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## Wallace Broeker's FINAL WARNING

*George Harvey*

Wallace Smith Broecker, the man some people have called the "grandfather of modern climate science," died on February 18, 2019. He was 87 years old and had been suffering from heart disease for decades. He worked despite his illness, and he addressed other climate scientists in an important discussion only a week before he died. Speaking to them, he gave the people of our planet a warning.

Because of his health, he was not able to meet his colleagues face to face. Instead, he had to give a recorded message. He sat in a wheel chair and breathed air enriched with oxygen from a tube. He knew he was in rough physical condition, but he told his audience, "My mind is running pretty smoothly."

His message was simple. We are not moving fast enough to stop climate change, and we have to work much, much harder. To do otherwise is unacceptable for the sake of the survival of humanity. He also spoke of one way we might stop it, although he only considered it as a last ditch effort. It would be a possible option even if we wait too long for emissions reductions and conventional carbon draw-down methods to work. That way is called "geo-engineering." It is not the most desirable approach but may be what we will have to do, if we wait too long.

*Wallace Smith Broeker, the grandfather of climate science. Image: Wikipedia*

Broecker had worked a long time in the field of climate science and in disciplines to which it is related. In 1975, he published a paper called, "Climate Change: Are We on the Brink of a Pronounced Global Warming?" The title was the first mention of global warming that made any impact on the minds of many people.

Broecker also brought popular attention to the

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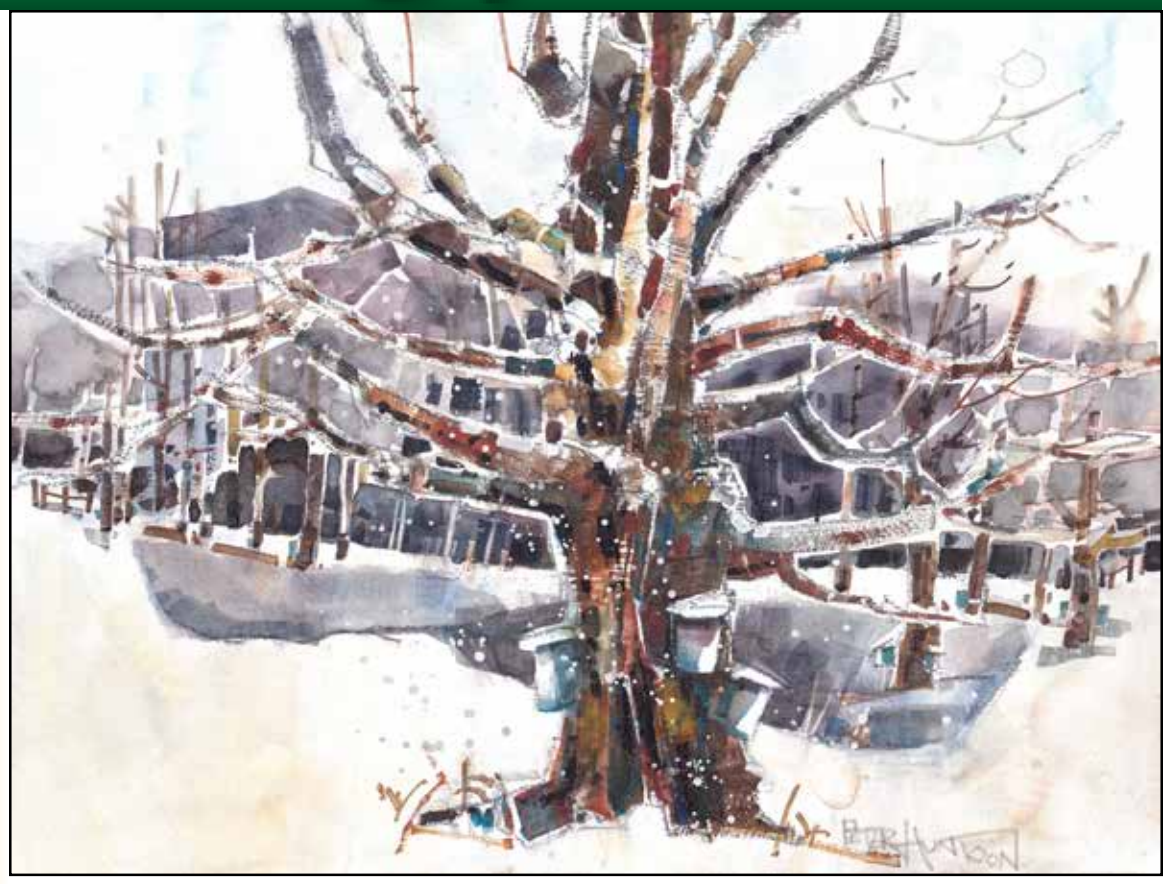
## The Sap is Rising!

**Cold nights and warm days bring in maple sugaring season in Vermont. Many operations today use tubing, but there are still a few sap buckets around that find their way back to the old maples year after year.**



*Painting courtesy of local artist, Peter Huntoon. This 2009 painting, "Sap Rising," is just one from Huntoon's weekly paintings based on scenes that he finds while traveling throughout the state. 'A Day in Vermont' collection celebrates the beauty of Vermont through art. See the full collection of prints at: ADayinVermont.com or peterhuntoon.com.*

## GREEN ENERGY TIMES EXPLAINS THE GREEN NEW DEAL

*George Harvey*

For all the talk about the Green New Deal (GND), I suspect that the number of people who really understand it is not large.

To start with, it is a very general plan about how to deal with a wide set of problems. It does not contain many specifics. There are broadly stated goals, but there are no details on how they are to be achieved. It only requires that the specific details of the goals, the programs, and the finances be addressed in the near future. There is no allocation of money.

The GND arises out of a perception that our country needs to be run sustainably. It is hard to imagine that any thoughtful, patriotic American would oppose this. Sustainability, whether environmental or economic, will not happen by accident. In the absence of at least some effective planning, we can only operate in an economic system narrowly focused on selected specifics, such as current revenues and costs, to the exclusion of anything else. In such a system, our democracy and our freedoms will pass into history as failed experiments, as we fail to steward the environment's ability to support our lifestyle.

The GND addresses the issue of sustainability by setting goals we can achieve for the environment, our health, and employment. It says we will be carbon-neutral in ten years, we will offer health care to all, and we will make sure that everyone can earn a livable income.

The hardest part of the GND may not be paying for it. In fact, it may pay for itself.

The energy side of the GND could turn out to be easily achieved. Falling costs of renewable energy have already hit parity with fossil fuels. Electric vehicles are already competitive with those dependent on gas and oil. Heat pumps already save money over carbon-based systems. Efficiency beats all else. And the nature of the technological learning curve (Wright's Law) is that the falling costs will continue to fall for some time, quickly making fossil fuels impractical.

We could save hundreds of billions of dollars each year just by eliminating air

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## GREEN ENERGY TIMES (G.E.T.)

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*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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**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 (G.E.T.)* will be celebrating our 10-year Anniversary in our May 3rd edition!

### May 4, 2009 – May 3, 2019

**We need your support to continue for the next ten years. Our mission-based resource publication is making a difference all around us, but we have a long way to go and much to do.**

Please consider donating directly on-line at greenenergytimes.org

or send your donation to 1749 Wright's Mountain Rd., Bradford, VT 05033.

You can align yourselves with *Green Energy Times* and all that you read about in each editon of G.E.T. Don't hesitate to join in our efforts.

Sponsorships, advertising and donations will help us keep going.

**There is no Planet B and the time is now to help us educate all those who pick up *Green Energy Times* or read it online. Let's keep it free.**

***With your support, we can continue for another ten years.***

# Remembering Jeff Skelskie

*Green Energy Times Team*

We at *Green Energy Times (G.E.T.)* want to take some time to remember and appreciate Jeffrey Wayne Skelskie, 70, who passed away at his home on February 17, 2019.

Jeff started his battery company, Special Services, as a Saab, Jaguar, Volvo, and Porsche mechanic, but he turned it into a distributor business for wire and cable connections. His knowledge of both batteries and solar power was extensive, and he spent a lot of time educating people in seminars on battery maintenance. He became known as the "battery doctor" for diagnosing battery bank problems for off-grid homes. He was known for his precision custom cables and wiring of battery banks that were said to look like works of art.


*Here is Jeff, next to his electric-powered truck, proudly displaying that it was electric-powered. Photo courtesy of Solarfest.*

For years, Jeff and his wife, Wenda Luff, volunteered at Sugarbush Resort in Waitsfield as adaptive ski instructors. This, however, was just one instance of his helping others.

He was involved with SolarFest since the 1990's, as a member of the Board of Trustees, advisor, technician, educator, exhibitor, and all-around participant in the fun. Most recently, he ran the information table at the 2018 SolarFest and offered guidance for 2019 planning. The SolarFest team said that Jeff's knowledge and enthusiasm will be greatly missed.

In years past, Skelskie dedicated a lot of time to the Northeast Sustainable Energy Association (NESEA) with Tour de Sol, as he clearly believed in doing all he could to help us transition to a fossil-free sustainable future. He was in charge of setup and takedown of the various stops on the Tour de Sol, and he helped with Junior Solar Sprints for many years. He received the NESEA Service Award for his contributions.

Pictured is Jeff's Chevy S-10 truck that he converted to run on battery power. It was 120-volt DC, and he used it as a power source at many venues, including the Garlicfest in Orange, Massachusetts. He ran power for off-grid stages at Pete and Toshi Seeger's Clearwater Festivals.

Jeff and Wenda voluntarily helped *Green Energy Times* with distribution in the Pioneer Valley of Massachusetts for many years, spreading the word on clean energy. He was always willing to provide assistance and believed in our mission. Jeff proudly kept a copy of every edition since *G.E.T.'s* inception in 2009. We valued his help immensely.

He will be missed greatly by all those whose lives he touched. The funeral service was held on February 23rd. There will be a short graveside committal on May 11th at 3:00pm in Rochester, VT at Woodlawn Extension Cemetery. ♻



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## G.E.T. EXPLAINS THE GREEN NEW DEAL

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pollution. It has long been recognized that it will be cheaper to prevent or treat medical problems before they become major problems than in emergency rooms.

Similarly, it has long been seen that it will be cheaper to employ people than to deal with the problems arising from their being unemployed.

A so-called free market is being exploited by people who donate to political campaigns to make sure politicians act according to their wishes. But the market, as it stands, is only free for oligarchs who dominate it. Freedom does not arise out of an unregulated system. I know of no one who would advocate for freedom to murder or steal. Sane market regulation is a requirement for a truly free market, not an impediment to it.

The current political regime has us tied to fossil fuels and a pursuit of American greatness in obsolete technologies. The result of this is that countries like China and India have surpassed us in vital economic activities ranging from vehicle production to computer engineering. Today, America is trying to enter the future by living in the past, hardly a path to greatness. We need a Green New Deal to save us from inevitable failure of a system that pretends its own sustainability is unimportant.

If our nation can become a place where everyone is employed and healthy, living in a clean environment, then we will have a nation wealthy beyond our current expectations.

Achieving the Green New Deal's Energy Goals

Opponents of the GND have claims ranging from the idea that electric grids would not be reliable with just renewable energy to the notion that supporting it would destroy the economy. These claims usually seem to be backed by obsolete data or unsupported suppositions. One source worth mentioning, however, is the Department of Energy's Energy Information Administration; the history of that organization's long-term projections on growth of renewable energy shows that they have consistently been wildly off the mark.

Backing for the GND, however, has been growing. The federal GND bills calling for it have 89 co-sponsors in the House and 11 in the Senate. A number of the presidential candidates have endorsed it. Others may join, as the issue is pressed by powerful, active forces.

One of these forces arises powerfully from a level of society that is among the least well represented. Our children, seeing that their futures are at stake, are demanding action. Between now and the next general election, millions of Americans will become old enough to vote. Any politician who does not pay attention to the future of the children is risking the future of his own place in politics.

This issue will not wait. Clearly it is highly unlikely to pass in both chambers and be signed by the president. Action at the federal level will be delayed until the climate deniers are no longer in control. That really does not matter in the end, however, because the movement can achieve huge success elsewhere. There is an adage for the environmental movement that is vitally important. It is, "Think globally – act locally."

This is not an issue that we should be content to watch our politicians fight over in Washington, D.C. We cannot allow action on it to be delayed until after the next election. Fortunately, it is an issue that we can win by taking it upon ourselves to move more amenable powers. The effects can already be seen.

It has been picked up by state governors, leaders in state legislatures, counties, and municipalities. Among the states importantly moving on the issue are New York, Massachusetts, Maine, Colorado, and Illinois. All three of Vermont's congressional delegates have endorsed it. It is being pursued by leaders in many states. (Please see the article on the Green New Deal in New York on page 3.)

According to an article in the Los Angeles Times, Los Angeles Mayor Eric Garcetti decided to cancel billions of dollars' worth of natural gas plants under development because of the health, environmental, and economic problems that the plants represented. "This is the Green New Deal," he said. "Not in concept, not in the future, but now" (http://bit.ly/LATimes-GND).

Los Angeles is not the only place where progress is being made. Support for climate action and the other goals for the GND is so widespread and extensive that it is hard to keep up with its current status locally.

Of course, environmental groups have run a number of closely related programs for years. One of the best known is the Sierra Club's Ready for 100 campaign. (http://bit.ly/ready-for-100) This is an issue that can succeed without support of the federal government. We, the American people, can bring it about by acting at the state, local, and personal levels. ♻


*Green New Deal presented by Representative Alexandria Ocasio-Cortez and Senator Edward Markey. Photo: Senate Democrats, Wikimedia Commons.*

## New York's Green New Deal (For Dummies)

*Jenna Batchelder*

On January 15, Governor Cuomo of New York announced his bold plans for the "Green New Deal," (not to be confused with the recent proposal of the same name made by congresswoman Alexandria Ocasio-Cortez) as a response to pressure from progressives concerned about rapid climate change.

This comes on the heels of the "Renewing the Energy Vision (REV)" proposal made by Cuomo in 2016 aiming to enact major changes to New York's energy usage. The REV proposed a switch to 50% renewable energy statewide by 2030, a 20% cut to energy usage in state buildings by 2020, an investment of $1 billion in clean energy technology and projects, a commitment to producing 2400 MW of wind energy, 3000 MW of solar, and 1500 MW of energy storage. The proposal also outlined plans to create new jobs and support cleaner transportation. This bold plan was met with enthusiasm from progressives and clean energy advocates alike.

In his 2019 Justice Agenda, Governor Cuomo called for even more aggressive steps to be taken towards clean energy reform, stating his goal for 100% carbon-free electricity across the state by 2040, an unprecedented increase from his 2016 REV proposal.

This new plan is ambitious but, if pursued, would ensure a more sustainable future for New York. The key points include an increase to 70% renewable energy by 2030, another $1 billion towards clean energy technology and projects, and a whopping $250 million commitment to electric vehicle infrastructure. There are plans to strengthen building energy codes and appliance efficiency standards, develop a "Net-Zero Roadmap" to bring us closer to statewide carbon neutrality in buildings, and ensure state agency facilities uphold strong sustainability and energy efficiency standards. The projected energy from the REV will increase dramatically with New York's offshore wind target quadrupling to 9000 MW, energy storage doubling to 3000 MW, and solar projections also doubling to 6000 MW. Finally, the Green New Deal proposes to expand the Clean Energy Communities program that incentivizes communities to buy and produce clean energy, as well as increasing funding for workforce development.

"Amidst the Trump administration's assault on the environment and in order to continue New York's progress in the fight against climate change, Governor Cuomo is announcing New York's Green New Deal, a nation leading clean energy and jobs agenda that will put the state on a path to carbon neutrality across all sectors of New York's economy," Cuomo's press briefing stated.

This new proposal was met with both shock and dissent from conservatives concerned with the effect it would have on the economy. However, it is more likely that the Green New Deal would jump start the economy with many new jobs, especially with state funding for clean energy education. An ambitious and bold proposal in its own right, it offers the chance for a sustainable future in the face of climate change. Although there are those who may argue against it, a possibility at a brighter future speaks for itself.

*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.* ♻

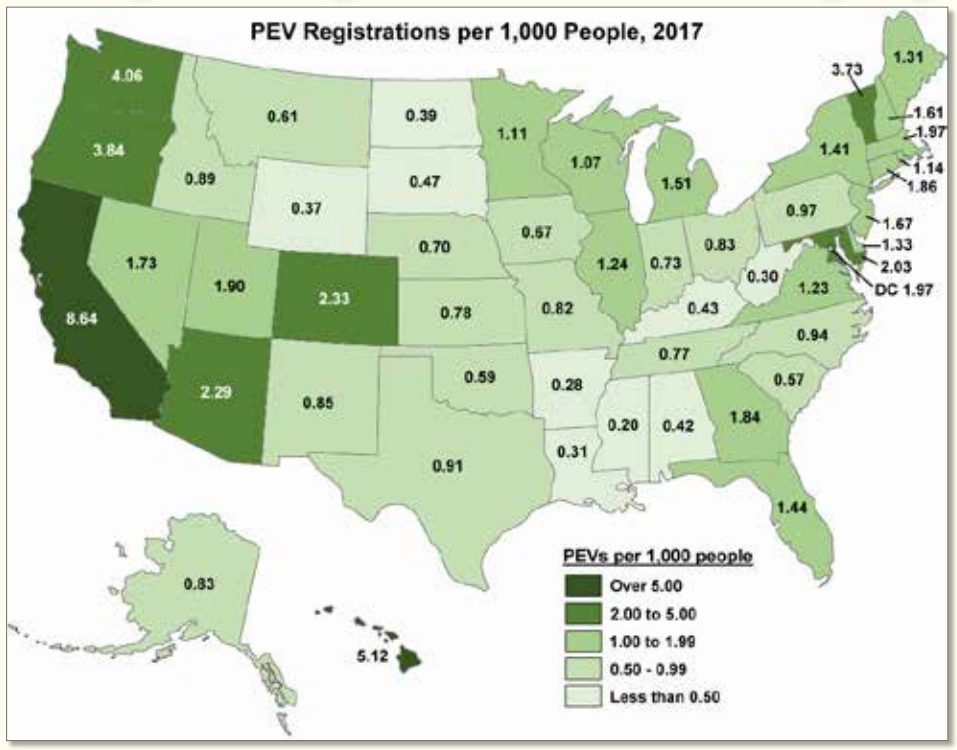
# Vermont Considers Regulating Electric Car Charging

*David Roberts*

Greater availability of new and used plug-in electric vehicle (EV) models combined with purchase incentives, charging infrastructure investments and growing consumer awareness are supporting transportation electrification across the region. The advent of longer range and more affordable plug-in electric vehicles (EVs) continues to boost sales in the northeast.

Many states are struggling with reducing transportation greenhouse gas emissions and have recognized the important role electrification can play in meeting climate and energy goals when done in concert with broader transportation efficiency programs to reduce vehicle travel. As an example, the State of Vermont's comprehensive energy plan calls for 10% renewably powered transportation, or about 50,000 EVs by 2025, growing to 90% of vehicles to meet the goal for 90% renewable energy across all energy sectors by 2050.

As EVs grow from less than 1% of registered vehicles to 10% (or more), there are unique issues many states and electric utilities are ensuring this shift brings the greatest benefits at the lowest possible cost to society. State public utility commissions have a special role in these efforts as they oversee a variety of regulatory programs affecting electric utilities and consumers.




*PEV include both all-electric vehicles and plug-in hybrid vehicles. Sources: PEV registrations – U.S. Department of Energy analysis of IHS Automotive data. Population – U.S. Census Bureau, Population Estimates, Annual Estimates of the Resident Population. Courtesy: U.S. Department of Energy.*

The Vermont Public Utility Commission (VT PUC) was directed by the Vermont legislature to launch an investigation into EVs by Section 25 of Act 158 of the 2017-2018 session (https://legislature.vermont.gov/bill/status/2018/H.917). The full charge to the VT PUC on EVs covered thirteen specific areas - the seven issues listed below are potentially of greatest interest for EV owners and those seeking to advance their adoption:

1. Reducing barriers to EV charging deployment, including strategies such as time-of-use rates to reduce costs;

2. Strategies for managing the impact of EVs on the electric transmission and distribution system;

3. Electric system benefits and costs of EV charging and electric utility planning for EV charging;

4. The recommended scope of government regulatory jurisdiction over privately owned charging stations;

5. Pricing of public charging and transparency to the consumer of rates;

6. How EV users will contribute toward the cost of maintaining the State's transportation infrastructure; and

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# VT Green Transportation Challenge Incentivises K-12 Schools

*Deb Sachs*

## May 22 Deadline to Sign-up and Earn Points for a Chance to Win

*Walk to School Day, Miller's Run School, Sheffield, VT Credit: Soph Hall*

Way to Go! to School, an award winning, incentive-based program encourages everyone to make smart travel choices to school (i.e., walk, bike, carpool and take the bus). Already, 72 schools and more than 20,000 faculty, staff and students are participating in the 2018/19 Way to Go! School Challenge. Schools are battling the growing carbon pollution problem by demonstrating how active or sustainable transportation habits really add up to hundreds of thousands of pounds of greenhouse gas emission savings!

