Issue 55 • May - July 2019 – CELEBRATING 10 YEARS: MAY 2009 - MAY 2019 – FREE!

10 YEARS!

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SQUAM LAKES SCIENCE CENTER GOES GREENER

George Harvey

Squam Lakes Natural Science Center is not quite a simple wildlife or nature preserve. It is accredited as by the Association of Zoos and Aquariums and has a collection of captive animals it cares for because misfortune had rendered them unable to survive in the wild. Nevertheless, it is not what most people might think of as a zoo. It has a strong educational mission and even has a nature-based Montessori early learning center. On the other hand, it is a place where people can go for a cruise in a natural setting or even just to visit an informal garden. We might say it has a unique approach to helping us get in touch with nature, giving us a lot to choose from.

Unsurprisingly, the Science Center's mission promotes care for the environment. That means adopting renewable energy and energy efficiency, avoiding polluting, emitting as little carbon dioxide as possible, and taking care of soil and water. The organization made a pledge to reduce emissions 50% and get half of its energy from renewable resources by 2030 as part of its strategic plan for 2016 to 2020. So, we were not surprised when we learned of two new examples of environmental progress at the Science Center.

One of these is a new array of solar panels on the roof of the Science Center's Lake Cruise Headquarters. This building, which is located across the street from the Science Center's main entrance, is relatively new, having opened in July 2017. Though the array was new, its panels were not. They were salvaged from an off-grid house that

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View of Squam Lake at the summit of Mt. Fayal from one of the hiking trails at the Squam Lakes Natural Science Center. Courtesy photo: Squam Lakes Natural Science Center.

MY ZERO ENERGY POOL is a Great Investment!

David Green

Great news! Making money by cutting your carbon footprint to zero is a new reality. I own a large house built in the 1970s. I've already cut its energy bills and carbon footprint to zero, making a 15% return on investment in the process (see my Zero Energy Project blog post for details at http://bit.ly/ZZeroEnergyRetrofit-Beats401K). Now I've done the same on my swimming pool. It was quicker, cheaper, and made a higher return on investment to "go zero" on our pool than it did on our house.

By "going zero" on our pool I saved about $3,000 a year and cut about nine tons of carbon dioxide emissions a year. We did this by installing energy saving devices that I call the "pool fab four": a new variable-speed pool-water circulating pump, an electric-powered pool vacuum/cleaner, a heat pump pool heater and about five solar panels to power it all. Going zero on our house saved us about $11,000 a year and cut our carbon footprint about 43 tons per year, so the savings on the pool made a significant addition to my total gain from going zero in the first place.

I am a physicist by training so I have a solid understanding of technologies like solar panels, heat pumps,

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The author's son enjoys their zero energy pool.

Saving Our Children

Dr. Alan K. Betts

On Friday, March 15, images and video flowed in from around the world, Australia, the Pacific, Asia, Europe and Africa, as more than a million students in 120 countries walked out of school to strike for the climate. Thousands of scientists supported them, but the real driver was their realization that global society intends to sacrifice them and their children, along with much of life on Earth, just to protect our consumer society and the profits of the oil companies and other wealthy corporations.

This winter, along with shoveling snow, I have been mulling over how our society's indifference towards the future of our children contrasts with the care we take to protect them in the present. There are days and nights when this fills me with dread. We need to discuss this, even though we would rather avoid it. Consider that there are political and religious campaigns to protect the lives of unborn children, but no similar campaigns to protect the unborn millions that will die in the climate catastrophe that we are creating. How can this be?

Other issues are at stake. The campaign in the present to protect the unborn is a convenient political fit for the disempowerment of women and their centuries-old subjugation by male authority. In contrast, the future deaths of the unborn,

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In March 2019, South African youths protested for action against climate change outside Parliament in Cape Town. Photo: Ashraf Hendricks, groundup.org.za.

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GREEN ENERGY TIMES IS TEN YEARS OLD

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Hopefully we have not forgotten to mention anyone. It is your help that paves the way to a sustainable future.

Please support our advertisers. They make G.E.T. happen!

ABOUT G.E.T.

Green Energy Times is produced by 100% solar power, off-grid with a 3.8 kW PV system. We live and know that Energy Independence is indeed possible – with clean, sustainable renewable energy along with reducing your needs. We walk the talk!

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

Solar Power works! … anywhere under the sun!

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Editorial Policy: *Green Energy Times* works with a variety of writers and also publishes community submissions on various topics. We aim to publish content that is independently researched, unbiased and relevant to our audience. Submissions are subject to our guidelines. Publication is subject to our editorial judgment & schedule.

Subscriptions: $30/yr. See form on page 36 or contact us.

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 dean, 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

Disclaimer: *G.E.T.* allows space to, but does not endorse, contributed content from professionals or vendors.

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

Green Energy Times Is Ten Years Old!

When I founded Green Energy Times (G.E.T.) *ten years ago, the expectation that it would be so well received and have as far and broad of an outreach area as it is today never entered my mind. I just knew from my own personal experience that solar works! I also understood that energy and building efficiency with conservation was the key. No one who came to visit had a clue that such a thing was actually possible. I felt like a tour guide repeating and showing visitors how it all worked so well. And so it was time to share my story with the people who lived in the area.*

At the time, I knew of an impending climate crisis, but as the years passed, it became very clear that the bigger reason for continuing to produce G.E.T. *was indeed for our children and grandchildren. Not to fix the mess we unknowingly created and will be leaving to them is intolerable. We* MUST *try to do all we can, in hopes that they will be able to survive with the world we are bequeathing to them.*

Green Energy Times *started as a 16-page newspaper in 2009 and was delivered to the local communities in the Cohase Valley where I live. The requests for it to be available in communities not only surrounding my region but also neighboring states have come in steadily since. We try to accommodate these requests as best we can based on what we can afford, because it is a* FREE *publication. The* G.E.T. *that was solely produced by one person — me — clearly needed more help tois accommodate the requested and needed outreach that still continues to this day. Those around me will hear me say, "If only someone would invest in* GET, *we could reach more, with the sky (literally) as the limit… if only…"*

So, here we are today, continuing to bring our resource publication to you all, every two months. With a network of distribution teams throughout VT, NH, NY and MA, we somehow manage to keep our heads just above the rising waters (again, literally, too). Our production team of just three with additional editorial contributions and our advertisers keep us working very long, hard hours to bring our news to you, the reader.

If we are to continue another ten years, we need your help in the form of donations from you, as a reader and with the support from related businesses, as well as your help to spread the word about our need for investors or grant funding opportunities! Help us keep going and to grow, to take our message as far as across the country and beyond! Think of the impact we could make!

If you simply think about how much solar there was in our region just ten years ago and look at how much you see today, you will realize that G.E.T. *has played an important role in educating people and businesses in the Northeast. It retains an important place in the world today to help educate everyone about the many, many things we all need to do. We need to take responsibility for what we can do individually, now.* G.E.T. *also shows what others are doing today. We must consider, most of all, the future for our kids! It IS all about the kids! Help us continue to make* G.E.T. *happen.*

Please take a moment to call 802.439.6675 or 603.437.0167. Sign up to become a sustainable member of our team with regular monthly, yearly commitments or as a one-time reader-supported donor. Your donation will help to keep G.E.T. *going. Or give directly online at greenenergytimes.org. You can also send your donation to 1749 Wright's Mountain Rd., Bradford, VT 05033.*

Can we count on you to help us keep going strong with a sustaining commitment to send us a monthly donation? Please call us now to set this up at any level that you can afford, to show us what we are worth to you. We need it, our children need it most of all. Call today: 802.439.6675 or 603.437.0167 or contribute to G.E.T. *online at greenenergytimes.org.*

Thank you for your much-needed help, as the people and businesses below have done!

– 'Nancy Rae' Mallery, founder of 'Green Energy Times'

Green Energy Times **wishes to thank everyone for their kind donations:**

- New York Geothermal Energy Organization (NY-GEO)
- Joanne Coons: *"Thank you Green Energy Times for enlightening the world!"*
- Wyldon Fishman, president of *NY Solar Energy Society*: *"Thank you GET for 10 years of excellent articles, superb writing and giving* NYSES *a perfect educational resource to fit our mission."*

Happy Anniversary!
Thank you GET for bringing us information on renewable energy for these last 10 years!
We're planning to help you to continue for another decade!
– Bob Irving
R. H. Irving Homebuilders

Congratulations to G.E.T. on its first decade!
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NEW HAMPSHIRE BUSINESS SOLAR SUMMIT

To be Hosted in Derry, NH: June 5, 2019

Craig Lazinsky

The Town of Derry New Hampshire's NetZero Energy Task Force, along with Tupelo Music Hall, are co-sponsoring a New Hampshire Business Solar Summit from 5:30 pm to 7:00 pm on Wednesday June 5, 2019. Join New Hampshire businesses, Chambers of Commerce, renewable energy providers and non-profit organizations to learn how installing solar equipment can save money for your business. The Summit will be held at Tupelo Music Hall, 10 A Street in Derry, NH 03038. Participation is at NO CHARGE, but a reservation is requested at this link: https://www.eventbrite.com/e/derry-nh-business-solar-summit-tickets-4618985510.

Ten ground-mounted solar trackers at Derry's transfer station will yield 155,000kWh per year. The system was installed May 2018. Photo by Granite State Solar.

Derry, NH's NetZero Task Force is an all-volunteer committee chartered to explore and achieve cost effective solutions for reduced energy, water use and sustainable energy development on town-controlled property, municipal buildings and vehicles, schools and the community of Derry, New Hampshire.

According to Jeff Moulton, Committee Chairman, "This Business Solar Summit assembles solar energy professionals, renewable energy associations, and business owners to share information about how solar energy can save thousands of dollars for New Hampshire businesses. Invited speakers will provide real-world advice about how solar energy can benefit business and building owners large or small, review current New Hampshire State energy legislation, and Tupelo Music Hall's owner will describe the motivation and benefits of installing solar panels to provide virtually 100% of Tupelo's electrical needs."

Tupelo Music Hall owner, Scott Hayward, reported, "We worked with Brentwood, NH-based ReVision Energy to install a 100 kilowatt grid-tied solar electric system. The solar array is forecasted to save over three-quarters of a million dollars in electric costs over its expected 40-year lifetime."

Derry Director of Economic Development, Beverly Donovan, noted, "Derry is a growing community that consistently demonstrates its business-friendliness and welcoming attitude. This past year we've seen a flurry of commercial activity, and many of the businesses I have met with are interested in sustainability and green practices. It's encouraging that being 'green' is now a regular part of the economic development conversation."

Josh Bourdon is a Derry Town-Counselor-At-Large and Co-Chair of the NetZero Task Force. He remarked, "We're excited to have several solar projects successfully completed in Derry, serving as a model for town businesses to consider investing in renewable energy. Over its twenty-five year warranty, the 86kW solar installation completed last May at the Town Transfer Station will help the town of Derry save about $25,000 in electricity costs per year - these savings will be passed on to Derry taxpayers.

"We started the Net-Zero Task Force in 2016 focusing on municipal buildings and schools, but another one of our goals was to find out who else in the community would be interested in investing in solar - we are looking for local businesses that may benefit from installing solar panels. The NetZero Task Force is willing to consult with Derry town businesses, commercial and residential apartment building owners and connect them with professional installers who can help them evaluate and install solar energy. The upcoming Business Solar Summit can help answer questions in a communal setting, enabling business owners to maximize their renewable energy investment."

The Derry-Londonderry Chamber of Commerce and the Town of Derry invite New Hampshire business owners, members of the public, renewable energy companies, government, non-profit organizations and media to participate in this event.

Craig Lazinsky, Public Member of Derry's NetZero Energy Task Force can be reached at craiglazinsky@comcast.net. Lazinsky has a background in marketing scientific instruments, advanced materials, HVAC and energy-conserving environmental control systems. He currently consults for technology clients and volunteers with energy-related non-profit organizations from his home in Derry, NH. ♻

Learn how solar energy can save money for NH business owners

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Recently Announced Electric Car Models

David Roberts

Spring has sprung in the Northeast and along with the blossoms and daylight hours, it is also the time when many automakers take the wraps off their 2020 model year vehicles. The annual New York International Auto Show (NYIAS) just ended and here's an update on some the newest electric options coming our way later this year and beyond.


Rivian R1T Pick-up Truck


Rivian R1S SUV

Rivian R1T Pick-up Truck and R1S SUV

Rivian is a start-up developing very capable on- and off-road electric vehicles – their booth was one of the most popular stops for electric vehicle fans at the NYIAS this year. Taking a page from Tesla's playbook, they are starting at the upper end of the market with their R1T pick-up truck with up to 400-plus miles of range, all-wheel drive, and a 0-60 mph time of three seconds. The R1S is a 7-passenger SUV with similar specifications. Pricing is not yet set, but both models will likely start around $70,000. The pick-up truck and SUV market represent the majority of new auto sales these days, so it's great to see more electric options coming. Preorders have started, with volume production expected to begin in 2020. Amazon and Ford have recently invested $1.2 billion in the company, so it looks like they are well on their way!


Kia Niro EV

Kia Niro EV

Kia has sold the Niro as a regular hybrid and plug-in hybrid for a while. This year they are launching the Niro EV, an all-electric variant offering about 240 miles of range and

Drive Electric Vermont

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Way to Go! Awards and Green Mobility Party

June 5, 10 a.m. - 2 p.m., Statehouse on State Street, Montpelier, VT

Celebrating and Recognizing Green Mobility: Way to Go! encourages everyone to make more efficient travel choices

More Vermont K-12 schools than ever are participating in the statewide Way to Go! program encouraging active, healthful and safer transportation to school. On June 5, 2019, we'll celebrate their year-long activities including walking school buses, bike rodeos, ridesharing, bus riding, school travel plans and more.

Grab a bag lunch and join school groups, innovative Vermont businesses, state officials and non-profit representatives on the statehouse lawn. Exhibits will open at 10:00 am and the awards ceremony with dignitaries and winning school groups will take place at 11:30 am in the statehouse chamber. Solar, electric-assist bicycle demonstrations and youth interactive activities will continue from noon to 2:00 p.m. Experience the party celebrating the thousands of Vermonters choosing safe, efficient, and locally-powered transportation options. We invite all participating schools and others interested in battling carbon pollution to join us!

Way to Go! is made possible by Safe Routes to School and Way to Go! organizers, school coordinators, principals, teachers and volunteers who all share a vision of schools and communities becoming safer places to commute green. All year, schools have been battling the growing carbon pollution problem by demonstrating how active and sustainable transportation habits really add up to hundreds of thousands of pounds of greenhouse gas emission savings!

Courtesy photos

Each year Way to Go! recognizes top performing schools for their continued action to practice green transportation. This year, seventy-four schools competed for the Carbon Cup and the Carbon Leader awards. Several lucky schools will win an awesome prize, including an AllEarth PowerFlower, Darn Tough socks, QOR 360 active chairs, bike racks, and more, all made possible by program sponsors.

Activities will demonstrate the connection between solar and clean transportation, highlight how schools are advancing low cost projects for safer streets, with opportunities to try electric bikes and buses (invited) and other human-powered options. We share a vision to make great places to live, learn, work and play. Sponsored by waytogovt.org. Event is free and open to the public, 10 am-2 pm.

10:00 a.m. Exhibits open

11:30 a.m. School Awards Ceremony (Statehouse House Chamber)

12:00 p.m. Activities on the Statehouse Lawn

- Way to Go! group photo (everyone welcome!)
- Kids mobility poster party
- e-Bike Demo – Take a spin!
- Climb aboard Vermont's first battery-powered eBus (invited)
- Making the solar connection – AllEarth PowerFlower
- Active learning with active sitting--QOR360 chairs
- Network and learn how Vermont is leading the way to a sustainable transportation system
- Free snacks! (or bring a bag lunch to enjoy outside)

It's never too late to get started, check out Way to Go! School Challenge. Sign-up. It's easy and fun. Did you know that ***May is the Vermont Bike Walk Challenge?*** Get active, learn more here and use Go! Vermont's free resources including the Green Rewards Program at Go! Vermont.

Way to Go! is thankful to the hundreds of volunteer organizers, teachers, and parents and many sponsors, Vermont Agency of Transportation and Chittenden County Regional Planning Commission, and supported by a broad network of statewide entities, NGO's and business partners including Local Motion, VEEP, Department of Health, Net Zero Vermont and Place Creative, and many others. Together we're leveraging resources, sharing experiences through the growing network of educators, volunteers, and wellness coordinators all working together for safer, neighborhood and community connections. The results are thousands more kids and adults are walking, biking, riding the bus and carpooling, as opposed to making single car trips.

Referenced Links:

Learn more about the program waytogovt.org

May is Vermont Bike Walk Challenge Month bit.ly/bike-walk-challenge

Go! Vermont connectingcommuters.org/ or call 800.685.RIDE (7433)

For questions, contact Deb Sachs at deb@netzerovt.org, (802)-238-9807 or visit www.waytogovt.org. ♻

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SMART COMMUTING IN NH & VT

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

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

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

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

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

IN NEW HAMPSHIRE

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

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

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

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

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

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

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

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

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

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

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

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

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

IN VERMONT

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

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

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

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

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

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

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

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

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

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

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

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

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

Is New Hampshire EV-Friendly?

Randy Bryan

Wikimedia Commons

According to American Auto Manufacturers statistics, New Hampshire registered 1123 new plug-in electric vehicles (PEV) in 2018, up from 788 in 2017. That's a 42.5% increase in PEV sales for the year. You might say that's great growth, but, in fact, it's a poor showing. Overall, U.S. PEV sales growth was 81.4% vs 2017.

NH has typically been high in the list of new-tech vehicle sales. NH was in the top twenty states in hybrid electric vehicle (HEV) adoption and about the same for PEV adoption until 2018. Why this poor showing? Is it poor supply or poor demand?

Drive Electric NH staged three times as many public electric vehicle (EV) events around the state in 2018 as in 2017, reaching nearly three times as many people (over 1500 people by my counting). How does this help? By themselves, these EV events stimulate five to 10% of visitors to purchase EVs over the next year (MA statistics). More EV events equates to more EV demand on top of the general demand level.

More and more people are familiar with EVs, and the EVs now available (150-300 miles range) are a good fit for many NH residents' needs. Most EV dealers also tell of not being able to keep EVs in stock.

However, EV dealerships also speak of not enough EV prospects coming through the doors. Maybe true, but, if there's no stock of EVs on the lot and waiting for swaps with out-of-state dealers means delay or failure, and the sales and service staff know less about EVs than the prospect, why go to the dealer?

To sum up, NH EV demand is not yet through the roof, but it certainly exceeds supply.

Now let's look at EV supply. Conversations with many EV owners, prospects, enthusiasts, and dealership staff continually point out the lack of EV supply as a sales issue. Why do surrounding states have EV supply and not NH? The answer is easy, they joined the Northeast States for Coordinated Air Use Management (NESCAUM)/California Zero Emissions Vehicle Mandate Alliance that adopted California's rising EV sales quota system. These states get EV stock from the OEMs, so the OEMs can meet the mandate quotas. The needs of non-mandate states are more readily ignored. NH has not yet joined the NESCAUM alliance (though it still can).

It is not just EV supply that is lacking, it is lack of EV support, too. How much advertising for EVs do you see on TV or in print? Practically none. Not so for trucks and SUVs.

NH has very few charging stations compared to our neighboring states, especially fast charge stations. Look at a map of Northeast fast charge stations at plugshare.com) and see the donut hole over NH, and you'll understand the dilemma. "Why buy if I can't refuel?" Fortunately, this issue is largely a red herring. Over 80% of EV charging happens at home. No shortage of home charging boxes. New EVs have 150-300-miles range, and with NH's small size, the likelihood of a NH EV owner needing a fast charge in NH is small. There are plenty of fast chargers (and slow ones) just over the border. Actually, the lack of fast chargers in NH affects EV tourism more than resident EV owners.

The lack of EV incentives also needs mention. Why are incentives important? Two reasons: 1. They work, and 2. The electric car is still not-profitable compared to combustion vehicles, so it needs additional funds to the manufacturer to ease the transition. The states that buy the most EVs have state level incentives, too.

Utilities could also help. NH Electric Coop offers its customers EV rebates, and this program has been very successful. Other NH Utilities could follow suit. After all, the utilities are prime beneficiaries of EV adoption.

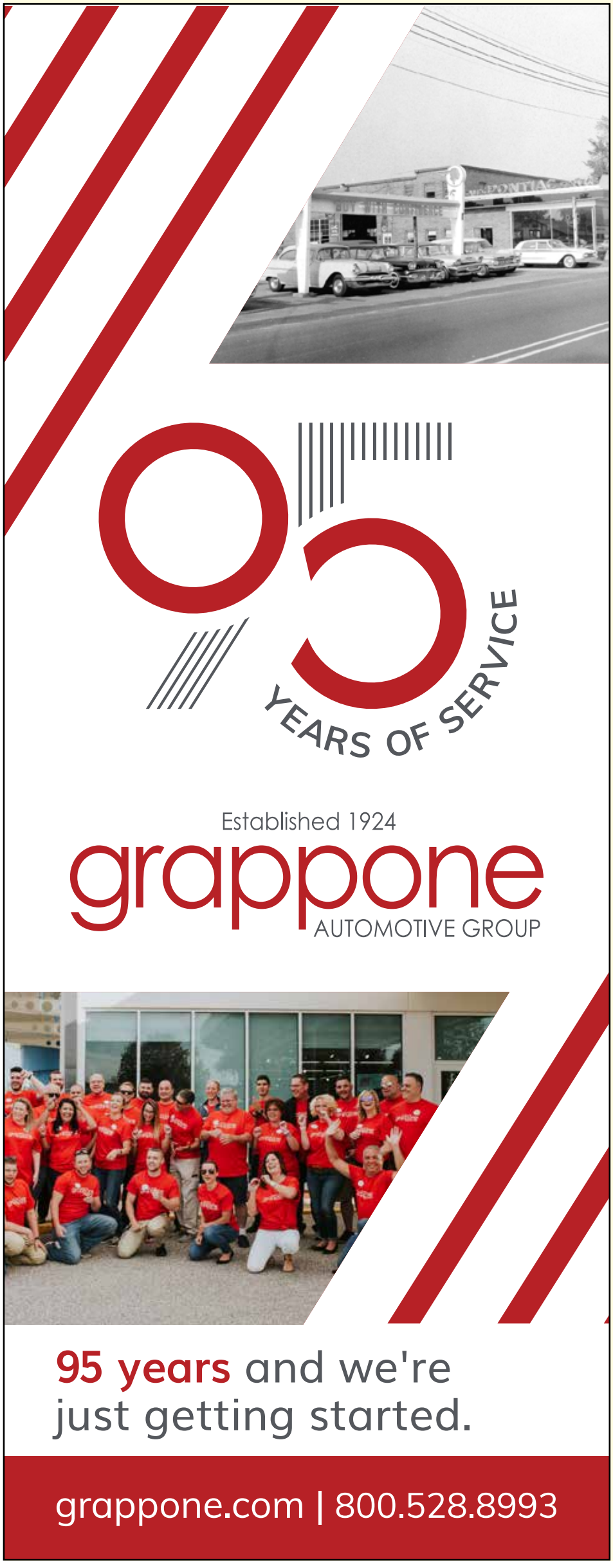
Why switch to EVs?

1. Combustion cars damage the environment, climate, and our health.
2. EVs are much less expensive to operate than conventional vehicles. EV owners can save $750-1000 per year on average on fuel and maintenance costs.
3. Those operating costs represent money that stays in NH and does not fly out of state to oil companies and OEM parts. Even better, when the fuel source is local solar. NH could realize two to three billion dollars per year in economic benefit if all its vehicles were EVs, more if the dominant electric source were local solar. In short, EVs are good for the EV owner and good for the NH economy.
4. EVs will shortly be lower cost cars than combustion equivalents. Incentives make up that difference until cost parity is achieved (2020 to 2025).
5. Did I mention EVs are fun to drive?

Is NH EV friendly? A resounding YES for the public. But, the OEMs/dealerships, utilities and government have not understood the ramifications of their foot-dragging.

Randy Bryan is a co-founders of Drive Electric NH and an advocate for electric cars. His company, ConVerdant Vehicles, has converted vehicles to plug-in hybrids, including his own Prius, and developed inverters that turn a Prius into an emergency generator.

***Graphs for this article available in the online posting of this article on the* G.E.T. *website.* ♻



Recently Announced Electric Car Models

Cont'd from p.4

Tesla Model Y

a practical hatchback body. With pricing starting at $38,500 and some good lease deals in the works, this promises to be a popular model as long as they can keep up with demand. Kia has offered the all-electric Soul EV model for five years, so this should give them a leg up in developing a reliable and comfortable electric car.

