1

2023 was 419.3 parts per million (ppm) — up 2.8 ppm over the course of the year. It was the 12th year in a row that carbon dioxide jumped more than two ppm — continuing the most **sustained carbon increase** rate in NOAA's 65-year monitoring record.

Even three years in a row of carbon increases of two ppm or higher had not been recorded before 2014. Carbon dioxide levels in the atmosphere have risen to 50% higher than in pre-industrial times.

"The 2023 increase is the third-largest in the past decade, likely a result of an ongoing increase of fossil fuel CO2 emissions, coupled with increased fire emissions possibly as a result of the transition from La Niña to El Niño," said Xin Lan, a scientist with the Cooperative Institute for Research in Environmental Sciences and head of the effort by GML to integrate data from NOAA's **Global Greenhouse Gas Reference Network**, which keeps track of greenhouse gas trends worldwide, in the press release.

Levels of methane in the atmosphere increased to a 1,922.6 parts per billion (ppb) average. Methane, while less abundant than carbon dioxide, traps more heat. The increase in atmospheric methane last year over 2022 levels was 10.9 ppb, which was lower than previous record rates in 2021 and 2022. However, it was the fifth highest since methane began to increase again in 2007. Current levels of atmospheric methane are more than 160% above those of pre-industrial levels.

Last year's nitrous oxide levels rose to



Emissions and environmental pollution from a chemical fertilizer plant's pollution, before farming continues the cycle of pollution. (AdobeStock_634805377)

336.7 ppb — a jump of one ppb. Nitrous oxide is the third most important greenhouse gas produced by humans.

"Increases in atmospheric nitrous oxide during recent decades are mainly from use of nitrogen fertilizer and manure from the expansion and intensification of **agriculture**. Nitrous oxide concentrations are 25% higher than the pre-industrial level of 270 ppb," NOAA said.

More than 15,000 samples were collected by GML by global monitoring stations last year. They were then analyzed in a Boulder, Colorado, laboratory. The NOAA-run Global Greenhouse Gas Reference Network (GGGRN) includes roughly 53 sampling sites worldwide and 20 tall tower sites, as well as North American aircraft operation sites.

NOAA said carbon dioxide is the most important greenhouse gas contributing to climate change. Carbon produced by humans has gone up from 10.9 billion tons annually in the 1960s to roughly 36.6 billion tons in 2023. The Global Carbon Project uses GGGRN measurements to calculate net impacts of global carbon sinks and emissions and said

last year's **carbon emissions** set a new record.

"The amount of CO2 in the atmosphere today is comparable to where it was around 4.3 million years ago during the **mid-Pliocene epoch**, when sea level was about 75 feet higher than today, the average temperature was 7°F higher than in pre-industrial times, and large forests occupied areas of the Arctic that are now tundra," the press release said.

Approximately half of fossil fuel emissions have been absorbed into the surface of the planet by land and **ocean ecosystems** like **grasslands** and **forests**. Ocean carbon contributes to acidification, which has an impact on marine life as well as humans. The world's oceans have absorbed roughly 90% of excess atmospheric heat

trapped by greenhouse gases.

A study by NASA and NOAA scientists in 2022, coupled with further research by NOAA in 2023, suggests that upwards of 85% of the methane emissions increase between 2006 and 2021 came from higher microbial emissions from agriculture, **livestock**, waste generated by humans, including agriculture, **wetlands** and other water-based sources. The balance was found to be caused by increased fossil fuel emissions.

Scientists with NOAA are looking into the likelihood that climate change is leading to wetlands producing increasing methane emissions, which in turn influence the climate in a **feedback loop**. However, the precise reasons for the recent rise in methane are not completely understood.

"In addition to the record high methane growth in 2020-2022, we also observed sharp changes in the isotope composition of the methane that indicates an even more dominant role of microbial emission increase," Lan said in the press release.

Jaynes is a writer of fiction and nonfiction. She holds a JD and an Ocean and Coastal Law Certificate from University of Oregon School of Law and an MA in Creative Writing from Birkbeck, University of London. She is the author of the short story collection *The Smallest of Entryways*, as well as the travel biography, *Ernest's Way: An International Journey Through Hemingway's Life*.