Organizers have designed this interactive program to support green transportation efforts in Vermont K-12 schools. Beyond travel behavior, Local Motion, Vermont Energy Education Program and others are helping develop school travel plans and organizing pop-up demonstration projects to improve infrastructure for walking and biking.

Edmunds Middle School in Burlington, for example, installed a pop-up protected bike lane, and Rutland's Christ the King School added curb extensions to calm traffic. In both cases, the school and community came together to install temporary materials to improve safety for students wishing to travel to school on foot and by bike.

There is still time for others to sign-up and earn points until May 22. A special incentive to all schools is offered if they sign-up by Wednesday, May 22 for a chance to win 25 pairs of Darn Tough Socks (to be raffled to six lucky schools). We encourage administrators, public health professionals, educators, parents and volunteers to check the status of their school at http://www.waytogovt.org.

**How It Works:** Participation in Way to Go! is easy and free. It's designed to engage all ages and Vermont schools to make incremental steps to save money and reduce environmental impacts through greener travel options, including riding the bus and carpooling. Identify a school coordinator, sign-up, select a fun activity like "snowshoeing to school", or simply choose to do one or more transportation-related activity from the broad menu of activities.

Report all activities and earn points for great incentives like free helmets and bike racks. Fifty points gets your school in the running for grand prizes: AllEarth PowerFlower and QOR360 active chairs! Learn how it works, how to earn credits and earn prizes at http://bit.ly/HowitWorks_WaytoGo. We are ready to support the good work you are doing with technical expertise and incentives, rewards and recognition for actions that makes a difference, no matter how small.

**It's Go Time!** Upcoming events to help you in your work are listed below. Mark your calendars!

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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**

# The Cheap Gas Station in Your Garage


Image: Flickr/Steve Jurvetson

What if you could go to a new gas station and fill up for 60¢ per gallon? How much would that save you and your family on fuel every month? Well, there's no need to go to the gas station to get this great deal. Now, you can fuel up for the equivalent of 60 cents per gallon right in your own garage thanks to Burlington Electric Department's (BED's) new residential electric vehicle (EV) rate, and do so with 100% renewably-sourced energy.

Here's how it works:

- **Get an Electric Vehicle** - Purchase or lease an EV by taking advantage of the purchase and lease rebates that BED makes available to customers, as well as financing support through three local partner credit unions. BED offers an increased rebate for low- and moderate-income customers to help make EVs more accessible for all.
- **Install an Eligible Home Charging Station** - If you purchase or lease a new EV, you may receive a BED incentive toward the purchase and installation of qualifying charging hardware that makes you eligible for the new EV rate. If you already own an EV, or have a plug-in hybrid, you still may sign up for the EV rate after installing the qualifying hardware (without the incentive). Currently, the qualifying hardware includes a level 2 home charging station from a participating charging station partner.
- **Charge Up Off-Peak at the Equivalent of 60¢ per gallon** - Once you have installed your home charging station and signed up for the new rate, *schedule your vehicle to charge at home between 10pm and 12noon (the following day)*, and you will receive a bill credit that reduces your EV charging rate to 8¢ per kilowatt hour. With BED's new, special rate, the cost of charging your EV is roughly equivalent to 60¢/gallon of gas.

Once you are signed up for the EV rate, you still may decide to charge outside the 10pm to 12pm timeframe, but your charging rate for that entire month would be the standard residential rate. Then, you would be eligible for the special eight cents per kilowatt hour EV rate again the following month.

With many new EV and plug-in hybrid vehicles coming to market, including more all-wheel drive and four-wheel drive options, BED customers have increasingly affordable and practical choices. In addition to the new home charging rate, EV drivers also have options to charge around the City at one of BED's 14 public charging stations that offer 26 charging ports. For all the details on EV rebates and the EV charging rate, including eligible hardware choices from a participating charging station partner, and a map of public charging stations, please visit www.burlingtonelectric.com/EV.

The new EV rate and our EV incentives are part of a vision for the future where we utilize the electric grid to meet more of our transportation needs. Mayor Miro Weinberger has outlined, and BED has adopted in our 2018-19 Strategic Direction, a goal to make Burlington a Net Zero Energy City by 2030. In addition to the new EV rate, BED is helping the City move toward the Net Zero goal by providing incentives to bring electric transit buses to Burlington and by offering instant rebates on electric bikes at local retail shops.

BED's efforts to support EVs provide a benefit for both our environment and our economy.

Environmentally, EVs and plug-in hybrids reduce air pollution and greenhouse gas emissions relative to conventional vehicles. This is especially true when EVs are charged on BED's grid, which is powered by 100% renewable energy. With transportation now making up the largest source of greenhouse gas emissions in Vermont, EVs and other modes of electric transportation offer opportunities for meaningful emissions reductions.

Economically, the new EV rate is a great deal for EV drivers at the equivalent of 60¢per gallon of gas. But the best part about our EV rate, however, is that it will help more EV drivers charge off-peak and use the grid more efficiently. When our community uses power off-peak, we avoid the need for additional grid infrastructure investments and avoid additional costs, providing a benefit to all BED customers and ratepayers. In addition, Vermont sends over $1 billion annually out of state to import fossil fuels. Electric transportation provides the opportunity to use our own resources - the local electric grid and local EV charging stations - instead of distant and finite fossil fuels.

Electric transportation represents a significant part of our Net Zero Energy City strategy for Burlington and helps us contribute toward meeting the goals of Vermont's Renewable Energy Standard. BED's new EV charging rate is another opportunity to make driving an EV more affordable for Burlingtonians. We hope you will consider driving electric in the future. ♻

# Drive Electric New Hampshire
## Five Years of Pickup-SUV Ads, Really?

*Randy Bryan, Drive Electric NH*

*Sorry, this is an opinion piece. I can't help myself. I've already seen one too many truck and sport utility vehicle (SUV) ads.*


Seeing the spectacular rise of Tesla in 2018 has been tremendous. From a hopeful to a real player. They are starting to reach profit stage and redefining the industry. It is Tesla's production that propelled U.S. Plug-in Electric Vehicle (PEV) sales to an 81% growth rate in 2018. Let us hope their growth continues into 2019.

Personally, I don't see much PEV competition for Tesla this year and maybe some next year. The German car companies Volkswagen, Audi, Porsche, and Mercedes have to reboot their designs yet again to be competitive and profitable. Toyota and Honda started late and are still years out. Hyundai and Kia are showing promise with their SUV and crossovers, but I hear of low volumes in 2019. The Chinese are going gangbusters at home but not stepping out of China yet. So, Tesla has the field. There's plenty of demand for Teslas, but they may be running into sales limits at their current price point. Tesla's solution is to continue ramping production, drive down costs and price and sell more overseas. As a result, I don't expect 2019 to be a big U.S. PEV growth year, maybe 30-50% growth, though Tesla may grow 80-100%. Where are the other players? How many PEV ads have you seen on TV so far? How many PEVs do you see filling the lots of car dealers? Hardly any.

I am saving my biggest disappointment for General Motors (GM) and Ford. Both have announced to the world that they no longer will produce sedans and will focus on gas guzzling trucks and SUVs to make money for the transition to electric vehicles (EVs). That means we may have to watch five years of non-stop truck and SUV ads. That might work for a year or so, then the makeup starts to melt. Unfortunately, they have little choice now that they foreswear the car market years before they had viable EV designs ready. It will take 3-5 years to get those designs to market in volume.

So, one asks, if Tesla made a profit by producing in volume, why doesn't GM start producing 200 thousand Bolts and Volts per year and clone the drivetrain to other vehicles to get profitable? The answer is complex, but basically, I don't think they can. They shut down the Volt future when they announced the end of plug-in hybrids and the Cruse (car frame for the Volt). The drivetrain port to Cadillac didn't sell. The Bolt is a good effort at pure EV design but still not low enough cost to make in volume for

*Cont'd on p.7*

# ReVision Energy and Energy Emporium Merge

*George Harvey*


*Energy Emporium's home base in Enfield, NH will soon be re-named ReVision Energy. Photo courtesy of Kimbery Quirk.*

There are some companies that keep coming up with good news. Two of them, both companies that *Green Energy Times (G.E.T.)* has covered in numerous articles and on-line postings, are ReVision Energy and Energy Emporium. On February 4th, they announced that they are merging.

In some ways, the two companies were very different. ReVision Energy has five offices in three states and 250 employee-owners. Energy Emporium had a single office in New Hampshire, run by co-owners Kim Quirk and Anita Gonzales, along with three employees.

Even so, there are reasons why the merger makes perfect sense. Despite the clear difference in size, the two organizations share a common approach to their work that is deeply important to both. They both work to benefit their customers to the best of their abilities, reducing both fossil fuel use and energy costs, and in that they are a clear match.

ReVision Energy is a certified B-Corp. This means that the bottom line for the company is not profit but making a difference, benefiting the communities, the customers, and the environments wherever it works. It is also an employee-owned cooperative.

ReVision Energy has been increasingly active in the Upper Valley area of New Hampshire and Vermont. Its work in that area include large systems installed at Dartmouth College. ReVision Energy's work shows up in nearly every issue of G.E.T. One example is in the article, "New Hampshire's First Multi-Family Passive House," which appeared in the June, 2018 issue (bit.ly/GET-NH-1st-passive-house). ReVision Energy co-founder, Dan Clapp, made the scope and scale of the company's goals clear when he said, "ReVision's mission is to transition our region to 100% solar and solar-powered complementary technologies, and the Upper Valley is critical to that effort."

Energy Emporium of Enfield, New Hampshire, founded by Kim Quirk, has been focused very closely on customer benefit and satisfaction. Though it has not been a B-Corp, its values are very much to the benefit of the customers and communities. The business was the subject of one of *G.E.T.'s* "Getting to Know Your Solar Installers" articles (bit.ly/GET-EE-solar).

It has also been held up as an example of an effective organization run by women in a field some people think of as male-dominated, as G.E.T reported in the April, 2017 story "One Woman's Amazing Story: Solarizing In The Upper Valley." That article described how Energy Emporium provided solar systems for fifty-three homes taking part in a solarize campaign in one year (bit.ly/GET-EE-solarizing).

We asked Anita Gonzales, an employee at Energy Emporium, about the merger, and she made it clear that the largest part of the reason was ultimately to benefit the customers. "We really like our customers," she said, "We want to be able to ensure that they are taken care of in the long term." ReVision Energy will continue to serve Energy Emporium's customers as its own. The service will, in fact, come from the same physical office in Enfield, though with a different name on the sign. And it will be done by the same people, because Quirk and Gonzales will be employee-owners of ReVision Energy.

Other benefits for the customers include greater access to service and offerings than Energy Emporium could provide. The merger will allow the customers to get the benefit of experience and knowledge in a wide range of technologies beyond solar systems, including solar powered heat pumps and vehicle charging systems.

In the merger, ReVision gains an Enfield office with connections to local communities in the Upper Valley, into which they were already expanding. For its part, Energy Emporium became part of a larger B-Corp, which means that its values have become official parts of the corporate charter, and its people are now employee-owners. For the customers, it means that service continues as before, with added benefits.

The new ReVision Energy office, formerly Energy Emporium's, is in Enfield, NH. It is in a house built in the 1850s, which Kim Quirk had retrofitted to be a zero-net-energy building. ReVision Energy also has offices in Portland and Liberty, Maine; Brentwood, New Hampshire; and North Andover, Massachusetts. ♻

## Drive Electric New Hampshire

*Cont'd from p.6*

the existing price point. Also, their battery chemistry is still loaded with cobalt which is expensive. It will take years to get the cobalt out with street-worthy chemistry. With EVs remaining a money loser, GM will keep the volume low. Even worse, GM's federal tax credit is running out. And for risk, they announced Cadillac as their new lead brand for electric vehicles, then promptly admitted the EV transition may be Cadillac's last chance to get it right (Saturn redux anyone?). Ford's story is similar to GM's. They started a few months earlier but have a longer way to go. Don't even bring up Chrysler. Maybe Apple will rescue them.

To be sure, there is some good news here. GM and Ford have committed to serious EV transitions and focusing sales and production on trucks and SUVs will be keep them profitable for a while. GM leading with the Cadillac brand might be smart with upmarket potential for early profit on performance EVs. But can Cadillac get it right? When will they ship the first EV? A recent trade article predicted three years. Ford said they will focus early on the Lincoln brand (yawn). GM and Ford also announced they will develop PEV trucks and SUVs. Hooray! I see promise there but still over three years out.

So, again, sorry, we're in for five years of mind numbing truck ads! Enjoy.

*Randy Bryan is one of the co-founders of Drive Electric NH. Bryanhas been an advocate for electric cars for eight-plus years. His company, ConVerdant Vehicles, has converted vehicles to plug-in hybrids, including his own Prius in 2008, and developed and sold inverters that turn a Prius into an emergency generator.* ♻







# Solar Power for Sunset Lake Farm

## *Provides Multiple Layers of Sustainability*

*Steve Snyder*

*The new Sunset Lake Farm dry cow barn with its newly-installed 178kW solar PV system. Rt: The interior of the new barn in Alburgh, Vermont. Photos by Jim Merriam, Norwich Solar Technologies.*

When its 178kW solar electric system went online in November, Sunset Lake Farm owner Sam Bellavance was returning to his clean energy roots to boost the sustainability of his family's dairy farm. Before becoming project manager of the farm, the 24-year-old Bellavance worked for the DC Sustainable Energy Utility in Washington, DC and as a solar installer in Vermont.

For Bellavance, sustainability means more than just green living. It also involves the long-term viability of his dairy farm by limiting risks to the operation brought on by a host of factors, one of which is unpredictable energy costs and future availability. Another is ensuring a reliable source of water and ample land to grow fodder for his medium-sized Vermont dairy.

Bellavance said that although he received offers to install methane digesters or wind turbines on his land, solar photovoltaic (PV) was a better fit. "Time is a farmer's most valuable commodity and solar doesn't take up the time to operate that a digester would, or the space required for commercial wind. Because we have a barn engineered to withstand New England's snow load, rooftop solar made a lot more sense. And we didn't have to use valuable farm land," he said.

Sunset Lake Farm is a member of the 360-farm St. Albans Cooperative Creamery as well as Ben & Jerry's Caring Dairy Program. The Caring Dairy Program helps more than 70 farmers in the program to evaluate their sustainability, while helping them develop and implement improvement plans for creating a sustainable future for dairy. Adding a clean energy system helped Sunset Lake earn a Gold Rating in the program. "Financial incentives provided by the Ben & Jerry's program to make our farm more sustainable were rolled back into the farm and allowed us to go forward with our solar project," Bellavance said. "This is making a difference."

The PV system Norwich Solar Technologies installed on Sunset Lake's dry cow barn will provide long-term energy savings and stability. The newly-constructed barn has 18,000 square feet of unshaded and low-angled space for optimal solar electricity production. Additionally, the solar PV array will help shield the metal roof from the elements and extend its life.

Bellavance added, "The way solar produces peak power mid-year matches perfectly the cycle of when a dairy farm uses the most power. Peak consumption is a hot July day, and with ventilation fans running nonstop at full speed there are significant energy costs." Solar power will cut his Alburgh power bills by two-thirds. "Federal and state tax incentives and a USDA REAP grant cut my out-of-pocket cost dramatically," said Bellavance.

Sunset Lake's PV system is expected to produce 195,555 kWh per year, enough to cover the energy costs for the milking parlor and fresh cow barn. Other sustainability attributes include offsetting about 8,900,000 lbs. of $CO_2$, the equivalent of planting 102,483 trees or 9,204,000 miles not driven over 25 years.

Bellavance says solar also gives him more choices for future operations at the farm such as greenhouses, kilns, or cheese-making.

*Steve Snyder works for Norwich Solar Technologies. To lean more visit norwichsolar.com. Contact Steve at 802.359.7406 or steve.snyder@norwichsolar.com.* ♻

# Even Greener Recycling at TAM Waste and Recycling

*Jessie Haas*

Trevor Mance of Pownal, VT has always considered himself "the ultimate environmentalist." This led to starting a business, TAM Waste and Recycling, when he was still in high school. As a 17-year-old, he couldn't legally own a corporation, so his father had to be president for a year, but at 18 Trevor deposed his father and took over. Twenty-three years later, his business has grown from 60 stops on a Saturday, to a fleet of 40 trucks handling 50,000 tons of waste, 8,000 tons of recycling, and a large compost yard.

Mance wanted to "go solar" for years, but the time was never quite right. At one point a few years ago, he made the choice to 'go down the composting path' for environmental reasons. But with the recycling market in the doldrums, solar became imperative both for environmental reasons and to reduce costs. When TAM built a large building to house a tip-floor, they also did the engineering necessary to make the roof strong enough for an array. The extra cost was small, so they went ahead. Two more years passed while they applied and re-applied for a U.S. Department of Agriculture (USDA) grant. When that didn't come through, Trevor went ahead and self-financed the project.

To design and install it, he turned to Bhima Nitta, of Power Guru Electric Systems in Bennington. Nitta, a native of India, came to this country in 1987 for graduate school. He worked in the chemical industry for years but had a growing longing to do something for the environment. He moved to Vermont in 2008 and began his solar business with a small installation on his own garage. From a slow beginning of a couple of installations a year, his work increased steeply, and he now averages fifty a year.

For TAM he installed a 92kW array of 288 Hanwha modules, 144 SolarEdge optimizers, and one 100kW SolarEdge inverter. The project had to move quickly so the credits could apply to TAM's 2018 bottom line. Nitta "went on a war footing" with a crew of eight people, including two designers. As the installation had been long-planned, TAM had the net-metering registration and certificate of public good in hand. The installation took two months and went live on schedule, around the 20th of December. Through group net-metering, the output will be split between TAM's Pownal and Shaftsbury facilities. It should supply 90% of the electricity the company needs.

Most people don't realize, Mance says, that recycling uses a lot of energy, starting with the trucks. "We use a boatload of power, just plugging our trucks in." Each block-heater uses 15000 watts, and, in the winter, they all need to be plugged in to be ready to roll in the morning. Though Nance has worked hard to stagger the load and minimize the time each truck is plugged in, it still amounts to a lot of electricity.

*The 92kW solar array at TAM Waste and Recycling consists of array of 288 Hanwha modules, 144 SolarEdge optimizers, and one 100kW SolarEdge inverter. The system should supply 90% of TAM's electricity needs. Images: Power Guru Electric Systems*

Recycling itself is also energy-intensive. TAM has a monthly electricity bill of around $2600. That's something Trevor Mance thinks about a lot--the many elements of our personal energy footprints, including the power used by the stores and factories that provide us with goods and services. To understand our true impact on the environment, we have to become informed consumers. People in the Bennington area can feel good knowing that their waste, recyclables, and compost are being handled by someone with decades of practical concern for the environment.

Mance is a believer in rooftop solar, yet on a 38-foot-tall building, his array has received little public attention. Mance would like his customers to feel good knowing that not only are they recycling, but that the power needed is coming from the sun.

*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.* ♻

# The Largest Solar Array in Vermont

*George Harvey*

*The Coolidge Solar Project, the largest solar array in Vermont, is 20MW and consists of about 83,000 photovoltaic panels. Image: NextEra Energy.*

Not long ago, the largest solar project in Vermont had a capacity of 2.2 megawatts (MW). For a long time, however, there was no one array that was largest. There were a lot of 2.2 MW solar arrays, because that was the largest size allowed under net-metering.

A change came along when the net-metering law was renewed, specifically allowing one 5 MW net-metered array on a landfill in Brattleboro. That array was tied to the grid last June, and it was formally commissioned on October 11, 2018 (bit.ly/brattleboro-solar). It looked like the solar array on a landfill in Brattleboro might be the largest in the state for a while. There was no state incentive to have larger solar systems, there was comparatively little activity going into developing them, and there was no guarantee that any of them would be completed.

The costs of renewable energy have been continuously declining, however, as a result of what is popularly called the "learning curve." Formalized as Wright's Law, it tells us that as we do more work with a technology, we learn more about it, and it becomes less expensive. As a new technology is increasingly adopted, its costs decline in a fairly predictable manner. The costs of solar photovoltaic (PV) systems exemplify this. The result is that it is possible to develop solar systems in many places that would not have been cost effective without state incentives only a couple years ago.

We started hearing rumblings about possibilities for much larger solar arrays planned for Vermont back in 2015. One of them was the Coolidge Solar Project, to be built mostly in Ludlow, with a small part in Cavendish. At 20 MW, it was planned to be four times the size of Vermont's largest solar system. Initially developed by Ranger Solar, development passed to NextEra Energy, and it was approved by the Vermont Public Service Board in March of 2018.

Work on the array started quickly. A very few months passed in which groundwork was done, and construction materials were arriving in August. The Coolidge Solar Project has approximately 83,000 PV panels in it. They were installed by a work force that grew temporarily to 115 people.

Ludlow has a population of a bit less than 2,000. Since it is not a large community, special arrangements had to be made for such simple things as parking for the installation workforce. During the late summer and fall, some of the local businesses were kept pretty busy, keeping up with demands of the increased numbers of people in town.

The project was completed in the middle of December, at which time it began feeding power to the grid. Its energy is being sold to customers in Connecticut, along with the renewable energy credits, but that is more a fact of accounting than of the flow of power on the grid.