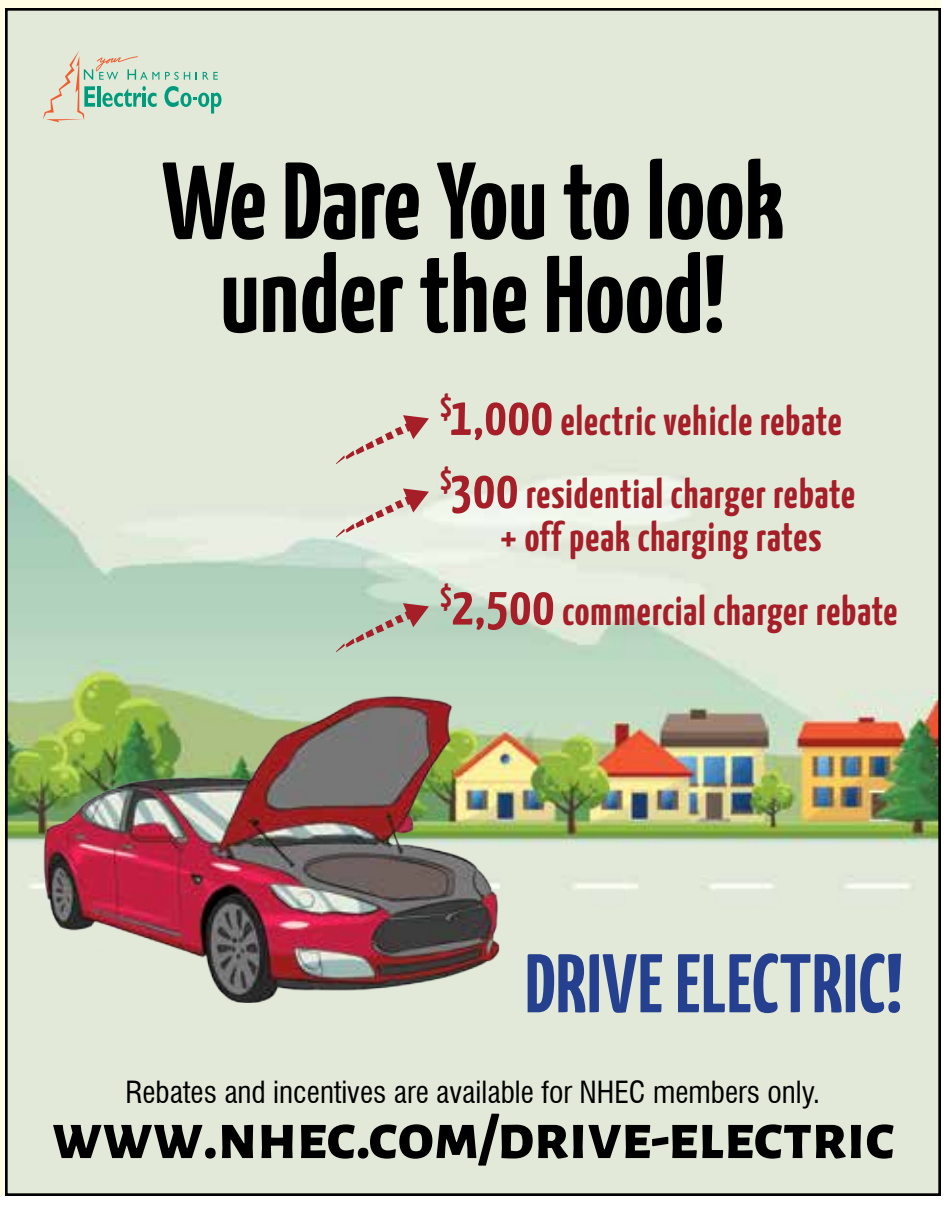
Tesla Model Y

Tesla recently announced their crossover Model Y vehicle is expected to ship in late 2020. This will be built on the same platform as the Model 3 sedan, but will offer more seating and cargo capacity. As with the Model 3, a 300 mile "long range" version will be first to production and cost around $47,000, followed by a 230 mile "standard range" version expected to start at $39,000 and be available in 2021.

It's not all good news, though. A few EV models are also ending their production runs - most notably Chevrolet is phasing out the Volt plug-in hybrid and Smart has announced the end of their Fortwo electric models in the U.S. Now is the time to go shopping if either of these were on your wish list for your next vehicle purchase.

Fortunately, there are over 40 plug-in models still available across the Northeast, including the newly arrived Subaru Crosstrek Hybrid -a plug-in hybrid all-wheel drive vehicle that can run up to 17 miles on the battery before switching over to gas. Odds are good you can find one you like the next time you're in the market for a new or used vehicle. Find and compare more electric drive options on the Drive Electric Vermont website: https://www.driveelectricvt.com/buying-guide/compare-vehicles

David Roberts is the Drive Electric Vermont coordinator. He has driven an all-electric car for the past six years and says if you must drive, drive electric. http://www.driveelectricvt.com. ♻



Celebrating Solar's Visibility

Wayne Maceyka

Remember when solar was something some people wanted to hide away on their roofs or behind their homes or businesses?

Imagine this being something that we said, looking back with amusement, five years from now. Now imagine that shift in perspective happening only two years from now, or even sooner.

For some people, finding ways to mask and mitigate the aesthetic impacts of a solar array is still of primary concern.

That's changing.

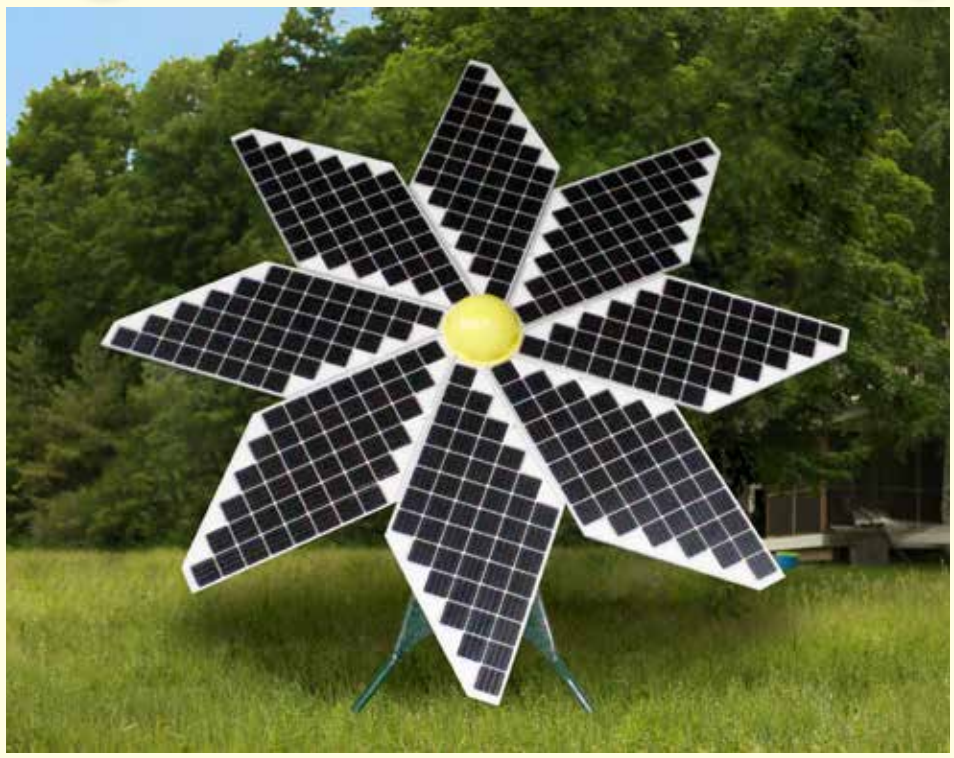
There's a new movement emerging in solar design to make solar more prominent, as a proud and public display for companies and individuals. It's focused on integrating solar generating materials into aesthetically pleasing, yet fully functional and cost-effective designs. This has resulted in a new metric called "return on visibility."

Think of taking a portion of the solar that's currently hidden on a company's roof or tucked into their backyard and, instead, placing it front and center for all to see. Consider, for the forward-thinking and discerning consumer, how a visually striking solar display can increase the appeal and value of a neighborhood.

The majority of people appreciate solar and other forms of renewable energy and want to see more of it in use. Likewise, people ascribe positive attributes to organizations that are leading the way and investing in clean energy. This makes sense. We know that people prefer to do business with organizations that are good stewards of the environment and their communities.

That is why we think it's time to upend the old way of thinking. Instead of concealing a solar array, display it proudly and prominently! Instead of merely putting panels on your roof, imagine installing a visually stimulating and fully functional solar sculpture on your front lawn.

AllEarth Renewables has entered this new, visible-with-intention solar marketplace with the brand new PowerFlower. Planned for limited release in Vermont during the summer of 2019, the PowerFlower aims to make a statement with solar, while making no compromises in terms of functionality.



AllEarth Renewables' brand new PowerFlower is planned for limited release in Vermont during the summer of 2019. Courtesy photo.

At the intersection of form and function, the PowerFlower, measures 15' high at its steepest angle and generates about 2,500 kWh/yr, depending upon its location. Need more clean electricity? Add another PowerFlower or string together up to five. Designed with ease of use in mind, this can be a backyard project for the do-it-yourselfer. Or, you can have an authorized installer do it for you.

And why not proudly display solar? It's already happening in much of Vermont and New Hampshire where solar density is on the rise.

Over the last ten years, as our market has experienced significant growth for individuals and businesses, the benefits of going solar are increasingly well-defined. Solar brings value in the form of cost savings, consistency in energy costs, and environmental benefits. A solar adopter gets the value of taking control of their energy, locking in their savings, and doing their part to stave off the worst of global warming.

Now, the "softer" elements of solar are opening the market to another wave of consumers that appreciate the elegance of moving structures that make clean energy. New products, like the AllEarth PowerFlower, are embracing the visual aspects of renewable generation and re-imagining aesthetic impacts as a value-adder.

One of the keys to moving a new technology from the early adoption phase and into the mainstream is for that technology to be visible and easy to use. 'The neighbor effect' helps do just that, not only in solar, but for other technologies early in the adoption curve. When we know our friends, neighbors, or coworkers are doing something, we become more likely to do it ourselves.

The collective impact of making solar more visible, in an appealing way, is to cause more people to think 'it might be time for me to do this myself, either for my business or my home.' This is the true return on visibility.

A whole new wave of solar is being introduced that's challenging the status quo of solar design. With the introduction of new and visually stimulating products like the PowerFlower, isn't it time we all started to reimagine what our solar future really looks like?

Wayne Maceyka is Director of Marketing and Sales at AllEarth Renewables. Maceyka has been in Vermont's solar community since 2014. He resides in Hinesburg with his family, plug-in hybrid, and 6.7kW solar system. As a recovering engineer, he's interested in how collaborating across institutions can help solve the climate crisis. ♻

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Solar for Better Health Systems

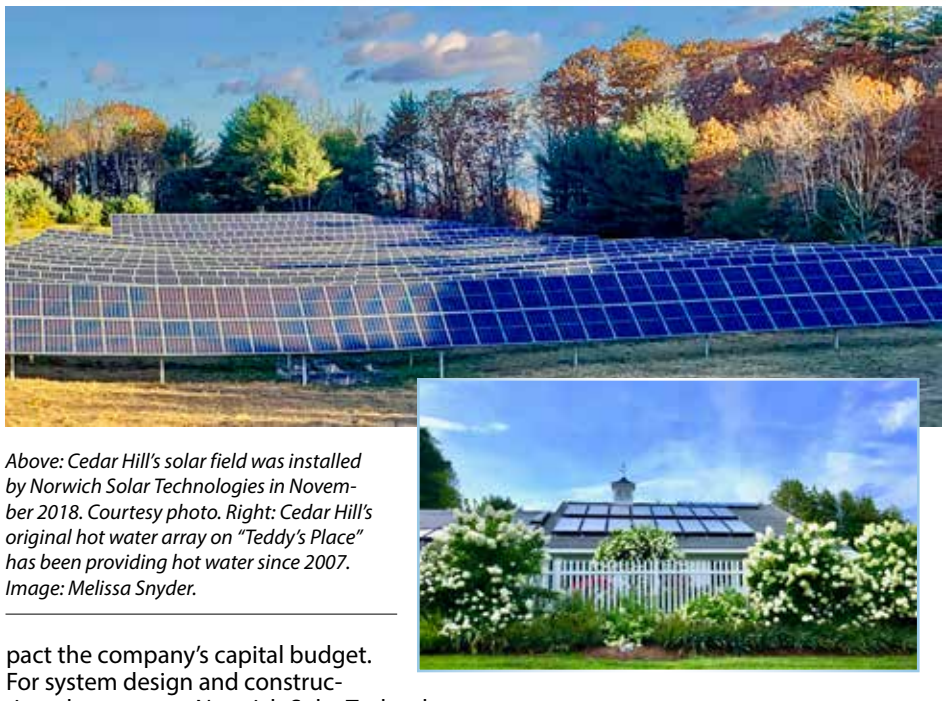
George Harvey

Norwich Solar Technologies (NST) recently built three projects that are interestingly related. All three involve health care providers that chose NST to install new solar photovoltaic (PV) systems.

Cedar Hill

Cedar Hill Continuing Care Community, which includes both Cedar Hill Health Care Center and The Village at Cedar Hill, is a family-owned facility. According to co-owner and Community Executive Director Patricia Horn, Cedar Hill had started investing years ago in renewables, including a solar hot water system. They bought hybrid and electric cars, and they composted food scraps, but they had considered solar PV too expensive until recently. With costs declining rapidly and tax credits still available, they started looking into what they could do for electric power.

Cedar Hill's owners and their families financed the project themselves through the Vermont Economic Development Authority and VSECU, so it would not impact the company's capital budget. For system design and construction, they went to Norwich Solar Technologies, which advised and guided them through the project from start to finish.



Above: Cedar Hill's solar field was installed by Norwich Solar Technologies in November 2018. Courtesy photo. Right: Cedar Hill's original hot water array on "Teddy's Place" has been providing hot water since 2007. Image: Melissa Snyder.

Cedar Hill Continuing Care Community. Image: Melissa Snyder.

Cedar Hill provides skilled nursing, rehabilitation, assisted living, and memory care. It has over 100 residents and more than 125 employees. They use a lot of electricity, and Cedar Hill had typically paid for over 750,000 kilowatt hours of electricity each year. NST installed a 501kW (DC) system, which will offset about 82% of Cedar Hill's electricity needs.

The solar array will offset approximately13 million pounds of CO_2. This is equivalent to planting about 153,000 trees.

Mt. Ascutney Hospital

Mt. Ascutney Hospital and Health Center (MAHHC) in Windsor, Vermont, is also committed to more than just good health for its patients. It is also committed to healthy social and natural environments. It is Energy Star rated, and already has two solar systems. Nevertheless, wishing to reduce its carbon footprint further, its leadership decided in 2017 to build a third PV system.

MAHHC contracted with NST for a system with 2,000 panels, with a total capacity rating of 745kW (DC). It is expected to offset 20 million pounds of CO_2 over the course of its 25-year warranted lifetime, all the while providing low-cost electricity. After that, it will most likely just keep on making electricity, saving the hospital money and the environmental load of CO_2.

Mt. Ascutney Hospital array. Image: Norwich Solar Technoloties.

NST found a good site for a solar array of this size near the intersection of Routes 4 and 12 in Hartland, Vermont. The location benefits from proximity to a highway and power lines. It is on a rolling hillside that had been recently timbered and would be difficult to use for commercial or residential development. The slope of the land was acceptable for a solar system. Existing vegetation allows only a fleeting view of it for people passing by on Rt 4.

Construction of the Mt. Ascutney Hospital's solar array started in November 2018. As this is being written, it is complete and generating power, with some landscaping remaining to be done.

Cont'd on p.21

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Solarizing Bethel, Vermont

George Harvey

The Solarize Bethel campaign was coordinated by Integrity Energy and the Bethel Energy Committee. It was started with a meeting in the Bethel, Vermont town hall on January 18, 2019, and it continued for three months, ending on April 18. After the initial meeting, promotion was done by the organizers in a series of events, including operating tables at the local Shaw's Supermarket and meeting groups of people in private homes. Notably, they ran a one-day class at Bethel University. Much of the campaign was aimed at educating people.

Amos Post, one of the owners of Integrity Energy told us, "We had a good response and many people who were interested were able to go forward, getting their own solar energy systems." All told, the campaign produced contracts for fifteen systems in Bethel and the surrounding towns. Together, they added up to 110 kilowatts (kW).

All but one of the systems are to be grid-tied. The one that will not bes not grid tied was an upgrade to an existing off-grid system, and so needed no battery. One other system had a backup battery and could be detached from the grid to operate as an off-grid system, if necessary; it uses a new Rolls AGM battery. The systems will be set up to be net metered wherever possible. Twelve of the installations are for rooftops. Three will be ground mounted.

Integrity Energy of Bethel, VT installed both this rooftop and the grount-mounted solar systems as part of the Solarize Bethel campaign. Photo: Courtesy photos.

All fifteen systems are being built around Q Cells solar panels. Post told us, "They have a good warranty, great efficiency, and competitive price point." Inverters came from SolarEdge. The racking was made by IronRidge. Rolls AGM batteries are being used for the grid-tied system with battery backup; they were purchased through RAE Storage Battery. The off-grid system used its existing batteries.

The solarize campaign ended on April 18, three days after installation of the first system had begun. The entire set of solar arrays is projected to be complete during the first week of July.

Integrity Energy typically installs about thirty solar systems per year. These range in size from the smallest home installations to commercial arrays. The largest Integrity Energy has done so far was 87 kW. The company has two full-time employees, the owners Amos Post and John Mattern, and three part-time employees.

Integrity Energy is based in Bethel, Vermont. Its website is ienergyvt.com. ♻

PECK Electric: In the News Again

George Harvey

I believe that there are many people, even in Vermont, who don't think of Peck Electric as a big deal in the solar industry. They might think it is, after all, just another business in South Burlington, Vermont. A recently posted news article provides an interesting proof of how seriously some people take the company, however.

Peck Electric installed a 59.84kW ballasted roof-mount solar array at the Lake Champlain Sailing Center on the Burlington, VT waterfront. Courtesy photo.

When I started writing this article, I went to find the latest news about Peck Electric on the internet. The first item I found was "Peck Electric to capitalize on significant growth opportunities across Northeast region" (http://bit.ly/SteelGuru-Peck), published at SteelGuru.com. SteelGuru is a specialized web site whose articles I see often, and so I knew what it was. It is focused primarily on steel, metals, mining, coal, gas, oil, and power generation. It runs from India, and its primary geographical focus is India, Europe, the Middle East, and China. It has a lot of visitors and claims to have had over 40,000,000 views in 2013.

Truth be told, the news I was working on might first have appeared at Bloomberg, on April 30th, in an article nearly identical to Steel Guru's. And, of course, it was locally reported in Vermont Business Magazine (http://bit.ly/Vermont-Biz-Peck).

The articles all report two things that seem rather mundane. The immediate news is that Peck Electric installed seven solar systems in the last quarter of 2018 that ranged in size from 20.6 kilowatts (kW) to 6,937.92 kW. The total installed is 9,106.32 kW. That is a fair amount for a local installer in Vermont.

Cont'd on p.18

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Two More Sizeable Solar Arrays for Vermont

George Harvey

Hartland's 745kW community solar array is built on a brownfield site and is expected to supply the annual needs of about 125 households.

> "We feel that with this project, right here in our backyard, we can both inspire other funders to consider investing in renewable energy and show energy consumers how they can close the loop and save money by committing to purchase energy from renewable sources."
> – Clay Adams, President, Mascoma Bank

Encore Renewable Energy, an integrated clean energy project development company in Burlington, Vermont, recently built two sizeable solar arrays in Vermont. One is a 745-kilowatt-peak (kWp) community array on land owned by Long View Forest in Hartland, VT. The other is a 200-kWp array on the roof of the von Trapp Brewery and Bierhall in Stowe, VT.

Long View Forest, Hartland

The project in Hartland was built on three acres of land belonging to Long View Forest, an employee-owned forest management and contracting company. The land is part of a 28-acre remediated brownfield site which is considered prime land for solar projects in Vermont, because it is environmentally degraded, making it unsuitable for many purposes. The 745-kWp array is expected to provide about 900,000 kilowatt-hours (kWh) of electricity each year. Renewable energy certificates (REC) produced by the array will be transferred to Green Mountain Power to be used to meet the utility's renewable electricity requirements under the Vermont Renewable Energy Standard.

The Hartland array is a community solar project. The amount of electricity it generates is sufficient to supply the annual needs of about 125 households.

Financing for the project was provided by the Mascoma Bank, which is getting most of the net-metering credits produced by the array. Montshire Museum of Science is also getting benefits. Between them, the two organizations will save about $700,000 on their electric bills over the course of the array's lifetime.

Clay Adams, President, Mascoma Bank said, "We feel that with this project, right here in our backyard, we can both inspire other funders to consider investing in renewable energy and show energy consumers how they can close the loop and save money by committing to purchase energy from renewable sources. It's been a fantastic experience to work with both Encore Renewable Energy and Long View Forest, and we look forward to continued partnerships with both companies."

Trapp Family Lodge, Stowe

Like the project in Hartland, the one at the Trapp Family Lodge provides its net-metering credits to the owners of the array properties and the RECs to the utility. In both cases, the businesses hosting the array get electricity at a reduced rate, saving money while the utilities move along toward their renewable energy goals.

Encore also built an array on the roof of the von Trapp Brewery and Bierhall at the Trapp Family Lodge in Stowe, VT. Trapp Family Lodge Executive Vice President, Walter Frame explained, "As a partnership with Stowe Electric Department and Encore Renewable Energy, Trapp Family Lodge was able to successfully implement a 200-kW roof-mounted solar array at the von Trapp Brewing and Bierhall in Stowe, Vermont. Our partnership delivered this important project for Trapp Family Lodge, which allows us to minimize annual electric costs and support the statewide renewable energy initiatives. The electricity generated by the array provides a clean source of electricity for Stowe Electric Department, with all renewable energy credits retired for compliance under the State of Vermont's recently enacted Renewable Energy Standard."

Encore Renewable Energy is a certified B Corp that aims to create harmony between the natural and built environments. It was founded in 2007 to develop renewable energy projects, and since that time, has installed enough power generating systems to cover the annual needs of 16,336 New England households.

Encore Renewable Energy builds projects on both a develop-build-own-operate and develop-build-sell basis, managing all the details those functions imply. It has extensive experience with every phase of the process including design, permitting, financing, and construction. Operating as a B Corp allows it to make a profit, but it also requires the company to provide benefits to the communities in which it operates and the people with which it employs.

The Encore website is encorerenewableenergy.com. ♻

Many thanks to our sponsor:

Mascoma Bank

The 200kW rooftop solar array at von Trapp Brewery and Bierhall in Stowe, Vermont. Courtesy photos.

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New Hampshire Solar

Newfields Municipal Solar and Milford Solar Farm

George Harvey

U.S. Senator Maggie Hassan joined local leaders including, Catherine Nelson (in pink from the Town of Newfields) and NH State Senator Martha Fuller-Clark (in black and white stripped sweater) at the Newfields solar array ribbon cutting ceremony on February 8, 2019.

Newfields Municipal Solar

There are certain types of places that are very well suited to solar installations. Green Energy Times has published a number of articles about capped landfills, for example. But there are other types of properties to think about as particularly well suited to large photovoltaic (PV) arrays, and one of these is water treatment plants. Typically, they have available roof or land areas where PV systems can be set up. Such plants are also heavy users of electricity, which means that the lines to support their use are already installed, and they can use the electricity produced.

The plants need not be large to be beneficial. The Town of Newfields, New Hampshire, has a water treatment plant to cover the needs of its 1,700 inhabitants. And now the town also has its own PV array installed at the water treatment plant by ReVision Energy.

The Newfields solar array has 216 solar panels, with a combined capacity of 75.6 kilowatts, which are expected to provide just about all of the water treatment plant's electricity. The 93,000 kilowatt-hours of electricity it generates each year should offset the equivalent of 98,000 pounds of carbon dioxide, which is the amount of CO_2 released by burning nearly 5,000 gallons of gasoline.

ReVision Energy designed and installed the system at no cost to the town. Instead of paying for the array, the town entered into a power purchase agreement leaving ownership of the array with ReVision. The town gets an appreciable reduction in its electricity costs and is expected to save at least $530,000 over the array's lifetime. The cost is fixed, and the town has an option to buy the array after seven years.

The ribbon-cutting ceremony for the Newfields solar array took place on February 8, 2019. U.S. Senator Maggie Hassan joined local leaders at the event.

ReVision Energy's website is www.revisionenergy.com.

Milford Solar Farm

This year, at a town meeting, the voters of Milford, New Hampshire, approved a measure to allow a solar project to be installed on 120 acres of land owned by the town. The array is to be built by Granite Apollo, which is based in Manchester, NH.

The land for the array once was used by Brox Industries, which produces paving materials. The town purchased the land about twenty years ago, and since then, community leaders have been looking to put it to use.

Last year, town officials and Granite Apollo signed a letter of intent, which gave the solar installer the go-ahead it needed to plan the system. The suggested lease deal would provide the town with $1,000 per acre of land in the project. The amount was to increase every five years for the duration of the lease, or 25 years. Under the lease terms, the town stands to see $3.5 million in revenues, with possibly up to $6 million, if the lease is renewed. The town will also benefit from tax revenues which are in addition to the lease income.

The Milford solar array is to have a capacity of 20 megawatts. At that size, it would be sufficient to supply average annual power for about 4,500 New Hampshire homes. The electricity will be sold to the grid.

The array was opposed by some neighbors who expressed concerns about its effects on wildlife in general and wetlands in particular. The array had to meet the state's environmental standards, however, and when the matter went before the town meeting for a vote, over 71% of those who voted on it were in favor.

Granite Apollo is working on other large solar projects in New Hampshire, which we will follow. The company website is www.graniteapollo.com. ♻

The Newfields solar array has 216 solar panels, with a combined capacity of 75.6 kilowatts, which are expected to provide just about all of the water treatment plant's electricity. Photos: ReVision Energy.

Gone Fishing? Gone Solar!

Evan Lawrence

If you're going fishing for the big one in Lake Sunapee, you might want to stop by the Tackle Shack on Route 103 in nearby Newbury, New Hampshire, to stock up on bait and catch a view of its rooftop photovoltaic system. The 41-panel array is expected to generate 15,000 kWh annually, enough to offset the business's entire electrical demand.

The Tackle Shack carries fishing supplies and live bait, hunting, archery, camping equipment, and kayaks. It has a 20-yard indoor archery range.