Originally published in EcoWatch on April 8, 2024. (<https://www.ecowatch.com/ghg-noaa-scientists.html>) ☺

ELMORE ROOTS' PERMACULTURE KNOW-HOW

Springtime Yellow You Can See From Afar

David Fried

Today the sky is the bluest blue after a bit of spring cool rain. I can lie on my back and get lost in this blue. Maybe this is why when a friend is a real friend, they are called "true blue." The same sky that gives us rain and rainbows, snow, and sunny days nourishes our beings with warmth on spring days. I stopped to watch five little white crocuses with orange throats looking up at me in the new grass that has just been uncovered as the snow eases back across the lawn. Their life is so simple. All winter they are dreaming of spring. Now that spring is here, they smile, dance and look so pretty, while they are so natural looking. They do not have to pretend to be anything they are not. All eyes are on them now, and they are shining their light into the world.

Maybe this is our best chance of success, too. Whether we are planting a garden or volunteering at a school, we get to shine our light wherever we are. Saying hello to a deer or a little dog, we are acknowledging their existence and turning something on in them where they are just a little more alive than they were a minute ago. The seeds we plant in our garden beds sprout and grow and be-



Watercolor Painting by Joyce Dutka

come food for us and for wildlife. The graceful acts of kindness we seed about will continue to spread far and wide. This is the least we can do, and also the most we can do sometimes. When the world looks like a rough place, we can smooth it out with our acts of gentleness.

My mother was an artist for as long as I can remember. We have her sculptures and photos and watercolor paintings all over our house. Today I was looking in one of her sketchbooks for inspiration, and I saw this penciled into the margin of

a drawing, "Yellow you can see the furthest." All of a sudden, I was remembering all things yellow in the fields and the gardens: how the honey bees seem to appear out of nowhere and now cover every shining yellow dandelion from here to Timbuktu. When I was nineteen, I hitchhiked to a river in the country of Mali in West Africa. Standing on the banks of the river I was told if I went to the left, I would see many dugout boats and maybe hippopotamuses. If I went to the right, I would eventually come to Timbuktu. (I went to the left.)

Giving a tour of our farm and food forest a few days ago, I pointed out that all the trees in the orchard had been nicely fertilized all winter by deer droppings. Not much work on our part! Of course, we cannot grow tulips here or many other flowering bulbs. It seems that deer surely enjoy them like we two legged ones like onions. But there is at least one bulb that the deer stay away from: the daffodil.

The daffodils are seen from far across the hill and at first, I think the sun is rising in a new place.

Glorious yellow blossoms under the trees, under the fence, under everything!



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When I get closer, I remember there are daffodils here. Each year there are more. There is music in the air, moisture in the air and yellow majesty all around us when the daffodils are here.

I wonder if the deer have different tastes than we do. Why do they love eating tulips but not these? Maybe the wise deer council of the deep forest one day decided that they would leave us two-legged ones something to be cheerful about. Maybe they need the "sunlight on the hill" as much as we do. You sure can see these flowers from far off, and I see them all over the place now. It is like driving along a large field just before sunset in Vermont, and you know if you look for a moment deep into the field, you will see some deer out there. What are they doing? Probably they are looking at the daffodils and getting lost in the brightest of yellow suns while under the bluest of blue skies. The kind that you only get in the north country.

David Fried is a poet and garden writer who also grows trees at Elmore Roots Nursery in northern Vermont. ♻️

Ponds, Lakes, Rivers - Cont'd from p.32

and driveways to keep them in place in heavy rains. A combination of the right kind of materials along with the right maintenance techniques can go a long way towards discouraging erosion. Since developing a unique way of performing this maintenance thirty-five years ago, I have had plenty of opportunities to perfect my methodology while maintaining up to twenty-five local developments. Based on this practical experience, I had the opportunity to present road maintenance workshops throughout southern Maine and New Hampshire, primarily to local road associations who have faced issues similar to those now facing my local pond owner's group. I have learned there are as many ways to address the issue of stabilizing unpaved or gravel roads as there are practitioners of the art. I also learned techniques from some, helped to dispel the misconceptions of others, and have come to appreciate that there are differences in the kind of road building materials available from place to place.