While the work was good for the community economically, there are other, more enduring benefits. The site will permanently employ a small workforce to service the system. Between installation and ongoing employment, the project will provide $15 million spent on local labor through the end of its first twenty years. The site will pay taxes of $4 million over the same time, benefitting both Ludlow and the state of Vermont. Economic activity will add $25 million to the gross domestic product of the state over the same time.

The village of Ludlow will have direct economic benefits as a result of negotiations with Ranger Solar. Two payments were made when the solar array went live, one of $100,000 to the community and one of $75,000 for a new gymnasium floor in the elementary school. Payments to Ludlow will continue at $35,000 per year for the first five years and then at $25,000 per year until the array is forty years old. The total contributions to the village will come to $1,225,000, which is an import benefit for a small municipality.

Scott Murphy, the municipal manager for Ludlow, told us, "The Town fully supported the development and permitting of the Project. It is a comfort to know that Ludlow is helping to bring clean, renewable, and cost-effective energy to the region as well as the jobs and economic benefits from the construction of the facility." ♻

## American Made Solar Prize

We just learned about a competition being run by the National Renewable Energy Laboratory designed to revitalize US solar manufacturing.

To read more about the American Made Solar Prize go to: https://www.usa-solar-prize.

# Served with a Side of Sunshine:

## Hoyt Community Care Center's New Solar Panels Help Feed Hundreds in the Granite State

*Chris Gillespie*

Last March, the residents of Newport, New Hampshire made statewide headlines for approving the largest municipal solar project in the Granite State. This March, Newport is garnishing attention for a solar installation that is much smaller in scale but perhaps even more meaningful for many in western New Hampshire.

The Hoyt Community Care Center, which is home to the Newport Food Pantry and a community learning center, recently started harnessing solar energy to power its facilities, thanks to the help of their neighbors at Sol-Air.

"We're a locally owned and operated company," said Sol-Air Systems Design Specialist Ian Pahl. "As a small company, we truly care about giving back to our community organizations."

*Aerial view of the Hoyt Community Care Center's 42 panel, 12.81kW photovoltaic rooftop solar array which is expected to cover 60% of its electric load. Image: Eric Rudman, Sol-Air.*

For the team at the Hoyt Community Care Center, partnering with Sol-Air for the project was an obvious choice. Founded in 2006 as New England Solar Concepts, Sol-Air specializes in the residential installation of photovoltaic solar panels, heat pumps and solar energy battery solutions. Originally, Sol-Air only serviced New Hampshire, however, they have recently expanded into Vermont.

"Start-to-finish, every step of the installation went smoothly," said Pahl. "We were a little delayed by a winter storm, but other than that, everything went very well."

The Hoyt Community Care Center's rooftop array is currently live. The forty-two panel, 12.81kW photovoltaic system is expected to yield 1,300 kilowatt-hours a month, equaling approximately 15,000 kilowatt-hours a year. Overall, Sol-Air estimates that the array will cover roughly 60% of the Hoyt Community Care Center's energy load.

Providing over half of the Hoyt Community Care Center's energy is no small feat, as the Newport Food Pantry utilizes quite a few heavy-duty kitchen appliances, including several large electric refrigerators which store perishable goods such as meat and produce.

In fact, now that they will be spending less to power the refrigerators, the Newport Food Pantry team plans to redirect those savings towards purchasing more food to put inside the refrigerators.

"We're going to save money in one place and spend it in another," Newport Food Pantry director Jim Demers told the Claremont, NH Eagle Times in November.

The additional food is sure to make a positive difference for families in Newport, as well as in the nearby towns of Goshen, Croyden, Lempster, Grantham, Sunapee, Washington, Acworth, Unity and Springfield, who are also served by the Newport Food Pantry.

"Working with the Hoyt Community Care Center has been incredibly rewarding for all of us here at Sol-Air," said Pahl. Sol-Air also helped the Hoyt Community Care Center apply and get approved for an interconnection agreement with Eversource, which will allow the Hoyt to transfer excess solar energy back into the utility when sunshine is abundant.

Pahl has firsthand knowledge of how accessible solar energy can be even for those who are operating on a budget, as Sol-Air has installed several systems for local non-profits, such as Lake Sunapee Protective Association and Sanctuary Dairy Ice Cream of Sunapee.

"A lot of people think that solar energy is really expensive and is therefore unobtainable for charities or nonprofits, but there are grants out there that will help make it all possible."

The solar installation at Hoyt Community Care Center, for example, was completed with funding from the New Hampshire Charitable Fund, specifically $30,000 from the Thomas W. Haas Fund and $10,000 from the Newport Charitable Fund.

Pahl contends that, in addition to saving money, charities and nonprofits can also stand to gain positive attention and nonverbally promote their mission by installing solar panels.

"[Going solar] is a great way for charities to stand out in their communities and be 'put on the map,' so to speak," said Pahl. "I think it really conveys the values of a charity; mainly that they are serious about helping people and that they really care about the environment."

*Chris Gillespie is a contributing writer for Green Energy Times. He can be reached at chris@greenenergytimes.org.* ♻

# 100% Renewable Energy For Keene, New Hampshire

## Keene Becomes 5th NH Municipality Committed to 100% Clean, Renewable Energy

***City Council approves measure to convert the city entirely to renewable energy joining Concord, Cornish, Hanover, and Plainfield, New Hampshire.***

On January 17, 2019, the City Council of Keene, New Hampshire voted 14-1 to establish a goal of transitioning the city to 100% clean and renewable energy. Keene joins the communities of Concord, Cornish, Hanover, and Plainfield to become the fifth municipality in the state to establish the goal.

The resolution adopts a goal of using 100% renewable energy for electricity by 2030 and for all sectors, including heat and transportation, by 2050. Keene is the 104th city in the United States to commit to transition to 100% clean, renewable energy. A full copy of the resolution can be read at http://bit.ly/KeeneRenewableEnergyResolution.

Through numerous efficiency measures implemented over the past 20 years, the City of Keene reduced emissions from municipal operations by 25%, while cutting operating costs significantly. Homes and businesses can often reduce their energy needs 20-30% through weatherization and other efficiency measures.

Already many area businesses and homes are powered with clean energy through competitive electricity suppliers. The Monadnock Food Co-op's solar panels generate 50,000 kilowatt hours per year. Keene State College, the Savings Bank of Walpole, Target, MOCO, and the Keene Unitarian Universalist Church are all generating solar energy. The City has just installed a 662-kilowatt solar array on the Police and Public Works facility on Marlboro Street. This will bring the community's total solar generation to over 2 megawatts.

*The city of Keene, New Hampshire: Wikipedia.org.*

Since the resolution was introduced, leaders from business, education, faith, nonprofit and other sectors have voiced their support for the 100% renewable goal, including Keene State College and Filtrine Manufacturing Company.

Existing and emerging technologies make the 100% renewable energy goal achievable and offer economic benefits and opportunities.

New Hampshire obtains more of its electricity generation from wind power than from coal-fired power plants, according to the U.S. Energy Information Administration, a trend that could expand greatly with offshore wind.

Renewables are the fastest growing energy source in the United States, comprising 67% of new electric generation capacity installed in 2016, and clean energy jobs are the fastest growing job sector.

"The Clean Energy Team is excited, grateful, and proud to see the city pass this resolution. For several years, we have worked hard building relationships, learning and researching resources that can help us achieve energy efficiency with 100 percent renewable, affordable energy goals for everyone in the Keene community. Now, working in collaboration with the city and many of our supporters, (during the next two years) we will continue doing community outreach, offer educational events, share stories and help others realize how we all may reach these sustainable, renewable energy goals," said Nancy Gillard of the Clean Energy Team.

"We see a huge increase in environmental awareness of our applicants," said Steve Silverstein, president of Tree Free Greetings. Tree Free is currently hiring and anticipates doubling its workforce in the next five years. "Young families and workers may resonate with our business, but they must also resonate with the values and opportunities in our community. They ask themselves -- does Keene represent us? It would be a huge real and symbolic selling point if we can tell prospective employees that Keene is at the forefront of renewable energy."

"The transition to clean energy is happening. I want to do what I can to accelerate it because I am concerned about climate change and the world my grandchildren will live in," said Julie Dickson, a Keene resident, on behalf of her two grandchildren, ages 1 and 6.

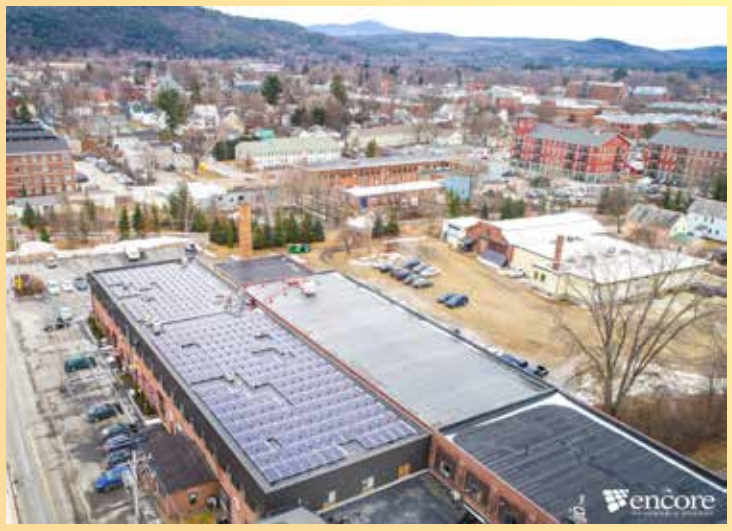
"In the Monadnock Region, where we are thoughtful and collaborative about our future, change is happening… This can be an important element of our brand as a city, a region, a state," said Greater Keene Chamber of Commerce CEO Phil Suter in a statement to City Council, citing the many area businesses that support renewable energy.

Other municipalities and states have demonstrated that increasingly-affordable battery storage can lower peak demand charges for utility customers. Using a distributed battery network, Green Mountain Power is saving Vermont customers money -- $600,000 was saved by using stored power during a heat spike in August, for example.

To learn more about what Keene is doing, visit: cleanenergykeene.org. ♻



## Commercial-scale Solar Project Adds to Keene's 100% Renewable Energy Goal




*This 123.165kW DC commercial-scale roof-top solar project is located at 160 Emerald Street in Keene, New Hampshire. Image courtesy of Encore Renewables.*

On January 17, 2019, Keene became the fifth municipality in New Hampshire to commit to a 100% renewable energy goal. By a vote of fourteen to one, the city council committed the city is to get 100% of its electricity from renewable sources by 2030 and to get 100% of its energy, including transportation and heat, from renewable sources by 2050.

As it happens, one small but important step in the work of getting to that goal was already underway when the city council voted. Encore Renewable Energy was installing a solar photovoltaic array with a capacity of just over 123 kilowatts (DC) on the rooftop of an old commercial building at 160 Emerald Street. The system is Encore's first commercial solar project in New Hampshire. Encore was awarded a grant by the Public Utilities Commission to help maximize the financial returns to the project owner. As this is written, the array is nearly complete.

The system has 357 Hanwa Qplus panels, each of 345 watts. It has two Solectria PVI 50TL inverters. The

*Cont'd on p.16*

## Municipal Solar Project Adds Even More to Keene's 100% Renewable Energy Goal

Enough is going on in Keene, New Hampshire, that it might be easy to lose track of the projects. While the commercial 123-kilowatt (kW) array is going up on Emerald Street, a somewhat larger, municipal array is being readied for a ribbon cutting ceremony. It was built by ReVision Energy on the roof of the Keene Public Works building and the adjacent Keene Ice Center on Marlboro Street,

*Another one of NH's largest solar arrays in Keene is 643.2kW and consists of 2,101 panels. The array is installed on the rooftops of the Keene Ice Center and adjacent Public Works Department building. Image: ReVision Energy.*

The Keene Public Works array has a capacity of 643.2 kW. It will generate about 740,000-kilowatt hours of electricity each year and this will offset roughly 777,000 pounds of carbon pollution each year, according to a statement from ReVision Energy. This is the equivalent of taking 76 average cars off the road, or preventing 817 barrels of oil from being burned each year. Seen another way, the carbon emission reduction is the equivalent of 416 acres of forest sequestering carbon.

The Keene Public Works

*Cont'd on p.16*

# Community Solar Means Clean Energy for Everyone

*Travis Tench*

City dwellers may laugh at the idea of putting solar on their roofs, but there's an alternative: community solar.

This arrangement goes by many names, including shared solar, community shared solar, and community distributed generation (CDG), but the concept is the same. Instead of buying and installing solar panels on your home or property, you subscribe to a piece of a large local solar project built nearby, often along with a few dozen to a few hundred other people who live in the same area. A portion of the electricity generated by these projects gets credited directly to your utility bill, you get a discount on electricity, and you don't have to pay anything to join.

*A 375kW community solar installation atop a warehouse in Bronx, NY. Photo by Travis Tench.*

Community solar allows households, small businesses, and places of worship to receive the benefits of solar energy without the cost or hassle of a rooftop installation. Roughly half of residences in the U.S. can't host a solar installation because the occupants don't own the property, or because the roof is too old, too shady, or facing the wrong way for optimal sun exposure. Community solar eliminates these issues, making solar power more accessible to more people than ever before.

In order to be eligible, a resident must live in the same electric utility zone as the project. This might seem like a limiting factor, but it also ensures that the project a group of subscribers is supporting is a local one and that all the energy produced is going into the local grid system. And because this local, clean electricity generation helps out with things like transmission losses and congestion on the grid, potentially alleviating the need for costly grid upgrades, this energy is highly valued and that's passed on to subscribers in the form of savings.

"Too many people either don't have access to renewable energy or don't think renewables are a real option for them. This is how we change that," said Mark Chambers, Director of the NYC Mayor's Office of Sustainability. "Community shared solar is one of the best ways to ensure that clean, affordable energy is available for everyone."

In addition to allowing people to participate in solar projects, community solar is also helping states meet their climate and clean-energy goals. New York State, for example, has ambitious goals of meeting 50% of its energy needs from clean energy resources like solar and wind by 2030 while reducing greenhouse gas emissions by 40% from 1990 levels. In order to hit this target, the state will have to add 13,700 megawatts of distributed solar within 12 years—about nine times the total solar installed to date, according to the Acadia Center's EnergyVision 2030 report. This is a tall order, but community solar will play an important part in helping to reach this goal by increasing the number of people who can participate in solar projects.

Although community solar has only been around nationwide for about a decade and in most states it's only been an option for a few years, it's quickly growing in popularity. According to the Solar Energy Industries Association (SEIA), 1,294 MW of community solar has been installed in the U.S. through the third quarter of 2018, and nineteen states now have legislation to support community solar projects for their residents. The solar industry now also employs over 242,000 people nationwide, a number which is expected to increase in 2019, according to The Solar Foundation's 2018 Solar Jobs Census report.

The clean energy transition is underway, but it will take all of us doing our part. With community solar, that is now easier than ever before.

*Travis Tench is Director of Outreach at Powermarket, an NYC-based company that works with solar developers to establish and manage community solar programs. A list of current community solar projects is available at powermarket.io.* ♻

*Above and at end: A 5.5MW project in New Windsor, NY. This is the largest community solar project in New York's Hudson Valley producing enough power for about 750 homes. Photo by Green Street Power Partners.*

# 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.

- Starting July 1st retails sales of "Advanced Wood Boilers" are exempt from Vermont's 6% sales tax. http://tax.vt.gov/exemptions,
- **Details at www.RERC-vt.org or call (877)888-7372**
- **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.

### 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

**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: https://www.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

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

# Liberty Time-of-Use-Storage Pilot: A Glimpse into the Future of Energy

*Henry Herndon*

Energy storage is coming to New Hampshire! Well, at least for a small subset of Liberty Utilities electric customers.

In January 2019, Liberty Utilities received approval from the New Hampshire Public Utilities Commission to roll out a cutting-edge energy storage program for selected residential customers. Over the coming year, Liberty will install and own between 100 and 200 Tesla Powerwall battery packs in residential homes.

What makes this storage program especially innovative is the accompanying time-of-use rate that each participating customer will enroll in. The time-of-use rates send a price signal to the batteries, directing them to shift energy consumption away from times of high cost to times of low cost. Under the new rates, customers will charge their batteries overnight at about $0.07 per kilowatt-hour (kWh), less than half the typical price of electricity. Then, between 3pm and 8pm, prices jump up to approximately $0.36 per kWh, roughly double typical pricing. During these "critical peak periods" when demand for energy is high, the battery will power the customer's home and the customer can avoid drawing expensive power from the electricity grid. Table 1 shows the complete rate design.

As a result of this kind of storage-enabled load shifting, customers can save money by buying cheaper, off-peak power, and Liberty Utilities can save money by reducing stress on the system when demand for energy is high. This saves money for all Liberty Utilities customers, not only those with home batteries!

The program gets even more interesting for participating customers with solar-powered homes. Customers with solar arrays can use the sun to charge up their batteries. Then, when the 3pm-8pm critical peak comes around, excess solar can be exported to the grid when it needs energy the most. Think of this as a better way deploy solar as a grid resource. It's called "dispatchable solar" because the battery allows for solar energy to be dispatched on command.

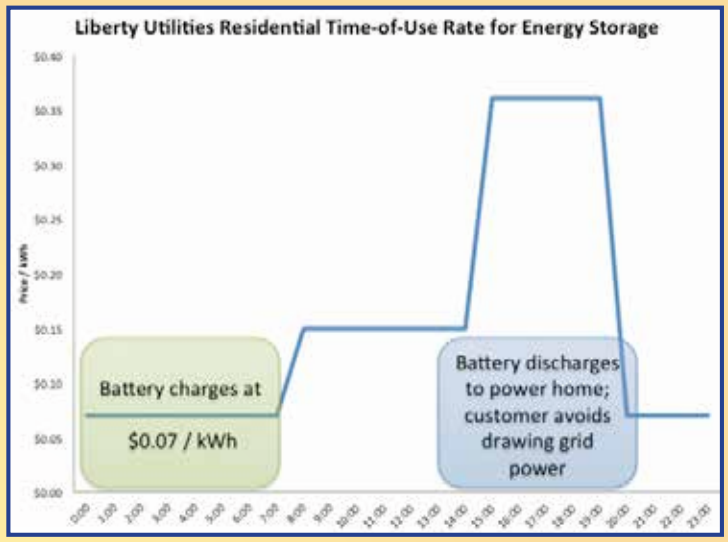
While the Liberty Utilities Pilot is for residential customers only, New Hampshire's other electric utilities have plans to achieve similar demand reduction goals. As part of their NHSaves energy efficiency program offerings, Eversource and Unitil will be committing $343,765 toward developing "demand reduction initiatives" for their commercial and industrial customers. These pilots will not necessarily involve energy storage and time-of-use pricing, but the goal is the same: reward energy users for shifting consumption to times of low cost.

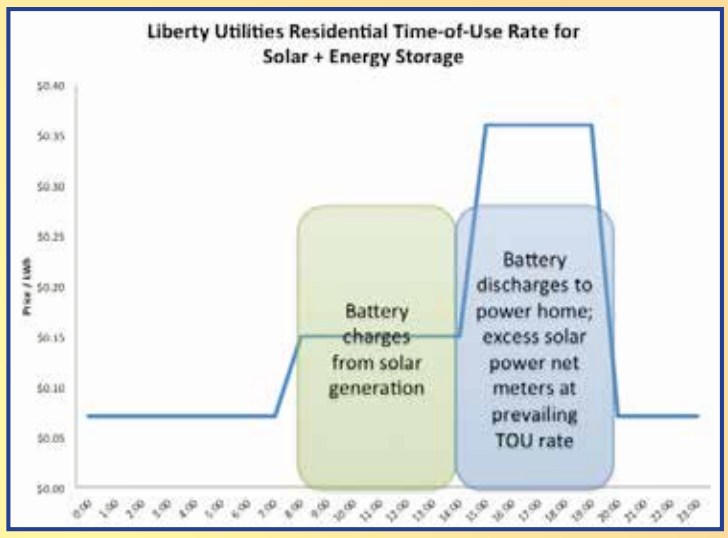
Efforts to reduce energy costs with energy storage, load shifting, and creative policy approaches are spreading across New England. Massachusetts recently became the first state to make energy storage an eligible technology to receive energy efficiency funding through Mass Saves, the counterpart to NHSaves energy efficiency programs in New Hampshire.

The Liberty Storage Pilot may be small, but it is significant. If Liberty's approach proves successful, the program will be expanded to allow for competitive market actors to provide energy storage solutions to customers who wish to take advantage time-of-use pricing. This essentially means you could "bring your own" energy storage system to participate in the program instead of Liberty owning your battery. The pilot gives us a glimpse into the future of the electric grid, and it is looking good for customers who want innovative solutions to their energy challenges.

**Table 1 – Illustrative Time-of-Use Rate**

| | 8pm-8am (Off-Peak) | 8am-3pm (Mid-Peak) | 3pm-8pm (Critical Peak) |
|---|---|---|---|
| Energy Supply | $0.03 / kWh | $0.08 / kWh | $0.15 / kWh |
| Transmission | $0.01 / kWh | $0.02 / kWh | $0.13 / kWh |
| Distribution | $0.03 / kWh | $0.05 / kWh | $0.08 / kWh |
| **Total** | **$0.07 / kWh** | **$0.15 / kWh** | **$0.36 / kWh** |




*(Graphs developed by Henry Herndon)*

*Henry Herndon is Director of Local Energy Solutions for Clean Energy NH. He works with municipalities across New Hampshire to implement energy efficiency and renewable energy projects to lower community energy costs and advance the goals of sustainability.* ♻

## K-12 Schools Incentivised

*Cont'd from p.4*

**April 11th is the Safe Routes to School, Safe Routes for All Annual Gathering,** where Way to Go! affiliates are invited to network and learn. Participants will gather at the Granite Museum, Barre, Vermont. RSVP and learn more at https://www.localmotion.org/safe_rtes_school_2019. This event is free and open to the public. Breakfast and lunch will be served.