The aerating and chill units for the fish tanks, mini-split air-source heat pumps, and store lighting can use a lot of electricity, especially in the winter. Owner Dale Sandy told us, "We want to have as low an overhead as possible, so we can be competitive on prices. Mainly, I wanted to eliminate the electric bill, plus I like the idea of solar."

Sandy said he chose to work with Sol-Air, a renewable energy company in Newport, in part because he and Pahl come from the same hometown. Pahl did a consultation and Sandy accepted Sol-Air's proposal. He said his choice was "pretty much all because of Ian and his professionalism. There was no pressure." He appreciated the fact that the company took care of everything, including permitting, design, construction, and arranging for state inspection.

Sol-Air's installation crew put up the panels in three days. They used all-black Trina panels and Enphase microinverters. "One size does not fit all," Pahl said. "We design what the customer wants." The array was up by early February. Connecting to the grid took a few weeks longer while Eversource completed some upgrade work on its end. Sandy is hopeful that the next bill will go to zero, saying, "I want to bank enough [credits in the summer] to go through the winter when I use the mini-splits. That's the goal."

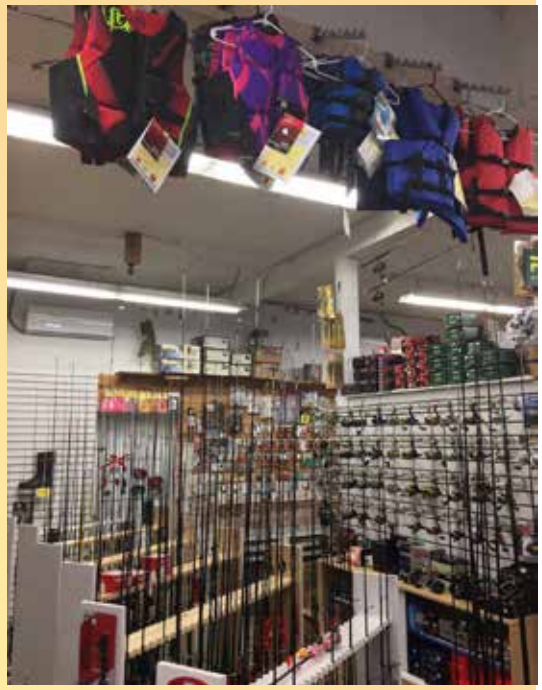
The Tackle Shack installed forty-one solar panels to produce 15,000kW annually, which is enough to offset the business's entire electric demand. Photos: Sol-Air.

Sol-Air is not just a solar installation company. "Our goals are to help homeowners and businesses reduce their electric consumption while also reducing carbon emissions," Pahl said. Other than our LED System Consultant, Peter Salvitti of Efficient LED Lighting Systems, Sol-Air is operating completely in-house, according to Pahl. "We do not sub anything out, do all the work from stem to stern, and also offer hyper heat series mini splits and on/off grid battery solutions."

For retail businesses, where lighting can be the primary use of electricity, switching from incandescent to LEDs can reduce consumption by 30% to 50%. The next step is solar generation, which provides the power the lights need during the day. Retail businesses usually close at night when the panels aren't producing.

"The system is perfect," Sandy told us, "I can go on line and see what the system is doing."

Sandy said he is happy he chose Sol-Air. "They're wonderful. They're great to deal with and I've recommended them several times."



On Saturday, June 8, 2019 starting at 1 p.m. there will be a Solar Celebration Event happening at the Tackle Shack with promotions throughout the afternoon including popular vendors from the store.

Evan Lawrence is a free-lance writer in Cambridge, NY. ♻

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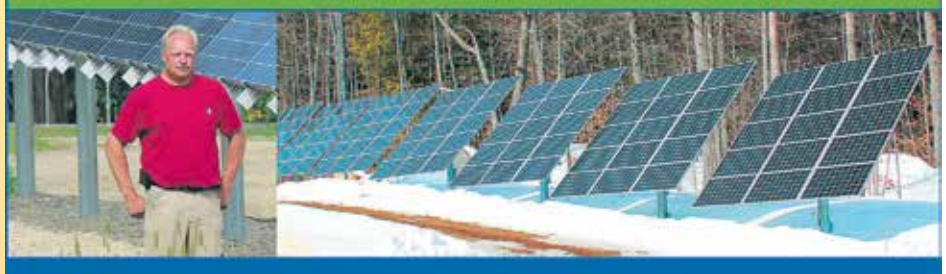

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• SERVING THE UPPER VALLEY AND NORTH & CENTRAL NH •

A Game-Changer for Off-Grid Battery Storage

N.R. Mallery

As Bob Dylan wrote, "The times they are a changin'…". The change is now. Battery storage, on or off the grid today has produced a real game-changer. And my off-the-grid experience proves it.

In the beginning, I wanted to "go solar" so much that I made a lot of changes to my lifestyle. To be able to go solar at a time when solar PVs were over $10 per watt of output capacity, I actually learned how to cut my electric use from 20kWh per day to 3.5kWh per day. I wanted a battery bank sized to keep me powered for three to five days of cloudy weather. With a year of research, I was able to make a 3.8kW solar system work with a suitably sized lead-acid battery bank. There was also a backup propane generator for when necessary. The bottom line is, I have done it with minimal fossil fuels usage since 2002. Life was great for a few years while the batteries were new.

My system was originally designed by groSolar, back in the days when they designed and installed off-grid solar. They designed it to produce enough electricity to last me three to five days or longer. You may wonder how this is possible with such a small system, but we will cover that in another story. Suffice it to say for now that I do live a normal lifestyle, complete with electric refrigerator, microwave, dishwasher, vacuum cleaner, laundry, jacuzzi tub, computers, and two robotic lawn mowers. I also have an electric bicycle. And there is electricity to spare.

In the fifteen years since that system was put together, we have gone through battery banks. I tried different battery sizes. Originally, we had a bank of eight six-volt batteries. When those needed to be replaced, we went to four 12V batteries. The last lead-acid battery bank consisted of twenty-four 2V batteries. The power was always 48V. On average, these battery banks had to be replaced after five years.

The lead-acid battery bank consisted of 24-2V batteries. All photos: N.R. Mallery

The batteries had to be housed indoors to keep them from freezing, in a well-sealed and protected box. When they are charging, the batteries get hot, which is regulated by the charge controllers, but they give off fumes that need to be vented.

Last year, after fifteen years of living off the grid, with winter approaching, my batteries were failing once more. In fact, they were failing miserably, and the generator was coming on daily. This was not acceptable to me, because I strive to live as free of fossil fuels as possible. So, in fifteen years I have already paid for three battery banks, which means the lead-acid batteries were only lasting five years. The last battery bank was $7,000, at cost. Pablo Fleischmann of Green Energy Options, in Keene, NH, confirmed that a lead-acid battery bank nowadays costs about $8,000.

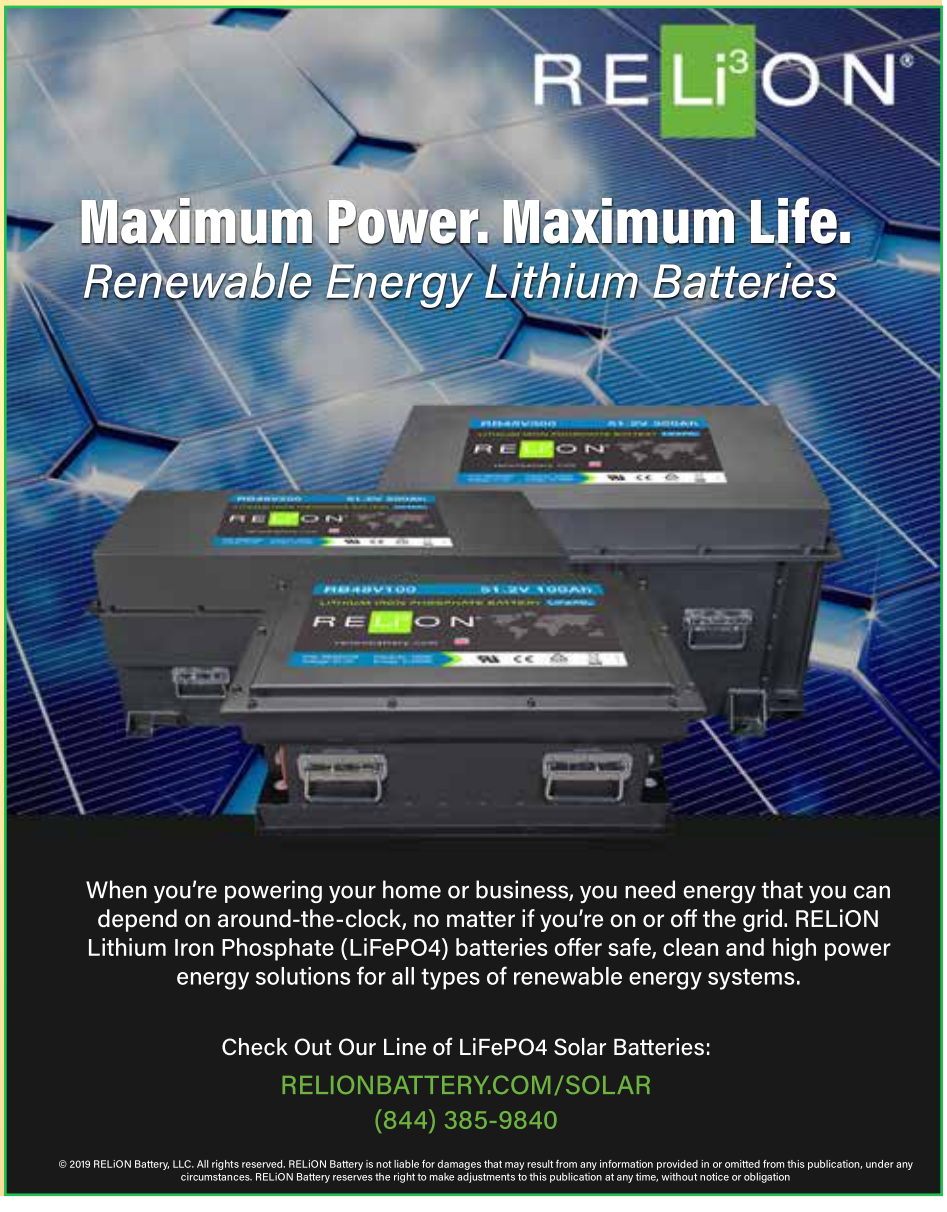
The new RELiON LiFePO4 battery bank consists of 3-200 Ah batteries.

As publisher of Green Energy Times, you might think that it would be a simple thing for me to choose which battery to buy. Well, it wasn't. My attempts proved to be very discouraging. Some lithium battery options would only work with new solar systems and components. Many are not really suited for the demands of off-grid living. Many of the alternatives to lead-acid batteries had things I questioned, and many vendors never even bothered to return my calls. One company with a promising battery technology went bankrupt. I was getting to the point of thinking I would have to get yet another lead-acid system.

It took me months of research online and calling to find the battery option that was right for me. But when I finally found the right one, was it ever right! I expect my new batteries may last the rest of my life. In fact, my granddaughter, Makenzie, might inherit them when I'm no longer around.

I bought three 200-Ah RELiON $LiFePO_4$ batteries. (See cost comparison chart) While their cost seemed high at first, it turns out they will save a lot of money because of longevity, efficiency, reliability, and no need to buy propane for the generator. My generator has not been on since my new batteries were installed last fall. This is a game-changer, especially when you live

Cont'd on p.17



FEDERAL

FEDERAL INVESTMENT TAX CREDIT

The federal investment tax credit (ITC) for most technologies, including solar, wind, heat pumps, and fuel cells, is 30% of expenditures. For commercial geothermal generating systems, microturbines, and combined heat and power the ITC is 10% of expenditures.

- Residential Renewable Energy Tax Credit: http://bit.ly/energy-gov-R-E-tax-credit
- Electric Vehicles - Tax credit for qualified plug-in electric drive vehicles including passenger vehicles and light trucks. For vehicles acquired after December 31, 2009, the credit starts at $2,500 and goes up to $7,500 based on the battery specs.

USDA RURAL DEVELOPMENT PROGRAM

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

- Finance the purchase of renewable energy systems, and make energy improvements; energy audits. Funding is awarded on a competitive basis; grant funding cannot exceed 25% of eligible project costs and combined loan guarantees and grants cannot exceed 75% of eligible project costs.
- Applicants include Feasibility studies/ regular REAPs: agricultural producers and rural small businesses. Energy audits and renewable energy development assistance: local governments, tribes, land grant colleges, rural electric coops, public power entities. Grant must be used for Construction or improvements, purchase and installation of equipment, energy audits, permit fees, professional service fees, business plans, and/or feasibility studies. Find more at www.rurdev.usda.gov/ NH-VTHome.html or call 802-828-6080 in VT or 603-223-6035 in NH

BIOREFINERY ASSISTANCE PROGRAM

USDA Rural Development offers opportunities to producers to develop biofuels through the Biorefinery Assistance Program. The program provides loan guarantees for the development, construction, and retrofitting of commercial-scale biorefineries.

The Biorefinery Assistance Program was established to assist in the development of new and emerging technologies for the development of advanced biofuels and aims to accomplish the following:

- Increase the energy independence of the United States
- Promote resource conservation, public health, and the environment
- Diversify markets for agricultural, forestry products and agricultural waste materials
- Create jobs and enhance economic development in rural America
- For more information go to www.rurdev.usda.gov/BCP_Biorefinery

REGIONAL

NEW ENGLAND GRASSROOTS ENVIRONMENTAL FUND

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

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

VERMONT

CLEAN ENERGY DEVELOPMENT FUND

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

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

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

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

Pellet Sap Evaporators:

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

Other Utilities Heating Offers

- Members of Washington Electric Co-op (WEC) can get a $1,000 rebate on approved pellet boilers/furnaces. This can be added to the CEDF and EVT incentives for a total of $7,000. Call WEC for details: 802-223-5245.
- Members of the Vermont Electric Co-op can get a $150 credit on the purchase of an approved pellet stove: www.vec/energy-programs.

VT TAX CREDITS

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

Tier III programs

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

EFFICIENCY VERMONT

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

Lighting

- Special pricing on select ENERGY STAR® LEDs at Vermont retailers.

Weatherization

- Comprehensive air sealing and insulation projects - up to $2,000 back with an Efficiency Excellence Network contractor
- DIY – up to $100 back for select window, door, air sealing and insulation upgrades (purchases must be made by 4/1/19)

Appliances (must be ENERGY STAR)

- Dehumidifiers $25 - $40 rebate
- Clothes Washers - $40 - $75 rebate
- Clothes Dryers - $50 to $400 rebate
- Refrigerators - $40 - $75 rebate

Heating/Cooling/Water Heating

- Central wood pellet boilers and furnaces: $6,000 rebate (in partnership with CEDF)
- Cord wood and pellet stoves: $650 off purchase at participating retailers (in partnership with CEDF)
- Heat pump heating and cooling systems: discounts up to $400 at participating distributors
- Heat pump water heaters: discounts up to $500 at participating distributors
- Smart thermostats: up to $100 back for select ENERGY STAR models.

Wood Stove Change-Out

CEDF Change-Out

(customer must have an existing/installed non-EPA certified stove to change-out):

- Pellet stoves: $1,000 incentive
- Cord wood stoves: $800 incentive
- A $100 incentive is also available to replace the catalyst in an existing EPA-certified woodstove.

Efficiency VT offers a $650 rebate for a new pellet or cord wood stove w/o the need to do a change-out. If the customer does have a EPA certified stove S/he wants to get rid of they can get another $100 for that. *Cannot be combined with above offer.*

Residential New Construction

- Enroll to receive a home energy rating, expert technical assistance, and incentives – Efficiency Vermont Certified™ projects receive up to $3,000 cash back
- Washington Electric Coop and Vermont Gas Systems customers may also receive additional incentives

Other Opportunities To Save

- Advanced Power Strips – special pricing starting at $6.95
- Pool Pumps – up to $500 back on select ENERGY STAR models
- Heat Saver Loan – low-interest loans of up to $35,000 for home weatherization and heating improvements

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Public Utilities Commission

NH PUC: Get up-to-date information at http://bit.ly/puc-nh-RE-rebates

Commercial Solar Rebate Program

Incentives are limited to 25% of the total project cost or $50,000 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:

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

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

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

PACE

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

Visit http://cpace-nh.com/index.html for more information.

Residential Solar/Wind Rebate Program

-Effective January 2, 2018, this program offers rebates to qualifying NH residents who install photovoltaic (PV) or wind turbine electrical generation systems. Rebate levels are $.20 per watt of panel rated power up to $1,000, or 30% of the total facility cost, whichever is less. *Check for updates at http://bit.ly/NHResidentalRebate*

Residential Solar Water Heating Rebate Program

- $1500 - $1900 per system based on annual system output

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

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

Systems must be 2.5 million BTU or less

Residential Wood Pellet Boiler/Furnace

- 40% of installed system up to $10k
- Must meet thermal efficiency and particulate emissions standards www.puc.nh.gov – Sustainable Energy or tel. 603-271-2431 for more information and current program status

LOCAL INCENTIVES

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

- *These are offered on a town-by-town basis.*
- The state also has passed PACE (property-assessed clean energy) enabling legislation which will allow towns to use the PACE mechanism to finance clean energy projects through property taxes
- Visit https://www.nh.gov/osi/energy for more information.

NH Electric Cooperative Incentives for Electric Vehicles and Electric Car Charging Stations

- NHEC offers a $1,000 incentive on a Battery Electric Vehicles (BEV), $600 on a Plug-In Hybrid Electric Vehicles (PHEV), and $300 on Electric Motorcycles.

NHEC offers incentives for Level 2 Electric Vehicle Charging Stations.

- For Commercial and Municipal Members – Incentives are up to $2,500 per charging unit. A maximum of two charging units may be installed
- For Residential Members – Incentives are up to $300 per charging unit. By participating in the residential program, you'll be able to charge the EV during off-peak hours at a rate that is lower than the basic residential rate.

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

NH Home Performance with ENERGY STAR

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

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

NH ENERGY STAR Homes

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

NHSaves Residential ENERGY STAR ® certified Products Program

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

NHSAVES Online Store

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

PAREI

- To explore the possibility of a solar installation. Plymouth Area Renewable Energy Initiative. www.plymouthenergy.org
- NH Solar Shares: www.nhsolarshares.org
- 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.

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.nh.gov/oep/programs weatherization/index.htm for application criteria, FAQs and local program contacts

MASSACHUSETTS

Commonwealth Solar Hot Water (SHW) Programs

- Applicants must be served by National Grid, Unitil (Fitchburg Gas and Electric), Eversource or a participating Municipal Light Plant community
- Homeowners are eligible for a base rebate amount of the lesser of $4,500 or 40% of the installed cost. The system may also be eligible to receive additional funding ("adders") which increase the amount of the rebate. Adders are detailed in the program manual at http://files.masscec.com/get-clean-energy/residential/commonwealth-solar-hot-water/SHW_Program_Manual_Small_Scale.pdf
- Visit http://www.masscec.com/programs/commonwealth-solar-hot-water

MassSave Heat Loan SHW

Through this loan program, customers may borrow at 0% interest the costs of a Solar Domestic Hot Water and/or Thermal Heating system. Apply through receiving the MassSave Energy Audit. You can borrow up to $25,000 at 0% interest for a 7-yr term.

Energy Efficiency

- After conducting a free residential Energy Audit, residential customers are eligible for up to $25,000, commercial loan up to $100k at 0% interest heat loan with terms up to 7 years to cover the following energy efficiency improvements: atticwall-basement insulation, high efficiency heating systems, high efficiency domestic hot water systems, solar hot water systems, 7-day digital programmable thermostats, Energy Star replacement windows
- Available only to utility customers of W. Mass Electric, National Grid, Berkshire Gas, Nstar, Unitil and Cape Light Compact
- Visit www.masssave.com/residential/heating-and-cooling/offers/heat-loan-program Please call 866-527-7283 to schedule a free home energy assessment.

Mass. Solar loan Program

Mass Solar Loan focuses on connecting homeowners who install solar PV systems with low-interest loans to help finance the projects.

- The $30 million program, a partnership between the Massachusetts Department of Energy Resources (DOER) and MassCEC, will work with local banks and credit unions to provide financing to homeowners interested in solar electricity. DOER's program works with banks and credit unions to expand borrowing options through lower interest rate loans and encourage loans for homeowners with lower income or lower credit scores.
- Since 2008, the solar electric industry in Massachusetts has grown into a robust economic sector with over 1,400 businesses and 12,000 workers, with enough solar electricity installed in the Commonwealth to power more than 100,000 homes.
- Mass Solar Loan will continue to grow this sector, while allowing more homeowners the ability to achieve the cost savings and environmental benefits of this clean, renewable energy source. www.masssolarloan.com. The most updated loan principal buy down rate based on household income can be found at http://www.masssolarloan.com/.
- Renewable Thermal Infrastructure Grant Program: https://www.mass.gov/funding

DEPT OF ENERGY RESOURCES

- MA State Income tax credit for residential solar hot water or PV systems are eligible for a one-time 15% off system cost, capped at $1000 max tax credit.
- No sales tax on residential solar hot water or PV system.
- There is no increase in property tax assessment for residential solar hot water or PV systems for 20 yrs.

MA SMART INCENTIVE

Currently SMART incentives are only available for PV systems sized under 25kW. All Eversource West and Most of National Grid Blocks are full for 25kW and larger. There will be a 400MW review process this spring and summer. Details at http://masmartsolar.com and https://www. mass.gov/solar-massachusetts-renewabletarget-smart.

MA STATE INCENTIVE

MA State Incentives can be found at: www.masscec.com/get-clean-energy

- Incentive updates for air-sourced heat pumps: https://www.masscec.com/air-source-heat-pumps
- Wood stove Change-out program: https://www.masscec.com/commonwealth-woodstove-change-out

Heating Programs

- The Commonwealth Woodstove Change-Out program, a partnership between MassCEC, the Massachusetts Department of Environmental Protection and the Department of Energy Resources, offers rebates to assist Massachusetts residents in replacing non-EPA-certified wood stoves with cleaner, more efficient EPA-certified wood or pellet stoves.
- Woodstove Program Info: http://bit.ly/mass-cec-woodstoves
- Heat Loan info: http://bit.ly/mass-save-heat-loan
- Insulation Incentives: http://bit.ly/mass-saves-home-insulation

Electric Vehicles

- After January 1, the maximum rebate for EVs in Massachusetts will be reduced to $1,500 and only fully battery electric or hydrogen fuel cell cars will be eligible. Hybrids will not be given rebates. In addition, the sticker price of the car must be under $50,000 to qualify for the program. Visit: https://mor-ev.org/

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NYSERDA

Welcome to the 2017 New York solar incentive and rebate information: 169 programs and incentives at: http://dsireusa.org (enter your zipcode) Programs and Services from NYSERDA: For the latest NYSERDA solar, ground source and air source heat pumps, EV residential and commercial incentives and more visit: nyserda.ny.gov/All-Programs.

EV Incentive from National Grid

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

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

National Grid: Heat Pumps

Total incentive amount not to exceed $1,100 for ASHP or $1,500 for GSHP (installations per project). Installation of the high efficiency measures must be completed between 4/1/2018-12/31/2018. *Mini-split heat pump units that only provide cooling are not eligible: http://bit.ly/Heat-pumps.

Home Energy Waste

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

RENEWABLE ENERGY/NY-SUN

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

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

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

Residential and Small Business

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

Commercial and Industrial

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

Commercial Energy Storage

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

Community Solar

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

Commercial/Industrial PV Installer

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

Residential/Small Commercial Solar PV Installer

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

Financing Options

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

Clean Power Estimator

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

Geothermal

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

Electric car

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

Utility sponsored incentives & tips:
http://bit.ly/utility_sponsored_incentives

Clean Energy on Farms

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

National Grid

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

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

Spring is Coming in the North Country, and so is Solar

Henry Herndon

Spring is coming in the North Country. The Israel River, filled up by the recent snowmelt, runs heartily through downtown Lancaster, New Hampshire. Pedestrians in light sweaters and short sleeves stroll among the main street businesses, pausing in the sun to chat with their neighbors. Just half a mile up the road, newly constructed municipal solar arrays are enjoying the same sunlight, cranking out clean, local electricity to power Lancaster municipal operations.

The 100kW solar array at Lancaster's waste water lagoon. Courtesy photo.

Lancaster's first solar projects went live in November 2016. The total capacity of the three array's is relatively small, just 107 kilowatts (kW). That's enough to mostly zero-out electricity costs for the transfer station, wastewater treatment at the lagoons, and some other municipal facilities on Water Street.

The Lancaster solar projects are unique in that they were constructed by town staff rather than a private solar company. "We did as much as we could ourselves," says Ben Gaetjens-Oleson, Planning and Zoning Coordinator for the town. The town contracted with a local renewable energy nonprofit, PAREI, to assist in navigating utility connection agreements, state incentive programs, and procurement of panels, racking, inverters, and other hardware.

"Our guys from the Highway Department and Public Works who worked on it, they're all really proud of it," said Gaetjens-Oleson. "A bunch of them, after they finished our town projects, they went and got solar installed at home."

The arrays were municipally funded through a bond approved in 2016. The town paid off the debt from the bond in 2017.

"I've been getting calls from Berlin, Twin Mountain, Franconia, Milan, all over, asking, 'How'd you do it yourself? How'd you do the funding?'" said Gaetjens-Oleson. In April 2019 two other North Country municipalities, Berlin and Whitefield, issued Requests for Proposals soliciting bids to install municipal solar.