In recent years I helped several homeowners on the shores of Madison's pristine Silver Lake deal with stormwater running directly into the lake. One of these projects became the cover story for a NH Lakes Association newsletter. Using the proper material and careful grading, I directed water off into the woods where any silt is trapped as water percolates into the ground. Last season I helped Dr. Bob Newton, a groundwater geologist who also spends his summers on Silver Lake, construct a rain garden as part of our ongoing stormwater mitigation plan for his property. The rain garden is designed to trap any silt carried by the small section of runoff that could not be directed safely into the woods. I am pleased to report that both of these Silver Lake projects have successfully controlled runoff since their installation.

While their Road Scholar programs are



A catch basin fits into a smaller space than a rain garden and traps stormwater otherwise bound for the lake and lets it soak away into the ground. (Courtesy photo)

available primarily to Public Works personnel, I have directed my training to the private contractors and laymen who are trying their best to responsibly deal with often difficult situations.

As a result of my years of "playing in the dirt," I wrote a road maintenance manual, "A Ditch in Time," that is available for free on my website, www.RuralHomeTech.com. It has been recognized by the NHDES as it "fills an important niche in the identification and promotion of best management practices to protect water quality."

I am pleased to report that the storms of 2023 that caused flooding damage to the Mount Washington Valley did little damage to that road system above my favorite local pond helping to prove that proper and timely dirt road maintenance can be effective at reducing surface water contamination.

Russ Lanoie is a long-time solar proponent in New Hampshire's White Mountains and operated his Alternative Systems business in the 1970s—80s selling solar hot water systems, composting toilets, and Window Quilts®. He lives in a passive solar home which has had Daystar solar hot water for forty years, and 11kW of PVs on his barn since 2015. www.RuralHomeTech.com. ♻️

Environmental Solutions

Cont'd from p. 17

husk as a crucial component in pollution abatement solutions, particularly for the food industry. Integrating coconut husk into the filtration process not only enhances water purification efforts but also proves instrumental in addressing oil particulates in food-frying manufacturing applications. This sustainable solution showcases S&SE's commitment to environmental conservation and innovation in the industry.

Two-Stage Filter System for Enhanced Air Purification

In response to the complex challenges of food-frying equipment manufacturing, S&SE emphasizes the importance of a two-stage filter system before routing air through the RTO. This strategic approach optimizes air purification, ensuring the longevity and effectiveness of the food equipment involved. By capturing larger particles and contaminants in the initial stage and finer particulates in the subsequent stage, the two-stage filter system enhances environmental sustainability while maximizing operational efficiency.

Sustainability: A Guiding Force

In 2024, sustainability is emerging as a critical pillar shaping the future of consumer-packaged goods and food packaging. The industry is experiencing a paradigm shift towards eco-friendly packaging and responsible sourcing practices, driven by the urgent need for climate change mitigation. Ship & Shore Environmental recognizes this shift and stands as a beacon of innovation, offering solutions that not only meet regulatory standards but also contribute to addressing climate change.

Pollution Abatement for Food Manufacturing Companies

As the importance of pollution abatement continues to rise in food manufacturing, Ship & Shore Environmental specializes in Regenerative Thermal Oxidizers

(RTOs) tailored for the unique challenges posed by various food manufacturing processes. From meat and poultry rendering to fragrance and flavoring operations, the company's solutions effectively handle emissions while ensuring compliance with local air quality requirements.

The Imperative of Pollution Control in Food Manufacturing and Packaging

Baking, frying, meat processing and food packaging, integral to the food industry, contribute to environmental pollution. Harmful emissions, including volatile organic compounds (VOCs), particulate matter, oil, and grease, necessitate stringent pollution control measures. Ship & Shore RTOs not only mitigate environmental impact but also offer significant cost savings, emphasizing the critical role of pollution abatement in the food manufacturing and packaging sector.

Driving Sustainability and Compliance

As regulations become more stringent and consumer preferences shift towards eco-friendly practices, S&SE remains steadfast in its mission to drive sustainability and compliance in the food industry. Through tailored solutions, local initiatives, and innovative technologies, the company continues to empower food manufacturers and packagers to meet environmental obligations while advancing their business goals.

Elevating Accountability and Consumer Trust

As companies navigate complexities of evolving regulations, Ship & Shore Environmental is providing businesses with solutions that go beyond compliance – they build accountability and consumer trust. The commitment to sustainable practices is not merely a trend but a fundamental driver, signaling a collective responsibility towards environmental conservation.