**May 6-17th is the Way to Go! to School Challenge**, two weeks for all K-12 schools to enjoy active transportation, encourage everyone to travel green and send us your pictures and stories.

**May 2019 is Vermont Bike Walk Challenge**. Learn more and join Green Rewards Program at Go!Vermont.

**June 5th is the 2019 Way to Go! School Challenge Awards and Transportation Fair** at the Statehouse in Montpelier. Join schools across Vermont for a fun day of learning and recognition. Those achieving 50 points or more will be recognized by Way to Go! and invited dignitaries.

*Way to Go! is sponsored by the Vermont Agency of Transportation and Chittenden County Regional Planning Commission and supported by a broad network of statewide entities, NGOs and business partners including Local Motion, Vermont Energy Education Program, Department of Health, Net Zero Vermont and Place Creative. Together we are leveraging resources, sharing experiences through the growing network of educators, volunteers, and wellness coordinators all working to make a difference.*

**Questions? Ask Deb Sachs at deb@netzerovt.org or phone 802-238-9807. For more details visit www.waytogovt.org or www.connectingcommuters.org, 800.685.RIDE (7433).** ♻

*Rutland Christ the King School, Rutland, VT-- Pop-up Project organized by school volunteers, VEEP, and Local Motion. Credit: Allegra Williams*

## Municipal Solar Project in Keene

*Cont'd from p.12*

array cost about $1.35 million. It was financed by a group of local impact investors, through ReVision Solar Impact Partners, which own the array. Electricity from the array is sold to the City of Keene at a reduced price through a Power Purchase Agreement. Over the life of the system, it is expected to save the taxpayers about $3.5 million. The financing and saving will enable the community to foster other economica developments.

This array is the largest ReVision Energy built in New Hampshire last year. Its 2010 solar panels bring the solar capacity of the City of Keene to over two megawatts. Of course, there is a lot more to do to get the city to its goal of 100% renewable.

It happens that ReVision Energy has a series of smaller projects under development now. A single example is a set of projects that is to be built for the affordable housing nonprofit organization, Keene Housing. This organization has added solar systems and heat pumps to a majority of properties in Harper Acres as part of a transition to energy efficiency and reduced consumption. The work is to be continued this year, and it will have ReVision Energy install solar systems at 25 more properties.

ReVision Energy's website is revisionenergy.com.

The progress on tackling climate change being made in Keene should serve as an inspiration for other communities. The solar arrays that appear in this issue of G.E.T. and the commitment to a goal of getting 100% of its energy from renewable resources, are not only just environmental policy. They also provide an economic environment that encourage more opportunities for businesses to flourish. ♻

## Commercial-scale Solar Project in Keene

*Cont'd from p.12*

racks are by Panel Claw.

Over the 25-year life of the project, it will offset about 2,375 metric tons of carbon dioxide. This is the equivalent of avoiding burning 2.6 million pounds of coal or eliminating 5.8 million miles of automotive driving.

Encore Renewable Energy is based in Burlington, Vermont. It has a proven track record of reclaiming undervalued real estate for community-scale photovoltaic systems. Its web site is encorerenewableenergy.com.

*The Flexible Capital Fund of Vermont (Flex Fund), Coastal Enterprises of Maine, and New Hampshire Community Loan Fund recently announced a joint investment of $1 million in Encore. The investment will provide permanent working capital, which will enable Encore to make targeted new hires to support their ongoing geographic expansion in the Northeast. The financing is a collaboration of three New England Community Development Financial Institutions, a model which the Flex Fund would like to encourage more use of, to align values and missions.* ♻

# Solar Solutions at Pooh Corner Farm

*George Harvey*

Sam Zuckerman, the president of Maine Solar Solutions, has shared another interesting solar installation with us. It is at Pooh Corner Farm, a garden center and florist in Mason Township, Maine.

Mason Township is not a large community. There are only about sixty people who live there. It is not far from Bethel, in western Maine's Oxford County. Pooh Corner Farm is rather remote, but that has not prevented the business from thriving. Anyone who talks with Carole Duplessis, its interesting and friendly owner, might very easily understand why.

*Solar trackers at Pooh Corner Farm. Photo courtesy of Maine Solar Solutions.*

Duplessis started the garden center in 1984 on a property of about a hundred acres. She began by selling vegetable starts from seeds she had planted. She and her husband, Richard, put up their first buildings, and the business grew. Now it has five greenhouses and a garden center.

A business of this type can consume a surprising amount of electricity. Greenhouses need water, pumped from wells, but they also need to be ventilated to keep from overheating. While many people understand that pumps use a lot of energy, we might not see how fans do. These are not the fans you plug into the wall and clip to the side of your desk. A hint about their size can be taken from the fact that they use 220-volt current. They move a lot of air, and every greenhouse needs to be ventilated.

Duplessis has long been interested in saving energy. She told us, "In the beginning, we used halogen lights. My electric bill was more than some people pay for rent." She switched to LEDs, and that helped a lot, but there were still those fans and pumps.

A few years back, she got to the point that she decided to do something about the power problem and started looking for a solar installer. Shopping around for prices, she found Maine Solar Solutions and soon realized that she had found what she wanted.

After reviewing the site, loads, and special needs, Zuckerman concluded that the ground-mount system Duplessis had been offered by other installers was not the best approach. Instead, he suggested a system with the photovoltaic panels mounted on trackers, which would always be pointing directly at the sun. Three AllEarth Renewables trackers would be used, each holding 24 Q-Cell panels. With each panel capable of delivering 300 watts, the capacity of the whole system is 21.6 kilowatts.

"Three trackers took up a lot less real estate than ground mounts," Zuckerman told us. "The ground mounts would have taken 100 panels. The system would have been 140 feet long." The tracking system also has other advantages. For example, trackers are designed to survive bad storms by holding their panels horizontally, in the position least susceptible to damage.

The Pooh Corner Farm solar array was financed in part with a Rural Energy for America Program (REAP) grant from the U.S. Department of Agriculture (USDA). Duplessis commented on this, noting that the process of getting the grant could have been daunting. She had high praise for the help she got from Maine Solar Solutions, without which she might not have received the grant at all.

Zuckerman said his takeaway on USDA grants of this type is that a lot of businesses could benefit from them. The grants are available for many situations. In particular, he pointed out that many people do not realize that their businesses might qualify, often because they believe REAP grants for rural areas are not available in the places where they live. Depending on the grant, businesses in communities that are as large as 50,000 might be able to get them. The grant structures are complicated, but information is readily available at local USDA offices, and good solar installers can often help.

Maine Solar Solutions, LLC is near the town of Freeport, Maine, not far north of Portland. The web site is mainesolarsolutions.com.

Pooh Corner Farm's web site is: poohfarm.com. ♻

*Pooh Corner Farm*

*Poohfarm.com*

# Strong Growth in Renewable Energy Generation in 2018

## Renewables Poised to Overtake Nuclear Power in 2019 or 2020

*Sun Day Campaign*

On March 4, 2019, an analysis by the SUN DAY Campaign was made available regarding the latest data released by the U.S. Energy Information Administration (EIA). The data confirms continued strong growth in electrical generation by renewable energy sources (e.g., biomass, geothermal, hydropower, solar, wind) in 2018.

According to the latest issue of EIA's "Electric Power Monthly" (with data through December 31, 2018), renewables increased their electrical output by 4.46% and accounted for 17.64% of the nation's electrical generation in 2018.

Non-hydro renewables grew by 9.83% with geothermal up by 5.0%, wind by 8.1%, and solar by 24.4%; biomass electrical production remained virtually unchanged.

However, these gains were partially offset by a 2.9% drop from 2017's level in hydropower electrical generation. Moreover, total generation by all electricity sources (including nuclear power and fossil fuels, especially natural gas) grew by 3.67%. Thus, renewables' share increased only slightly, up from 17.51% in 2017.

But the seemingly modest gains reported by EIA for renewables in 2018 mask the dramatic growth in wind and solar over the past decade. Wind-generated electricity was five times higher in 2018 than it was in 2008. And electrical generation by solar (utility-scale and distributed, combined) in 2018 was more than 100 times greater than that reported by EIA a decade earlier.* Meanwhile geothermal, hydropower, and biomass have each increased their electrical output by just over 1% annually, on average, during the past ten years.

Further, wind is now neck-and-neck with hydropower with the latter outpacing wind by just 6% during 2018. If wind generation continues its current rate of growth (8.1% in 2018) it will likely close the gap with hydropower at some point in 2019 or early 2020 and become the #1 renewable electrical source, even if hydropower returns to its near-record 2017 level.

EIA's data also reveal that solar ended the year topping 2% of domestic electrical generation for the first time (specifically, 2.29%). As noted, solar has enjoyed explosive growth during the past decade. If it sustains the rate of growth it experienced in 2018 and earlier, solar could triple its output and account for nearly 7% of the nation's electricity within five years.

Finally, hydropower seems poised to return to its historically higher levels in 2019. EIA data, for example, document that hydropower production was 6.0% higher in December 2018 than in December 2017.

Consequently, electrical generation by the mix of hydro and non-hydro renewables may soon permanently overtake nuclear power.

While renewables out-produced nuclear power during several months in 2017 and 2018, that development seems likely to become true on a year-round basis as well either this year or next. Nuclear power grew by just 0.3% last year and ended 2018 only 8.7% ahead of the electrical generation by the mix of renewable sources. If hydropower bounces back and if non-hydro renewables continue to grow at roughly the same annual rate as in 2018 (i.e., 9.83%), they will collectively generate close to the same amount of electricity as nuclear power in 2019, and very probably surpass it in 2020.

**EIA did not begin to report estimated small-scale photovoltaic generation until 2014 so its 2008 data reflect only utility-scale generation. If one compares only utility-scale solar in 2018 to only utility-scale solar in 2008, the increase is 77 times.*

*Source: EIA's latest "Electric Power Monthly" report was released on February 27, 2019. It can be found at https://www.eia.gov/electricity/monthly. See tables ES1.A, ES1.B, 1.1, and 1.1.A.*

*The SUN DAY Campaign is a non-profit research and educational organization founded in 1992 to aggressively promote 100% reliance on sustainable energy technologies as cost-effective alternatives to nuclear power and fossil fuels and as a strategy for addressing climate change. To learn more contact Ken Bossong, 301-270-6477 x.6* ♻

# Vermont Businesses Cut Carbon Output and Costs

## 2018 and 2017 Innovation Projects Offset 200 Million Pounds of Carbon

*New greenhouse lights were installed at Long Wind Farm in Thetford, VT where tomatoes are grown all year. This project helps to reduce Long Wind Farm's carbon footprint. Image: GMP.*

Green Mountain Power's Business Innovation Team is helping Vermont businesses offset 200 million pounds of carbon emissions. They are offering free consultations including analysis of business operations, technical advice, and financial incentives that help businesses make significant transformations to cut their carbon output and costs, and so benefit all customers.

GMP's team worked with 15 businesses that completed projects in 2018 and, over the lifetime of those projects, will offset 80 million pounds of carbon. That's on top of the 120 million pounds of carbon being offset by projects GMP completed in 2017.

Bolton Valley Ski Resort invested in new electric-powered snowmaking equipment with help from GMP, Efficiency Vermont, and skiers and riders who bought special Five Year Green Passes. "The expert advice and financial incentives were key for us in making this improvement," said Lindsay DesLauriers, COO of Bolton Valley. "We get to ditch about 20,000 gallons of diesel we were burning each year. It's a big transformation Bolton has wanted to make for a while. Our snowmaking is more efficient, and we're making a difference for the environment."

Flying Crow Coffee in Springfield replaced a propane-fueled roaster with a new electric roaster. The company now has a smaller carbon footprint to bring fair trade certified, organically sourced coffee to customers. "The bill credits from GMP made this investment possible. It really jumpstarted my business," said Ben Hills, Flying Crow Coffee's owner. "I'm able to roast more coffee than I was before, but I'm not paying more for energy. It's awesome because my company is built on being eco-conscious."

GMP often partners with Efficiency Vermont on business transformation projects, with each organization bringing unique expertise. There are more than 19 businesses lined up for green transformations in 2019. Most of the work involves custom solutions to reduce their total energy consumption along with switching some or all of a business's energy use from fossil fuel to electricity through innovative new technology.

"This investment is good for my business, but it is also critical for fighting climate change," said Dave Chapman, the owner of Long Wind Farm in Thetford. The business grows tomatoes year-round and worked with GMP and Efficiency Vermont to install new greenhouse lights and an insulating screen. "As a result of the lights and energy curtain, we are hoping to save about 42,000 gallons of propane used to heat this greenhouse. GMP's cleaner energy is allowing us to cut back on fossil fuels and to increase our tomato production. And in 2019, GMP will help us install heat pumps to make our greenhouses even greener." The business will get credits on its GMP energy statement to help offset the cost of the transformation.

Businesses interested in a free consultation to learn how they can transform their operations and what incentives are available can contact Jeff Monder of GMP's Innovation Team at jeff.monder@greenmountainpower.com or 802-770-3392. ♻



## VT Regulating EV Car Charging?

*Cont'd from p.4*

7. Strategies to encourage EV usage at a pace necessary to achieve the goals of the State's Comprehensive Energy Plan and its greenhouse gas reduction goals.

The VT PUC launched investigation 18-2660-INV in July 2018 in response to this charge and has held two workshops to date with another scheduled in mid-March 2019. They are required to report back to the VT Legislature by July 2019. Additional details on their deliberations is available on the VT PUC e-docket at https://epuc.vermont.gov/?q=node/64/134378 .

One of the first findings of this investigation is related to item four above – the regulatory jurisdiction of the VT PUC over privately-owned EV charging. Currently, the resale of electricity at EV charging stations is explicitly allowed only for electric utilities. This creates challenges for non-utility charging equipment owners looking to simply cover their costs since charging fees based on hourly rates or other price structures do not account for different charging of various EV options – for example an all-electric vehicle typically charges at 7 kW of power, while plug-in hybrids are about half of that. This means a plug-in hybrid receiving the same hourly rate as an all-electric is effectively paying twice as much for the same energy.

To help remedy this, the VT PUC recently issued a letter to the VT Legislature calling for a clarification in state law that their jurisdiction does not extend to EV charging stations. The exception to this would be cases where electric utilities are investing in charging infrastructure in ways that affect ratepayers collectively if a utility proposed including EV charging in their "rate base."

Vermont legislative committees are currently considering the VT PUC jurisdictional recommendation and other issues associated with EV adoption, including Vermont Governor Phil Scott's proposal to develop a state EV incentive program geared to low- and moderate-income Vermonters. Stay tuned to future issues of *Green Energy Times* for more updates on their work.

In the meantime, the VT PUC continues deliberations on other aspects of their EV investigation. Their next workshop in March will explore how EV drivers should contribute to transportation infrastructure. Shortfalls in transportation funding over the past several years are primarily due to gasoline taxes not keeping pace with increases in vehicle efficiency. EVs in Vermont also already provide registration fees and sales taxes toward transportation funding, but long-term solutions will be needed to make up for reduced gas taxes. Options for this include additional registration fees for EVs, assessing a per-kWh tax on energy used in EVs (like a per gallon gasoline tax), or possibly moving to a more wholistic approach of a road user charge based on vehicle miles traveled.

Recent research from the University of California at Davis (https://escholarship.org/uc/item/62f72449) highlights the need for careful consideration of EV user fees. Their analysis found adding fees on EV ownership could decrease EV sales by as much as 20%, which would present significant challenges as states will need to accelerate EV adoption in concert with other measures reducing vehicle travel to meet climate and energy goals.

*David Roberts is the* Drive Electric Vermont *coordinator. He has driven an all-electric* Nissan LEAF *for the past six years and says, "If you have to drive, drive electric." http://www.driveelectricvt.com.* ♻

Drive Electric Vermont

# PRECAUTIONS BEFORE YOU GREEN-UP YOUR INVESTMENTS

*Todd Walker, Greenvest*

With all the talk of divestment in the air, many investors are looking to rid themselves of investments in fossil fuel companies – or other socially offensive firms – and switch to greener companies such as clean energy.

But before you sell everything at once to go green, it's important to avoid some possible costly consequences. In fact, before you make wholesale changes to any investment portfolio – green or not – you should always consider these factors:

Taxes. Gains on securities are subject to capital gains taxes of up to 23.8% (including the Net Investment Income Tax), if they have been held for more than one year. (Gains on those held less than a year are taxed at ordinary income tax rates.) So, instead of selling in one swoop, you may want to sell appreciated securities over several years to mitigate capital gains taxes. Another tactic is to use any security losses to reduce or eliminate gains. One thing many people don't realize until too late is that on securities that are given to you when the donor is alive you usually assume the original "cost basis" of those securities. In other words, the original purchase price of the securities is used in calculating the tax. So, before you sell a bunch of securities given to you by your parents/grandparents during their lives, you should understand your cost basis to avoid a potentially huge tax hit. Securities inherited from a will follow different rules, and typically

there are no gains taxes on sales in a qualified retirement plan such as an IRA. The best idea is to always consult your accountant before selling or buying securities if you are uncertain of the IRS rules.

Change in Asset Allocation. Proper Asset Allocation is vital to long-term performance, which is why investment professionals diversify portfolios into certain percentages of large company stocks, small-company stocks, bonds, etc. So when you green up your portfolio you need to keep your recommended asset allocation in sight. Consider, for example, that selling big oil stocks (large company) and reinvesting in alternative energy stocks (usually small companies) could add some investment risk to your portfolio since small stocks tend to be more volatile. Still could be a sound idea, but you need to keep your mix and risk in mind.

Loss of Dividend Income. Are you depending on a portfolio for income? Then something else to consider is that selling high-dividend "non-social" stocks such as oil companies, utilities and tobacco/alcohol may reduce your dividend income unless you replace them with greener income alternatives, such as clean energy power producers, real estate investment trusts, socially-screened preferred stocks and bonds and more.

Timing. The latest market environment is another factor to think about. Is this the best time to sell/buy various types of securities? For example, those who sold everything in 2008 now regret it, since the market has more than recovered since then. Or you may want to avoid some overvalued sectors right now. Or a major election or tax law change is just ahead. The point is that you should not ignore what's going on in the economy/marketplace before you act.

Fees. Depending on the type of investment account you own, what it costs to realign your portfolio might also be a consideration. While transaction costs may be low in a fee-based account (where commissions are waived in lieu of an annual management fee), in a commission account your costs may be 2-5% on both sales and purchases. One solution to this is to convert to a fee-based account before you green up.

Research. Finally, it goes without saying that both security sales and purchases should be carefully researched before proceeding. If you are dedicated to investing with your values, this requires both economic and social screening. It's important to invest with your heart, but as with most things in life, let the head have a say, too.

So, as you divest, divest intelligently! Whether you invest on your own or use a financial advisor, make sure to include all these critical steps as part of any portfolio realignment.

That way you won't unnecessarily lose green … as you go green!

*Todd Walker is a Financial Advisor and Cofounder of Greenvest, a Vermont-based personal financial advisory firm specializing in socially and environmentally responsible investing. Securities offered through Vanderbilt Securities, LLC, member, FINRA, SIPC, registered with MSRB. Advisory Services offered through Vanderbilt Advisory Services, LLC. Clearing Agent: Fidelity Clearing & Custody Solutions. Supervising Office: 55 Main St, Suite 415, Newmarket, NH 03857 (603) 659-7626.* ♻

# THE ULTIMATE POWER COUPLE: ENERGY MANAGEMENT AND DATA TECHNOLOGIES

*Ethan Rogers*

Strategic energy management (SEM) programs are expanding beyond the industrial sector to commercial and institutional customers. These programs and data management technologies are two of the biggest opportunities to reduce energy use at large facilities. Not only do they save energy and decrease carbon emissions, they also help utilities build long-term relationships with clients and introduce them to additional efficiency programs.

*Image: Chess, from sintetia.com*

In a new report released January 10, 2019, The American Council for an Energy-Efficient Economy (ACEEE) analyzed 26 programs in the United States and Canada to evaluate how they are merging these opportunities to maximize energy savings. The report finds that such programs help organizations identify effective capital projects as well as operations and maintenance actions. It explores the potential for more programs and lays the foundation for accelerating their adoption across North America.

But what exactly do SEM programs do? They give organizations structure and methodology to discover opportunities, implement projects, and maintain practices that save energy. Energy management information systems (EMIS) help customers increase energy savings by automating data collection, integrating analysis of energy and manufacturing process information, thereby enabling data-driven process control. Integrating EMIS into SEM programs can boost the effectiveness of both approaches and ensure the persistence of energy savings by embedding standard practices in facilities.