Gaetjens-Oleson says Lancaster has lots of potential to build more solar. He says the town hopes to expand the arrays at the wastewater lagoons and the transfer station, and potentially elsewhere, "once we finish up with the roads and some of our other infrastructure projects."

The solar arrays are just one of the energy projects keeping Gaetjens-Oleson busy. Lancaster has squeezed out further energy savings by converting its streetlights to LED as well as much of the lighting in municipal buildings. The town also employs an Energy Advisor, John Ahern. Ahern provides public education services to help homeowners lower their energy costs by implementing energy efficiency measures such as whole home weatherization in partnership with Eversource and NHSaves. As a result of the program, home energy audits in Lancaster have tripled in the past year leading to more comfortable homes and lower home heating bills.

Many cities and towns across New Hampshire are upping the efficiency of their buildings and learning the ins and outs of solar with small and medium sized municipal projects like Lancaster's. But for some towns, especially smaller ones with fewer staff, finding the time to secure NHSaves rebates for lighting and insulation projects can be difficult, let alone to build your own solar array. That's why Clean Energy NH recently hired a new staff person based in the North Country to provide free assistance to municipalities seeking to identify and implement energy efficiency and renewable energy projects. Please contact Melissa Elander at Melissa@cleanenergynh.org to learn more about the North Country Energy Circuit Rider Program.

Henry Herndon is Director of Local Energy Solutions for Clean Energy NH. ♻

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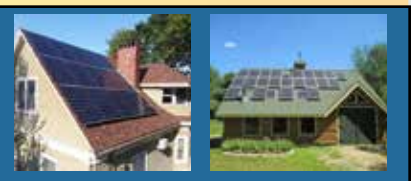

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A Game-Changer

Cont'd from p.13

Howie Michael of Suncatcher Solar installed the new RELiON LiFePO4 batteries, simply making some setting changes to the existing inverter and charge controllers.

off-grid. We just went through a tough, cloudy winter!

The new lithium batteries store the energy from my 15-year-old 3.8kW solar array. The solar system connects to the original components: a Xantrex SW4048 inverter and two OutBack MX-60-MPPT charge controllers.

Since the RELiON lithium batteries were installed, I no longer go into conservation mode at night or after a number of consecutive cloudy days. I don't hesitate to use electricity at night time. I don't worry too much about the lights being on, using the microwave, or washing laundry. I even use my hair dryer at night.

Most off-grid homes today run with 48 volts systems. The generator is programmed to come on when the battery voltage goes down to about 47 volts. Since the batteries were installed, I have never seen the voltage go below 52.3 volts. I have been thinking, "Why is it that the voltage isn't dropping?" Part of the answer is that, unlike lead-acid batteries with which you can only use 50% of their storage capacity, the RELiON batteries can be discharged 100%. (You really want to take them down only 98% because the whole system would shut down, but you would not harm the batteries if that happened. Full discharge would destroy lead-acid batteries).

I have not yet seen a need to charge these batteries with the (dreaded) propane generator, but they could be charged just a bit with no harm to the batteries. This also is not true of my former batteries.

There are a number of other benefits of the RELiON batteries. They have no maintenance, such as keeping battery cells full and checking electrolyte levels. They need no equalizing, which would be done every few months with lead-acid batteries. They emit no fumes, so there is no need to vent them. Lead-acid battery discharge cycles are measured in hundreds, not thousands. RELiON batteries are rated to go through 7,200 charge-discharge cycles or longer. For most households, there is one cycle per day, which means these batteries should go for at least twenty years. (I suspect they will keep going much, much longer.)

To sum it up, RELiON $LiFePO_4$ batteries offer significant advantages over other types. They are long-lasting, efficient, and take up much less space, making them much lighter.

Please note the size of my last battery system in the photos and compare it with the new system. What do you do with an empty battery box of this size? You stand it on end, put shelves in it, and store your past editions of Green Energy Times, of course! I don't believe in waste, after all.

The lithium chemical used in these $LiFePO_4$ batteries is different from what is used in many other types. It is safer, more reliable, and has no danger that they will heat up too much. They have no cobalt, which is used in many of the other lithium batteries and much of which is mined using child labor.

If you are on the grid, the RELiON batteries are even a better choice so that you can be assured that you will have power when the grid goes down. As the climate crisis continues, this will become a necessity.

This information about the batteries is based on what I know from experience. I was not paid to say these things. I felt a need to share my story and positive experience with our readers. It is a product that I have a need to speak up for and recommend. It really has been a game changer for me. I hope that it will be helpful to you, the reader, if you are thinkng or needing to invest in new batteries.

The old battery box is now a cabinet with shelves and holds older copies of G.E.T.

Being able to store electricity made from renewable energy is a must if we expect to be able to replace dirty, polluting fossil fuels. Don't just take my word for it, check them out for yourself. A video of a recent RELiON webinar, *Lithium batteries 101*, explains the basics: https://youtu.be/oA20aPBOUrk.

Learn more at the RELiON website: relionbattery.com. For knowledgeable answers to questions, I suggest you contact Craig Quentin, a great tech guy. He knows what he is talking about. His email is: cquentin@relionbattery.com. Tell him or anyone you speak to that I sent you!

RELiON is located in Rock Hill, South Carolina. Call them at 844.385.9840. You will get your questions answered! ♻

TOTAL COST OVER LIFE COMPARISON

COST FACTOR	FLA	AGM	GEL	RELiON RB100
Purchase Cost	$185	$270	$400	$1,050
Installation Cost	$25	$25	$25	$25
Maintenance Cost	$525	$40	$40	$0
Charging Cost	$970	$970	$970	$850
Replacement Cost	$2,600	$5,450	$3,000	$0
Replacement Labor	$700	$1,000	$375	$0
# of Replacements	(14)	(20)	(7)	(0)
# of Cycles Over Life	(500)	(400)	(1,000)	(7,100)
TOTAL COST OVER LIFE	**$5,005**	**$7,755**	**$4,435**	**$1,925**
Cost Per Cycle	$0.67	$0.92	$0.55	$0.27

The table compares the total cost of ownership of RELiON's RB100, a 12V 100 Ah LiFePO4 battery, to three equivalent size off-the-shelf lead-acid battery technologies. Using measured lifetimes taken from the manufacturer's published specifications of each battery, the analysis shows that the RB100 costs at least 51% less over life than even the most cost-effective lead-acid battery.

Latest FERC Data Confirms Sun Day Campaign's forecasts

FERC Projects Net New Renewable Energy Capacity Additions to be 100x those of Fossil Fuels + Nuclear Combined Over the Next Three Years

SUN DAY Campaign

According to an analysis by the SUN DAY Campaign of data just released by the Federal Energy Regulatory Commission (FERC), solar, wind, and hydropower accounted for nearly three-fifths (59.6%) of new capacity added to the U.S. electricity generation mix during the first quarter of 2019.

According to FERC's latest "Energy Infrastructure Update" (with data through March 31, 2019), 59 "units" of new solar provided 1,155-MW while 15 units of wind accounted for 1,011-MW and four units of hydropower added 29-MW, for a total of 2,195-MW. By comparison, 16 units of natural gas (1,482-MW) and two units of oil (5-MW) contributed 1,487-MW. FERC reported no new capacity from coal, nuclear, or any other sources.

Moreover, utility-scale renewable energy sources (i.e., biomass, geothermal, hydropower, solar, wind) now account for 21.49% of the nation's total installed operating generating capacity - more than double that of nuclear power (9.04%) and almost equal to that of coal (21.68%).*

FERC lists currently installed solar (38.10-GW) as providing 3.19% of total U.S. generating capacity. However, FERC does not include small-scale solar (i.e., less than 1-MW) which accounts for roughly one-third of U.S. installed solar generating capacity. Its inclusion would mean that total renewable energy generating capacity is now greater than that of coal.

Finally, a major change in FERC's most recent monthly "Energy Infrastructure Update" reports is the inclusion of a new column titled "High Probability Additions" in the table "Proposed Generation Additions and Retirements by April 2022."

It suggests that - over the next three years - net new additions in generating capacity by renewable energy sources will be nearly 100 greater than those of all fossil fuel and nuclear sources combined.

Specifically, net new additions of natural gas will total 20,304-MW but be almost entirely offset by net retirements of coal (14,624-MW), oil (1,030-MW), and nuclear power (4,252-MW) for a net increase of only 398-MW.

Meanwhile, each renewable energy technology is projected to experience net new additions -- wind: 24,866-MW, solar: 12,925-MW, hydropower: 415-MW, biomass: 319-MW, and geothermal: 280-MW -- for a combined total of 38,805-MW. That is 97.5 times more net new renewable energy capacity additions than projected for fossil fuels and nuclear combined.

"With renewable energy generating capacity now equal to that of coal and new renewable capacity additions projected to vastly exceed those of fossil fuels and nuclear power over the next three years, 2019 may eventually be remembered as the beginning of the era of renewable energy dominance," observed Ken Bossong, Executive Director of the SUN DAY Campaign. "At the least, it will prove to be yet another high-water mark for sustainable energy technologies."

Contact: Ken Bossong, 301-270-6477 x.6%. Sources will be available online at www.greenenergytimes.org with the posting of this article. ♻

Banking on the Environment

EarthTalk® From the Editors of E - The Environmental Magazine

Few of us think about how our banking affects the environment but, in reality, putting your money with a green-minded financial institution may be one of the best things you can do to help conserve land, protect air and water, save endangered wildlife and mitigate climate change. Banks (owned by shareholders) and credit unions (owned by the customers) lend and invest some of the deposited funds they are holding, which is how they're able to pay interest back to you. A bank or credit union that limits its investments to sustainability-oriented companies and institutions is well on its way to being considered green.

A green wave hasn't quite swept the banking industry in the U.S. yet, but a few pioneers are blazing new trails for sustainability-oriented depositors. Credit: Artem Bali, Pexels.

"Money is power—it allows people and businesses to meet their needs and act on their beliefs," says Laurie Fielder of the Vermont State Employees Credit Union (VSECU), a leading "green" credit union in Vermont. "Your credit union or bank has a lot of power in determining who has access to money, which means they determine which ideas and businesses are empowered." She adds that individuals investing in energy savings at home, or businesses committed to sustainable operations, are ideal loan candidates for VSECU, given its underlying commitment to ethical practices that benefit the community.

New York-based Amalgamated Bank started in 1923 to open up quality and affordable banking services to the masses and has been serving working people and their families ever since. In the modern era, Amalgamated considers environmental sustainability a key component of its overall investment criteria, refusing "to invest our own dollars in funds that harm people or the planet." Amalgamated offers a full suite of banking and investment services to individuals, businesses, non-profits and institutions.

Likewise, Minnesota-based Sunrise Banks offers a full suite of personal and commercial banking services and invests customer deposits in sustainable and community development projects that return high yields financially and environmentally. Another great place to bank if you care about the planet is California-based Beneficial State Bank, which distributes its profits to local community and sustainable development projects. Aspiration, an online-only bank that stays green not just by foregoing brick-and-mortar branch locations but also by investing only in businesses and institutions that have sworn off fossil fuels, is yet another green choice. Still other responsible options include: City First Bank of DC, First Green Bank, the Missoula Federal Credit Union, New Resource Bank, Southern Bancorp and Verity Credit Union. U.S. citizens can open online accounts with any of these banks.

To find more banks and credit unions that worry about achieving a so-called "triple bottom line" (financial, social and environmental gains), check out the website of the Global Alliance for Banking on Values, an independent network of banks using finance to deliver sustainable economic, social and environmental development. Only 11 of the 48 banks around the world that qualify as members of this Netherlands-based non-profit are U.S.-based, but industry analysts expect many more American banks will start to go green given increasing public demand for putting our money where our mouths are.

Contacts: "How are activists using divestiture to fight climate change?" emagazine.com/divesting-fossil-fuels/; VSECU, www.vsecu.com; Amalgamated Bank, www.amalgamatedbank.com; Sunrise Banks, www.sunrisebanks.com; Beneficial State Bank, www.beneficialstatebank.com; Aspiration, www.aspiration.com; Global Alliance for Banking on Values, www.gabv.org.

EarthTalk® is produced by Roddy Scheer and Doug Moss, visit www.earthtalk.org or question@earthtalk.org. ♻

PECK Electric

Cont'd from p.9

The articles all mentioned that Peck Electric had earlier entered into an agreement with Jensyn Acquisition Corp to enter into what is termed a "business combination," during the second quarter of 2019. This new business, which is to be called "The Peck Company," will be traded publicly on the NASDAQ exchange under the symbol "PECK."

The thing I find interesting about all of this is that the story about Peck Electric is not just local or state news, or even national news. Though it would seem to sound rather modest, seven solar systems and a business deal is a big deal, world news that is even reported in India for readers in the Eastern Hemisphere.

Peck solar installed a 500kW solar PV array on top of the parking lot expansion at Burlington International Airport in 2014. Courtesy photo.

Peck Electric has come a long way since it was founded in 1972 by Harvey Peck and Bernie Taylor. Ownership of the business has changed, but it has remained a family-run business, eventually led by Jeffrey Peck, who took over at age 28, as the twentieth century was closing.

As Peck Electric grew, it was taking on ever larger contracts with major corporations. It has had a long history of working with IBM, for example. Getting into solar power was a natural for the company, and it has been award-winning in that business. In April of 2019, General Contractors Magazine named Peck Electric "The Best Residential Contractor" in Vermont.

Earlier, *Green Energy Times'* editor, Nancy Rae Mallery, commented when Solar Power World listed Peck Electric as a top 100 contractor ranking sixtieth in the USA, "It is hardly a surprise that Peck Solar would be among the top installers in the United States. It has a great history, and it keeps getting better." This was covered in the August 2017 issue of G.E.T. at http://bit.ly/GET_Peck-SW.

Peck Electric's web site is www.peck-electric.com. ♻

Zero Energy Pool – A Great Investment!

Cont'd from p.1

and pool-water circulating pumps. I also have an MBA from Harvard Business School and spent twenty years as President or CEO of private and public companies. So I also understand how to use discounted cash flow analysis (the standard way companies analyze investments) to make financial calculations like internal rate of return (IRR, a measure of return on investment) and payback period (how long it takes to get your investment back). I keep detailed records of my pool's propane and electricity use in order to measure the effect of each improvement we made to our pool. My results are based on my own experience rather than generalized claims made by manufacturers or installers.

In going zero, I only took measures that made financial sense, i.e., upgrades that paid for themselves with the savings on heating and electricity bills. This excluded doing many things typically done in deep-energy retrofits for swimming pools:

- I replaced my old fixed-speed pool-water circulating pump with a variable-speed pool-water circulating pump and set its speed to the lowest setting needed to circulate all the pool water once each day, the rate of exchange required to keep the water clean. This reduced the pump speed from 3,450 rpm for about 12 hours a day to about 2,000 rpm for 24 hours per day. The laws of physics state that the electricity used by a pump goes up as the cube of the rpm, so slowing the pump down more than compensates for the doubling of the time that the pump is on. This effect is so powerful that it cut the electricity used to circulate the water by 87%, saving us over $2,000 a year. The new pump paid for itself in the first year with a return on investment of 100% a year. I wish I could invest my 401k in pool pumps!

Pool-water circulating pump

- I installed an electric-powered Dolphin™ pool vacuum/cleaner to replace the old pump-driven pool vacuum cleaner. This is safe because it is connected to a GFCI (ground-fault circuit interrupter) electrical socket and because we take it out of the pool and disconnect it whenever anyone is in the water. This alone saved us about 2,000 kilowatt-hours of electricity per year or over $400 worth. It pays for itself in about 3 years with a return on investment of 55% per year. This keeps the pool cleaner too, which eliminates the dreaded summer rite of scrubbing algae off the walls of the pool.
- We use the pool only in summer, so an air-source heat pump pool heater is appropriate. My pool heat pump is about four to six times as efficient as my old propane-fired heater. In many areas, electricity is also less expensive than propane as a fuel in dollars per btu delivered, if you use the electricity to run a heat pump. We installed a single heat pump, one designed especially for pools, at a total installed cost of $6,000. The savings on the propane bills, after accounting for the extra electricity the heat pump uses, will pay for the heat pump in about 16 years. That's a return on investment of about 4% per year after tax.

Heat pump pool heater

- I did not add a pool bubble blanket to insulate the pool. This is because with the heat pump and solar panels, the cost of heating our pool is very low, just over $100 a year. This is using the highest measure of the cost of electricity from my solar panels (7¢s per kilowatt-hour) and was calculated as the total installed cost of the panels divided by the guaranteed electricity output of the panels. The running cost of my solar panels is zero. Including the storage rack, a pool bubble blanket for our pool would cost about $1,000 and might last ten years (the warranty is eight years) for an annual cost of about $100 a year. Spending $100 a year on a pool blanket to save a small fraction of $100 a year in heating costs makes no sense. We didn't like the idea of having a large piece of rolled up bubble-wrap in the garden either.
- We did not use a pool chemical blanket either. Pool chemical blankets are liquids, usually alcohols, you pour into the pool that create a thin layer on the surface that reduces evaporation (and heat loss) from the pool. Over four weeks in the summer of 2017 I did experiments with and without a pool chemical blanket. I found that they do reduce the loss in temperature of the pool overnight by about 1°F (the pool naturally loses about 2-3°F overnight) but they cost about $50 a week. I can replace that lost heat with my heat pump and solar panels at about a third of that cost and with none of that inconvenience.
- I opted not to install the standard unglazed, mat-style solar hot-water panels because solar electric photovoltaic (PV) panels powering a heat-pump water heater are more cost effective. Plus, the net-metering agreement with our utility allows us to accumulate a credit for excess electricity generated on sunny days so we can use that electricity on cloudy days. With solar hot-water panels you are out of luck getting warm water on cloudy days and there's less opportunity to store the excess from sunny days. You can learn more about the combination of photovoltaic panel and heat pump water heaters in the original blog postat *https://zeroenergyproject.org/*.

Instead of installing solar panels only to power your swimming pool, you are better off installing solar panels for your house and installing a few extra to power your pool. Instead of installing solar hot-water panels, I covered the roof of my house with a 15kW array of 46 SunPower 345W panels and covered the roof of my garage with a 13kW array of 40 SunPower 327W panels. That sounds like a lot of solar panels, but I make money on every solar panel. Solar panels are cheaper than they have ever been and are heavily subsidized. My total investment in solar panels, after the tax breaks and subsidies, was about $42,000. My savings are over $5,500 per year on electricity bills. My investment in solar PV panels produces power at about 7 cents per kilowatt-hour (after tax breaks and subsidies). That's about one-third of what I would have paid my electric utility company here in Massachusetts, which is now 23¢ per kilowatt-hour. The solar panels will pay for themselves in about 7 years. But the most important economic measurement is the internal rate of return (IRR): 13% per year after taxes.

My overall investment (after tax breaks and subsidies on the solar panels) for the entire zero-energy retrofit of my pool was about $10,000 and I am saving about $3,000 a year on propane and electricity bills. The investments pay for themselves in just over 3 years and the IRR is about 44% after tax. That handsomely beats the growth of the Standard & Poor's 500 stock index of 11.7% over the last 43 years. It also beats the return on investment we achieved by going zero on our house, which was about 15% per year. Additionally, the S&P return is before tax and before fees whereas my return is after tax and with no fees. Finally, financial markets are risky especially when seeking the highest returns. The risk associated with energy efficiency improvements and solar are usually nil and are will increase with inflation.

Much as I found with going zero on our house, the conventional wisdom on going zero on a pool was often wrong and did not make financial sense. I found that using the standard financial evaluation process used by companies and investors together with some simple experiments cut through the myths. So I think I've found a way to both go zero and make money. This represents an inflection point for the zero energy movement. Going zero is no longer like buying an expensive lifestyle statement for your house or pool. It's cold, hard cash in your pocket, proving you can save money and save the planet!

You can read more about my experience and a summary of my books, Zero Carbon Home and Zero Carbon Pool, detailing how I did it all at GreenZeroCarbonHome.com.

This article is reprinted with permission from the February 15, 2019 posting at https://zeroenergyproject.org/.

David Green lives and works in Dover, Massachusetts. ♻

Electric-powered pool cleaner

The "pool fab four" saves thousands of dollars in pool operation and saves tons of CO2 emissions. This includes a variable-speed pool-water circulating pump, heat pump pool heater, electric-powered pool cleaner, and five solar panels (photo not shown) to power them all. Courtesy photos.

"Instead of installing solar panels only to power your swimming pool, you are better off installing solar panels for your house and installing a few extra to power your pool."

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Can the Healthcare Sector Match Big Tech in Going 100% Renewable?

Danny Kennedy

It seems as though every month for years, some company in the digital set has committed to, or better yet, achieved 100% renewable power supply. Facebook, Apple, Google and Amazon all have pledged to go 100% and some have made it, at least with their energy-intensive data centers. Even data center company, Switch, is building a one-gigawatt solar power farm in Nevada.

I believe that the healthcare sector will be next. Hospitals need to clean up their energy act. And with this, the U.S. will keep moving the needle in the right direction (although not yet far or fast enough). I'm heartened by a report from the Bay Area Council Economic Institute (BACEI) on "Building a Climate-Smart Healthcare System for California."

The report has lots of great facts and ideas for the giants of the medical industry to tackle costs, customer needs and carbon emissions.

The reason I'm optimistic we'll see a similar move from big healthcare companies, as with big data companies, is that it just makes sense. Dollars and cents. They have a lot to save.

(Embarrassing note: I had no idea how big — and how wasteful — healthcare is.)

California's healthcare sector spending was 13% of state GDP in 2016, the last year for which we have numbers. That's a bigger than the entire economy of Oregon. At a national level, where these things have been tracked for some time, healthcare emissions were 10% of all emissions. Those emissions are growing. And so is the scale of the industry, from $3.4 trillion nationally in 2016 to an estimated $5.5 trillion by 2025.

So, Doc, where should we start? Let's triage where the bleeding is worst.

> "Hospitals are like the data centers in technology: They are the energy hogs in the healthcare ecosystem."

Hospitals produce much of the healthcare system emissions – a whopping 36%. After spending 10 days in a modern hospital recently, visiting a sick relative, I had a sense that they could do better with lighting, cooling and heating. Boy, they can do better with lighting, cooling and heating.

And sure enough, the BACEI Report found that "ventilation reform" is the lowest-hanging fruit. Hospitals use three to five times as much energy as a five-star hotel on heating, ventilation and air conditioning (HVAC). This is often two-thirds or even three-quarters of a hospital's energy use.

That's a lot of hot air.

Many hospital staff have an ingrained belief about building management and the need to circulate more air for germ control. Some of that is true, but sometimes circulating air can have negative health effects. It's better to have smart controls to get the air just right.

Kaiser Permanente's South Bay Medical Center in Harbor City, California, is host to a first-in-the-nation demo project for advanced air distribution design and sensors. It will use smart building control systems and monitoring-based commissioning, and will reduce onsite natural gas consumption for space conditioning and ventilation by 30 to 50%. All the while it will meet or beat health and safety standards for indoor air quality in such a controlled environment.

> "Gundersen Health System became the first 'energy independent' health system in the United States by offsetting 100 percent of its fossil fuel use with locally produced renewable energy."

Lighting

Lighting is another ripe opportunity inside and outside most hospitals. As I learned in my recent visit, lights are on all day and night throughout those big hospital buildings. There are opportunities galore to manage the lumens better and to create a better, healthier experience for the patients and for the people that care for them.

In 2014, the NorthBay VacaValley Hospital in Vacaville, California, became one of the first healthcare facilities in the nation to install an energy-efficient networked adaptive outdoor lighting system (PDF). The changeover to LED luminaires led to a 33% reduction in energy use. The networked control system then reduced the LED lighting's energy requirement by 49%. The hospital saves 29 megawatt-hours annually against the baseline. (Hat tip to the UC Davis California Lighting Technology Center, which, I am proud to say, the California Clean Energy Fund long has supported.)

Hospital construction

As you may have noticed, a lot of new hospitals are going up. An aging population plus the replacement of buildings for seismic safety requirements means many new hospitals will be built in coming years. So, let's build 'em right. Which means tight and energy efficient. The DOE estimates that hospitals are 2.5 times more energy intensive than office buildings of similar size. Time to change.

Again, there's good news on this front, thanks to Health Care Without Harm, our partners in supporting the report from BACEI. It ran a pilot program from 2002 to 2011 that laid the foundation for LEED certification of healthcare facilities by the U.S. Green Building Council. These LEED-certified buildings, when built and run right, are estimated to reduce a hospital's energy use by 25%, bills by 19% and emissions by 34%.

The University of California San Francisco, one of the well-known medical schools and hospital campuses, has pledged to build all new facilities to meet a minimum Silver-level LEED certification. This is part of the broader University of California plan to achieve total carbon neutrality by 2025 and comes as it rebuilds its main hospital with a $500 million donation from the Helen Diller Foundation. But it's not only UC San Francisco leading the change.

Across San Francisco Bay, Kaiser Permanente has committed to be carbon net positive, not just neutral, by 2025. It has been maximizing energy efficiency, as demonstrated with the ventilation project above, as well as procurement of 70 MW of solar energy at up to 100 of its hospitals and other facilities. To get to "net positive," Kaiser Permanente also will buy offsite wind and solar and purchase offsets. And it will divert 100% of its non-hazardous waste from landfill, which is a big solution to reducing carbon emissions.

As Ramé Hemstreet, chief sustainable resources officer and VP of operations at Kaiser, puts it: "Kaiser Permanente is committed to eliminating and, not later than 2025, reversing our contribution to climate change by becoming carbon net positive. We will achieve this goal through a combination of initiatives including continuously improving the energy efficiency of our buildings, activating more solar and wind energy both onsite and offsite, and sourcing more responsibly the food we serve our patients and employees. These measures are good for the climate and make good business sense."