For more information, visit www.shipandshore.com. ♻️

Sulforaphane, the Amazing Antioxidant You've Never Heard Of



Larry Plesent

Breathing, moving, eating, being. The very act of living borrows electrons from otherwise stable unions creating notably unstable atoms with an extra electron whizzing around their cores. This extra electron leaves the molecule wanting to balance its energy. Balance is often sought by grabbing onto a nearby oxygen atom and sharing energy with it. While we all need oxygen, in the wrong place it causes a lot of trouble.

Think of this as rusting for biology.

This exact process is now believed to be a major cause of aging, in particular, aging before the optimal time to say our final adios. Wrinkles, lack of energy, susceptibility to diseases including cancer -- all these and more have been linked to a surplus of those former extra electron molecules and their now "free radical" oxygenated by-products.

Fortunately, nature provides us with thousands of anti-oxidation molecules. Most of them come from plants. Fresh, colorful, food from healthy mineral rich soil is full of antioxidants. That's the good stuff.

As their name suggests, antioxidants bind up and balance extra electron molecules, leaving no room at the inn for those pesky free radicals.

Right about now you may be thinking, "Hey! Tell me this isn't another article telling us to eat more plant-based foods to live longer and healthier lives while lightening our footsteps upon the earth, is it?"

Well, the answer is yes. And if this article is the final straw that gets you and

yours to eat less feedlot meat and chemically grown plant foods, then hal-lelujah!

Today's wellness article focuses on one specific antioxidant called sulforaphane. If the name reminds you of sulfur, you are correct. Sulforaphane is a special type of sulfur created exclusively by cabbage-family crops. Yes, it is found in kale. And yes, it is probably responsible for the minor gassiness sometimes associated with this group of super healthy vegetables. Cabbage, broccoli, brussels sprouts, and kale are the only known sources of this free radical scavenging powerhouse.

Many readers may already know that the easiest way to multiply the nutritional content of an edible plant is to properly sprout its seed and then eat the sprout. Sprouts have as much as four to eight times the nutrition than the adult versions contain. Sprouted high sulforaphane broccoli seeds increase their sulforaphane content dramatically and can be a potent force in the ongoing War Against Free Radicals.

Full disclosure. At the risk of committing TMI (too much information), cabbage crops do not actually contain sulforaphane. They contain a closely related molecule called isothiocyanate that converts



Sprouted broccoli seeds are a great source of antioxidants. Sprouts have as much as four to eight times the nutrition than the adult versions. (Oregon State University)

to sulforaphane when you eat it. There I said it.

If eating half a cup of broccoli sprouts a day is too unwieldy (or gassy) for your lifestyle there are concentrated supplements available. The exact amount of sulforaphane (ok, isothiocyanate) you ingest is secondary to ending a

diet of highly engineered fast food, junk food, desserts and snacks and replacing them with piles of veggies. That veggie pile should also include a big handful of sprouted broccoli seeds.

On a personal note, if I ever have a cancer diagnosis, and two-thirds of us are likely to, I would immediately switch to a diet of mostly organic plant-based. I would learn to pickle (ferment) my organic produce and sprout nonchemically treated seeds including broccoli.

In the meantime, I work steadily toward that goal, throwing out the bad stuff and encouraging the good. It's not the occasional dessert that takes us down. It's how we live each day.

Smokey the Bear told us "Only you can prevent forest fires."

Well, this is Larry the Soapman telling you that "Only you can prevent premature aging and reduce your personal cancer risk by switching to organic and lightly

processed food that are fresh, colorful, and full of desperately needed antioxidants."

OK. That was not as catchy a phrase as the bear's. But that does not make it any less true.

Larry Plesent is a writer, retired soap maker and grandfather of five still living and working in the Green Mountains of Vermont. He recently started the nonprofit called Soap Peace to teach the art of soapmaking (using only locally available materials) in West Africa and other developing regions. ♻️



Brussels sprouts are a source of sulforaphane, the free radical scavenging powerhouse. (Wikipedia)

Embodied Carbon Defined

What is "embodied carbon" and what percent of our greenhouse gas emissions does it make up? And how can we reduce it?