To download the report, visit: http://bit.ly/ACEEE-EnergyMangementReport

To continue reading the blog post, visit: http://bit.ly/ACEEEBlog-EnergyManagementDataTechnology.

*Ethan Rogers is the ACEEE Program Director, Industry*

*The American Council for an Energy-Efficient Economy (ACEEE) acts as a catalyst to advance energy efficiency policies, programs, technologies, investments, and behaviors. For information about ACEEE and its programs, publications, and conferences, visit aceee.org.* ♻

## China Moving Ahead on Solar Power

Last year, over half the solar panels installed in the world were put into Chinese solar projects according to Bloomberg New Energy Finance. A Chinese investment of $132.6 billion in renewable energy put over 53 gigawatts of solar capacity online in the country. By comparison, the United States renewable energy investment was $56.9 billion.

The Chinese approach differs from what we have in the United States partly because of Chinese strategy that seems to be to produce as much renewable energy generating equipment as possible in China. The country produces wind turbines and solar panels to provide for its own needs with enough left over to supply many other countries. Though China does not dominate sales of wind turbines elsewhere, it certainly manufactures most of the solar photovoltaic cells and panels used worldwide.

One company, JinkoSolar, has about 20% of the world market for solar panels, according to Nikkei Asian Review. In the face of the United States trade tariffs, it is simply selling the panels in other countries. It expects its sales to increase 30% this year, despite the tariffs.

China is also manufacturing over half of the electric cars and the great majority of heavier electric vehicles. The United States has fewer than a thousand electric buses by our last count. By comparison, China has manufactured them at a rate of over 100,000 per year for the last three years. These buses represent a $75 billion world market in which the U.S. is not participating. ♻

# Vermont Institute of Natural Sciences Goes Solar

*Steve Snyder*

*Executive Director of VINS, Charlie Rattigan and the 86-kW DC roof-top solar system that is expected to produce 111,000kWh of electricity per year. Image: Norwich Solar Technologies.*

Ever since his arrival at The Vermont Institute of Natural Science (VINS) four years ago, Executive Director, Charlie Rattigan, and the Board of Directors have wrestled with the question "How can we get VINS to go solar?" The team struggled with figuring out how a nonprofit, 501(c)(3), organization could raise the capital required to fund the purchase of a solar electric system large enough to offset their approximately $20,000 in annual electric bills. And even if they could afford it, siting the photovoltaic (PV) array in a way that made sense aesthetically would be a major concern. Any suggestion to put a system that large in their beautiful meadow would not be considered.

Then, in a 2018 visit to a Woodstock Rotary Club meeting, Rattigan heard Kevin Davis of Norwich Solar Technologies (NST) give a presentation highlighting his company's nonprofit PV projects. Through his talk of Solar Service Agreements (SSA), where nonprofits and businesses with limited capital simply purchase discounted net-metering credits produced by solar power without actually needing to buy the solar array, Davis finally revealed the path for Charlie and the VINS organization to reap the benefits of renewable energy without the hurdle of a high upfront cost.

Rattigan says Davis's talk on SSAs produced an "eureka moment" for him. He took the idea to his Board of Directors, and they promptly agreed that an SSA seemed like a good approach to take. "The economics appealed to us #1 because of the discounted rate offered on their electricity rates," says Rattigan, "and because the arrays become available for us to purchase after seven years at a steep discount."

If they do decide to purchase the system with a low-interest energy loan, "it will be paid off in roughly 12 years, giving them 13-18 years of no electricity costs so many generations of VINS will enjoy the power," Rattigan added. NST's Davis noted that although solar panels are warranted for 25 years, modern modules have an expected lifespan of 30 to 40 years.

VINS now has an 86-kW DC system producing 111,000 kilowatt-hours of electricity per year at their Nature Center in Quechee, Vermont and plan to use the yearly savings on electricity costs to sustain their mission of providing environmental education, research, and avian rehabilitation. NST provided guidance to VINS in choosing the most appropriate locations for the PV arrays, which are on the roof of one building and in a parking lot. Although it is common to have the arrays for a SSA offsite on land or an industrial rooftop leased from a third party, NST was able to maximize the design of onsite arrays to fit in with VINS's overall plan for the project.

Without any capital expense or upfront cost, VINS is now expected to save over $3,000 in year one and more than $85,000 over the next 25 years. In addition, the VINS solar array will offset nearly 86 tons of CO2, the equivalent of 191,000 miles not driven, or 43 tons of coal not burned every year. "Since the arrays are in an employee parking lot and on a rooftop, they don't intrude on the aesthetics of the site or the visitor experience, something important to VINS and an essential part of our design," says Davis.

"VINS will not only see solar power from the arrays improve our financial bottom line, but also further our educational mission," says Rattigan. "PV very much fits our mission of supporting the education of individuals in the community and sustaining the environment." Clean technology also ties into their STEM programs of the Next Generation Science Standards they provide to 28 Upper Valley schools, as well as their mission as an educational institution overall.

NST handled all details and major steps of the VINS project, including the permitting, construction and, ultimately, maintenance.

VINS is headquartered in Quechee, VT, on 47 acres of forest, meadow, and rolling hills. VINS features 17 state-of-the-art raptor enclosures that house hawks, eagles, falcons, owls, and other birds of prey. The facility includes four major centers: The Visitor Welcome Center and Nature Store, the Center for Wild Bird Rehabilitation, the Center for Environmental Education, and the Center for Environmental Research from which operates an active Citizen Science program. VINS also has a classroom-meeting space, interpretive nature trails, and a newly renovated four-season pavilion designed for exhibits, events, meetings, and live raptor programs. Learn more at vinsweb.org or 802-359-5000. ♻

# Museums in our Region Support Solar & Sustainability

*Jessie Haas*


*The Children's Museum of New Hampshire is thrilled to be partnering with ReVision Energy and the town of Dover to house part of a 318-panel rooftop solar array at the museum and pool, which share a common electricity meter. Image: © taraphotography.com.*

The Children's Museum of New Hampshire in Dover, along with the Dover Indoor Pool, installed roof-top solar in 2018. The 101.7kW array consists of 318 roof-mounted panels on the two buildings, with an expected production of around 120,000 kWh annually. This will offset 126,000 pounds of carbon pollution a year and is expected to meet about 30% of the combined needs of the facilities. That will rise to about 50% once the museum converts to LED lighting.

The Museum and city of Dover will purchase the energy produced on the two roofs at below-grid cost for five years, without an upfront payment. At the end of five years they will buy the panels. The installation was made possible by the Energize 360 program, a grassroots effort in New Hampshire to reduce energy use and transition to renewables. Through the program, 103 solar panels had been set aside to donate to nonprofits. The Children's Museum was chosen as the recipient, because it serves all the participating towns, along with the rest of New Hampshire and receives over 100,000 visitors a year.

The Museum had already been exploring installing solar when Energize 360 approached it with the donation of 103 Tier 1 panels. The city of Dover got involved as the landlord—the Museum's building is the former recreation building and is owned by Dover. According to Jane Bard, Museum president, with the seed of the 103 panels it made sense to go further and add rooftop solar to the adjacent city pool. The whole process took about six months working with ReVision Energy, Energize 360's solar contractor.

The Museum building was already LEED Silver certified. There are plans to improve efficiency further. The next project is to convert all lighting to LEDs. The Museum is actively seeking funding to help make this conversion which will increase the contribution of the solar panels and "help us invest more in our public programs and education," says Bard.

The Fairbanks Museum in St. Johnsbury, VT converted to LED lighting in 2015, replacing 400 fixtures. Lower energy costs were immediate. So, too, was an improved aesthetic experience, as the new fixtures were less obtrusive. And LEDs are better for many exhibits, as they emit fewer infrared rays and no ultra-violet.

Fairbanks went on to invest in solar panels, starting with three in the parking lot, supported by a USDA grant. Now investments in solar parks, including the Solaflect Fairbanks Solar Park in St. Johnsbury, offset all the Museum's energy use. The electricity bill in

*Cont'd on p.25*



# WHERE'S WINTER?

*By Erin Rounds,* Billyfish Books*, 34 pages, $7.99 (Kindle edition), $9.99 (paperback) or $15.99 (hardbound)*

*Book review by N.R. Mallery*


*Where's Winter?* is a little book that packs a big message. Every parent, grandparent, and child should know about Erin Rounds' inspiring new book.

*Where's Winter?* is a children's book about a bear who goes into hibernation for the winter, but when he wakes up, he finds that winter never happened. He wakes into a time unlike any spring he has ever seen. There are no flowers, no bees, and no berries for him to eat. The reason for this is that the world has changed into something unlike it has ever been before. The climate has changed.

After engaging the minds of children and helping them understand the nature of climate change, Where's Winter? gives them guidance on a variety of steps they can take to counter the problem. Armed with these ideas, they can understand that there are things they can do, and that they have the power to make a difference.

Erin Rounds, the author of *Where's Winter?*, also illustrated it. The pictures, which are intended for children, are of high quality, using a photo-montage for background images overlaid with artwork. The well-constructed story is supported by clear language which makes the global warming crisis understandable for its intended audience, children aged six through ten.

Children seem to be very taken by *Where's Winter?* becoming eager to put its lessons to use. We have seen reports of children becoming environmentally active, partly because of the book.

*Where's Winter?* is not Erin Rounds' first book. Before it, she published *Charlotte's Bones*, which she wrote but did not illustrate. It is about a fossil of a Beluga whale that lived 11,000 years ago in an inland sea that is

*Cont'd on p.31*

# The Benefits of Geothermal Energy

*Jesse Cook*

### Sick of high heat bills in winter and outrageous cooling costs in the summer?

There is a solution that cools and heats your home more quickly and for less money. It's called geothermal energy.

Geothermal systems take advantage of the unlimited, free energy from the earth. They provide even, constant temperatures year-round as well as complete humidity control for your home—and they're the best option for unparalleled energy savings and operating efficiency.

### How it Works

The earth absorbs approximately 47% of all incident solar energy and stores this free thermal energy beneath our feet. So, even though the air temperature is hot in the summer and cold in the winter, the ground temperature just a few feet below the surface is relatively constant year-round. Geothermal systems take advantage of this by transferring the warmer energy into our homes in the winter and reversing the process in the summer. In essence, the earth is a large solar collector and storage battery, with more than enough thermal energy for everyone.

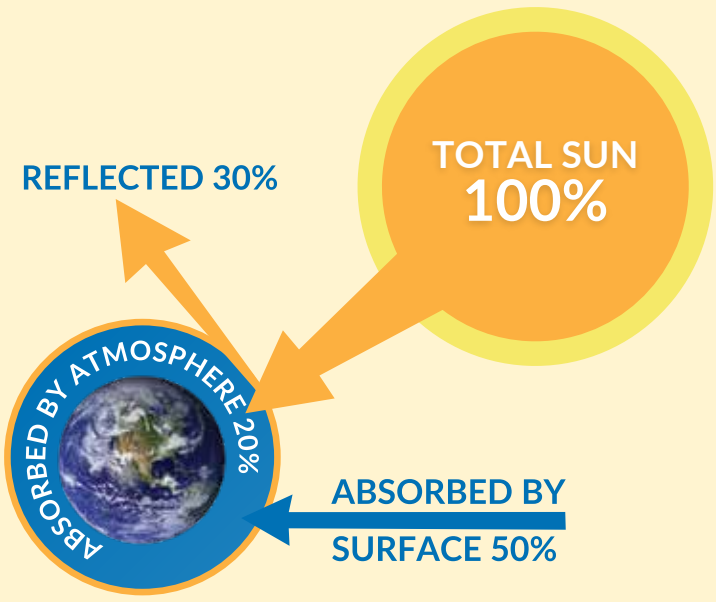
### How the Geothermal System Works

Three basic components make up a geothermal system. They are:

1) The ground loop heat exchanger,

2) the ground source heat pump and

3) the distribution system (ductwork, radiant flooring, fan coil, etc.).




The ground loop is the interface with the earth that transfers energy via a freeze-resistant solution pumped through the exchanger at a high velocity. Several ground loop types and designs are available to match the unique properties of each project (see below).

The ground source heat pump utilizes a refrigeration circuit to extract thermal energy from the ground loop and transfer it to the distribution system during the winter months to warm the home. During the summer, this process is reversed to cool the home.

The distribution system quietly delivers heat throughout the home, creating a very even and controlled temperature. Air-based systems use duct work, while radiant flooring or fan coils distribute heat with a water-based hydronic system.

### Environmental Benefits

According to the EPA, geothermal systems are "the most environmentally friendly way to condition our homes" since they need only a small heat pump to operate and give off no combustion emissions. Further, since a geothermal system only moves heat from beneath us into our homes, no energy is created by burning fuels or by using standard electrical consumption. Removing the combustion process from heating reduces our dependence on foreign oil and eliminates the potential for carbon monoxide poisoning.

### Cost Savings

Geothermal systems can reduce heating costs up to almost 80%. The EPA shows that homeowners using geothermal energy save an average of roughly $1,500 annually compared to those using traditional heating or cooling methods.

Another significant cost-savings benefit of geothermal systems is the longevity of the equipment. Geothermal components last on average for 25 to 50 years; that's typically at least 10 years longer than an average furnace or conventional AC unit. The EPA also shows that homeowners save roughly $1,500 annually compared to conventional systems.

A geothermal system can bring you the cost savings and low environmental impact that you've been looking for in a heating and cooling system. It's reliable, consistent and easy to maintain over time. And it may just be the solution you need.

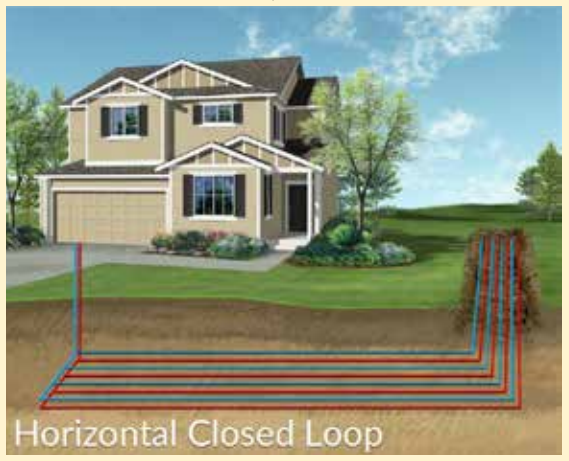
To learn more please visit:

https://geothermhvac.com/geothermal-heating/.

*Jesse Cook is the owner of Geotherm, New York's most trusted renewable energy experts.*

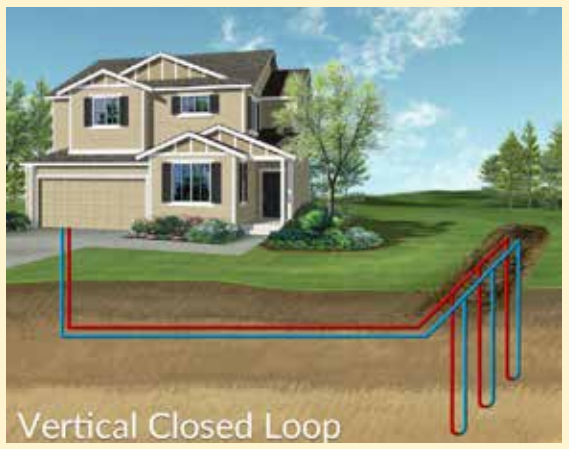
*The company is committed to high-quality, cost-effective energy reduction solutions for home owners, builders, municipalities, business owners, and communities. As the premiere resource for "green" energy alternatives, they help homeowners significantly reduce utility costs with environmentally responsible systems and products.* ♻

### Which Geothermal System is Right for Me?




The most common loop design utilizes an excavator to bury the heat exchanger horizontally in the ground approximately 6ft deep.


An abundant supply of high-quality water can be used to operate the heat pump. Water is pulled from a well and discharged into either a pond, stream or another well.




This loop allows smaller properties to take advantage of geothermal technology. A drilling rig is used to bury the heat exchanger vertically in the ground.


The most cost-effective strategy submerges the heat exchanger in a large body of water (because no digging or drilling is needed). Most homes require a half-acre pond with a ten foot minimum depth for proper operation.

# ThermoLift Heat Pumps

*George Harvey*

*Paul Schwartz, CEO/Co-Founder of ThermoLift, showing a prototype unit.*

Some things are both counter-intuitive and extraordinary. To understand them, we really need to have a grasp of science. So I hope no one minds if I start with explaining a couple of things about science.

First off, gases behave according to certain physical laws. Compress a gas, and it gets hot by a predictable amount. Decompress it, and the precise opposite happens.

This is how a refrigerator works. First you compress a gas, making it hot. Then, without decompressing it, you cool it off in a set of coils. Then you allow it to decompress, making it really cold in coils hidden within the refrigerator. The gas is then cycled back to the compressor.

The second thing is that heat is everywhere in the universe. Nothing we know of is at absolute zero temperature. That means that everything has some heat in it. An air-source heat pump extracts heat from the cold outside air and moves it into the house.

Heat pumps, refrigerators, and air conditioners nearly all work pretty much the same way, using electrical energy to operate mechanical devices that move heat around. A heat pump takes heat from a cold place, making it colder, and puts it into another place, warming it up.

It happens that a resistance electric heater operates at just about 100% efficiency, delivering an amount of energy in heat that is equal to the electricity consumed by the unit (though this does not account for the loss of perhaps 65% of the energy used to generate the electricity in the first place). And this is where we come to the first of the counter-intuitive things I mentioned. Using the same amount of energy, a heat pump can deliver a good deal more heat than the 100% efficient resistance heater. This is because it is moving heat instead of making it. Avoiding calling things more than 100% efficient, we use a very slightly different concept and terminology to describe how well it does this, the coefficient of performance, or COP.

Now comes the exciting part. There is more than one way to drive a heat pump. Most of the heat pumps on the market use electrically driven compressors. A very few, however, use other means.

ThermoLift, a startup company in Stony Brook, New York, is in the last stretch of bringing a new kind of heat pump to market, and it has some really impressive features. ThermoLift aims to reduce the cost of heating and cooling by 30% to 50%, using equipment that promises to have costs on par with existing equipment.

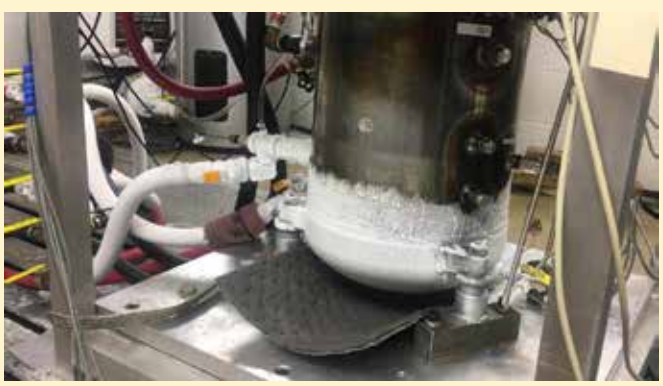
Advanced building simulation by the National Renewable Energy Laboratory and testing by Oak Ridge National Laboratory (ORNL) are proving the concept. The Department of Energy (DOE) looked at over 300 technologies for heating and cooling and gave the ThermoLift heat pump the highest rating. It has been financed in part by grants from the DOE and the New York State Energy Research and Development Authority.

ThermoLift's prototype heat pumps are powered primarily by combustion of natural gas, though other fuels could eventually be used in practice, including renewably produced hydrogen. The heat from combustion is captured in a chamber at the top of the unit containing helium. (We should note that no refrigerants are used, and helium is not a pollutant.) The helium and the heat are moved by a piston-like device called a "displacer" to a central, warm chamber from which it can be released into an area being heated. Meanwhile, a lower, cold chamber is drawing heat out of its own environment, and this heat is also pumped by a displacer into the central chamber.

The displacers are moved by the systems internal gas forces and synchronized by magnets, instead of motors and rods. Surprisingly, they are also the only two moving parts in the machine. This means that the heat pumps are very quiet and efficient. It also means they use nearly no electricity, possibly making them ideal for heating buildings that are not grid-tied.

In a laboratory, the cold chamber of the machine can be made colder than -150° F. The machine is actually extracting heat energy from an environment at that temperature and delivering it as what we perceive as heat. Because *Cont'd on p.26*

*Computer readouts demonstrate the technology in operation. L-R: Nicholas Allen (Mechanical Engineer) , Paul Schwartz (CEO) , Erik Kauppi (Electrical Engineer Manager) , Adrian Tusinean (CTO), David Yates (Chief Designer).*



*Machine freezing over at Oak Ridge National Laboratory. Photos: ThermoLift.*

# Is The Glen House the Greenest Getaway in the White Mountains?

## HOW THE RECENTLY OPENED HOTEL IS MODERNIZING A CENTURY-OLD LEGACY OF SUSTAINABILITY

*Chris Gillespie*

*Since opening last fall, The Glen House has welcomed guests looking to take in the winter splendor of Mt. Washington. Image: Mt. Washington Auto Road.*

If you're looking for a year-round destination to enjoy the natural beauty of New Hampshire's Presidential Range that is both stunning in its scenery and cutting-edge in its energy conservation, The Glen House is the hotel for you.

Although various iterations of The Glen House have come and gone in Pinkham Notch over the years dating back to 1852, the recently completed hotel exemplifies sustainability and next-generation energy efficiency so much that it has received recognition from Senator Jeanne Shaheen.