And it's not just the crazy kids on the Left Coast that are doing it. Gundersen Health System in LaCrosse, Wisconsin, became the first "energy independent" health system in the United States by offsetting 100% of its fossil fuel use with locally produced renewable energy.

Treating the system, not the symptoms

Some of the more ambitious plans, such as those from Kaiser and Dignity Health, include waste, water and food. This reminded me that a hospital is so much more than a data center. Patients in beds are not like servers in racks, and they will require much more ingenuity to serve better each year. Reducing the electron drip to an AMD processor feeding my Facebook addiction is a lesser problem than just the right drip into the life-blood of a newborn baby in a neonatal unit. The BACEI report understatedly notes that Kaiser's plans for the largest integrated system in the U.S. "is intentionally ambitious."

> "From ambulances to hazardous waste trucks, hospitals are well-placed to reduce transportation emissions."

Indeed, it is. There are technologies, goods and services that Kaiser cannot yet get to achieve the vision. But its strategic intent will create a market for entrepreneurs and intrapreneurs within the system to fix it. By going upstream into supply chains for food and water, Kaiser saves expense and emissions. By going downstream into waste management, it tackles much more of the system. But it also will have to deal with transportation.

Transportation

Hospitals are big employers and have complex logistical supply chains. From ambulances to hazardous waste trucks, they are well-placed to reduce transportation emissions. Some strategies could include changing employee commuting behavior, using EVs and fixing distribution channels.

UCSF also has been a leader in this field. It's the second biggest employer in San Francisco, with 25,000 people, and offers a wide variety of commuter options and benefits to staff, faculty and students. It's won awards for being one of the "Best Workplaces for Commuters" from the National Center for Transit Research.

More left to do

There are many more examples in the BACEI report of this whole-systems approach to being climate-smart, fiscally and physically healthy in the management of hospitals. Perhaps the most striking is the story of UC San Diego Health, which switched to a hotel room service model in its hospital.

In this system, patients got to order the food they wanted, when they wanted — of course, within the dietary bounds set by their doctor This increased patient satisfaction, but it also had an enormous impact on food waste and emissions. UCSD Health patients also can use iPads to control their own room temperature and lighting and access their electronic medical records.

In 2016, UCSD Health Nutrition Services compared food waste generated from this kind of room service (at its Thornton Hill hospital) to the cook-chill operation at Hillcrest Hospital, which reheats and serves up conventional meals in wards. It found that food waste per patient was 66% less. So, it's switching to room service at Hillcrest, too and this year it projects to reduce food waste by 53,000 pounds and save $50,000.

As BACEI noted, "UCSD will have happier, healthier patients and at the same time reduce greenhouse gas emissions by 147 MT of CO2e, which is equivalent to taking 31 cars off the road every year."

And ain't that what it's all about?

Single-payer or not, healthcare should be focused on better care, reduced waste and fewer greenhouse emissions. After all, professionals such as the California Nurses Association, who long have championed climate action, know that an ounce of prevention is worth a pound of cure, especially when it comes to the harmful effects of carbon pollution.

So, let's have a new race — a race like the one among big tech firms that started a decade ago — to de-link our bits and bytes of data from dirty energy. Let the games begin to see who can come up with the smartest solutions to the problems facing hospitals and healthcare more broadly, so those whopping trillions of dollars of care can first do no harm.

This article is adapted from GreenBiz's April 3, 2018 blog post, http://bit.ly/greenbiz_Renewable-Healthcare.

Danny Kennedy is the Managing Director for California Clean Energy Fund (CalCEF). ♻

Sustainability at Dartmouth Hitchcock Medical Center

George Harvey

Dartmouth Hitchcock Medical Center in Lebanon, New Hampshire. Photo: Ken Gallager, Wikimedia Commons.

The sustainability program at Dartmouth Hitchcock Medical Center (DHMC) in Lebanon, NH goes back to 1996, when the staff started taking a hard look at waste management. Waste is a particularly difficult problem for medical facilities, because a lot is produced, and it is very important that disposing of waste does not spread diseases. For environmental reasons, the decision was made at that time not to incinerate waste, which produces air pollution, but to sterilize it in an autoclave, despite the fact that it is more expensive.

Encouraged that things could be improved, people at DHMC identified ways to reduce environmental footprints. They looked at electric power, heat, waste, transportation, food, land use, and more. The hospital went from using number six fuel oil to natural gas, switched to more environmentally-friendly cleaning products, and increased the use of fresh, local, organic food. DHMC started getting recognition from organizations like Practice Greenhealth. It received LEED silver certification.

In 2015, the board of trustees adopted a set of sustainability goals for 2020. Some of these were intentionally demanding, but worthy, "stretch goals." Zac Conaway, DHMC's Manager of Waste, Recycling and Training, and Chair of DHMC's Environmental Sustainability Council, said, "A lot of that looked at GHG (greenhouse gas) emissions." But even "purchasing medical furnishings to be environmentally sustainable" was on the long list of things under scrutiny.

Among the goals was installation of solar photovoltaics. Work on this came quickly when Norwich Solar Technologies installed a 134-kilowatt solar array, offsetting a 10% share of DHMC's electric use.

DHMC has not stopped pushing to improve its efficiency and its environment. Installation of setbacks for HVAC in operating rooms and offices saved about $75,000 per year. The medical center has been turning to heat pumps and is looking to end the use of fossil fuels. The Jack Byrne Center for Palliative and Hospice Care has new geothermal heat pumps, which heat both for the building and hot water. Propane is still in use, but only for backup. Conaway explained, "All new construction buildings are to have heating that comes from sources other than fossil fuels."

Among the most interesting projects that DHMC undertook was how to deal with food waste. They composted 162 tons of food scraps and food-related waste in 2018. Three vendors supply food in four eating areas, and they are trying to compost everything feasible. The plastic clamshell containers that used to be used to present some cafeteria food have been replaced by bio-degradable packaging. The compostable waste is sent to the Lebanon Solid Waste Facility, where it is composted in a traditional windrow system. The compost is used as fertilizer in parks and recreation areas.

DHMC is looking at growing its own produce, as well. A quarter acre is presently being used for a vegetable garden, though there are hopes that this might be increased to as much as two acres. Work to raise the food is provided by volunteers, largely through Willing Hands, a local nonprofit group that focuses on getting food from local farms to people who need food assistance.

The work of providing for sustainability at medical facilities has turned to political action in many places, and DHMC is not exceptional in this way. In addition to having its own sustainability staff, DHMC has a government relations staff who represents the needs of the medical center in Concord, NH and Washington, DC. It is working with the Regional Greenhouse Gas Initiative and pushing for a cleaner environment, Conaway said.

Many of the stretch goals for 2020 will be achieved; some have been already. This year, the trustees are considering how to continue the process. They are starting work on a new ten-year program, with goals for the next decade, 2020 to 2030.

One thing DHMC is doing will surely get more attention from *G.E.T.* in the future. The medical center is working on its environment through sustainable landscaping. Rain gardens and living roofs are among the things that are of special interest. Its cattails and pond are especially appealing, and our hope is to do an article on landscaping at DHMC in an upcoming issue. ♻

UVM Medical Center's New Solar Array

George Harvey

UVM Medical Center on Holly Court in Williston, Vermont, has a new solar array on the facility's roof. It has an impressive peak capacity of 198 kilowatts. An aerial photograph taken from directly above it shows clearly the striking fact that very nearly all of the roof was used for the array.

The UVM Medical Center's system was developed by Encore Renewable Energy, which also did the engineering, procurement, and construction of the project. Acting in that capacity, Encore took care of all permitting and many of the other details. Importantly, Encore brought Sunwealth, one of its strategic partners, into the project as the long-term project financer and owner.

Sunwealth is a renewable energy investment firm utilizing investor capital to develop a diverse portfolio of commercial solar projects in all communities. Their goal is to provide energy savings to building owners, jobs for local installers, and market-rate returns to their investors. Sunwealth will own the project through its projected lifetime of 25 years, taking responsibility for its operation and maintenance.

Even though the UVM Medical Center is not paying for the array and does not have to attend to the details of ownership, it benefits quite a lot from allowing the solar system to be installed on the roof of its building. That medical center roof, which would otherwise have gone unused, will host a system to produce $142,000 in energy savings over the life of the project.

The array started producing power in December 2018, with development still progressing. Encore Renewable Energy announced that the array was fully commissioned on February 14, 2019. ♻

Solar Systems for Good Health ~ *Cont'd from p.8*

Solar system at Washington County Mental Health Services. Image: Image: Norwich Solat Technoloties.

According to town manager David Ormiston, Hartland has designated a number of sites along Route 4 as approved for solar development. Having gone through that work, Hartland stands ready to do its part to achieve Vermont's energy and climate goals.

Paul Calandrella, Chief Operating Officer of Mt. Ascutney Hospital and Health Center, pointed out that with NST's SSA, the array benefits all parties. The hospital saves money, utility ratepayers save money, and the environment benefits. He said, "There really is no downside."

Washington County Mental Health Services

Washington County Mental Health Services (WCMHS) added a solar PV array to the roofs of its headquarters in Barre, Vermont and the RSD Transportation in White River Junction, Vermont. WCMHS, a 501(c)3 not-for-profit organization, was very interested in saving money on its large electric utility bills.

NST offers its customers a Solar Services Agreement (SSA) that incorporates what it calls a "Triple Bottom Line," the three parts being financial performance, social impact, and environmental responsibility. An SSA is a financial mechanism that allows a solar purchaser to obtain many of the benefits of solar photovoltaic (PV) power without buying a PV system. In a SSA, a solar purchaser buys power from a project developer at a predetermined rate for a specified length of time without responsibility for system ownership, operation, and maintenance. The fact that this can be done without requiring a customer to bear the capital expenses can be especially important for non-profit organizations.

For WCMHS, entering into the SSA is to result in substantial savings. The company said the reduced cost for electricity makes it possible to provide increased healthcare to Vermonters.

For its part, NST attended to all the details needed to provide WCMHS with the PV system. NST took care of system design and specifications, permitting, and construction. With the system complete, NST continues to provide maintenance for the 25-year life of the contract.

WCMHS will save over $10,000 in the first year of the contract, with the savings increasing as utility rates rise. Because it is running as a non-profit, the savings can go directly into keeping the 800-person WCMHS workforce strong, benefitting the 8,000 people it serves. Also, costs are predictable for the period of the contract, which makes planning easier.

The WCMHS rooftop systems have a capacity of 450 kilowatts (kW) DC. It will save the Earth the burden of 12 million pounds of CO_2 emissions, which is equivalent to planting 130,000 trees.

Please Note: We at Green Energy Times *realize that when renewable systems go online in Vermont, they replace grid electricity that is already about 90% carbon-free. Nevertheless, the grid is a network that goes beyond state borders. When grid demand is reduced, the plants that produce less power are those that are most expensive, and today, they happen to be powered by coal and nuclear.* ♻

NY-GEO 'Top Job' Award for Home in Fayetteville, NY

Halco installer, Shawn Hodge (left), converted William Sunderline's (right) historic home from natural gas to geothermal heating and cooling, eliminating fossil fuel use in the home. Photo: Pamela Bender.

A historic Fayetteville home and a local HVAC contractor are the winners of the 2019 GeoStar Top Job Competition for a geothermal installation. Halco, an HVAC contractor with offices in Liverpool, Phelps, Rochester, and Ithaca, NY won the prestigious award at the annual NY-GEO conference held in Schenectady, NY in April. Halco was among five companies who were chosen to present their noteworthy geothermal (ground source heat pump) projects as finalists in the 2019 GeoStar Top Job Competition

Halco's winning job, 'The Noble House,' converted a historic home right in the heart of Fayetteville, NY from natural gas to geothermal heating and cooling, eliminating fossil fuel use in the home. The home was built in the early 1800's and was home to the prominent abolitionist and publisher of Uncle Tom's Cabin, Linnaeus P. Noble.

The award will be presented to Halco and the Noble House owner William Sunderlin in a ceremony at noon on Thursday, May 23rd at the Noble House. Elected officials, the public and the press are invited to the ceremony at 305 E. Genesee St., Fayetteville, NY. Light refreshments and snacks will be served and those interested in attending this free event are asked to register in advance at https://www.eventbrite.com/e/ny-geo-top-job-award-ceremony-tickets-61257133736.

"The objective of the GeoStar Top Job Competition is to highlight and recognize the incredible talent, care, creativity and imagination that geothermal system designers and installers, bring to their projects" explained Bill Nowak, Executive Director of NY-GEO. "The competition also communicates to those outside the industry the variety of ways that geothermal heat pump technology can be applied. The Noble House is an excellent example of the ability to install geothermal systems even on small lots and in historic homes."

A detailed description of the Noble House project can be found here on the NY-GEO website: https://ny-geo.org/pages/the-noble-house. It includes pictures and a short interview with owner William Sunderlin.

Following strict historic preservation guidelines including preservation of floor-to-ceiling historic windows, this was a large scale retrofit project with many upgrades made, including major shell work.

"Halco fully believes in the concept of 'Reduce before you produce,'" explained Halco owner Hal Smith. "Tightening up the home by improving the insulation and reducing drafts was an important first step."

Once all prep work was completed, the geothermal system was properly sized and designed to fit the heat demand of the home. Halco installed a 12-ton system, drilling (3) bore holes to a depth of 420 ft with 1.5" loops tied into 4 separate heat pumps;

- one heat pump for the hot water,
- one to heat and cool the second floor of the home,
- one for the main living space, and
- a fourth to heat and cool the adjoining apartment.

All heat pumps are tied into GeoStar remotely programmable thermostats, which allow comfort control, humidity control and access to energy use data for the homeowner.

Recognizing the GeoStar Top Job honor, homeowner William Sunderlin states, "Within Halco, the person who deserves special recognition is Shawn Hodge, their lead geothermal installer. Faced with the challenge of installing 21st century technology in a 19th century house, Shawn mobilized his ample creativity, problem-solving skills, and technical knowledge to surmount every challenge - there were many! - that got in his way."

Prior to install, Mr. Sunderlin was a natural gas customer. As a climate scientist, he had been considering going green for twenty years and is keenly aware of the importance of getting off fossil fuels. Today, William is a member of the steering committee for HeatSmart CNY, a community-based campaign helping building owners connect with assessments, incentives, and technologies to make homes and businesses more comfortable, cost-effective, and better for the environment. Mr. Sunderlin has opened his home to the public as part of HeatSmart CNY home tours and passionately encourages others to consider clean energy.Most recently, "The Noble House" received a Pearl Platinum Certification. Pearl Certification is a national firm that provides third-party certification of high-performing homes: homes with "performance assets" that make them

Cont'd on p.23

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Sixth Annual NY-GEO Conference

George Harvey

We got word from Joanne Coons and Michael Bailey about a conference that took place in New York State, over two days starting April 10. The Sixth Annual New York Geothermal (NY GEO) Conference, was held at the Rivers Casino and Resort in Schenectady.

Geothermal heat pumps (GHP) may already provide the most practical approach to heating and cooling for homes and businesses in much of the United States. Air-source heat pumps (ASHP) are quite a bit less expensive up front, and though they will often beat any combustion heating system for efficiency, they are clearly not as inexpensive as GHP to run. Like wind power, solar photovoltaics (PV), and storage batteries, heat pumps have been on a steeply downward price trajectory ever since they first appeared on the market.

Dandelion geothermal installation in progress. Photo courtesy of Dandelion.

Joanne Coons said the NY GEO conference was attended by 380 people. She said that the keynote dinner speaker's address, given by John Rhodes, the Chairman of the New York Public Service Commission, was particularly interesting, because he had attended and spoken at earlier NY GEO conferences.

In his address, Rhodes emphasized the importance of competitiveness. Renewable energy sources, such as solar and wind power, batteries, and efficiency can all be seen as strong competitors for fossil fuels. This means electrification is the most powerful route toward use of clean technologies.

Both GHP and ASHP have powerful competitive edges. They are less expensive to run than systems fueled by oil or propane. With availability of financing offers, they can even be less expensive for homeowners to install. They are clearly less expensive than natural gas for anyone who does not have easy access to a natural gas lines.

Rhodes emphasized the competitive edge of heat pumps, suggesting utilities and other businesses that can provide them should work to remove any barriers to financing. Rhodes said, "Utilities should make good smart investments that includes heat pumps." Bailey put a challenge to the heat pump industry to "collectively rise to the occasion," so New York could meet its goal of getting to 70% reliance on fossil fuels by 2030.

The biggest barrier to advancing GHP is that the industry is still in early stages of growth. As we move into the future, we can expect to see GHP follow the same sort of downward cost pressure as solar PVs, wind power, and batteries. While GHP may not decline as fast as solar power, it is already positioned to compete with fossil fuels. With time, in which the price of ASHP and GHP can reasonably be expected to fall, it is very likely that heat pumps will edge out fossil fuels altogether, simply because of their cost.

Because GHP technology is young and they make it easier to get New York off of dependence on fossil fuels, the Public Service Commission has authorized rebates to promote growth of the industry. They hope to increase installation rates and demonstrate the advantages of geothermal heat pumps to increase market acceptance. ♻

NY-GEO 'Top Job' Award

Cont'd from p.22

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healthy, safe, comfortable, energy and water efficient. These certifications help convey the hidden value of a home to potential buyers in the future. Pearl looks at each asset category (Heating and Cooling, Baseload, Building Shell, Home Management) and Platinum scores well in all four categories. William's home is 1 of 2 platinum scoring homes in New York State, the other is also a Halco customer.

In addition to the May 23rd Award Ceremony, the Noble House will also open its doors for a tour of its energy efficient renovation in June as part of ArtRage Gallery's annual "Pedal Power" bike tour fundraiser on June 15. Bicyclists will begin at ArtRage in Syracuse and bike along the path of the old Erie Canal, touring the Noble House before returning to ArtRage for a luncheon. To register visit http://artragegallery.org/bike-fundraiser/. ♻

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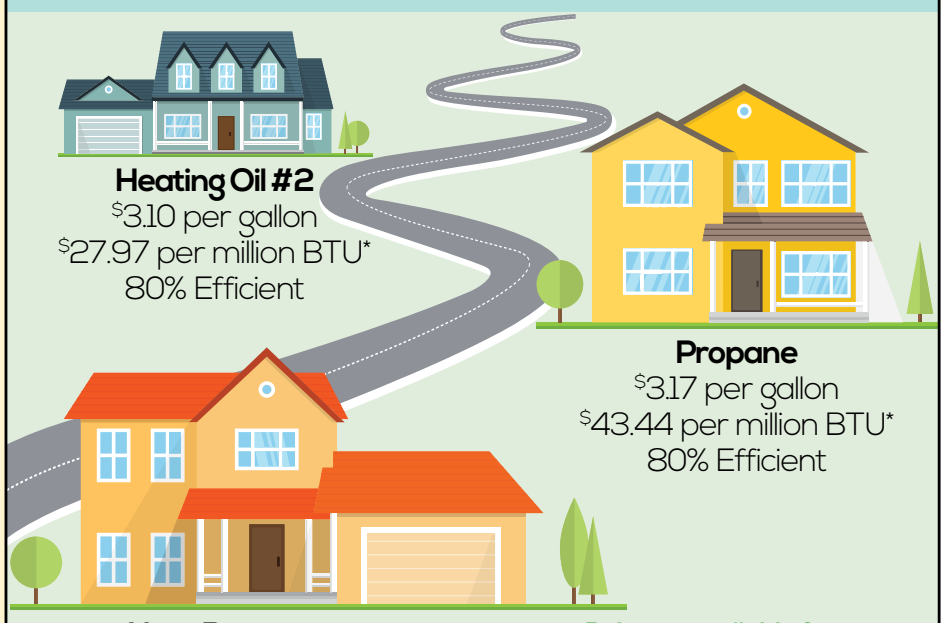

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Geobarns Modern Farm House

George Harvey

The modern farm house built by Geobarns in Waterbury, VT. All photos courtesy of Geobarns.

One of my favorite pieces of music is Beethoven's Sixth Symphony. It is also known as the "Pastorale Symphony," and most people who hear it understand immediately why it has that name. Beethoven loved to walk out in the countryside, and he wrote the Pastorale to express, in music, the emotions he felt in his outdoor experiences. Like nearly all of Beethoven's music, it is highly sophisticated, and yet, it conveys a sense of natural ease and charming rustic life that is unusual for his work. Its movements are highly evocative of a country setting. An open meadow surrounded by woodland is brought to mind clearly by themes representing nightingales, quails, and cuckoos. But its soft-spoken comfort is turned to drama, as the composer portrays musically the intensity of both a storm, followed by the gratitude a person caught in the storm feels at deliverance from danger.

We at *Green Energy Times* often see pictures of the homes built by Geobarns, builders who like to share images of their creations. The buildings are a little hard to describe adequately using the usual vocabulary of building, so I found myself having to leave that language to make a comparison: A Geobarns home is rather like Beethoven's Pastorale Symphony, realized in solid form. Each home is evocative of simple, rustic life, and yet they are all highly sophisticated. They look in some way old-fashioned, and yet they have 21st century efficiency. Geobarns homes have unique style and construction – each is a palace built in a homey form.

The Modern Farm House kitchen.

Most look a bit like very beautiful barns, but the Modern Farm House is true to a name that honestly represents it. Nevertheless, it is much like other Geobarns homes, because it looks as natural on the land where it is built as the trees, rocks, and streams of the countryside.

The construction involves some proprietary elements that were developed by George Abetti. No plywood is use for siding. Because the framing is done set on a diagonal instead of vertical, it has the inherent strength of a triangle. The structure is unusually strong and rigid, so it does not need plywood to stiffen it. The strength of the design also makes it possible to have soaring expanses of interior space, somehow giving the impression of a building that is bigger on the inside than it is on the outside.

The Modern Farm House design was coordinated by Geobarns project manager Ryan Hereth, who cooperated closely with the clients. The people who work at Geobarns have highly diverse backgrounds, and Hereth is no exception. His background is in fine arts, with a Bachelors of Fine Arts from Virginia Commonwealth University.

It has a minimalist design, which is adequate for its owners' present needs, with room for possible expansion. It has ten-foot windows facing southwest, with a view of Camel's Hump and the Winooski River. Though the Modern Farm House has a feeling of simplicity, it was clearly laid out for comfort and esthetic values.

The building's orientation was planned taking into account a possible solar array in the future. That is not a concession to environmentalism, however. Right from the start of the design process, Efficiency Vermont's residential program principles were incorporated into the design. This included everything from windows to vapor barriers.

The first floor is heated by a Weil McClain Gv90+3 boiler, which provides radiant heat in four zones. It is set up for optimal efficiency, with intelligent controls. It also supplies heat for upstairs baseboard heaters, but there is a separate system for the second floor. The bedrooms on that floor have Mitsubishi air-source heat pumps, which supply both heat and air conditioning quite efficiently.

The lighting is done with LEDs with motion detectors. There are also built-in home stereos, local area networks, and Wifi. Interestingly, the combined phantom load for all this is less than ten watts.

The electronics is controlled by a Samsung Smart Things system. The house has ZigBee smart switches and uses a Sensibo system for the heating. The level of control is truly impressive. The condition of everything from the garage door and the water pump to Nest cameras and the coffee maker is known to the system. Heating is done centrally but can be adjusted by room occupants. If there is a malfunction or unusual condition, appropriate action is taken, and an alarm is raised. If no one is home, the alarm is sent out by a text to the appropriate cell phones.

The Modern Farm House can perhaps be described architecturally after all. It is a traditional house of the future. Still, to me it is a symphony.

The Geobarns website is geobarns.com. ♻

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Janet Joseph

Solara Apartments has an 155kW photovoltaic array and fourteen solar hot water panels on the roof for each of the twenty-four unit buildings. Courtesy photo: NYSERDA.

In April, the New York State Energy Research and Development Authority (NYSERDA) announced the grand opening of Solara Apartments in Rotterdam, NY, a new multifamily development that is built to net-zero construction standards. Advancing these low-carbon buildings throughout the state is a cornerstone of achieving Governor Andrew M. Cuomo's clean energy and climate goals and putting New York on a path to carbon neutrality while spurring growth of the green economy.

Developing a net-zero apartment complex requires commitment from the earliest planning stages. The developers of the Solara Apartments implemented net-zero design in a way that benefits each resident while meeting the most efficient energy standards possible. As the second net-zero multi-family development from developer David Bruns in New York's Capital Region, once Solara is complete, it will feature 248 apartments using state-of-the art renewable and energy-efficient technologies.

By working together, we will continue expanding access and the upward trajectory of market growth of low and net-zero buildings. Advancing net-zero buildings at scale to drive down costs for consumers and encourage cleaner energy and more comfortable living and working spaces will benefit all New Yorkers. Statewide, New Yorkers pay about $31 billion annually for electricity and heating fuels, and buildings are responsible for 56 percent of statewide greenhouse gas emissions from fuel combustion.

Approximately 100 million square feet of new construction is built per year in New York State and multifamily development represents 40 percent of projected new building construction (by square footage). Once a building is constructed, it is in operation for about 50 to 100 years, and it becomes much more expensive to execute significant energy and carbon reducing measures after a building is completed.

A report released in April, New York Getting to Zero Status Report, by the New Buildings Institute shows New York State is leading the Northeast in net-zero buildings with 27 documented ongoing and completed net-zero building projects and a total of 132 net-zero, high-performance, and Passive House building projects. The report also showed that in just the past 10 years the net-zero market has seen tremendous growth, that New Yorkers themselves are driving demand and revolutionizing how we build and retrofit our building stock, and that with steady cost compression net-zero construction costs can be lowered to be competitive with those reflected in conventional construction.