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

As the process of reducing carbon dioxide (CO₂) emissions continues to grow in importance, the building operations industry has been working hard on limiting theirs. The problem is that this industry typically targets operational carbon rather than embodied carbon. Operational carbon is the sum of the carbon produced over the lifetime of a building and includes things like lighting, heating, ventilation, and general power usage throughout the building. On the other hand, embodied carbon is all the emissions that are created during the process of constructing a building. Embodied carbon is associated with the harvesting, manufacturing, transportation, installation, maintenance, and disposal of building materials.

Buildings in general tend to account for at least 39% of annual global carbon emissions. At least a quarter of these emissions are the result of embodied carbon. Cement alone is responsible for around 8% of the world's CO₂ emissions. The production of iron and steel emits roughly the same number of emissions. These carbon-intensive materials are large contributors of embodied carbon.



Building with sustainably grown wood reduces embodied carbon significantly as compared to using concrete and steel. (Pexels.com)

There are some measures that have already been taken in efforts to reduce embodied carbon. The Inflation Reduction Act, which was passed by Congress in 2022, includes six sections that address the embodied carbon of construction materials. For example, section 60112 gave \$250 million to the EPA to develop a program to help support enhanced

standardization, measurement, reporting and verification of embodied carbon of construction materials and products. Overall, these sections of the Inflation Reduction Act gave money to various government organizations to help transition to lower carbon materials.

To reduce embodied carbon, the building industry will have to make operational changes. One key way to do that is to design buildings in a way that minimizes the number of materials needed. Companies can also replace carbon-intensive materials like concrete and steel with greener options like sustainably grown wood. Repurposing existing buildings instead of building new ones can also reduce embodied carbon.

Another way to limit embodied carbon is to use greener construction equipment. The traditional diesel-powered equipment so commonly used in construction accounts for roughly three percent of embodied carbon in new construction projects. There are some equipment manufacturers that are developing zero-emission construction equipment. Liebherr, the German-Swiss equipment manufacturer, has developed an electric crane that releases no emissions and still performs on par with the traditional diesel equipment.

Limiting operational carbon is important, but it is also important to remember all of the carbon that comes from the processes prior to buildings being operational. The processes behind the scenes still emit CO₂. Limiting embodied carbon needs to be prioritized on par with the emissions that come from typical building operations.

Source Links: Reducing Embodied Carbon of Construction Materials through the Inflation Reduction Act, <https://bit.ly/ReducingImbeddedCarbon>; Reducing embodied carbon in new construction, <https://bit.ly/ReducingInNewConstruction>.

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

Fostering Hope with a Dryer?

Helen Hong

Ask anyone why they shop at the COVER Store in downtown White River Junction, and you will get a myriad of answers. "The Store has a funky, rolling yard sale vibe. The staff is helpful, and they know what's on hand or where to look." "I try to buy used before buying new at a big-box store." "I am remodeling my house and 80% of the appliances, fixtures, and furniture are from COVER."

The treasure-hunt for a bargain is intoxicating. Buying a used item reduces our environmental footprint and landfill waste. Some are artists who upcycle or repurpose discarded items into objects of beauty and new use. Or a DIY-er might find building materials and tools at affordable prices, like doors priced between \$15 and \$50 or a pound of nails for \$1.

The COVER Store recently opened its newest enterprise: a bookstore on the streetside of its building. Cover to COVER Books sells high-quality used books that are sorted and curated by book-enthusiast volunteers. With most books priced between \$1 and \$5, anyone can browse and perhaps bring a book or two (or a box-full) home.

Last year, shoppers and donors to the COVER Store diverted 75 tons of appliances, building materials, books, and housewares from the landfill. Store profits funded 29% of COVER's home repair and weatherization program. Since 1998, COVER Home Repair has been bringing volunteers and trained staff together to complete urgent home repairs for low-income homeowners in the Upper Valley. Last year COVER built ten accessibility ramps for safe entry and exit from

a home, 12 roofs and nine insulated skirtings for mobile homes, and completed over 50 smaller repairs to make homes warm, safe, and dry.

But did you know that shopping at, or donating to, the COVER Store can change a neighbor's life?

Last summer, Al contacted COVER to help make his modest home more functional. Despite a healthy lifestyle, Al was diagnosed with diabetes when he started having trouble with his feet. He eventually had five toes amputated. Al doesn't drive, and his declining health makes employment difficult. His doctors are treating his diabetes-related complications and various charities and caring friends help him with groceries, lot rent and transportation needs. Al called COVER because he needed a handrail for his stairs after his amputation, and because his clothes dryer had stopped working.