Development of the modern incarnation of The Glen House started a decade ago but was cut short by the Great Recession. When the team at Mt. Washington Auto Road decided to resume development of The Glen House in recent years, they were afforded the chance to "start from scratch" and "really head in the direction of sustainability," under the guidance of Mt. Washington Auto Road and Great Glen Trails general manager, Howie Wemyss.

"I pushed pretty hard for it to be sustainable," said Wemyss, who started working as the general manager of Mt. Washington Auto Road over thirty years ago. "Sustainability is a personal philosophy of mine, so it has been rewarding to have been able to steer the company in this direction over the years."

Since opening on September 12, 2018, The Glen House has become the latest achievement in sustainability for the Mt. Washington Auto Road. The company has a long history of embracing conservation, from utilizing hydropower from a nearby water source in increasing efficiency since the late 1800s, to becoming one of the first businesses in New Hampshire to install electric vehicle charging stations in 2013.

"We are fortunate to be stewards of a piece of property here that is on the edge of the wilderness, and I feel that it is incumbent on us to take as good care of the property as we can," said Wemyss. "With modern technology, it's much easier to make the business case to go in this direction and, coupled with being better for the environment, it's a pretty easy sell, in my opinion."

Mt. Washington Auto Road's commitment to sustainability is truly manifested at The Glen House: the entire facility, from the guest rooms to the parking lot, is outfitted with exclusively LED lighting and is heated and cooled using geothermal energy. The Glen House even features state of the art elevators whose motors double as generators that yield enough energy to drastically reduce the elevators' operating costs. The construction management of this eco-friendly hotel was done by Martini Northern of Portsmouth, NH.

All of these sustainability measures, while impressive, are just the beginning for The Glen House. In the near future, Wemyss and his team plan to look into installing solar panels on the property and expand their hydropower system to better utilize the currently underutilized upper two-thirds of their waterway. The goal, Wemyss says, is to use solar power to cover whatever electric demand is not covered by hydropower.

"Within two years from

*Cont'd on p.25*

# AeroBarrier™ – An Air Sealing System That Fills the Gaps

*Sean Flynn*

## THE PROBLEM

As a custom home builder in the high-end market for the past 20-plus years, I have watched the emphasis on energy efficient building practices grow to the point where a blower door and tape roller have become as standard in the toolkit as a block plane and a circular saw. On every house we build, we have been engaging in rigorous taping and sealing procedures --from the foundation through the roof -- to great effect, and often achieving ACH50 (a measure of how much air leaks per hour) numbers well below 1. However from a cost-per-square foot basis on a complex project, these wins often come with a significant price. These numbers often prove very difficult to achieve, even when code dictates that they must be reached and verified. To that end, we are constantly searching for new products and practices to streamline the air-sealing process and achieve our results with less cost and a knowable result.

## THE SOLUTION – AEROBARRIER™

Aerobarrier™ is an aerosol air sealing system we recently added to our toolkit to try and address these issues. In essence, the system involves blower door pressurization of the house (to +100 Pascals), a series of tripods with spray nozzles on them and the introduction of a fine mist of specialized acrylic caulk. From there, much like a balloon with pin holes in it, the pressure drives the sealant to all the small cracks in the building and seals them up. During installation, we monitor the air changes per hour on our screen and watch the needle drop as the various holes and cracks throughout the house fill with sealant. When we reach our leakage target we turn off the machine, clear the air with a few fans and open windows and clean up. In most situations, we can take a house from around 7 ACH50 down to below 1 in under two hours of spraying, with set up and clean up on either end amounting to another few hours. The space can be worked in again within about thirty minutes, and once cured, the sealant is a non-toxic, low-VOC substance that is GreenGuard Gold certified for use in schools and hospitals.

*The Aerobarrier spray system in action. Photos AeroBarrier™.*

We can install at two different points in the building process: 1) Up against the exterior sheathing plane, after all mechanical penetrations are complete. In this case, it is important that there be insulation applied to the exterior of the sheathing, in order to keep the wall-assembly dew point away from the air barrier. 2) Up against the sheetrock plane (after mudding and taping, before finish paint). This method sometimes requires more protection before spraying (see figure) but ensures that the air barrier is as far away from the dew point as possible. This method is also used in multi-family projects, as it ensures air-space separation between units.

AeroBarrier™ will, in principle, fill a hole of any size given unlimited time and material, but in practice, it is limited to gaps of around 1/2" or less in width. The product does not stick to any vertical surfaces, but it will adhere to horizontal ones. So, while window sills and sashes are easily covered with tape before spraying, finished floors, counter tops, appliances etc. require protective covering. From a cost perspective, AeroBarrier is usually about $1.50-$2.00 per square foot of floor to install.

In general, this system has changed the way we approach air-sealing and could change the way we think of insulation practices. However, it is not an all-in-one approach to good building practices. We continue to take care to keep our sheathing planes continuous, gasket or spray foam building penetrations and in general build our houses tightly and soundly. What we have moved away from is excessive use of tapes, wraps, and sealants for air-sealing, freeing up more of our time to be carpenters and craftspeople.

Learn more about AeroBarrier™ at https://aerobarrier.net. Contact Sean at zone6energy.com or (802) 324-1493.

*Next issue, we will share some local stories about projects sealed with the AeroBarrier™ system, as we learn about this amazing new innovation that is transforming the way to achieve airtight high performance construction.*

*Sean Flynn is the owner of Silver Maple Construction in Middlebury VT. His company specializes in super energy-efficient, high-end custom homes and unique commercial projects. He lives with his wife and three young boys in Weybridge VT.* ♻

## Museums in our Region

*Cont'd from p.21*

*The solar array in Dover is partly installed on top of the roof of one of the town's pools, while the other is partly installed on the roof of the connecting Children's Museum of New Hampshire. Courtesy photo.*

2017 was $17,000. Today it is zero.

Montshire Museum of Science in Norwich, VT has also switched to LED lighting and taken other steps toward sustainability, including installing automated controls for the HVAC system and adding a modern wood pellet boiler. The pellet heat system was designed and installed by Lyme Green Heat of Lyme, NH and is detailed in the October 2017 issue of Green Energy Times at http://bit.ly/GET_Montshire_HeatSystem. Montshire also uses eco-friendly cleaning supplies. Finally, the museum store emphasizes sustainable products like reusable food wrap and stainless steel water bottles. Climate education is a large part of Montshire's mission, and there are programs addressing it for children and adults. During Science Stories, a summer camp for middle schoolers, campers interview members of the community who are engaged in sustainability efforts (such as Vermod of Wilder, VT, which develops zero energy modular homes) in order to create a podcast to share their story.

Shelburne Museum in Shelburne, VT shifted to all LED lighting in 2013, with an annual savings of $28,000 a year.

Commercial LED lighting ranks 44th on the Drawdown list of global warming solutions, with the potential to reduce 5.04 gigatons of carbon production and save $1.09 trillion dollars by 2050. (The numbers are even larger for household LED adoption, which ranks at 33.) Lighting accounts for 15% of global electricity use, more than the output of all nuclear plants combined. Project Drawdown is the collective work started by Paul Hawken to identify and research the most effective methods to reverse global warming.

*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.* ♻

## The Glen House Greenest Getaway?

*Cont'd from p.24*

now, once we have real data on the electric demand of the hotel, we'll design and install a solar array to take care of the rest of the hotel's electricity," said Wemyss.

Wemyss encourages business owners to take advantage of whichever renewable energy options are available to them.

*The Glen House has many pieces of hardware, including the geothermal circulation pumps seen here, that save money and energy. Image: Mt. Washington Auto Road.*

"We are fortunate here to have running water coming down the hill so utilizing that resource was the 'lowest hanging fruit' for us, so to speak," said Wemyss. "Almost everyone, though, is in a situation where the sun is shining on them, so every business owner with an electric burden should be looking at solar these days."

Wemyss hopes that visitors to The Glen House will become educated about the importance and accessibility of sustainability and also be inspired to implement more sustainable solutions in their day-to-day lives.

"We aggressively recycle here, so it amazes us when we meet guests who are not used to recycling at all," said Wemyss. "Ideally, once they learn how to recycle while staying with us, they'll start recycling more when they return home."

Regardless of which room guests stay in, they will find an informational brochure outlining all of The Glen House's sustainability practices and renewable energy technology, as well as a small pouch for them to take their room's bars of soap home with them. They won't find, however, any plastic bottles, as The Glen House only uses refillable containers for their liquid soap, shampoo and conditioner. Additionally, the hotel has a water bottle filling station and sells only Boxed Water, avoiding single-use plastic water bottles.

"Since we are in a pristine location, I think our sustainability resonates more with guests, because we're showing them that we're trying to take care of our home and the environment around us," said Wemyss. "We need to show people that there are businesses out there that are doing this and that they themselves can do it at their own homes as well."

For more information on The Glen House and to book a stay, visit www.theglenhouse.com.

*Chris Gillespie is a contributing writer for* Green Energy Times. *He can be reached at chris@greenenergytimes.org.* ♻

# The Climate Crisis - More Complex Than Simple Solutions

*George Plumb*

There have been many commentaries recently about what is happening to the Earth caused by climate change. Most of the commentaries focus on what needs to be done about reducing our greenhouse gas emissions and include suggestions such as putting a carbon tax on fossil fuels, moving to renewable energy, or weatherizing our homes. However, the issue is more complex than those relatively simple solutions.

We must address all the underlying causes of global warming, and the other devastations we are doing to the Earth, such as the Sixth Great Extinction. This is best understood by using the equation: I=PxAxT.

This equation was first proposed in the early 1970's by two scientists, John Holdren and Paul Ehrlich (who had written The Population Bomb in 1968 and whose predictions were then demeaned but are now coming true), as a way to calculate the impact of humans on the environment.

Their equation explains that a population's environmental IMPACT (I) is a result of the size of the POPULATION (P) times the population's AFFLUENCE (A) times the TECHNOLOGY (T) used by that population.

By way of example, if the population of a country is the size of the current U.S. of 326 million, is quite wealthy, and uses a technology of highly fossil-fuel consumptive vehicles, then its environmental impact via carbon dioxide (CO2) emissions is going to be very high. On the other hand, in 1800 when the U.S. population was only 5 million, income was generally very limited, and the technology for transportation was largely by horses, then the carbon emissions from transportation and other sources were minimal.

According to the UN's scientific experts, the world must cut climate polluting emissions to 45% below 2010 levels by 2030. And by 2050, it must reduce them to zero to avoid catastrophic global heating. We are on track to see at least 6.3°F warming by 2100 and much more after that. Numerous reports have shown that it is highly unlikely that civilization as we know and expect it is possible at an increase of 6.3°F.

We obviously can't do much about reducing our population size in such a short period of time. However, thinking long-term, we must nonetheless stress the need to reduce our population numbers. For example, having one fewer child reduces a parent's carbon footprint by 64 tons of CO2 a year.

Regarding the Affluence factor, this relates to our economy and politicians. Developers and most economists keep saying, 'we have to grow the economy.' Not only does this generate more greenhouse gas emissions, it degenerates the environment in many other ways, such as decreasing wildlife habitat. Instead, we should be moving towards what is called a "steady-state economy," one that is more sustainable and benefits all people, not primarily the rich. A steady-state economy doesn't use natural resources beyond their renewable level.

Finally, the technology used, such as for renewable energy, is critical as many climate-change advocates discuss but do not personally always follow. As an example, even most environmentalists use the technology of jet planes to enjoy their travel to foreign lands instead of limiting their recreation to enjoying the nearest forest land. So, we need to think of I=PxAxT at two levels. One is the systemic level involving governmental and corporate dimensions. For this level's two dimensions there is a need to have a more in-depth conversation about what is happening to the Earth, what the moral responsibility is, and what can be done about it, such as a tax on fossil fuels.

The other level is the personal and spiritual one. What does the I=PxAxT equation mean for each of us? I know several people who live a lifestyle that conforms to this formula, and they are quite happy people. My personal heroes are still Helen and Scott Nearing, who lived largely off the land here in Jamaica, Vermont from 1932 to 1952 and then in Brooksville, Maine for the rest of their lives. They wrote the book, Living the Good Life (1954) that inspired thousands of people.

As a couple, they had no children, although Scott had two sons by a previous marriage. Their daily formula was four hours of hard work growing their own food and living largely off the land with limited income by producing maple syrup while in Vermont and then blueberries in Maine, four hours of professional work, and then four hours of personal enjoyment such as playing music, reading, and writing poetry. It certainly led to a healthy lifestyle for them with Scott living to 100 and then choosing to die by not eating, and Helen lived to 91, but died as a result of a car crash.

We can deal with climate change and other environmental issues, although to do so we do need to take a broader look at the causes accomplishing this with the I=PxAxT equation as our lodestar.

*George Plumb, of Washington, VT, is a board member of Better (not Bigger) Vermont and the organizer of the 2014 report "What is an Optimal/Sustainable Population for Vermont?"* ♻



# Vermont Ski Museum Hosts Climate Change Discussion

*Roger Lohr*

The Vermont Ski & Snowboard Museum in Stowe, Vermont is hosting a Red Bench Discussion on April 11th at 6:00pm on the topic of "Actions to Slow Climate Change."

*A section of the 35-tracker solar farm at Smugglers' Notch Resort, with the ski trails on Madonna Mtn. in the background. Image: Smugglers' Notch.*

Participants in the discussion will include a representative from the Protect Our Winters organization, which is a nonprofit climate advocacy group in the winter sports community building a movement against climate change; Nick Sargent of Snowsports Industries America, a member organization of a new coalition called the Outdoor Business Climate Partnership including SnowSports Industries America (SIA), Outdoor Industry Association (OIA), National Ski Areas Association (NSAA), and state ski area groups from California, Colorado, Vermont and others; Burton Snowboards on sustainability, Craftsbury Outdoor Center, and others.

**Climate Change Discussion**

In December 2018, NASJA and Stratton Mountain produced the Northeast Winter Weather Summit to begin a dialogue between ski areas and meteorologists in the region, and at the event there was interest in discussing the issue of climate change. While the topic was intentionally kept off the program agenda, because it did not correlate with the event goals, the topic was briefly discussed following a comment by one of the meteorologist presenters. The back-and-forth was highlighted with an outburst by an attendee asking whether meteorologists consider themselves scientists, not exactly a productive dialogue.

The snowsports industry is somewhat divided on the issue of climate change for a number of reasons beyond labels such as "deniers" and "warmists." One of the elephants in the ski industry's room is the amount of energy it takes to run a ski area that uses snowmaking, multiple high-performing lifts, slope grooming, heating, and so on. There have been great strides with energy efficiency on all fronts, and many ski resorts are exploring sustainable practices in various aspects of their operations. The industry has a multitude of programs such as the NSAA Sustainable Slopes and Climate Challenge and there are a number of snow sport organizations that lobby the government.

Will bankers be reluctant to provide financial support to ski industry businesses, because they don't understand snowmaking and their concern that the more southerly ski areas' days may be numbered due to global warming? Many ski areas have invested in renewable energy credits (RECs) or power purchase agreements, and there is some resentment about that practice when it is juxtaposed against on-site emission reductions, energy savings and/or energy production.

Writers such as Allen Best in Denver and Alan Betts in Vermont recognize solar and other forms of renewable energy, but they've questioned RECs, "The buying and selling of RECs does not help the Earth at all. It is a delaying tactic providing a fig leaf, so that states can pretend they are making the transition, when they are not shutting down fossil fuel plants fast enough, and building renewable alternatives. No amount of honest or fictitious bean-counting can hide this critical and disturbing fact."

Of course, information and education are key, and there is a great need for the ski industry to become aware of the prominent issues associated with climate change starting at every company. ♻



## ThermoLift Heat Pumps

*Cont'd from p.23*

*Paul Schwartz (center), CEO/Co-Founder of ThermoLift, with a prototype unit.*

of this, ThermoLift's heat pumps can heat a building when it is really, really cold outside. A COP of 1.3 is achieved by extracting heat from air that is at -13° F.

The first test units are being put to use. Twenty of them are being installed at government sites, including military installations, to be tested. And ThermoLift is getting ready for commercial release, possibly in 2020. We will watch for developments.

ThermoLift's web site is www.tm-lift.com. ♻

# The Clash between Oil and the Future

*Dr. Alan K. Betts*

Global ocean temperatures set a new record in 2018, beating the previous record set in 2017. New studies show that both the Antarctic and Greenland ice sheets are melting faster than ever, so that sea-level rise is accelerating. In the third week of January, the weakening polar vortex gave us bitter cold weather and heavy snow (and as I write more is falling). However, our spinach and lettuce in cold-frames are doing fine, as the snow cover has protected them.

That's the real world. But here in the U.S., the new surreal world continues. I remarked last month that the President refused to read the fourth National Climate Assessment mapping out how bad climate change will be for the U.S. if we stay on our present fossil fuel energy system. The EPA head also said he was too busy to read this report, which his own agency helped produce. His extraordinary excuse was that much of the science in the report came from the time of the Obama presidency. Am I to suppose by implication that the next NCA report will be filled with Trump science?

The Federal government shutdown affected a lot of government science along with so many other "non-essential" government branches. Science is considered worse than non-essential, because much is incompatible with right-wing doctrine. The shutdown prevented the weather service from upgrading models and updating codes to receive all 2019 global data. It prevented many scientists from reviewing recent climate data. Slowly but surely, government by ideology and blackmail is pushing the U.S. into third-world status.

Both snow and missing data have meant that I have had time to read and think deeply. Reading the extraordinary book, "Oil, Power and War" by French author Matthieu Auzanneau, has given me a new global perspective on how our dependence on oil has led to far-reaching conflicts over the past century. I learnt a lot about the central role of oil in warfare – and the millions that have suffered and died for oil. The U.S. military and economic dominance has been closely tied to the control and access to global oil supplies. This still continues in the ongoing turmoil in the Middle East, and the latest struggle to regain control of the large Venezuelan oil reserves.

I thought I was well-informed, but now I realize the immense secret power of the U.S. oil monopolies has ruled government policy for the past century, rather than the reverse. In parallel to the military role of oil, the rapid material growth of the U.S. economy in the decades after World War II was also enabled by the U.S. global control of cheap oil supplies. Remember the magnificent icon of our growth and prosperity was the gas-hungry 1950s V8 Cadillac with fins.

But because we refuse to make the transition from oil, the crash is coming closer. In a tragic microcosm across the border in Mexico, people risk their lives by tapping pipelines for gasoline. The poor are desperate for fuels, and it is a $3 billion-a-year business for organized thieves.

*Pumping oil. Image: mexicinstitute.wordpress.com*

I see much more clearly how accelerating climate change is linked to the power of oil in both our industrial society and our military dominance. The EPA has recently been told to roll back efficiency standards for cars once again to keep us trapped in this spiral of demand driving supply that is profitable for the oil industry. Right now the U.S. has record oil production, but we ignore the fact that in a decade or so, when this shale oil extraction peaks and the crash comes, the climate impacts will be irreversible.

Yet plug-in hybrid cars can right now deliver an 80% reduction in gasoline use, with large savings in fuel and maintenance costs to the owners, large gains for the climate, and a smooth transition away from oil. However, both society and the automobile industry are reluctant to really market them, because oil consumption and inefficiency control policy.

But shifting back to the renewable world, Vermonters are starting to tap trees for maple syrup as they have done for centuries, and soon we will be eating fresh spinach again.

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

# OUR PLANETARY GARAGE

*John Bos*

*Smog surrounding Los Angeles. Image: Wikimedia Commons*

Here's a question: how dangerous is it to operate a gasoline engine in a closed garage? The answer is very dangerous, life-threatening in fact. The carbon monoxide emitted by the engine – your lawn mower or snow blower – can reduce the amount of oxygen to the brain causing CO intoxication and lack of reasoning. At first. The "sleep" comes a little later on after the CO concentrations reach the Immediately Dangerous to Life and Health (IDLH) concentration of 1,200 parts per million (ppm) in only seven minutes when a small five-horsepower gasoline engine is run in a 10,000 cubic foot room.

Now consider the IDLH concentrations of a 135 horsepower automobile running in a single car garage of 1,600 cubic feet.

If one can accept the facts above, here are some sobering follow-up statistics:

- The number of registered vehicles (cars, trucks, buses and motorcycles) in the United States in 2018 was 276.1 million, up 6 million from 2017.
- The automotive trade journal Ward's Auto has estimated that the total number of vehicles in the world crossed 1 billion vehicles sometime during 2010. Less than four years later there were more than 1.2 billion cars on the road.
- By 2035, a record 2 billion cars will be exceeded. According to a report from Macquarie Bank, 88.1 million cars and light commercial vehicles were sold worldwide in 2016, up 4.8% from a year earlier.
- Not included in these statistics are gasoline or jet aircraft.

You don't have to be an atmospheric scientist to get the picture. Calculating the total number of motor vehicles on the planet is an inexact science but that the number of CO emitting vehicles is growing rapidly cannot be denied. Nor can the resulting impacts on human health.

Our planetary garage is simply not big enough to prevent CO2 pollution from killing people. Lots of people. One has only to look at photographs of the fog of pollution in Beijing, Mumbai and Los Angeles to know that breathing that air is less than healthy.

CO2, combined with particulate pollution (PM2), contributes to an estimated 7 million premature deaths each year according to the World Health Organization.