To spur net-zero multifamily development NYSERDA launched the $30 million Buildings of Excellence Competition in March to advance the design, construction, and operation of low- and zero-carbon buildings. The competition provides $10 million in funding for three rounds with up to $1 million available per project. Applications for the first round are due on June 4, 2019. Through this effort, we are working with developers and architects to demonstrate the economic viability and profitability of low- and zero-carbon buildings which will help us shape the future of our built environment.

Collaboration, public-private partnerships, and ongoing support of the growing clean energy economy are critical to advancing New York State's energy goals. To supplement these efforts, NYSERDA is expanding the Net-zero Energy for Economic Development program to include $15 million for net-zero projects including large campuses and communities.

The opening of such a forward-thinking and energy efficient development like Solara shows how public-private partnerships can yield significant economic and environmental benefits. And, this is just the start. By continuing to work together, we will transform the State's building stock and as a result, provide cleaner, greener communities for all New Yorkers to enjoy.

Learn more at NYSERDA's website: nyserda.ny.gov.

Janet Joseph is NYSERDA's Senior Vice President, Strategy and Market Development. ♻

Solara Apartments

The net-zero-energy Solara Apartments in Rotterdam, New York, are just the latest project by David Bruns, a developer in that area. Bruns has been in the business of developing net-zero apartments for a while. His netZero Village, with 72 apartments, was the subject of the June, 2016 Green Energy Times article, "Rotterdam, NY Developer Builds Homes to meet Our Future."

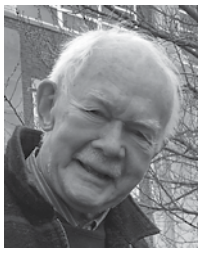
Solara Apartments are said to be the largest net-zero apartment community in the United States. There are 248 units in the project, all powered entirely by sunlight. Achieving this was a matter of combining the most advanced technologies for building efficiency, lighting heating for both the building itself and the water, and electric power.

There are three different ways the sun is used in the Solara Apartments. Most obviously, there are solar PVs set up in canopies over the parking areas, providing electricity for both the buildings and free electric car charging. Water is heated in a set of solar thermal systems on the roofs of the buildings. And the buildings are designed for passive solar heating. When these technologies are combined with highly efficient insulation and windows, exceptional air sealing, energy recovery ventilation, highly efficient appliances, and smart building systems control, the buildings need very little energy.

Cont'd on p.36

A CLIMATE CHANGE TEST

John Bos



This is an invitation to test what you really know about climate change. You can find out by first taking a short, online test with five questions. After you get those test results, I invite you to respond to four simple questions in this column below.

The online test was created by Bill Gates, one of the founders of Microsoft. Bill Gates knows a lot about climate change.

Gates has joined an international coalition determined to figure out how to protect people from heat waves, floods, and storms as the temperatures rise and the climate shifts. The Global Center on Adaptation will advance "bold actions to help societies across the world become more resilient to climate-related threats" and, we hope, help the human race survive extreme weather.

For this effort, Gates has teamed up with former U.N. Secretary-General Ban Ki-moon, World Bank CEO Kristalina Georgieva, and seventeen countries, including China, India, South Africa, Indonesia, Canada, and the U.K. (The U.S. under President Trump is absent from this coalition.)

Think you know more than Bill Gates about global warming? If so, Gates is challenging you to test your knowledge and try to beat his score. Take this quiz, "How much do you really know about what causes climate change?" and find out if you can match him. It has only five questions and is found at https://www.gatesnotes.com/Energy/Climate-change-quiz.

Here's one fact that may surprise you. The generation of electricity (through power plants) causes only 25% of the CO2 emissions. Where do you think the other 75% comes from?

The October 8, 2018 Intergovernmental Panel on Climate Change (IPCC) released a daunting report suggesting that we are currently on track for around an increase of 37 degrees Fahrenheit of warming caused by greenhouse gas emissions. The IPCC authors promise that we will see coastal cities swallowed by the sea, global food shortages, and $54 trillion in climate-associated costs as soon as 2040.

Look, the world is facing a near-impossible decision – one that is already determining the character and quality of the lives of our next generations.

The latest IPCC climate report makes it abundantly clear that the first and only effective course, although a politically and otherwise deeply unpopular one, would be to stop using any fossil fuels. None. Nada.

The second course of action would be to voluntarily limit their use as much as climate scientists have calculated would deliver some prospect of success.

Or we can carry on with business as usual by meeting the growth in so-called "demand" for lifestyles dependent on fossil fuels and dependent upon market forces to mitigate the problems that will arise from taking no action. This will leave it to the next generation to solve the problem that the present generation has been unwilling to deal with.

The measure of everything these days is in dollars. Dollars over legislation affecting health care, education, social security, national parks, and how to respond to an ever-warming planet. Dollars are not counted in measuring the impact of lowering taxes once again for corporations and extremely wealthy people or for increasing the world's highest military budget. (World military spending totaled more than $1.6 trillion in 2015. The U.S. accounted for 3% of the total, more than the total of the next seven highest spenders combined.)

The Pentagon, the insurance industry, coastal cities and other entities that look after dollars first are all spending millions to prepare for the impacts of now undeniable evidence of global warming. They must have conducted an extremely sophisticated cost-benefit analysis before deciding to spend millions of dollars to escape or combat the impacts of climate change.

Now it's your turn to make the same analysis but in a highly simplified set of the four questions below.

The first two questions should be answered within the context that the president's belief is that IPCC global warming projections are not true. In other words, false. In this case,

What would the consequences be if no national action were taken to mitigate climate change?

What would the consequences be if a full national scale were undertaken to mitigate climate change?

YOUR GLOBAL WARMING ACTION CHART

What do you think the results would be if we TAKE action or take NO action in response to global warming? Put your responses in the YES or NO boxes, then go to: www.youtube.com/watch?v=zORv8wwiadQ&t=7s

Global Warming	Action "YES"	Action "NO"
FALSE		
TRUE		

For a free full page PDF chart printout, email: john01370@gmail.com

The next two questions should be answered within the context that the IPCC projections are true, that civilization will be severely damaged or worse, if we don't take action. In this case,

What would the consequences be if no national effort were made to mitigate global warming?

What would the consequences be if a full national scale effort were undertaken to mitigate climate change?

You can use the risk assessment chart shown in the figure if that would help. I can send you a full-page version of this chart to use with family and friends, if you think this quiz is important. Send an email with "Chart" in the subject line to john01370@gmail.com, and I'll send you one that you can print out immediately.

Some people I have given this chart to have used little smiley or sad faces in place of words to answer the four questions.

This chart was conceived by Greg Craven eleven years ago and recently updated on YouTube. It's called "The Most Terrifying Video You'll Ever See," and it has been viewed by over 13 million viewers. You can't afford to ignore this wonky nine minutes of your time with respect to the future of our planet earth. Go to www.youtube.com/Craven.

When the continually worsening IPCC reports have been issued in the past, the climate change denial community has sprung into action with two primary points of refutation: (1) that the IPCC findings are not true, and (2) even if there is some truth to what a majority of the world's scientists have agreed upon, trying to stop the planet from frying would severely damage the economy. Our president has called climate change an "expensive hoax." There's that money measurement thing again. What about the projected negative $54 trillion in global warming impacts we are heading toward by 2040 by taking no action?

Oh yes, and what about the human costs?

John Bos lives in one of five great places to live in America, Shelburne Falls (according to the American Planning Association) and writes frequently about climate change. Let him send you a full size global warming action chart by writing "Chart" in the subject line of an email to john01370@gmail.com where you can also comment on this column. ♻

EARTH DAY AND THE SIXTH GREAT EXTINCTION

George Plumb

There have been many commentaries written about global warming and how critical it is that we work to reduce our greenhouse gas emissions. And justly so, as we can already witness the catastrophic events that are happening all over the world including now also in the U.S.

However, there is also one other major potentially catastrophic environmental issue that is already happening but is rarely mentioned. That is the Sixth Great Extinction.

The world is facing mass extinction of species. All species of mammals, birds, reptiles, amphibians, arthropods, insects, fish, crustaceans, corals and plants have declined, in many cases severely. Our oversized human civilization has had a negative impact on most living things.

We are amidst the most dramatic period of species extinction in the last 60 million years. Scientists estimate that we are now losing species at 1,000 to 10,000 times the normal rate, with multiple extinctions daily. As just one of many facts related to species, 40% of the world's bird species are in decline, and one in eight is threatened with global extinction.

While we should be concerned about all forms of species, the biggest threat to human survival is the loss of insects. A study published in the journal Biological Conservation, found that 40% of insect species are now facing extinction over the next few decades, and around 41% of all insect species have seen declines over just the last ten years. Butterflies and moths are among the hardest hit. When was the last time you saw a grasshopper, cricket, or hornet building a nest on the ceiling of your porch?

If all of the insects disappear, there will be no pollination of a wide variety of plants that we eat. If much of our food supply cannot be produced, then there is going to be mass starvation and wars over the diminishing food supply.

So, what can we do to help prevent the worst of the Sixth Great Extinction?

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The first thing is to stabilize and then reduce our population to a more sustainable level. If everyone in the world lived as Americans do, we would need five Earths to support humanity. While in just the few years left to reduce greenhouse gas emissions, that isn't going to give us much time to reduce our population. Nevertheless, each couple should still consider having but one child, or perhaps even none, so that we put less demand on our remaining natural resources.

If we are currently living on a largely meat-based diet, the second thing for us to consider might be to switch to a more vegetarian-based one. Our confined feeding operations to raise beef, milk cows, poultry, ham, and other mammals are major contributors to greenhouse gas emissions. According to a United Nations report, the meat industry causes more global warming (through emissions of carbon dioxide, methane, and nitrous oxide) than all the cars, trucks, SUV's, planes, and ships combined. An amazing 26% of the planet's ice-free land is used for livestock grazing, and 33% of croplands are used for livestock feed production, thereby taking away natural habitats for other species.

Then there are animals raised for meat in huge confined feeding operations where thousands of animals are under a roof and never experience their natural feeding grounds. This is very inhumane. As is sometimes said, if people could look into these factories and witness the suffering, if they had any compassion, they would likely stop eating meat. Let's at least think about a "meatless Monday," and if we are going to eat meat then let's be sure it is locally-raised, pasture-fed, and slaughtered as humanely as possible.

The third thing for us to do is stop using all

Cont'd on p.27

What's Going on in New York?

The Good, the Bad, and the Nonsensical Approach to Nuclear

Michel Lee

In January 2017, two actions took place in New York that could significantly affect the energy system and policy of the state. The first was the signing on January 9th of an agreement to close the Indian Point nuclear plant. The second was the filing on January 13th of a lawsuit seeking to overturn a massive nuclear power subsidy program established by an August 1, 2016 order of the New York Public Service Commission.

If the closure of Indian Point proceeds according to the articulated plan, and the nuclear subsidy scheme iWhats rolled back, New York has a once-in-a-generation opportunity to rapidly advance towards a truly clean energy economy. So far, the closure of Indian Point, which has already operated past its original license term, appears to be progressing according to schedule, with full shutdown expected by April 2021. However, the ability of solar, wind and other renewables to rapidly grow in New York – and even in other states – depends largely on the outcome of the lawsuit. This is because "Tier 3" of the Commission's order distorts the energy market to the extreme disadvantage of renewables.

Begun as a "Proceeding on Motion of the Commission to Implement a Large-Scale Renewable Program and a Clean Energy Standard," the scheme morphed suddenly and dramatically into a $7.6 billion corporate welfare package, with virtually all the money going to a multibillion conglomerate, which runs the state's four aging upstate nuclear reactors. Tier 3 forces NY to prop up uncompetitive industrial facilities that generate the most toxic waste product on the planet for twelve years, no matter what dangers emerge or how great the opportunity to move towards clean generation is. It forces every ratepayer in NY to subsidize these old reactors and restricts consumer choice. Astonishingly, it actually prevents individuals, businesses, and municipalities from buying 100% renewable power – even if they are willing to pay more for clean energy.

Tier 3 also delivers more than twice as much in funding for these four legacy reactors as the order provides to all new renewable forms of power combined.

Thus, companies struggling to gain a foothold in the NY energy market by providing renewable power must duke it out against all the others seeking clean energy credits as well as against low-cost gas. Meanwhile, nuclear power is completely elevated out of the messy market competition process.

Bizarrely, NY ignored all the research mapping out how the state could transition to a clean energy-based system. NY did not even bother conducting a study of how rapidly renewables could scale-up with greater funding and policy support. The order provides no incentives whatsoever to promote efficiency, demand-side initiatives, or decentralized resource development – in other words, the very tools essential for giving the electric system the flexibility and agility needed to go green.

Nuclear power is supremely ill-suited to combat climate change. But we will leave that argument for another day. Here, let's just focus on the absurdity of the argument that the best way to combat climate change is to divert $7.6 billion of public money away from clean energy. Notably, Exelon is now busily promoting NY's Tier 3 as the "model" for other states.

And this is where the gravest danger lies. The Commission did not only deliver a windfall profit to a $33 billion megacorporation that now has even more power to dominate multi-state energy markets. The Commission adopted the PR conceit that we must remain in the 20th-century paradigm whereby powerful companies with big fuel-based operations run the show.

As things now stand, Tier 3 places a substantial financial burden on school districts, municipalities, small businesses, hospitals, non-profits, and cash-strapped families, without providing the benefit of investment in the system and technologies needed for a sustainable future. Tier 3 shackles NY to nuclear power for over a decade more, with no escape clause.

At the outset we mentioned the closing of Indian Point, and there's a bit more good news. There is one route out, and it is being led by a group of environmental nonprofits and a small farm. That's the lawsuit. It's brought in the form of a so-called "Article 78" action, which challenges the Commission's disregard of state-mandated procedure and its arbitrary and capricious action. The case is a David vs. Goliath battle – but recall that David won that one.

Michel Lee, an attorney, is a senior policy analyst with Promoting Health and Sustainable Energy (PHASE). ♻

A Warming World Needs Nuclear Power?

Roy Morrison

California currently uses 32% renewable power with a mandate for 100% renewables by 2045. Capital cost for utility scale solar is about $1.00 per watt and falling with zero fuel costs.

New nukes are several times as expensive plus fuel plus waste treatment with ever-rising costs.

We do not need carbon taxes. We need state and national mandates like Green New Deal for increasing percentages of renewables plus storage.

Elon Musk has said that a trivial amount of land covered with PV, around a 60-mile square, could supply all U.S. power. Of course, this is best done in distributed fashion and include a mixture of wind, solar geothermal, hydro, tidal, digester bio mass and synthetic gas et al.

The last thing we need is to bank on a future generation of nukes or on carbon taxes. We need mandated annual increases in renewable energy that is rapidly dropping in cost and increasing in efficacy.

That's climate solution at hand. We have the industrial capacity to mass produce the renewable energy infrastructure that can power our cars, heat, cool and light our homes, and run our factories.

In the way Ford's River Rouge plant in WWII went from producing cars to having million-part bombers roll off the assembly line, one every hour, we can produce planet saving renewable transformation with breakneck speed.

This will not happen under Donald Trump or similar climate-change deniers and fossil fuel politicos.

Desperation says maybe nukes can save the day. If the next twelve years are crucial, then renewables are at land and can drive a quick transition, if we can make that choice between sustainable renewable-based prosperity or global collapse.

Does not seem like a hard choice to me.

Roy Morrison builds solar farms. His next book is Ecological Economic Growth: Hot to Stop Climate Change and Build an Ecological Civilization (to be published in 2019). ♻

<< Cont'd from p.26

pesticides and herbicides which kill our insects and the very important soil microbes needed for healthful and productive soils. Pesticides and herbicides are still widely used on a wide variety of crops.

Yes, we certainly do need to immediately address global warming and deal with species extinction and the Sixth Great Extinction.

This commentary is by George Plumb of Washington, VT. He is a board member of Better (not bigger) VT and a member of Buddhist Peace Action Vermont. He wrote this commentary in honor of Earth Day on April 22, 2019. ♻

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Saving Our Children

Cont'd from p.1

and much of creation, is consistent with centuries of exploitation of the Earth by humanity. It is coupled to the concept of human dominance, historically male dominance. This led to a misplaced sense of our power and authority over nature, which developed over the centuries in the western and colonial worlds. It led also to the ruthless suppression of the indigenous peoples, and their deeper understanding of our relation to the Earth's ecosystem.

As science and technology emerged as drivers of our civilization, this frame of human dominance and exploitation of the Earth and all its resources spread further. We became deeply embedded in a consumer society powered by oil, which could be cheerfully marketed as liberating for women, as long as they lived in a rich country.

Now the growth of our consumer society and economic system exploit the poor everywhere, the planet's resources and ecosystems, all to maximize current profit and channel wealth and power upward. Advertising and mass media keep us in line and continually feed us the sacred myths about our entitlement. Oil companies and other polluting industries bribe our politicians. Meanwhile, our time horizons get shorter rather than longer, as they would to match the time-scales of the Earth. The reality is that our global consumer economic system, powered by fossil fuels, is driving the energy imbalance of our planet that in turn is driving climate change. This is a crime against the Earth that will haunt humanity for centuries, and yes, eyes closed, we are sacrificing our children.

A rude awakening is coming because humanity does not control the Earth. This is obvious in every climate-related disaster, whether it be rising seas and hurricanes, floods and storms or droughts and fires. Afterward, we borrow the money and rebuild, but so far, our societies have refused to discuss and confront the consequences of our doctrines of power and exploitation. We can cooperate with each other on smaller scales, but the understanding that we need to collaborate with the Earth on a grand scale has been suppressed by our economic system, which is protected by well-funded propaganda.

Instead, we should listen to Mary Christina Wood and encourage our teenagers to campaign for a new planetary patriotism that transcends national boundaries and give them the resources and training to build a truly sustainable society. They need guidance and massive support, but their future is on the line, and our aging corrupt politicians have failed them. To protect the interests of our children and grandchildren, we must accelerate the transition away from fossil fuels to a much more efficient society, powered at least 80% by renewable energy. That is a morally acceptable use of our excellent technology, whereas destroying our stable climate system is not.

The snow has finally melted, and I have been thinning lettuce and spinach that wintered over under glass and admiring the rhubarb sprouting. The community farm in Pittsford, Vermont, where I live is starting its second year: growing more food locally brings communities together.

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

Habitat for Humanity: Champions of Efficient Housing in Vermont

Peter Schneider

Working as an energy consultant for Vermont's statewide energy efficiency utility has allowed me to witness – and play a role in – one of the greatest affordable housing success stories in the country.

Across Vermont there are ten affiliates and chapters of Habitat for Humanity. Combined, they represent one of the largest housing development organizations in the state, and their unique model has provided hundreds of Vermont families a hand up and out of very poor housing circumstances.

Vermont's first certified Passive House, built by Green Mountain Habitat for Humanity in Charlotte, Vermont. Image: Philip Jensen Carter http://www.jensencarter.com.

Habitat for Humanity has evolved and grown to become one of the true champions of designing and building to the highest energy efficiency standards. Efficiency Vermont has been honored to support this evolution over the years by consulting in all stages of Habitat for Humanity projects; from design and construction through final commissioning. In many cases ongoing relationships with families and Efficiency Vermont have been maintained as the organization checks in to advise them on the proper operation and maintenance of their high-performance systems.

In the early days, Habitat for Humanity was focused, as were many of us, on the "first" cost of a house. Anyone who's ever owned a home can appreciate that what you pay upfront for your house is only the beginning. There is the cost of maintaining the home, the cost of paying taxes on the home, and the cost of insurance, to name a few.

There's also the cost of energy – powering lights and appliances and keeping the home warm in the winter and cool in the summer. These energy costs are substantial and they disproportionately affect lower-income families.

Partnering on a Passive House

About 10 years ago, Green Mountain Habitat for Humanity broke ground on a new home that accomplished three "firsts" in a single project in Charlotte: Vermont's first certified Passive House, North America's first modular (built in a factory and finished on site) certified Passive House, and the world's first Habitat for Humanity certified Passive House.

That project helped set the stage for today's reality. Nearly every Habitat for Humanity home built in Vermont is designed and constructed to earn Efficiency Vermont Certified recognition. Habitat's leadership has been supported by Efficiency Vermont's Residential New Construction program, which provides technical support and up to $6,000 in incentives for income-eligible customers meeting energy performance standards.

The generosity of the Vermont Housing and Conservation Board (VHCB) has been instrumental in enabling Habitat projects to meet the highest energy performance standards. VHCB funding has helped pay for the construction of more than 125 Habitat for Humanity homes around the state. Recently, VHCB raised its grant amount to $39,900 for Habitat homes that meet the Efficiency Vermont Certified High-Performance level and $35,900 for Habitat homes that meet the current energy standard of 54 HERS (Home Energy Rating System).

The impact of this partnership means that Vermont families who purchase homes through the Habitat for Humanity program will spend less on energy, will be more comfortable, and will breathe more healthful air. The value of these benefits is difficult to quantify but is reflected by families who stay in Habitat for Humanity homes many years longer than typical first-home buyers.

Vermont is very fortunate to have such a strong and committed network of Habitat for Humanity affiliate chapters working to improve the lives of families in every corner of the state. Vermont is equally fortunate to have an organization like VHCB providing the financial resources that help make these high performing homes available to families who stand to benefit the most from them. The hundreds of volunteer contractors and workers who pitch in to build these great homes at the lowest possible cost are the final ingredient in a recipe that brings energy efficiency and affordable housing together to help strengthen Vermont households.

Reprinted with permission. Originally written for Efficiency Vermont's blog on April 22, 2019 at http://bit.ly/Habitat-for-humanity-energy-efficient-housing.

Peter Schneider is a Senior Energy Consultant at Efficiency Vermont and a member of their Residential New Construction team. ♻

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Tiny Houses for the Planet

Jessie Haas

Lincoln tiny house on wheels at Mt. Hood tiny house village near Portland, OR. Image: tinyhousetalk.com.

Tiny houses are hot these days. But practical? Can they help save the planet? Quite possibly.

A tiny house is usually 400 square feet (sf) or less, with the average being 186 sf. (By comparison the typical American house is over 2,700 sf.) The tiny house movement developed around the concept of mounting the dwelling on a trailer chassis, but many tiny houses are stationary. And yes, the environmental impact is large.

Heating and cooling an average home releases 12,000 lbs. per year of CO2. A tiny home? 844 lbs.

An average home embodies seven log trucks worth of wood; a tiny home, half a log truck's worth.

An average home contains 45 light bulbs, versus six for a tiny home.

An average home uses 12,773 kwh of electricity a year versus 914 for a tiny home.

Tiny homes are affordable. The average tiny house costs $23,000 for an owner-build. The typical new American home costs over $272,000. Sixty-eight percent of tiny home owners have no mortgage.

There are obstacles to widespread adoption, however. Banks rarely give loans to build a tiny home. They depreciate in value over time, more like an automobile than a traditional house.

Local zoning laws can also be an obstacle. Many tiny home aficionados aspire to live off-grid or without conventional utilities, but municipalities may require a full sewer hookup or conventional septic system. Building on a trailer may not be a way around these laws. There are ordinances in many areas against living full-time in what may be considered a travel-trailer.

Other, more traditional ways of 'living small' have no legal challenges. It's widely recognized that an urban apartment can be more environmentally friendly than a country house, due to the shared envelope of an apartment building, access to public transportation, walkability, and closeness to service infrastructure like laundromats.

Another approach is to shut off part of a larger house during the winter. The occupants can den up close to a wood-stove and stay cozy for six months, then expand into other areas of the house during the warmer months, perhaps developing a cool grotto in the basement for very hot days. This can reduce your carbon impact, though not your fixed costs.

Whether urban or rural, living tiny can free up your mind and time for other pursuits—gardening, activism, the arts. Space can limit some of those activities, however. In our 450sf home, it can be hard to find a place to store the harvest, ferment wines, overwinter geraniums, or spread out a knitting project to block. (On the other hand, finding a friend or family member's space in which to do these activities builds community.)

Success in tiny home living depends on access to excellent city amenities, or a large outdoor area. For example, we have a free-standing screened porch, bathhouse, and storage shed, so, especially in the warmer months, there is a feeling of elbow room.

The other issue with tiny home life is stuff. Look closely at photos of tiny homes. You'll see a minimum of clutter—no mail, no magazines, no library books, no children's toys, no dogs, and, in fact, almost no people. That helps make the pictures pretty, but obscures the scale. Really, almost no one will always have a place for everything and always put everything in its place. Your stuff is going to be scattered about at least some of the time. That has disproportionate impact in a tiny house. You can't not see it. You can live with this by becoming neat, by not caring, or by creating some even tinier oasis of serenity—but one way or another, you will deal with it.

But most people have 'lived small' on this planet. There are models. Two sailors have walked into our house and exclaimed, 'It's a boat!' For weathering life's storms, or helping the Earth do so, a tiny house can be an empowering choice.

Sources: https://tinyhousebuild.com/; https://yestermorrow.org/; https://thetinylife.com/

Jessie Haas has written 40 books, mainly for children, and has lived in an off-grid cabin in Westminster West, VT since 1984, www.jessiehaas.com. ♻

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Appliances and Energy Efficiency

Jessie Haas

Many of us are aware of the impact that changing out an old appliance can have on our fuel bills and carbon footprint, and the older the appliance, the more astonishing the result can be. Refrigerators have the biggest impact, as they run 24/7. In warm climates, replacing an older refrigerator will reduce cooling costs, and as the climate is getting warmer for all of us, that may be a consideration even for people in the Northeast.

Those living off-grid are highly aware of the impact of energy efficiency. In general, every dollar spent on efficiency saves $3 in energy generation costs. But can you afford an energy efficient refrigerator, stove, dishwasher, washer and dryer? And how do you know what to look for?