COVER's home repair staff installed ten feet of handrail, so Al could walk up and down his front steps safely. When a dryer was donated to the COVER Store, COVER was able to supply it free of charge to Al through its voucher program. Handrails and a dryer may not seem like much, but to Al it showed that his community cared and created a sense of security and hope.

So, the next time you are near the junction of I-89 and I-91, drop into the COVER Store at 158 South Main Street in White River Junction. You may end up finding a bargain and helping the environment and a neighbor at the same time!

Learn more at www.coverhomerepair.org.

Helen Hong is the Executive Director of COVER Home Repair. ♻️



COVER's home repair staff installed ten feet of handrail, so a community member could walk up and down his front steps safely. (Courtesy photo); Saving fuel and dollars: Last winter COVER staff and volunteers weatherized 40 homes and built 275 interior storm windows for conventional and mobile homes, saving 2,750 gallons of heating fuel in one season. (Alex Wells); The COVER Store offers tools and building materials at affordable prices. (Alex Wells);

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Can Lawn Chemicals Cause Canine Cancer?

EarthTalk® From the Editors of E – The Environmental Magazine



Maybe you shouldn't let your dog run free at the park or in your neighbor's yard if carcinogenic chemicals are used on the lawn. (Brett Sayles, Pexels)

sentinels for potentially harmful environmental exposures in humans," report the researchers behind the bladder cancer study.

What can you do to help prevent more dogs (and humans) from getting sick? For starters, avoid using lawn care chemicals around your home. And if you hire or manage someone else to take care of your yard, make sure they are not using 2,4-D, glyphosate or any

other potentially hazardous pesticides, herbicides or fertilizers. Getting rid of your lawn altogether and replacing it with regionally adapted native plants that don't need fertilizers or pesticides to thrive is another way to protect dogs from chemicals while saving yourself the trouble of having to mow the lawn.

If you can't live without a grassy lawn and can't bear to just let it go wild, opt for all-natural, organic inputs. For instance, organic compost distributed across your lawn with a shovel in a thin layer can do just as well or better at nourishing your grass as chemical fertilizers. For weed control (beyond hand-pulling), a great all-natural alternative to RoundUp is BurnOut, which uses the power of food-grade vinegar and clove oil instead of glyphosate to eradicate unwanted plants.

As for protecting your dog while out on a walk, steer clear of private lawns, even if you have to leash Fido to keep him out of neighbors' yards. And the days of letting your dog run free in parks where your municipality may use questionable landscaping chemicals are over now that we know the potential consequences. Fortunately, many enlightened cities and towns have taken steps to rid their publicly accessible lands of such hazardous treatments. But

you won't know unless you ask, so contact your local parks department to find out exactly what they're spraying. And if you don't like the answer, rally other dog owners to help get it changed, for dogs' sake.

Source links: "Household Chemical Exposures and the Risk of Canine Malignant Lymphoma, a Model for Human Non-Hodgkin's Lymphoma," ncbi.nlm.nih.gov/pmc/articles/PMC3267855/; "Detection of herbicides in the urine of pet dogs following home lawn chemical application," ncbi.nlm.nih.gov/pubmed/23584031; BurnOut Weed and Grass Killer, amzn.to/2XyhKGe.

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Compost Food Waste in Style

Product review by N.R. Mallery

We assume most readers of *Green Energy Times* compost their food scraps. If you do not compost, we hope you will start immediately.

If you garden, you have probably been composting for a long time. In a posting on the Natural Resources Defense Council website, the "Composting 101" article states, "Recycling food and other organic waste into compost provides a range of environmental benefits, including improving soil health, reducing greenhouse gas emissions, recycling nutrients, and mitigating the impact of droughts." (<https://www.nrdc.org/stories/composting-101#whatis>). Food scraps accumulate daily. We can and should use them to our benefit. This is a step nearly everyone can take.

It all starts by collecting your daily food waste. It is easy to just put food scraps into any old bucket or bowl, but this may not be something you want to keep visible on your countertop. We came across a nice solution, the Bamboozle kitchen compost bin. The container is crafted from bamboo fiber and spruces up the kitchen counter in style with an assortment of colors to choose from.