The biggest source of particulate pollution known as PM2.5, according to the WHO study, is from heating and cooking, since meals are prepared and homes heated by mostly cow dung, wood or other biomass.

Agriculture is the next biggest contributor to premature deaths from air pollution. Ammonia from livestock and fertilizer cause the formation of ammonium nitrate and sulfate particles, which contribute to air pollution.

China is the largest emitter of carbon dioxide in the world. The country emits more than 10,375 million metric tons per year, which causes serious health problems for the population, especially in the big industrial cities. Beijing is the most polluted city in the world where there are literally weeks when locals don't see the sun because of the smog. Many citizens wear protective masks when they go outside and the local authorities have installed giant screens, which show sunrises and sunsets, to prevent depression. Nevertheless air pollution in China causes millions of deaths every year and although the country has a thriving economy, it is also the biggest polluter in the world. That's why the Chinese government has announced plans to take up to 6 million vehicles that don't meet new emission standards off the roads in an effort to mitigate that country's air pollution crisis.

In second place is the world's (still) largest economy, the U.S.A. American citizens are one of the most mobilized populations and the traffic on the streets and in the skies is so high that air pollution is becoming a more and more pressing problem. The infrastructure of American cities and suburbs forces people to travel by cars which, combined with industry, emits 5,414 million metric tons of CO2 every year.

Petroleum powered vehicles are only one source of CO2 pollution that we humans can control. As a culture we are in deep denial about the irreparable damage we have visited upon our collective home. Earth cannot begin to reverse its slide into an uninhabitable climate without the resolve and help from those who live on it.

*In America, vehicular traffic combined with industry emissions accounts for 5,414 million metric tons of CO2 emitted into the atmosphere every year.. Image: la.crbed.com*

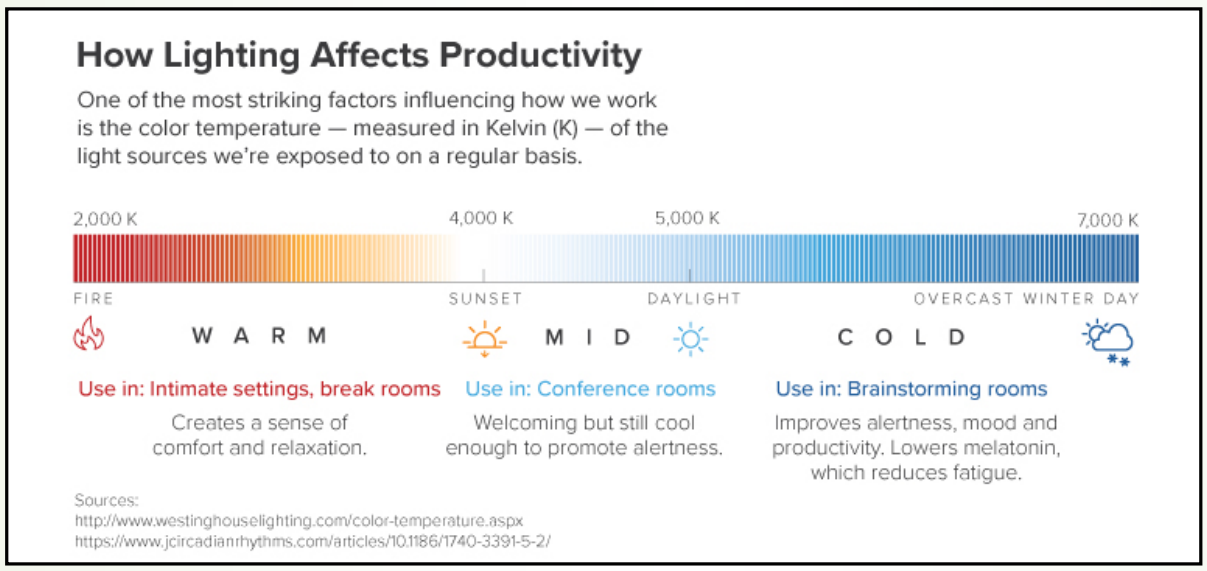
John Bos lives in one of the five great places to live in America - Shelburne Falls – as ranked by the American Planning Association. He is a columnist for the West County Independent and a frequent contributor to the Greenfield Recorder writing about climate change. He invites comments and dialogue at john01370@gmail.com. ♻

# SWA's Top 10 Tips for a Healthier Indoor Environment – Part 2

*Lauren Hildebrand*

## *Here's to Our Buildings, and Our Health!*

The evidence in support of more healthful buildings is overwhelming. Children living in green housing have significantly lower incidents of asthma. In the workplace, we see greater employee productivity, with staff that are more engaged, creative and innovative, and less likely to leave for a competitor. And, the same concepts can be applied to tenants in apartment buildings and condos as well.




In Part I of this article, published in the January 2019 issue of Green Energy Times (http://bit.ly/IndoorEnvironment_GET_Jan2019), we outlined our top five (of 10) tips for more healthful buildings, which discussed strategies for better indoor air quality as well as mitigation of harmful household chemicals. We now conclude with our remaining top tips for a healthier indoor environment:

### 6. PESTS, LEAVE MY KIDS ALONE!

More than 20 million people suffer from chronic asthma, including eight million children. There is a correlation between the prevalence of asthma among children and adults and the presence of pests, allergens, and pesticides. To help manage and avoid pests, use our PEST strategy: Prevent by design; Evaluate existing conditions and create an integrated pest management (IPM) plan; Service existing issues and implement preventative measures; and, Train building management, maintenance, and occupants on best practices.

### 7. REDUCE NOISE, REDUCE STRESS

Studies have shown a correlation to depression, stress, and heart disease when occupants are exposed to high levels of sound, such as road traffic and construction. According to Harvard's 9 Foundations of Health, each year roughly 30 million Americans are occupationally exposed to hazardous noise levels, and another 26 million Americans ages 20 to 69 have hearing loss that may have been induced by noise exposure in the workplace or leisure activities. To control for sound, we recommend specifying sealing and sound attenuation to separate dwelling units, choosing fans based on sone ratings, installing remote-mount fans, studying 'free area' for grilles and louvres to avoid whistling, and testing for background sound.

### 8. BRIGHTER WORK DAYS, DIMMER NIGHTS

Lighting affects our alertness, productivity, decision making abilities, and circadian rhythm. Artificial (electrical) light throws off our natural rhythms and can lead to sleep disorders, increased risk for accidents, metabolic disorders, cardiovascular disease, and certain types of cancer. Visually induced health impacts include visual strain, eye irritation, and blurred vision. Access to natural light is always the best option, but for spaces where that is not possible, a lighting strategy that follows natural circadian rhythms through balanced lighting levels, intensities, and colors should be employed.

### 9. BRING THE OUTDOORS IN

In a 2018 report published by the World Green Building Council, studies found that people are seven times more engaged if they have a friend at work and that 80% of people feel relaxed after spending time in a garden. Tip #8 touches upon the benefits of natural light, and we can also incorporate elements such as benches and rooftop gardens that provide a communal space to gather and promote more time outdoors. Perceived connection to the outdoors from within buildings through daylighting, views and natural design elements (biophilia) have been linked to improved sleep duration and mood, reduced sleepiness, reduced stress, lower blood pressure, and increased physical activity. We can also help foster this connection with nature – and with each other – by installing murals, pictures, living walls, and other patterns that we observe from our exterior surroundings.

### 10. GET ACCESSIBLE AND GET ACTIVE

Many of the issues targeted by public health initiatives (i.e., asthma, diabetes, heart disease, mental illness, etc.) qualify as disabilities under the Americans with Disabilities Act (ADA). Healthy People 2020 cites the design of the built environment as being critical to "achieve growth, development, fulfillment, and community contribution" for the disability community. We recommend incorporating Universal Design elements that align with strategies for aging in place, social networks, active living, age-friendly workplaces, and person-centered healthcare. Additionally, physical inactivity rivals smoking as the leading cause of preventable death in the world. A 25% increase in physical activity could avert 1.3 million untimely deaths worldwide annually. Using NYC's Active Design Guidelines can help encourage people to move more within their buildings.

The healthy building movement is increasingly being embraced by real estate professionals and the marketplace. Let's not only get healthy through smarter design choices – let's invest in it!

*Lauren Hildebrand is the Sustainability Director at Steven Winter Associates, Inc.* ♻

# How Safe Is YOUR Indoor Air?

*Barbara and Greg Whitchurch*

Indoor Air Quality (IAQ) refers to the quality of the air within buildings, especially as it relates to the health and comfort of the occupants. A home that's healthful for the occupants has the proper moisture level, is pest-free, contaminate-free, and well-ventilated with filtered outside air.

IAQ is affected by building design, construction practices, materials, and by the furnishings and finishes; also by having a tight building envelope that keeps undesirable outside pollutants out of the building, such as mold, pollen, and smoke. All this is consistent with what we now know about energy efficient building practices: a tight, well-insulated building gives one control over the quality of the inside air, while leaky, "breathing" buildings are at the mercy of outdoor pollution, wind, and temperature swings.

In the past, we relied on air leakage to ventilate homes. The old myth saying "a house has to breathe," has been debunked. Improved construction methods achieve airtightness with continuous vapor and air barriers and airtight windows.

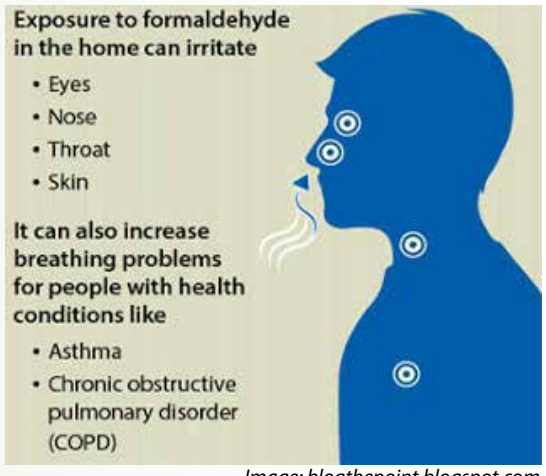



*Image: blogthepoint.blogspot.com*

One common problem is formaldehyde (bit.do/hhs-formaldehyde), a chemical that is used in pressed wood products, plywood, paneling, foam insulation, carpets, drapery, glues, and gas ranges – even paper towels, dryer sheets, and baby wipes.

To cut down on formaldehyde in your home, avoid the products that contain it. But what if they're part of the building itself? Certain plants (e.g. bit.ly/SD-plant-cleaning-air ) and materials (e.g. bit.ly/CT-air-renew-drywall) can assist in scrubbing specific pollutants out of indoor air. But once the toxin is in that air, the simplest answer is ventilation.

**Why ventilate?** Ventilating a building brings in air with the oxygen we need to live. As we breathe, the oxygen is replaced with carbon dioxide (CO2). Without proper ventilation, oxygen levels in your building can be reduced and cause headaches, fatigue and concentration difficulties.

**Ventilation controls humidity.** Human activity creates humidity (breathing, taking baths or showers, cooking, laundry). A family of four can release about five gallons of water vapor into their home each day. Excess moisture can cause odors, oxidation (e.g., rust), mold, rotting and condensation. And, in cold climates, the typically very low humidity in winter causes reduced resistance to colds and flu. Proper ventilation can keep the humidity levels from dropping too low.

**Ventilation is important to eliminate pollutants.** Smoke, paints, solvent and glue fumes, pollen and mold spores are all pollutants that increase the risk of contracting respiratory allergies, rhinitis, asthma, and bronchitis. Ventilation reduces the risk of exposure to radon gas, considered the second leading cause of lung cancer - after tobacco smoke.

The simplest ventilation technique is to open your windows. Obviously, this is hardly any better than depending upon air leakage from the construction materials and methods of older buildings. In most homes, the leaky places where air comes in are where bugs and vermin travel, hide food, die, and deposit their wastes and dander.

Addressing leaky houses, Allison Bailes III, PhD, of Energy Vanguard says, "Probably the most common type of whole-house mechanical ventilation system in homes is an exhaust-only system. The problem is, this type of system sucks. Literally. And if your house is sucking from an attached garage, a moldy crawl space, or dirty attic, you could be making things worse. The way to avoid having a house that sucks is to do balanced ventilation (bit.do/ev-vent4).

**Balanced ventilation with a heat or energy recovery ventilator (HRV or ERV)**

These devices push stale air outside and bring fresh filtered air inside while saving most of the thermal energy (heat or coolness) already invested. The HRV just saves temperature; the ERV also saves the moisture difference. If you wish to go beyond the ERV by including a small heat pump for heating and cooling, consider the Conditioning ERV (CERV bit.do/be-cerv) or the Minotair (bit.do/minotair) -- both devices can

*Cont'd on p.30*

# Catalyzing Clean Energy in Northern New England

A study released on February 13, 2019 by The Nature Conservancy (TNC) and Coastal Enterprises Inc. (CEI) identified strategies to transition New Hampshire, Vermont, and Maine to a clean energy economy. Innovative public-private partnerships and new investments can spark a clean energy future that has the potential to catalyze the creation of new jobs, expand access to renewable energy and energy efficiency, and lower greenhouse gas emissions.

Image: Wikimedia Commons

According to the report, it will require $100 billion of investment across the three Northern New England states to transition to a clean energy future. Northern New England spends $8.2 billion every year on imported fossil fuels that could be redirected toward local clean energy solutions to eventually meet 80% of the region's energy needs with renewable heating and electricity, energy efficiency, and electric vehicle transportation.

The transition to cleaner and more efficient energy will rely largely on private investment and leadership from businesses, governments, and non-governmental organizations (NGOs). Investments in clean energy have proven economic benefits. Energy efficiency and distributed clean energy can reduce energy costs, hedge against volatile energy prices, and support local jobs. The report shows that improved policy approaches like expanded opportunities for community solar energy projects and innovative financing mechanisms can help overcome upfront cost barriers and allow businesses, consumers and municipalities to realize costs savings from day one.

TNC & CEI are striving to create a vision for a clean energy future that is rooted in affordability, accessibility, and availability. This report helps identify tools to increase investment and finance to support the region's transition to clean, reliable, affordable energy for ratepayers of all types and scales.

The Nature Conservancy in Vermont, New Hampshire, and Maine and Coastal Enterprises Inc. commissioned the Vermont Energy Investment Corporation (VEIC) to research and identify the opportunities and challenges to clean energy investment. The results of which can be found in the "Advancing Clean Energy Investment in Northern New England" report. Learn more at http://bit.ly/VEIC-advancingRE-ne.

The Nature Conservancy website is nature.org, Contacts: Jim O'Brien, Director of External Affairs New Hampshire at 1.603.856.5378, jim_obrien@tnc.org or Eve Frankel, Director of Strategic Communications Vermont at 802.229.4425, eve.frankel@tnc.org.

The VEIC website is veic.org. Contact: Alayna Howard at VEIC at (802) 658-6060 x7656, ahoward@veic.org. ♻

## How Safe Is YOUR Indoor Air?

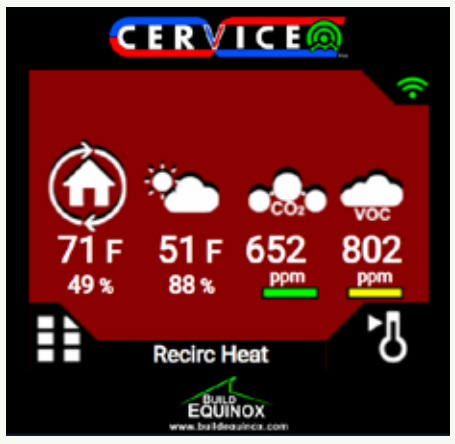
*Cont'd from p.29*

also control other heat pumps throughout the home.

The CERV shows a continual readout of parts per million (ppm) of CO2 and ppm VOCs throughout the day - the tolerance levels for those pollutants can be adjusted by the homeowner. It is used in Efficiency Vermont-related projects (bit.do/evt). We have a CERV in our own award-winning Passive House (bit.do/vgbnphc).

The U.S. EPA (bit.do/epa-iaq) and Efficiency VT (bit.do/evt-iaq) provide information and links to research regarding IAQ effects on cognitive function, quality of sleep, and frequency of employment sick leave.

Superior indoor air quality is one of the many benefits of a high performance home. But even if you have an older home, you can still improve your IAQ, perhaps while you improve its energy efficiency; for help, contact Efficiency VT bit.do/evt-hea.

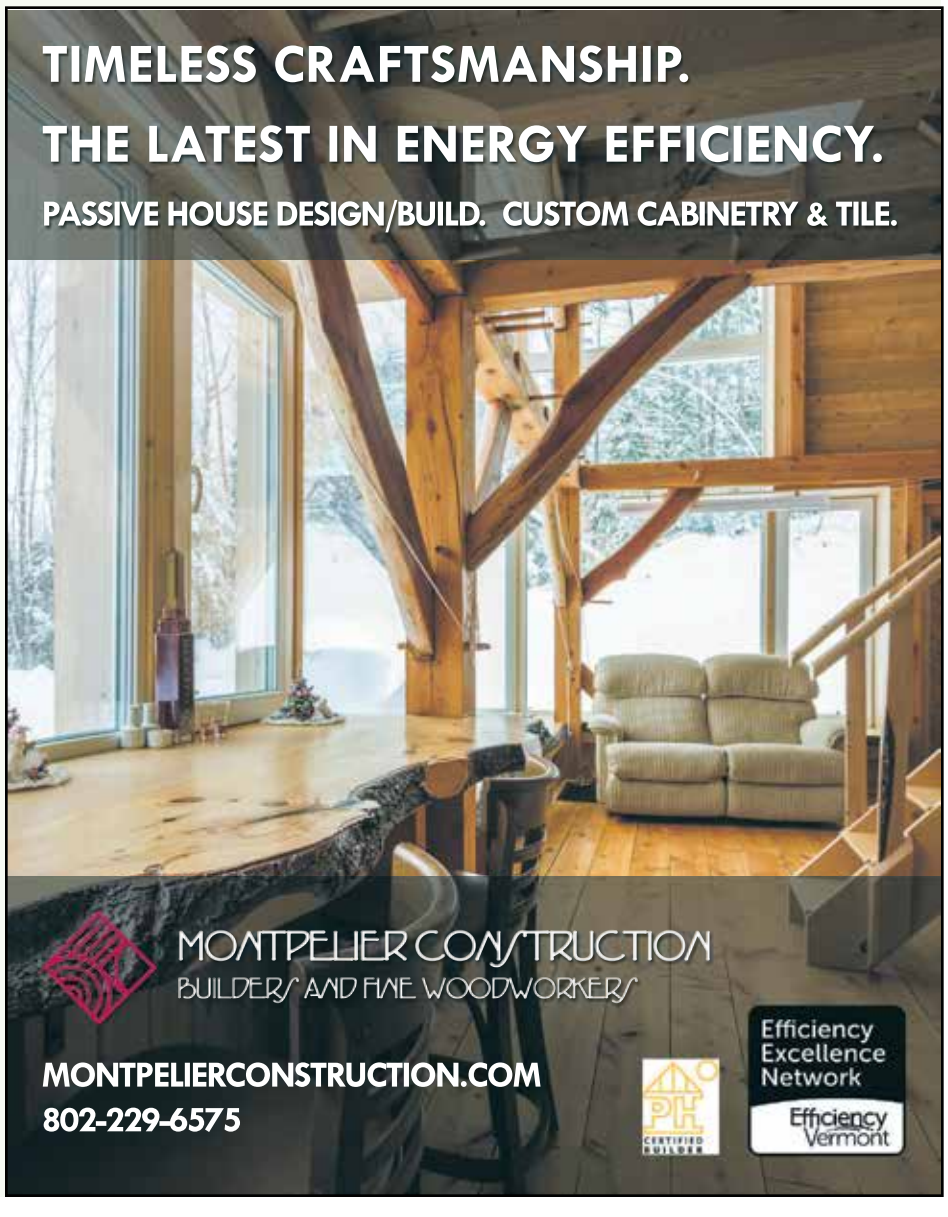



*Front panel display of CERV showing temperature, humidity and indoor contaminant level. Image: Build Equinox.*

*Barb and Greg Whitchurch own a net-zero Passive House in Middlesex, Vermont.* ♻







## Broeker's Final Warning - Cont'd from p. 1

recently discovered "ocean conveyor belt," a system of circulating currents that includes the Gulf Stream. He worked on the issues of how the ocean currents and temperatures are related to climate change. His work covered the current situation, but he also looked at the whole question from a historic perspective, using scientific evidence and dating techniques.

In his final talk, Broecker urged scientists to be ready for geo-engineering. Again, that is not to say that he was urging actual geo-engineering. He regarded it as a last resort, but one we should study so we can be ready if we need it.

The issue of geo-engineering is best illustrated by an event in 1991. Mount Pinatubo, a volcano on the Philippine island of Luzon, suddenly started to erupt. While the quick buildup of the eruptions was interesting in itself, and the emergency evacuation of thousands of people was widely talked about, climate scientists are interested in another aspect of the event.

Along with about 10 billion tons of magma, the eruption of Pinatubo put 20 million tons of sulfur dioxide ($SO_2$) into the atmosphere. In terms of the material it ejected, it was the largest eruption since Krakatoa's, in 1883. The effect of this was a global cooling of 0.5° C (0.9° F) that lasted for well over a year.