The answers can be found on the website of Efficiency Vermont (EV), Vermont's energy efficiency utility and other sources listed at the end of this article. Appliances are rated according to their Ennervee Score ®, from highest to lowest within a range of efficient models. Search for Appliances, click on the "Research Qualifying Products" button in the box on the right, and then click on "See All."

And keep scrolling. Price and score don't necessarily correlate. As of April 15, 2019, the highest-scored refrigerator cost $7,899. One very nearly as efficient cost only $849. The least expensive unit listed was priced at $464 and had a score of 95; the most expensive, at $8,099, was scored at 96. Efficiency Vermont scores and lists many types of appliances and offers rebates to consumers, so the site should be the first stop when you go shopping. Rebate size does track the Ennervee Score, with the highest-scored receiving a $400 rebate, and the lowest $75.

Front-load washing machines are more energy efficient than top loading ones, as they save water and electricity. Image: g-mark.org.

Do you need a new refrigerator? Answer yes if yours if over ten years old, has French doors, or your household size has decreased. Look for a right-sized unit with top-mounted freezer and expect to save about $200 per year, depending on the efficiency of the refrigerator you are replacing.

What about your stovetop? Induction is the most efficient, 84-90%, but you need special cookware to use an induction stove. A regular electric stovetop comes in at 74% efficient, better if the cooking pot completely covers the element. Gas stovetops are only 50-55% efficient.

Front-load washing machines save water and electricity, and heat-pump dryers work more efficiently than other types. Washers, dryers, dehumidifiers, and many other types of electrical appliances are rated by EV, and some are subject to rebates.

If a new appliance isn't in your plans, there are still ways to lower your electric bill and carbon footprint.

Set your water heater to 120°F. Insulate the hot water tank and pipes. This will save energy in the kitchen, bathroom, and laundry room.

Wash full loads in your clothes and dishwashers. In the dishwasher use no-heat drying and the rinse feature.

Drying clothes on a clothes line is a great energy-efficient option. Image: Wikipedia.

Wash clothes in cold or cool water and use the extended spin feature to shorten drying time.

Dry your clothes on a clothesline. If using a dryer, clean the lint trap before every load. Seal gaps around ducts and vents. Don't overfill the dryer; that will take extra time and heat to dry.

Replace refrigerator door seals. Keep the temperature at 35-38°F. Minimize door opening. Locate away from any heat source, including direct sunlight. Keep coils clean and allow air to circulate behind the refrigerator.

If changing out a refrigerator or freezer, the old unit should be recycled. Federal law requires all refrigerators, air conditioners, and cars to have their refrigerant gases harvested when they are discarded. These are a potent greenhouse gases (ghg). The gas can be recycled into useful, non-ghg forms. Managing refrigerants was identified by Project Drawdown as the number one action we can take to reverse global warming, so yes, it really matters.

Sources available on G.E.T.*'s website.*

Jessie Haas has written 40 books, mainly for children, and has lived in an off-grid cabin in Westminster West, VT since 1984, www.jessiehaas.com. ♻

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NHSaves Earns Highest Energy Star Leadership Award

NHSaves, a leader in guiding residential, commercial, industrial and municipal gas and electric customers toward energy savings through incentive-based programs, has earned the highest ENERGY STAR honor bestowed by the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE).

NH Saves received the 2019 ENERGY STAR Partner of the Year Sustained Excellence Award for continued leadership in energy efficiency and commitment to the ENERGY STAR program on April 11, 2019 at a ceremony in Washington, D.C. NHSaves was selected for its Energy Star Homes New Construction program.

"It's an honor to be recognized by the EPA and DOE for our energy efficiency efforts in New Hampshire," said Eversource Senior Vice President and Chief Customer Officer Penni Conner on behalf of NHSaves. "NHSaves resources are helping customers across the state better manage their energy, and ENERGY STAR is a great partner in this effort."

In order to receive the ENERGY STAR Partner of the Year Sustained Excellence Award, partners must receive ENERGY STAR Partner of the Year recognition for two consecutive years. Award winners include a wide range of companies, small and large, representing new construction, renovations, retrofits and upgrades in the residential, commercial, industrial and municipal sectors.

NHSaves is supported by Eversource, Liberty Utilities, New Hampshire Electric Co-Op and Unitil to help New Hampshire residents, businesses and municipalities reduce energy costs and protect the environment.

NHSaves provides customers with technical assistance that allows them to more accurately project long-term savings with energy efficient projects. Contractors are also provided training that helps them identify energy-efficient opportunities and the best installation measures that can be taken. Finally, NHSaves guides vendors and contractors through the design process with the goal of qualifying for the highest possible rebates.

For residential customers, the ENERGY STAR Homes Program offers incentives up to a maximum of $4,000 for new construction projects that meet ENERGY STAR certification.

"I applaud the 2019 ENERGY STAR Award winners," said Bill Wehrum, EPA Assistant Administrator for Air and Radiation. "Their innovation and leadership enhance America's economic competitiveness. Reducing costly energy waste improves air quality and public health, while protecting the environment."

View available cost savings at www.nhsaves.com.

Efficiency Vermont and NYSERDA were among the winners. A complete list of 2019 winners and more information about the ENERGY STAR awards program can be found at www.energystar.gov/awardwinners. ♻

MT. RAINBOW COMMUNITY SOLAR ARRAY

SUSTAINABLE WOODSTOCK, VERMONT

Green Energy Times Staff with Tesha Buss

Tesha Buss has had more than her share of renovating houses in Vermont. In fact, she had completed three of them when she decided to add solar electricity to the barn apartment where she lived in Ludlow, Vermont. For guidance on that, she reached out to Dave Bonta at Sundeavor.

Bonta started with a good look at the situation, not just to answer the question of siting and sizing a system, but also at the overall energy use and efficiency at the site. Looking back on that experience, Buss said, "Dave opened my eyes to all energy-efficient technologies for my leaky, lofted barn apartment and my 185-year-old retreat-home business: retrofit insulation techniques, mini splits, heat pump hot water heaters and the payback on solar power." They went through the numbers, which all made sense to Buss, and that was the beginning of a business relationship that turned out to be ongoing.

Buss found a daycare center for her daughter Izabella when she turned two, Rainbow Playschool. Rainbow was a well-established organization, having gone through thirty-six years of operation. Because Buss was both the mother of a child in the playschool and a business woman, she quickly became a member of the school's board. One of the first things on the agenda at the time she joined was the utility bill of $17,000, and so it was an immediate topic on which to focus her attention. And because she had been through all the renovations, including energy retrofits and solar installation, she knew immediately what needed to be done at the school. When she explained it to the board, she got approval very quickly to go ahead with her work.

The Rainbow School, in Woodstock, VT. Courtesy photo. Right: Site plan for the 150kW Mt. Rainbow community solar array. Image: Sundeavor.

For her next step, she knew exactly what to do. She said, "We engaged our friends Pete from Vermont Spray Foam and Nick from Paquette Plumbing and Heating for our retrofit insulation and heat pump technology needs. The next call was to Dave Bonta." She asked him, "How could we afford a solar array that would power seven heat pumps for 7000 square feet of space?"

She and Bonta sat down to a number session, which she described. "Dave and I are dreamers, outside- the-box thinkers and extremely frugal! Our pencils went to work right away crunching numbers and asking questions. Rainbow owns the land so there will not have to be a land lease cost. I wonder if Green Mountain Power (GMP) would accept power if we made this array 150 kilowatt (kW). I think Sustainable Woodstock has been looking for a community solar option for its supporters for years! Sure enough, our hunches and thoughts all came together to create a 150kW array named the Mt. Rainbow Community Solar Array."

Their idea was to have 50kW owned by the school in exchange for the use of the land for the array, land maintenance, years ten to thirty of repair and maintenance, and insuring the array for all thirty years. The remaining 100kW would be sold to fund the installation of the array.

"Sustainable Woodstock championed our idea," Buss said. "They offered support for advertising, public comment meetings, and public feedback on the structuring of the arrays arrangements. GMP agreed to accept us onto the grid. The project is in the forty-five-notice period to obtain its Certificate of Public Good."

Buss explained her "take" on community arrays. "Community arrays provide a flexible option for choosing solar. Panel production is credited to your bill no matter where you live on the GMP grid, which means that now even renters have an option in Woodstock to choose solar. The 30% federal tax credit still applies until the end of 2019. There is an accelerated depreciation for businesses." ♻

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HEALTHY SOILS LEGISLATION HELPS GREEN NEW DEAL

Seth Itzkan, Steven Keleti, Karl Thidemann

Congressional Democrats have offered an ambitious legislative framework for 2019. Titled the Green New Deal, it seeks to tackle impending climate threats while generating innovative opportunities in the energy, transportation, and agricultural sectors. The Green New Deal includes support of soil health. Between 50% to 70% of agricultural soil has been lost, and rebuilding soil health is crucial for food system security, water quality, and climate change mitigation.

A bi-partisan movement at the state level is calling for what is termed "Healthy Soils Legislation." Proposed bills nationwide promote good land stewardship through principles and practices that support the aspirations of the Green New Deal by providing practical support for farmers and ranchers, many of whom might not otherwise be supportive of climate efforts. Speaking to this point, Bill McKibben, founder of the global climate movement, 350.org, stated, "Soil is increasingly taking its rightful and necessary place in the climate fight; this is a battle farmers and ranchers can help the world win."

A promising indicator of this comes from New Mexico where a Healthy Soils Act was approved with rare, overwhelming consensus. . Officially titled "An Act Relating to Natural Resources," the New Mexico law creates a Healthy Soil Program and a Healthy Soil Grant Program in the state's Department of Agriculture. The purpose of the program is "to promote and support farming and ranching systems and other forms of land management that increase soil organic matter, aggregate stability, microbiology and water retention to improve the health, yield and profitability of the soils of the state."

It should be noted that the phrase, "increase soil organic matter," literally means to increase the carbon content of soil. Carbon is naturally accumulated in soil through the photosynthesis process. Conventional farming and ranching practices have greatly depleted soil of its carbon, contributing to global warming and exacerbating the impact of droughts and floods. Fortunately, improved cropping and grazing methods embraced by environmentalists and producers, and emphasized in healthy soils legislative efforts, can reverse this negative trend and increase soil carbon, making these approaches important allies in the climate flight. It is estimated that improving soil globally can sequester many billions of tons of excess atmospheric carbon annually. Such "drawdown" efforts — meaning they pull carbon out of the air — will be essential as we take measures to bring atmospheric carbon dioxide back down to safe levels.

Commenting on the bi-partisan nature of the New Mexico effort, Jeff Goebel, a management consultant involved in drafting and lobbying for the legislation stated, "We understood that the only people who can actually change the health of the soil on a daily basis are ranchers, farmers, foresters, and gardeners. Therefore, we need to do everything possible to help land managers be successful. We were adaptive (consensual) in the language without giving up the integrity of the legislation."

Nebraska recently passed legislation to create a Healthy Soils Task Force to develop a healthy soils initiative and action plan. A Massachusetts bill, "An Act to Promote Healthy Soils," directs the state to form a Healthy Soils Program that shall "seek to optimize climate benefits while supporting the economic viability of agriculture in the commonwealth." With strong bi-partisan support from both chambers, passage is likely. Healthy soils legislation has also been in legislatures in 2019 in CT, VT, NY, IL, IO, WA and OR.

A complete list of state-level healthy soils legislative efforts is available at the Soil4Climate website, www.soil4climate.org. ♻

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Solar Panels on Agricultural Land

George Harvey

Sheep graze below solar panels. Photo: Merrill Smith, U.S. Department of Energy.

In April, two reports on the use of solar panels on agricultural land appeared almost simultaneously. One was a press release from Fraunhofer ISE, "Agrophotovoltaics: High Harvesting Yield in Hot Summer of 2018" (Fraunhofer report). The other was the "Farmers' Guide to Going Solar," from the U.S. Department of Energy (DOE). They share a single main message, which is that farmers can benefit from having solar arrays on their fields, without necessarily reducing agricultural output.

The Fraunhofer report describes an experiment in which solar panels were placed over a field of potatoes. According to the report, the electric energy output of a hectare of land where solar panels were co-located with potatoes was 86% of what it would have been without a crop, because the panels had to be spread out a bit more, so fewer were installed.

While the solar output might be considered pretty good, given co-location, the data on potatoes was surprising. Potato production was 103% of what it would have been without solar panels. It appears that potatoes, and many other crops, do not need as much sunshine as they get. The solar panels prevented them from burning in the sun of a record-breaking hot summer, but reduced cooling at night, so they could continue night-time growth a bit faster than usual.

The Fraunhofer ISE report can be seen at http://bit.ly/FISE-Report.

The DOE report is aimed at farmers who are considering the installation solar panels. It has nearly twenty commonly asked questions, along with their answers. The material at the site is very easy to read.

Some of the questions are surprising. One, for example, asks whether the land under solar panels can be burned off each year. Unsurprisingly, the answer was negative.

Another question, asking what the benefits of co-location are, has a multi-part answer with its own surprises. For example, there is reduced legal risk for developers for solar arrays co-located on farmland, because the land is already disturbed, and so there is a reduced likelihood of environmental issues coming up.

Other facts presented in the DOE report are worth mentioning. Pollinator plants can be grown under solar panels for the production of honey, and when this is done, benefits can be had at any farm within three miles. It is possible to raise panels high enough that many pieces of standard farm equipment can function beneath them, though doing so costs more. Also, solar panels do not heat or dry up crops, and many crops, including lettuce, do well in the partial shade they produce.

The DOE report can be found at http://bit.ly/DOE-Report. ♻

Climate Change Being Fueled By Soil Damage

Healthy soil makes for healthy crops. (Credit: USDA NRCS South Dakota)

An article at BBC News said there is three times more carbon in the soil than in the atmosphere, but that carbon is being released by deforestation and poor farming. This is both fueling climate change and reducing our ability to feed the growing population. Problems include soils being eroded, compacted by machinery, built over, or harmed by over-watering. (Does flooding count as over-watering?) You can find the original article at http://bit.ly/soil-damage.

There is some very good news about soil and carbon sequestration at The Nation. The easiest and least expensive way to sequester carbon is probably photosynthesis. Plants and microbes take carbon dioxide from the air and combine it with water to make simple sugars, with oxygen as a by-product. The sugar is used by plants to grow, and that includes putting roots into the soil. When a plant dies, the roots decompose, mostly into black carbon products that stay in the soil. The news is that this process has been shown to be able to take carbon dioxide out of the air at rates previously thought impossible.

See http://bit.ly/The-Nation-soil. ♻

PLEASE DO EAT THE DANDELIONS

George Harvey

Dandelions are an important early food source for bees in the springtime. Image: Jo from Pixabay - Wikimedia Commons.

When I was about four years old, I visited my grandfather's house in Kansas. One of the various things I remember about that trip was watching as he did yard work. He fussed a bit over a dandelion, and then he gave up. "There's no point in pulling them," he said. "You have to get the whole root, or it just grows back. And you never get the whole root." I had no idea why he would want to pull the plant.

I have wondered about dandelions many times since then. For years, I used to walk to and from school, along a street with what looked to be a vacant lot or a large dandelion garden. When they were in bloom, it was gorgeous. When they had gone to seed, it was still gorgeous, though in a different way. When it was just green leaves, it was certainly no worse than grass. I told my father about it. I said I thought dandelions must have been planted on the lot, because there was nearly nothing else there. He was scandalized.

DID YOU KNOW ... THAT JUST ONE TEASPOON OF NEONICOTINOID PESTICIDES CAN KILL 1.25 BILLION BEES!

Recently, someone suggested that Green Energy Times run an article about dandelions because of their benefits and value. Clearly there are benefits. There are a lot of uses for dandelions in traditional medicine, a lot of claims, and not nearly enough research. Perhaps we could talk Larry Plesent into writing on the subject. But in the meantime, I can clearly say the non-medical uses for dandelions are many.

Crown to root tip, every part of a dandelion is edible and nutritious. As I think of this, more images from my youth appear. In one neighborhood we lived in, women would walk down the street, stepping into yards to harvest the flowers. I believe they were probably using them to make dandelion wine.

Dandelion roots can be dried, optionally roasted, and made into dandelion coffee. Chinese medicine finds many benefits from use of the whole plant. The leaves are delicious in salad in early spring, though they are a little bitter once the flowers appear. In earlier times, aristocrats thought of them as a delicacy appropriate to be added to their sandwiches. The leaves can be cooked like spinach. The flowers have been used as an ingredient for tea, wine, syrups, and flavoring. And by the way, Goldfinch love dandelion seeds.

I think of dandelions gifts of nature to be cherished. With no effort at planting, weeding, or tending, they are free for the harvest. ♻

Elmore Roots' Permaculture Know-How

The Gift of Life, Again

David Fried

Image: Ben Fulton

Here in the north country of Vermont, winter with its swirls of snow and deep chunks of ice can have us wondering when will life begin again? The trees sway back and forth in the winds, and you can hear them cracking and popping on the coldest nights, cells freezing and buds luckily packed tight inside their thin branches. I like this time for hibernating. I don't have to see anyone or do anything, and nobody expects anything of you, while the snow piles up higher and higher around our homes.

When the rains come, one of my favorite smells is the spring rain. It gets in everywhere and soon it is warming up. Everything is melting and lilac buds are amongst the first to swell and turn green. It is very hard to dress for this weather – one minute it is cold, next minute hot, in between a pelting cold rain. But the trees and ducks let it slide off. They know how to ride out the storm and the early spring weather!

All our longings are contained inside that thin branch. That something so small and slender and brittle can contain so much color and baskets of fruit! The tree is dreaming all winter of putting out the fragrant blossoms, and then the fruit that swells and nourishes so many.

How does it hold all that inside? It is the promise of springtime, the life of the tree. Our lives are based around not just the mulberry bush but all trees and plants. They nourish us deeply and fully, both with their majestic splendor and with the food they provide to us and all animal life. New Jersey may be called "the Garden State," but all plant life on earth is really a state of exquisite bounty we call jungle or forest or farm.

So here we are, spring is jumping up all over, and we are given this gift of renewed and replenished life and hope, again.

Some tips for bringing spring branch tips into the home for color, texture and interest:

Cut willow bush twigs early and put them into a vase of water for pussy willows! When they send roots into the water, you can plant them outside and have a handy pussy willow bush to enjoy right there or to cut from each very early spring.

Bring forsythia branches into the house and keep in some water. They, too, will root after a week or two of yellow fresh flowers brightening up the place. Wait until it is above freezing outside for a while and then plant them gently wherever you would like to have more forsythia bushes. Keep them watered the first spring and summer for best success.

If you see a cherry tree with round big buds, chances are you can bring a small thin branch or two inside and put it in a warm place in water. In a week or so, it could flower inside the house.

You will be bringing the springtime of a tree into the world of people, close up.

David Fried is a poet, garden writer, and grower of fruit and nut trees at Elmore Roots Nursery in northern Vermont. ♻

Ingredient of the Month

Dangerous Brew

Larry Plesent

pxhere.com

I didn't always love beer. That came later in life, after the craft beer revolution began taking off in the late 1980s. Give me a lightly hopped IPA with hints of citrus – almost heaven. But peeling back the layers, just how benign is that beer? Let's get into it.

Beer is made from three simple natural ingredients; hops, barley malt and yeast. What can possibly go wrong? The answer is: Plenty! Including the addition of the following ingredients: Yeast enhancers, mold inhibitors, artificial colors, artificial carrageen (thickener), MSG, foam enhancers, stabilizers (including PVP and PVPP), potassium metabisulphite, PGA, anti-microbial preservatives, EDTA, propylene glycol and more. These are all legal and none has to appear on the label. Buying USDA-certified organic beer is one way to ensure that none of these FDA approved food additives find their way into your brew.

While you are recovering from that list of additives, here's another shocker. All aluminum cans are lined either with PVC or BPA-containing plastics. Neither of these is a safe acceptable Soapman-approved food surface when you look into them. So, you molecule watchers out there will want to think twice before drinking anything out of aluminum cans.

But what about draft beer?

Can I plop down at my favorite watering hole and have a nice safe draft beer in peace? Better think again. The aluminum kegs the beer is delivered in are just larger versions of your single-serve cans. Like their smaller cousins, beer kegs are also lined with an inner BPA or PVC coating. Further, the lines (hoses and taps) have to be flushed out with disinfectants every day to prevent critter growth. Yuck!

Beer glasses are almost always a chemistry experiment. While there are very few pubs that heat pasteurize their bar glasses, most are washed in strong detergent, quick rinsed in water, and dipped into a leave-on, medical-type disinfectant. This is what you get to drink when they fill you up a fresh glass. I get a much bigger hangover from the medical disinfectant than from the alcohol itself. If you care about good taste and good health, have the bartender rinse off your beer glass in clear water first.

And as long as I am being the Debbie Downer of beer this month, it is important to point out that most beer is made from municipal water. Many municipalities add fluoride to their water. This does not filter out during the brew process. Drinking fluoride containing beer may possibly have a health benefit; especially if you are a child or teenager in a fluoride-deficient geological zone (not the Northeast). You or I would probably do better without it, but, hey, everybody has an opinion.

Chloramine (this is not fancy chlorine) is a pipe disinfectant used by about 40% of municipal water suppliers. It is a mixture of ammonia and chlorine. Filters remove the chlorine, but the ammonia remains unless special two-stage filters are used, and they rarely are. Some people are especially vulnerable to chloramine and to ammonia in their drinking water. Others don't seem to notice it.

Phew! Good thing all these chemicals are cleared through the FDA, so I have nothing to worry about, right? That, my friend, is up to you to decide. But until someone tells me definitively which chemicals are the ones giving us cancer, I am paying attention to who makes and who pours my beer. And so should you.

Thinking about all those chemicals in my beer is exhausting. I sure hope I can find a safe microbrew to chill out with after work!

Larry Plesent is a writer, philosopher and founder of the Vermont Soap Company; dedicated to replacing yucky stuff with yummy stuff for all the girls and boys who care. Thanks for reading. Learn more at www.vermontsoap.com and www.reactivebody.org. ♻

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Do We Have a Quorum?

Jessie Haas

Soil is mysterious. We have identified only about 5% of soil micro-organisms, which means we have no idea what we're doing when we garden, farm, or build. But we're learning.

Recently, soil scientist Christine Jones introduced the idea of "quorum sensing" in soil microbes. All microbes use chemical signals to sense how many of their own kind are present in a given environment, as well as how many other organisims exist. When a "quorum" is reached, just as at a select-board meeting, the group can take action, turning on and off genes in themselves and their host. In our bodies, this action allows flu or strep to overwhelm our immune systems. In the soil, it appears that when the microbiome senses a certain threshold of plant diversity, it kicks into higher gear, working together, Jones says, "as a super-organism."

In recent cover crop studies during extreme drought, single-species crops failed. Three species mixes, seven species mixes? Failed. But the farmer running the experiments threw every bag of leftover seed he had into his planter, for his last plot. That 27-species mix thrived on the same inch of rain.

A New Zealand dairy farmer, following Jones's advice to use managed grazing, bio-stimulants, and reduced nitrogen inputs, grew six inches of new topsoil in three years. When he reported that to Jones, she told him that he was behind the times. To really increase soil fertility, he had to diversify his planting mix. (He had been using only rye-grass and clover.) He planted a 12-way mix on one hillside, and it was growing nicely three months later when Jones visited the farm. She asked him to dig a hole so she could look at the soil.

Slide 23 from Common Ground: The Circle of Life presentation by Cat Buxton.

His soil was whiteish, volcanic material, more recently covered in the new, six-inch dark layer of topsoil. He plunged in a spade and found only a trace of volcanic soil at the very tip of the core. "We must have burned a tree here," he said, and moved to another place to dig, and another. Fifty holes later, he and Jones were forced to conclude that by the new method, he had grown six inches of topsoil in three months.

Later analysis showed that total organic carbon (TOC) in the soil had tripled, nitrogen and phosphorus levels had increased, Brix levels had tripled, and the land could carry twice as many cows. Milk production increased, and somatic cell count was cut in half.

Reports like this have a counter-cultural, Findhornish quality. One has to pinch oneself and remember that this is science. It's just that science is showing us a reality larger and more magical than we had previously imagined.

The big lesson here is that biodiversity matters. It's not just a pretty by-product of clean farming. It's the engine of a rich new form of agriculture that has great potential to solve our worst environmental problems. That new soil is carbon, drawn down out of the atmosphere and assembled by the microbiome into a luscious chocolate-cake like structure with a great capacity to soak up excess water and hold it in reserve. The plants are more nutritious. The cows are healthier. The farmer has better economic prospects, and the person who drinks the milk will get more benefit.

Soil scientist Walter Jehne speaks of the "cathedrals underground" built by soil micro-organisms. As we mourn the damage to Notre Dame, we can resolve to make this growing season into a building season. Plant more plants. Maximize diversity. Minimize disturbance. Leave no soil uncovered. Extend the photosynthesis season. And rejoice. It all matters, and we can all help.

The meeting will now come to order.

Jessie Haas has written 40 books, mainly for children, and has lived in an off-grid cabin in Westminster West, VT since 1984, www.jessiehaas.com. ♻

MUSICAL PERFORMANCE TO EDUCATE ON CLIMATE CHANGE

Green Energy Times Staff

Counterpoint is a professional a cappella group based in Vermont. It performs many kinds of music in all sorts of places. It has a mission beyond entertaining, however, and this includes performing in ways that benefit society. One of its specific goals is to contribute to educating children, and it often does this by engaging student musicians in local performances.

The group's schedule has included performances that relate to and educate about climate change. Counterpoint's web site lists the performance in the series called "Six Degrees" as taking place until July 14. As Green Energy Times goes to press, two of these remain, one on May 23 in Fairlee, VT and July 14, in Weston, VT.