What is so great and different about The Bamboozle bamboo container? It's sustainable! The 8" x 6.25" x 9" container holds a lot of scraps before needing to be emptied. The vented and filtered lid is designed to catch unpleasant odors while allowing airflow for optimal composting conditions. The hemp or charcoal filter blocks smells and is disposable, so the kitchen does not smell like a dumpster! When it is empty, whether you use a compostable liner or not, simply pop it in the dishwasher for a good cleaning.

The bin is durable enough to survive countless trips to your composter or community drop-offs. And years from now, when it is time to bid adieu to your compost bin, it simply returns to the soil



The bamboo Bamboozle compost container. (Courtesy image)

without a trace because it, too, is compostable. This is called sustainability!

We hope you have been composting all winter long. With gardening season upon us as well as farmer's markets brimming with wonderful fresh vegetables this is a good time to take steps to reduce your food waste in style with Bamboozle. The biodegradable compost bin looks like ceramic but is made from repurposed bamboo in a nice design that complements the look and feel of any kitchen. But the beauty of Bamboozle is just how well the brand merges form and function, and how easily it promotes a simple shift towards kitchen composting.

A stinky trash can is a thing of the past as more people understand the many benefits of composting their food waste.

This Bamboozle compost bin is nice enough that we think you will want to leave it on your counter, because it is not just about function; it is a statement piece that fits in to either a modern kitchen or a cozy country kitchen.

Learn more at: <https://www.bamboozlehome.com/collections/compost>. ♻️

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DIY: E-Bike Battery Charged by EGO Yard Maintenance Battery

Russ Lanoie

When we considered purchasing e-Bikes this past summer, I pondered whether a maker of cordless electric yard tools could produce their own e-Bikes so that expensive batteries could be shared. This would help eliminate having to have yet another brand of battery systems like most of us who own different brands of power hand and yard tools have accumulated in recent years. These run the gamut from the electric chain saw down to the electric tooth brush. It would also mean that we could take along spare batteries that we already have when we go places that are away from plug-in power (campers call it Shore Power) but want to recharge or swap bike batteries without having to run a generator.

But then I realized that I could use the batteries from our new EGO Zero-Turn riding mower and our other EGO



An EGO e-bike is being charged by an EGO lawn equipment charger. (Courtesy photo)



yard maintenance tools to recharge bike batteries using the inexpensive inverter that couples to any of the batteries. The 110 volt charger that comes with the bike could simply plug into the inverter as a form of portable power.

So, on one camping trip to a state park without electrical hookup, we tried this scenario on our new Can-

nondale level 2 e-bikes and found it to work without a hitch. It is a bit of wiring spaghetti but not all that complicated. As shown in the photo, the battery slides onto the inverter, the e-bike battery charger plugs into the inverter just as it would a wall socket, and the output wire plugs into the bike battery without even having to remove it from the bike. The draw from the bike battery charger is well within the capability of the inverter, and we now have several batteries to

provide power since four substantial batteries (10 amp-hours, or Ah) came with the mower, and we also have a couple of 5Ah batteries for our string trimmer, hedge trimmer, leaf and debris blowers and tiller/cultivator.

Whether or not we could actually connect all of this range-extending hardware together when we are riding is a curious consideration, but it is unlikely that we would ever ride long enough to require such a marriage. Just knowing that we could carry at least one spare battery with the inverter and bike battery charger is comforting. I have not priced a spare Cannondale battery but now really have no reason to!

And wouldn't you know it, EGO is about to bring out their own bike powered by their interchangeable fleet of batteries. It is considered more of a scooter that will go 28 miles per hour, but because it does not have pedals, it will likely be banned from many of the trails that electric assisted pedal-powered bikes are permitted to use. Still, it is a step in the right direction and may in fact point the way for e-bikes to be powered by lawn mower, string trimmer, or leaf blower batteries.

Russ Lanoie is a contributing writer and distributor for G.E.T. Lanoie is a long-time solar proponent in New Hampshire's White Mountains and operated his Alternative Systems business in the 1970s—80s selling solar hot water systems, composting toilets and Window Quilts®. He lives in a passive solar home which has had Daystar solar hot water for forty years and 11kW of PVs on his barn since 2015. www.RuralHomeTech.com.

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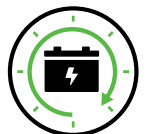


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