Performing with students has been an important aspect of the group's activity. On April 25, students from Burr and Burton Academy and Maple Street School in Manchester, VT joined Counterpoint to perform the first of the Six Degrees events. At least one of the upcoming events will have local school children join in the performance.

According to Counterpoint, the title, Six Degrees, refers to the fact that an increase of six degrees Celsius would imperil life on Earth, to the fact that there are "six degrees of separation" that connect all human beings and to the six continents on which nearly all people live. *http://bit.ly/six-degrees-events.* ♻

RESOURCES

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

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Solara Apartments

Cont'd from p. 25

There are ten buildings in the complex, each with its own PV array. Together, these have a capacity of 1,500 kW. The PV systems were installed by ActiveSolar. The solar thermal water heaters were installed by E2G Solar. Financing for the $40 million project was provided by Berkshire and M&T Banks.

Bruns indicated that he regards the project as a "shining example of Gov. Cuomo's Green New Deal." But the underlying thinking, which has motivated him since long before the Green New Deal came to be, has been his understanding of the importance of dealing with climate change. He points out that about 50% of our carbon emissions come from buildings.

As a developer, he has clearly seen, and acted on, his opportunity to do his part to combat climate change. And by doing so, he is giving many others a way to do their part, living in net-zero energy homes. ♻

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GUIDE TO ADVERTISERS

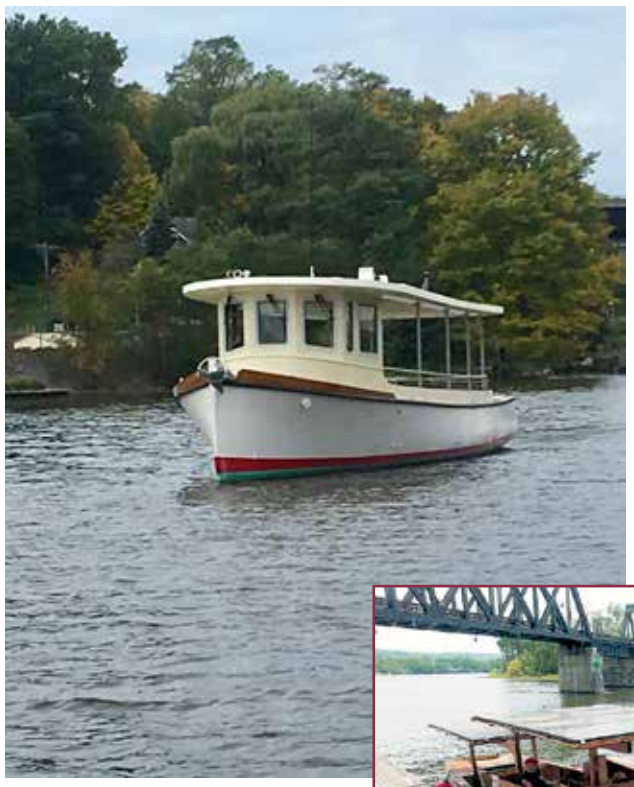
Rockin' the Boat

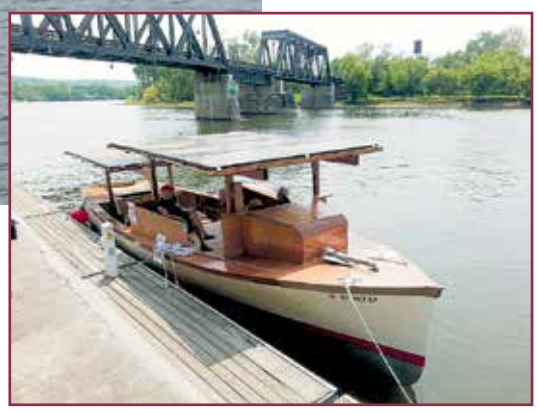
Imagine a boat powered by the sun

Jenna Batchelder

As summer draws closer and the weather gets nicer, boating season will begin. Many people are looking into purchasing boats. A huge concern for the environmentally conscious consumer is the large amount of fossil fuels required to power even the smallest of motorboats, not to mention the massive cost of the fuel. However, the fun of shared trips to the lake or a solo fishing trip is now attainable without all the guilt with new hybrid, solar, and electric-powered boats.

San Francisco is at the forefront of hybrid boat technology, housing the largest green energy boat, the 600 passenger Enhydra, at the San Francisco Pier 43 ½. The Enhydra's aluminum monohull is equipped with a lithium battery-electric hybrid propulsion system that allows the ship to sail for extended amounts of time in electric mode. The 128-foot boat was built by All American Marine of Bellingham, WA and is the largest hybrid cruise boat in North America. It is one of five vessels operated by Red and White Fleet, currently owned by Tom Escher. Escher has been described as a true visionary, and plans to convert to a zero-emissions fleet by the year 2025. The Enhydra exceeded the design criteria during trials and was certified for 300 passengers on the third deck by the U.S. Coast Guard, 50% more than originally projected. The hybrid system itself performed 40% better than expected as well, maintaining stability and speed while reducing emissions considerably. Red and White Fleet has high hopes for the Enhydra, and what this new technology could mean for the environment.





The Hudson River Maritime Museum's 100% solar-powered tour boat Solaris, formerly known as the Solar Sal-44, is on the Rondout Creek in Kingston, NY. Photo: Hudson River Maritime Museum.

Another option for green-energy-fueled boats is solar. Captain David Borton, visionary and builder of the large solar-powered boat Solar Sal saw the need for a clean energy alternative to polluting cargo boats in 1974 during the energy crisis. His vision was to convert many of the boats on the Hudson River in New York State from fossil fuel to solar. First, he built his personal 25-foot solar powered boat that he keeps in the Adirondacks on a small lake that doesn't allow gas-powered vehicles, but he always dreamed of a larger project. Thus was born Solar Sal, a 40-foot wooden cargo vessel built by Borton and volunteers from the community. Borton has built a few other smaller solar powered boats, but Solar Sal was his ultimate accomplishment. With unlimited sun, the solar model is very efficient without the downside of pollution, loud motors, or nasty fumes. Borton has plans to build a fleet of solar-powered boats both for cargo use and for tourism.

Solar Sal revolutionizes water travel sustainability, powered by 16 solar panels at a capacity of five kilowatts, or about 6 ½ horsepower. Like electric boats, Solar Sal runs a bit slowly, around four miles per hour. She was recently purchased by the Hudson River Maritime Museum (HRMM) and will be used to give water tours beginning in 2019. The museum also elected to rename the boat, Ellie Burhans, development and communications director for the museum said, with "input from the Hudson River community, Trustees of the Hudson River Maritime Museum, and local dignitaries. The newly named Solaris will make a great addition to the HRMM, showcasing both a piece of the Hudson's past and its future.

Solar and hybrid powered boats may not be the perfect fit for speed demons, but for any leisure lovers looking to cut down on pollution, they are a great investment opportunity. You can read more about Solaris (formerly Solar Sal) in past issues of G.E.T. at http://www.greenenergytimes.org/2015/10/18/solar-sal-2/ and http://www.greenenergytimes.org/2015/06/18/solar-sal/.

Don't forget how much fun it also is to get out on the water in a kayak, canoe or stand-up paddle board. Of course, they are all powered by muscle and not motors of any kind and are totally fossil-fuel free!

Jenna is a 21-year-old climate change activist and passionate clean energy supporter. She is excited to be writing for Green Energy Times *and encourages all young adults to become more involved in activism.* ♻

Squam Lake's Science Center Green Initiatives

Cont'd from p. 1

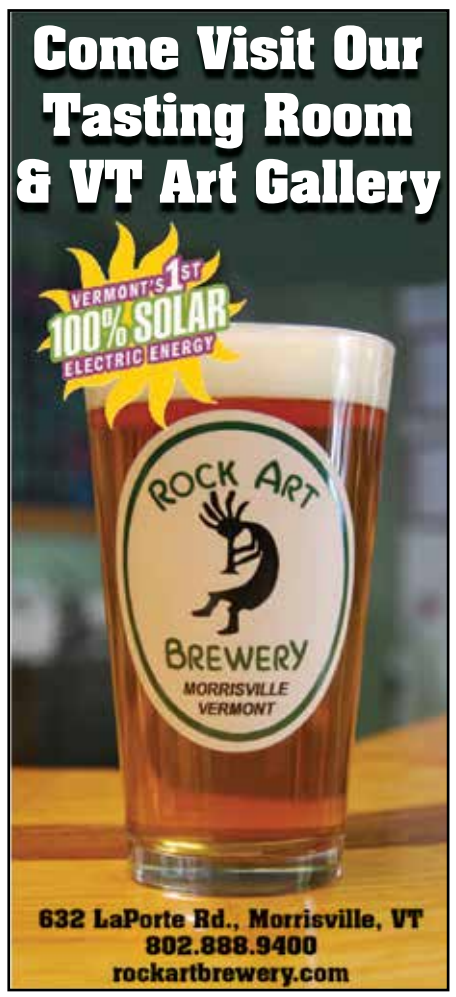
The Science Center's lake cruise headquarters' solar array seen from the water. Courtesy photo: Squam Lakes Natural Science Center.

was being deconstructed. The sixteen panels are fifteen years old, but together they can generate nearly two kilowatts of power, which is enough for the building. They have been set up with batteries, and the building is not grid-tied. The solar system was installed by Mauchly Electric of Plymouth, New Hampshire.

Another initiative was the installation of a composting toilet. It was set up on the live animal nature trail, next to the Gordon Children's Center and Interactive Playscape. Because a lot of people use the trail each year, the composting system is expected to save a lot of water, about 70,000 gallons each year. It will emit small amounts of water vapor and carbon dioxide, and it will produce compost. It is the Science Center's second composting system, and it was installed by Clivus New England, based in Lawrence, Massachusetts.

Squam Lakes Natural Science Center has a refreshingly interesting and very extensive web site, nhnature.org. ♻

Many thanks to our Sponsor: clivus new england incorporated



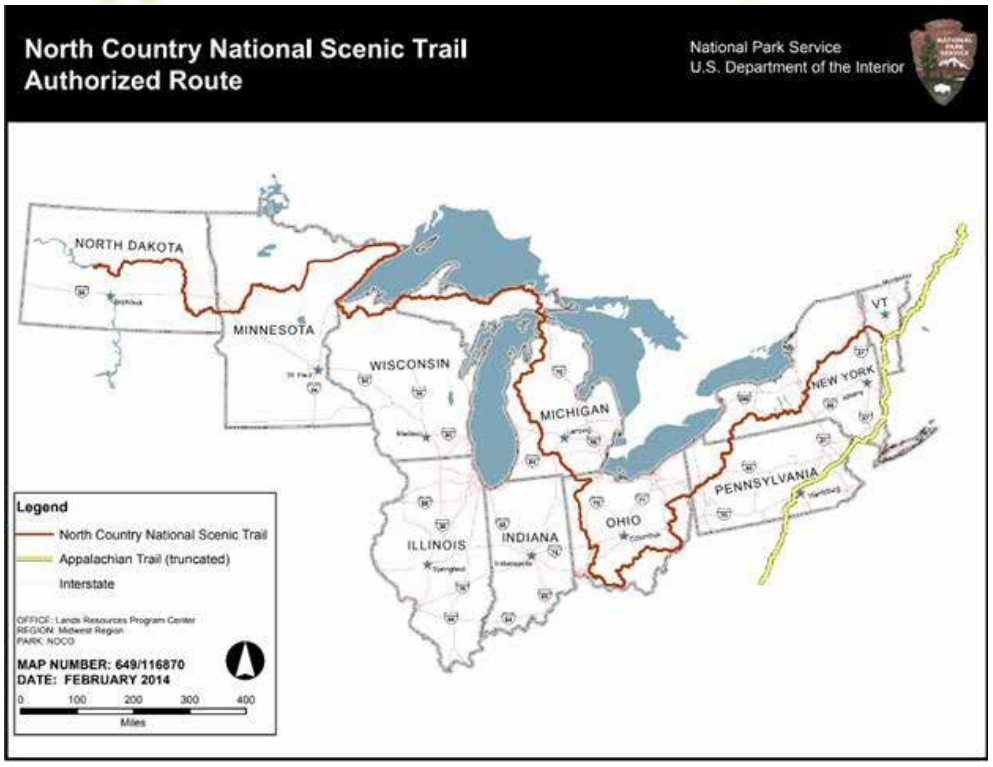
Congress Approves North Country Trail Extension into Vermont

Roger Lohr

This April, Congress approved bipartisan legislation, the North Country National Scenic Trail Adjustment Act, introduced by Vermont Representative Peter Welch that will extend the 4,600-mile North Country National Scenic Trail (NCT) from Crown Point, New York into Addison County, linking it to the Appalachian National Scenic Trail via Vermont's Long Trail.

"Vermont has unparalleled natural beauty that provides us with year-round opportunities to enjoy the great outdoors by trail," Welch commented. "As hosts to both the Appalachian Trail and the Long Trail, we have a rich tradition of trail hiking. Connecting the North Country Trail to the Long Trail and Appalachian Trail will provide Vermonters and tourists with even more opportunities to enjoy the great outdoors through hiking, recreation, tourism, and economic development."

The NCT is one of eleven national scenic trails, and some of them are within the National Park Service (NPS) such as the Appalachian Trail and the Continental Divide Trail. The legislation which included some adjustments to the North Country Trail took twenty years to get passed due to feasibility studies. The Senate (S.47) and House of Representatives (H.R. 2016) have passed, and the legislation has been signed by the President. The feasibility study has determined some of the route in Vermont, and there are some miles still to be decided.



The NCT is headquartered in Lowell, Michigan. The trail currently has trailheads in Lake Sakawea State Park in North Dakota and Crown Point in eastern New York. In the 2013 Feasibility Study, the Preferred Option C route has been identified as a Corridor of Opportunity across central Addison County, VT and would receive Federal approval. The NPS would work with and assist public and private interests and landowners in establishing and managing segments of foot trails between Chimney Point and the Long Trail. Within this corridor, a trail way that is approximately 200-1000 feet or more in width would be protected for North Country purposes. A wider trail way may be necessary to incorporate significant features of a particular area. The corridor is intentionally designed wide enough to allow flexibility in working with cooperating landowners to site the trail since all participation is voluntary. The established corridor will define areas for purchase using public and private funding and will serve as advisory information for town and county land use planning.

This preferred Corridor of Opportunity is approximately thirty-two to forty miles in length and five to seven miles in width and runs in a generally east-southeasterly direction across Addison County. The trail would follow the Long Trail south to Maine Junction and the Appalachian Trail, an additional distance of approximately 25 miles.

The NCT goes through North Dakota, Minnesota, Wisconsin, Michigan, Pennsylvania, New York, and when the leg is finalized, it will extend into Vermont. For more information, visit https://northcountrytrail.org/. The contact information is866-HIKE-NCT or nq@northcountrytrail.org.

Roger Lohr lives in Lebanon, NH where he writes about snow sports, outdoors, and sustainability. He is G.E.T.*'s recreational editor.* ♻

Hikers on wood planks: image from travlesfinders.com. NCT sign image from burninuptheroad.blogspot.com.

Boating with Muscles and No Motors

Tamsin Venn

Image: Tamsin Venn

One of the beauties of kayak touring is that it is so easy to do. Anyone can take up the activity with minimal instruction, and you don't need to be the Hulk to move your boat nimbly over the water. You go as far as your own paddle power will take you.

Kayak touring requires three basic items: A lightweight boat, no more than 35 pounds, one you can hoist onto the top of your car by yourself; a lightweight wood or fiberglass paddle; and a PFD or life jacket. Beyond that is an array of safety gear, depending on risks you want to take and what is required by law. That ranges from a whistle to an EPIRB (emergency position indicating radio beacon), T-shirt to a drysuit, see-you-laters to a float plan filed with friends or family.

The following are some of our favorite inland places to paddle in G.E.T.'s wide region. They share much in common: spectacular scenery, a chance for the rarity of complete silence, and good public access.

The Adirondack Park in upstate New York has more than 3,000 lakes and ponds and 30,000 miles of rivers and streams. They are vast, wild, and primal. You can string these bodies of water together via carries dating back to the Native Americans. Protected paddling (except when it's not), detailed maps, and lots of other paddlers make this one of the best places for paddlers in the Northeast. We return every summer to tour the Bog River, Little Tupper Lake, Round Lake, Rock Pond, Saranac Lakes, and Fish Creek to name a few.

New Hampshire's Squam Lake has good access from the Squam Lakes Association plus island camping. Grafton Pond bans motorboats with engines over 8 mph. The very remote Connecticut Lakes are a bird watching paradise. The Contoocook River is a silvery ribbon meandering through the countryside. The Mahoosuc Mountains provide a stunning backdrop for a trip down the Androscoggin River.

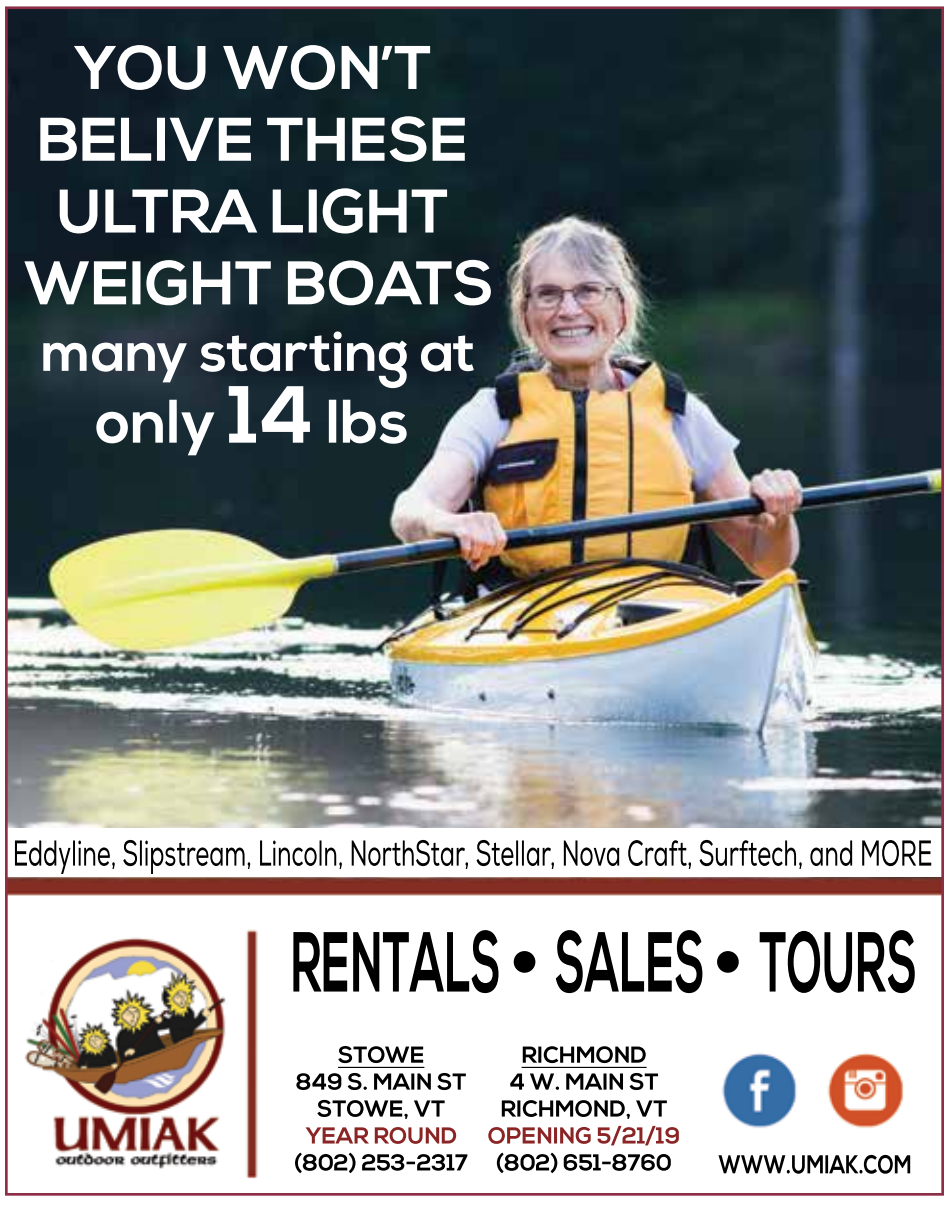
In Vermont, the Brattleboro Outing Club (BOC), one of the oldest civic outdoor sports associations in the country, hosts paddle trips every summer for members. Just show up with your own boat or board and related gear. Rentals are available locally through the Canoe Touring Center in Brattleboro. BOC goes to the Connecticut River, Tully Lake, Harriman Reservoir, Ashuelot River, and others. It's nice to paddle in the company of other kayakers.

The Charles River in Massachusetts has strategically located boathouses in the Boston area. You can spot a car and do a six- or ten-mile paddle downstream, stop at a restaurant for lunch, paddle through the locks next to the Science Museum and maybe paddle into Boston Harbor to see the USS Constitution.

In northern Maine, Appalachian Mountain Club (AMC's) new Medawisla Lodge and Cabins is completely off the grid and located on Second Roach Pond, with free kayaks and stand-up paddleboards provided. It sits in 70,000 acres of forestland permanently conserved by AMC as part of its Maine Woods Initiative. At nearby ponds, AMC has placed canoes at portages, so you can make your way from one pond to the next — moose and loon sightings guaranteed.

The AMC Quiet Water Guides are a good source for motor-free paddle trips.

Tamsin Venn is the publisher of Atlantic Coastal Kayaker Magazine: atlanticcoastalkayaker.com. ♻



Get a Robotic Mower and Take Back Your Time

NR Mallery

Robomow® RS630

Robots are all around us. From vacuum cleaners to vehicles, at work and home, they have arrived.

My personal favorites are my two robot lawnmowers. I tell everyone, they are the next best thing I have done since going solar seventeen years ago. I haven't mowed my two acres of lawn for four years now. It is actually hard to think of how I had the time to mow it before my Robomow RS630 mowers came to do it for me.

I did a lot of research before making my first purchase, learning what was available then. When I sat down to see what the reviews are saying for 2019 robot mowers, I was amazed at how many robot mower options there are today. They are flooding the market, but the Robomow brand is among the top mowers in every review I read! My own experience more than proves why the Robomow is still the one I recommend.

The Robomow website (usa.robomow.com) says it better than I can, but I CAN testify to this:

- The Robomow mower has over twenty years of experience in the robot mower industry. (I know an eye doctor near Boston who just replaced his original Robomow mower. After ten years, he still loves his as much as I do mine.)
- The Robomow is easy to install with no need to bury the wire. It is easy enough that most people can do it themselves.
- The consistent high performance means it is strong, fast, and is very easy to use. The wide cut on this powerful, yet quiet, mower makes my uneven lawn, formerly a cow pasture, look pristine with a better, consistent cut on all two acres.
- They mow the edging (no other brands offered this at my time of purchase).
- They are safe around children and pets.
- They do the hills without skipping a beat.
- The mowers have a rain sensor and go "home" when it rains.
- Did I say how quiet it is?
- There is no gas, oil or belts to maintain.
- I have my original batteries.
- My grass is 'greener' and healthier because of the super mulching from the double blades. The cut grass composts into the soil with no need for fertilizers to have a lawn that looks like a golf course. No emissions mean it is greener for the planet, too.
- There is never any residual grass to be raked or brought inside from your shoes or pet's feet.
- The support person I deal with knows the mowers in and out and is there when and if I need him. There are also guides and tutorials available.
- And, of course, there is an app for it, too.

Time is precious to most of us. Money is, too. My experience shows that robot mowers give you back your time and are well worth their initial cost, which is much less than a riding mower, but can do a better job, without YOU. I think a robot mower worth its weight in gold. Keep in mind how much your time is worth if you do the mowing or how much you pay a service per year. And how much does it cost for fuel and maintenance of your current mower? Is your lawn always mowed, raked, healthy with no fertilizers added, and what is the noise level when the lawn is being mowed by the service or you?

Although I am quite partial to my Robomow, there are many options on the market today. There is no longer a need for people to mow lawns when the robot can do it for you. I am still thrilled every time I notice them going past the window. I can only speak for the Robomow brand. ♻

Other Eco-Friendly Mowing Options

For those of you who still like to mow your lawn, there are other great eco-friendly, electric lawnmower options available. There are walk behind mowers, and riding mowers available, such as Mean Green Mowers. This was covered in *G.E.T.'s* April 2017 issue on pages 38 and 39 which is available on the *G.E.T.* website: greenenergytimes.org. ♻

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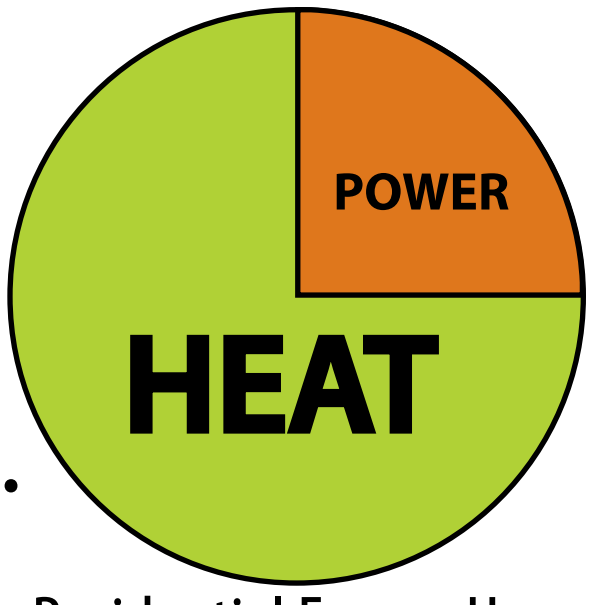

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