It happens to be the case that $SO_2$ and related sulfur compounds are precursors for sulfuric acid ($H_2SO_4$). $H_2SO_4$ reflects quite a lot of sunlight back into space, dimming the surface of the Earth, allowing it to cool off. So the thinking is that all we need to do to reverse the global warming that has happened so far is to dump about 20 million tons of $SO_2$ into the atmosphere every year or two. Of course, as we emit more carbon dioxide ($CO_2$), we would have to increase the amount of $SO_2$.

I know there are probably many readers who want to shout at this point, "That's crazy!" I do not blame them one bit. It is crazy! And that is why Broecker wanted us to study it as a potential last resort. He hoped we would never have to use it, but if we need to use it, we should use it as intelligently and carefully as we can.

Coal-fired power plants have been emitting $SO_2$ for over a century, and this has been returning to Earth as acid rain containing $H_2SO_4$ along with some sulfurous acid ($H_2SO_3$). It melts marble, kills fish, kills birds, inhibits growth of vegetables, destroys paint on cars and buildings, and eats iron, not to mention what it does to our health. That is why the Environmental Protection Agency requires that power plants take care not to emit it above certain low levels.

Putting $SO_2$ in to the atmosphere is actually a type of chemotherapy, intended to keep the Earth alive. No one would choose chemotherapy, unless there is no other option. No sane person would choose to push 20 million tons of $SO_2$ into the air we breathe without a really good reason. The problem is that if we do not act faster to reduce $CO_2$ emissions, $SO_2$ emissions may come to be our only hope.

Please notice that our best hope is stated in the conditional clause: Act faster to reduce $CO_2$ emissions. If we can do that, we are doing our best to avoid the worst. ♻

## WHERE'S WINTER? - Cont'd from p. 21

now part of Vermont. Many years ago, her bones were found in a farmer's field, and they are now the official state fossil. Like *Where's Winter?*, *Charlotte's Bones* is a book with an environmental message.

*Images:* Billyfish Books.

Erin Rounds is a dedicated fourth grade teacher who is passionate about the environment. Her books are successful because she uses her interactions with children to impact her writing in a way children can relate to. Those who wish to meet her might take note of the Waterbury LEAP (Local Energy Action Partnership) Energy Fair, which will take place in Duxbury, Vermont, on April 6, at the Crossett Brook Middle School, from 9:00 am until 3:00 pm. She will be there, sharing a table with *Green Energy Times* (see ad on page 3). Tammie Stevens and Jason Lewis cofounded *BillyFish Books* to champion stories that educate, uplift and inspire. Their books are sold worldwide

*Where's Winter?* is strongly recommended and makes a wonderful gift for a child. ♻

# Sustainability at Dartmouth College Continues

*George Harvey*

*Above and bottom right: Dartmouth College solar totals more than 2,000 solar panels. All images courtesy of ReVision Energy.*

Dartmouth College shows up regularly in news and articles at Green Energy Times (G.E.T.). Most of this is at the G.E.T. website, as announcements of programs, lectures, and achievements come out. Attention the college was giving to housing was the subject of a June 2016 G.E.T. print article, "High Performance Faculty Housing for Dartmouth." A lot has been going on.

This is not new. Sustainability efforts at Dartmouth go back decades. For example, the Dartmouth Organic Farm was started by students in the early 1990s, and its first harvest was gathered in 1996. Students also started Dartmouth Bikes, a program supporting the use of bicycles at the campus. In 2006, students started work on the Sustainable Moving Sale, which offered goods of all sorts that were unwanted but could be reused, with refurbishing if necessary. The sale is hosted by the Sustainability Office and is run during the orientation period each year, giving it special value to incoming students.

Despite the efforts, Dartmouth College did not really have the sustainable leadership position it would have liked, and the administration wanted to do better. In April, 2016, President Philip J. Hanlon founded the Sustainability Task Force to pursue the issue. That body issued its report, "Our Green Future: The Sustainability Roadmap for Dartmouth," a year later, on April 15, 2017 (http://bit.ly/dartmouth-roadmap).

Though it does not get into the specifics of how its goals are to be achieved, the roadmap sets out what those goals are. In its Executive Summary, it says, "The best available science indicates that, in order to limit temperature rise to two degrees centigrade, greenhouse gas emissions must be decreased by at least 80% by 2050. Our report recommends principles, standards, and commitments in the areas of energy, waste and materials, water, food, transportation, and landscape and ecology. Energy is the largest contributor to Dartmouth's greenhouse gas emissions and is also the area where prior analysis best positions us to take action. We believe that providing 50% of campus energy from renewable sources by 2025 and 100% by 2050 is feasible."

According to the roadmap, in 2016 Dartmouth consumed 3.5 million gallons of number 6 fuel oil and 50,000 megawatt-hours of grid electricity each year. Use of energy from oil and the grid accounted for about 75% of Dartmouth's greenhouse gas emissions. Those two items were clearly the ones that needed the greatest effort.

The roadmap is the creation of just one of the Sustainability Office initiatives. There are four others, two of which might be of special interest to G.E.T. readers. The Food Working Group and the Tiny House Project could both be subjects of articles of its own. There are also ten programs in addition to the organic farm, bike project, and moving project mentioned earlier. The others range from internships to a program introducing students to sustainable maple syrup practices.

Once the issues of sustainability at the college were identified, the work of reducing carbon emissions could be started in an organized manner. With a lot going on, there is one effort we might especially mention as an example, partly because it can be neatly quantified, and partly because it also relates to a solar installer we have featured elsewhere.

In 2017, ReVision Energy was awarded three separate projects. These were installed over the summer and fall. Clearly, the college was happy with the results, because in 2018, it gave ReVision Energy the job of installing more than a dozen more systems which were spread among eight campus buildings.

Together the new systems have more than 2,000 solar panels in them. They bring the Dartmouth College solar capacity to nearly 700 kilowatts, and they are capable of offsetting nearly a million pounds of carbon dioxide emissions each year.

Dan Weeks, ReVision Energy's Director of Market Development, commented on the work at Dartmouth saying, "For years, scientists from Dartmouth and beyond have been sounding the alarm about climate destruction as a result of our continued dependence on fossil fuels." Speaking more generally, he added, "As a mission-driven benefit corporation, ReVision is proud to partner with Dartmouth, as well as students and schools across New England, in implementing real solutions to the climate crisis before it's too late. Solar and other renewable sources have the potential to meet 100% of society's energy

*Cont'd on p.33*

# COW POWER IN NEW YORK AND VERMONT

*Evan Lawrence*

In Vermont, a program that pays farmers to generate electricity from cow manure provides enough power for 3,200 homes. In New York, farmers are discouraged by low power prices that make it difficult for the expensive manure-powered systems to break even. Fourteen of Vermont's roughly 800 dairy farms are in Green Mountain Power's (GMP) renewable energy program, but in New York, with about 4,600 dairy farms, only a few dozen farms statewide are believed to be generating electricity with anaerobic waste digesters.

"One of the big factors is an agreement with the power company," said Aaron Gabriel, crops and soils educator at Cornell Cooperative Extension in Washington County, N.Y. Gabriel said he knew of only two farms with digesters in his region.

Anaerobic waste digesters heat manure and other organic material in an oxygen-free tank, where naturally occurring bacteria break it down. The bacteria release methane which can be collected and burned for heat or to run a generator. Because methane is a more potent greenhouse gas than carbon dioxide, the digester greatly reduces the farm's impact on the atmosphere.

In three to four weeks, the remaining sludge is separated into liquid and fibrous solids. The liquid can be sprayed on fields as fertilizer. The sanitary, odor-free solids can be returned to the barn as fluffy bedding or sold as nutrient-rich compost.

Green Mountain Power, the utility that delivers most of Vermont's electricity, estimates that a digester-generator system costs around $1,400 per cow. Farmers may need loans, grants, and a good rate for the power they produce to make a system feasible. GMP customers who want to support renewable energy from anaerobic digesters pay an extra four cents per kilowatt-hour (kWh) on all or a portion of their electric bill. Farmers receive a fair market price for the electricity plus the tariff. GMP doesn't make money on the program.

The 16-year old program includes dairy farms around the state, explains GMP spokeswoman Dorothy Schnure. She knew of no farms that have dropped out of the program. Customers include businesses, non-profits, and homes. "It's a great success story," Schnure said.

The Wagner farm in Poestenkill, NY installed an anaerobic digester and generator in 2010 to handle manure from its 400 cows. The farm took advantage of a state program, no longer available, that paid an incentive for power produced for three years.

Image: pixabay.com

Although the cost of the digester was a big hurdle, the Wagners found that learning to operate it was also a challenge. "Getting into a digester, you don't know much about it," said Keith Wagner, who manages the system. "There's a large learning curve."

In summer, the system generates excess power that the farm sends to the grid. The farm's electrical utility, National Grid, pays only three cents per kWh, "well below market value," Wagner said. In the winter, "we break even or spend money on electricity." The utility was not eager to deal with the system, he said. The biggest benefit has been the bedding solids, which the cows like.

When the Wagners installed their digester, New York's energy policy was based on standards that encouraged renewable energy development. However, that policy is under review. The state's goal is to obtain 50% of its electricity and reduce greenhouse gases by 40% by 2030, but new policies may or may not favor the economics of digesters.

NY Assemblywoman Carrie Woerner has many dairy farms in her upstate district. She supports legislation that would require utilities to pay a fair market price for electricity from anaerobic digesters.

"Power from digesters is different from other forms of green energy," Woerner said. Unlike solar and wind, which are intermittent and depend on weather and season, "you know how many cows you have, how much they eat, and how much they poop. You can predict very accurately how much power they'll produce and put on the grid. They are a base producer. Utilities know how much they need to meet peak demand. If they know how much digesters are producing, they know how much less power they'll have to buy on the open market."

Digesters also "take methane out of the equation, which reduces greenhouse gases and produces power. I think that's something we should be encouraging, but we're not able to recognize the opportunity of this technology, because the Public Service Commission doesn't require distributors to pay a fair market price," Woerner said.

*Evan Lawrence is a free-lance writer in Cambridge, NY. This article appeared in a longer form in the December 2017-2018 issue of Hill Country Observer.* ♻

## Dartmouth College *Cont'd from p. 32*

*Dartmouth's organic farm on Lyme Road, north of Hanover.*

needs while putting millions of young people to work."

ReVision Energy owns the first phase of the solar projects at Dartmouth, but the solar systems installed in 2018 were financed by a Dartmouth alumnus, William Hoyt '68. He said, "As an alumnus, I'm particularly excited to support the Dartmouth initiative to expand the use of renewable energy and at the same time significantly reduce carbon emissions in New Hampshire."

Together, the investor-partners owning and operating the systems are selling the electricity for campus consumption at below-market rates through a power purchase agreement. The college has an option to purchase the arrays after five years. The systems are expected to last over forty years, and during that time, they should save the college millions of dollars.

Readers who wish to learn more about the Sustainability Office can visit its web site at https://www.sustainability.dartmouth.edu. ReVision Energy's web site is https://www.revisionenergy.com/. ♻

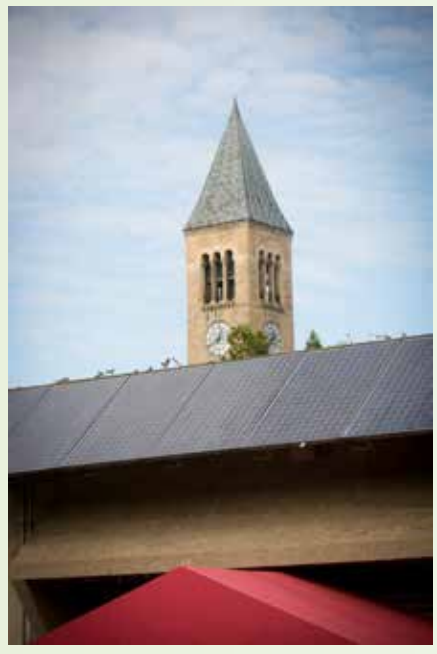
# Twenty-one NY Universities Form Renewable Energy Purchasing Consortium

*Steve Hanley*

Twenty-one public and private universities in the state of New York have banded together to create the New York Higher Education LSRE Project, which seeks to lower financial barriers to renewable energy procurement through combined purchases. The consortium plans to consider large scale solar photovoltaic, wind, hydroelectric and energy storage projects for development in New York State, according to the Sustainable Campus initiative at Cornell University.

The new group says its mission is to "create positive change in our regional renewable energy market, advance partnerships between New York State higher education campuses, and help us advance our academic missions by powering our campuses in a manner that is financially viable, environmentally conscious and socially just." That translates into obtaining all the electricity needed to operate all twenty-one campuses from net zero carbon resources.

The group includes all sixteen campuses in the State University of New York (SUNY) system together with Cornell University's



*Rooftop solar at Cornell University's McGraw Tower from behind the school store. Image: Jason Koski/ Cornell University Photography.*

*Cont'd on p.36*

## Elmore Roots' Permaculture Know-How

# There's Something about a Leaf

*David Fried*

*Image drawn by Ben Fulton*
*Enhanced by N.R. Mallery*

The way it sits there.
The way they all work together as one.
Fluttering
and relaxing to produce energy from the sun.
How does a leaf open? I don't really know.
I want someone to assure me that it is magic.

All of that energy is stored up all winter in a little ball that barely is affected by the cold.

It is probably not even really there yet, just a scent of it, as a rabbit or deer go after the leaf bud. When the spring rains come, the leaf bud starts to shake and comes alive. After enough warmth, it opens like a butterfly. When everything is leafed out on the hillsides, a soft green light is glowing all over Vermont. After days of sunlight, the leaves turn from very light, soft green to their dark and shinier regular selves.

In high school, I wrote a story about a boy who finds himself inside a leaf. When I grew up I was fascinated by trees and leaves and a lot of my life work is helping others to grow high quality trees and plants. I work inside a world of leaves. I even have tropical fruit trees in my dining room where they keep me surrounded with their leaves during the winter.

One of my favorite things in summer is to look up from the ground, while on my back, through the leaves as the sunlight streams through them.

All the fruits we eat and all the vegetables are only formed because their leaves are turning sunlight into food energy.



Then they all turn color and begin to tumble back to cover their roots. This shimmering fullness of contrasts takes my breath away each time.

As you leaf through this publication, think for a minute about what a gift it is to live on a leafy, green planet!.

*Image drawn by Bridget Houston*
*Enhanced by N.R. Mallery*

*David Fried runs Elmore Roots Fruit Tree and Berry Nursery in northern Vermont.* ♻

# What is a Low-carbon Diet?

## *Is it Good for Losing Weight or Is It Only About Saving the Planet?*

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

Not to be confused with a "low-carb" diet, which involves avoiding carbohydrates to lose weight, a low-carbon diet – whereby you limit foods that generate a lot of carbon emissions in their production and distribution – is about reducing your carbon footprint. That said, proponents of a low-carbon diet say that eating with reduced greenhouse gas emissions in mind is more healthful for us than the typical American diet wherein carbon-intensive meat, dairy and processed foods occupy too large a share of our overall food intake.

A recent study from the University of Michigan Center for Sustainable Systems backs up these assertions. Researchers correlated data from the National Health and Nutrition Examination Survey – a snapshot of what 16,000 Americans consumed over one 24-hour period – with information on the nutritional value and greenhouse gas impacts of different food items, concluding that the better a diet is for the planet, the better it is for our health. Furthermore, the 20 percent of Americans who eat what researchers consider a "high-carbon" diet (rich in red meat, dairy and exotic and processed foods) are responsible for almost half of the nation's food-related carbon dioxide ($CO_2$) emissions. The upshot is that changing the behavior and food choices of this small segment of the population could pay big dividends for reducing our overall national carbon footprint and for public health.

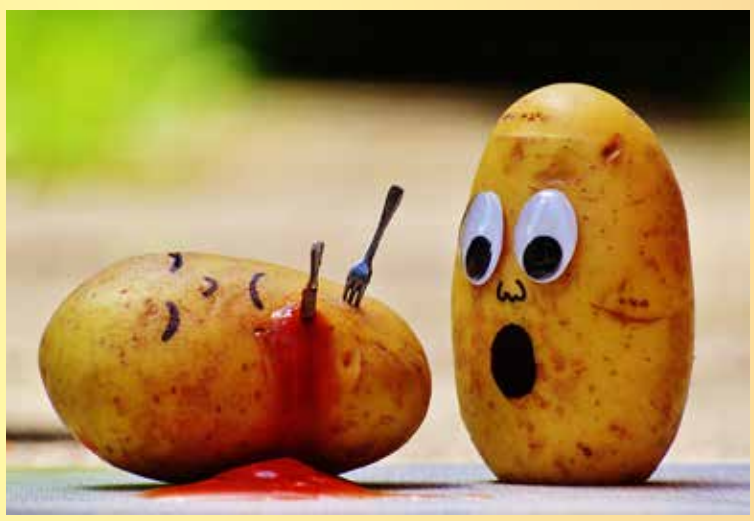
The concept of a low-carbon diet was first popularized in the U.S. by Bon Appétit Management Company, which runs more than 1,000 cafés in 33 states for corporations, universities and venues. Back in 2007, the company partnered with the non-profit Ecotrust to compile and conduct Life Cycle Assessments (LCAs) – measuring the amount of $CO_2$ emitted during a given food product's entire life cycle – for thousands of different foods. These LCAs became the basis for the "Food Scores" section of its EatLowCarbon.org website, which provides information to help people reduce their carbon footprints through food choices.

Besides launching EatLowCarbon.org, Bon Appétit's managers also embarked on a five-year internal campaign to ratchet down the emissions generated by the company's own operations and offerings by 25 percent. The company stopped buying air-freighted seafood, reduced its use of tropical fruit by half, shrank beef purchases by 33 percent and cheese by 10 percent while cutting food waste by one-third. Overall these moves shaved some five million pounds of carbon emissions per month off Bon Appétit's contribution to global warming.

The fact that food and the systems to produce and distribute it are responsible for about a third of all greenhouse gas emissions means that everyone has a lot of potential for fighting climate change through sourcing locally produced and in-season foods to minimize emissions-intensive 'food miles,' buying only as much as we can eat to reduce waste, and minimizing consumption of red meat, dairy and processed foods. In the case of climate change, if we don't watch what we eat, it could really come back to haunt us.

*Contacts: National Health and Nutrition Examination Survey, cdc.gov/nchs/nhanes/; "Greenhouse gas emissions and energy use associated with production of individual self-selected US diets"; https://iopscience.iop.org/article/10.1088/1748-9326/aab0ac; Bon Appétit Management Company, bamco.com; Ecotrust, ecotrust.org; Eat Low Carbon, EatLowCarbon.org.*

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



*Reducing red meat, dairy, processed and air-freighted foods is an easy way to lower your own carbon footprint and help the world battle global warming. Credit: Pixabay.*

# Grass-Fed Dairy Initiative

*Jessie Haas*


Image: newswise.com

When UVM agronomic and soils specialist Heather Darby initiated a study of twenty grass-fed dairy farms three years ago, there were 130 of them nationwide. This year she is heading a study of all grass-fed dairies, and there are now 500. The effort is funded by a $1 million grant from USDA.

Well-managed grazing can rapidly increase soil organic matter, and sequester carbon by "percentage points in years, not lifetimes," Darby said. Soil organic matter (SOM) creates soil that acts like a sponge, absorbing water during heavy rains, and retaining it during dry spells. This in turn helps keep waterways cleaner and prevents flooding. Other environmental services include a local cooling effect, due to soil being continuously covered with growing plants, and a measurable increase in rainfall.

Grass farmers provide these environmental services as part of their business model, and grass-milk currently receives a premium price in the market. But Darby worries that even so, it's not enough to make a decent living. "We need to bring farming and the environmental community closer together," she said. "We need food, and we need the environment. These aren't just things we want."

The money from USDA's Organic Research and Extension Initiative will fund a look at where grass-fed dairy works, and how it can work better. The grass-trend is consumer-driven, and that's one of the things Darby's team will study. Why exactly do consumers want grass-milk? Taste? Personal health? The environment? That part of the study includes pulling grass-milk from grocery store shelves all over the country and sampling.

But the bulk of the study focuses on the farmer. A survey has just gone out to grass-milk farmers nationwide asking about what has worked for them, what has not, and what issues they've had during the transition. The responses will form a database that participating farmers can consult. It will also deploy a benchmarking program to help farmers track production and costs, so they can compare within the grass-milk community.

Another part of the research focuses on nutrient flow, a major difference between grass-fed and conventional dairy. Conventional farmers can feed grain to make up for a poor forage crop; grass-milk farmers don't have that option. That can strongly impact productivity. Soil depletion is also a concern. After all, nutrients are leaving the farm in the form of milk or beef. These need to be replaced, or the soil will deteriorate.

Darby sees this as a relatively minor problem that can be solved in a short timeframe, a year or two, as compared to the much longer time it can take to transition to a different breed of cow. One of the most important strategies is to incorporate legumes like clover and alfalfa into the pasture mix. These plants fix nitrogen from the air and can supply it to the grasses that grow with them, eliminating the need for chemical fertilizer—a major source of greenhouse gases. Legumes also provide nutritious fodder and contribute to biodiversity. (Red clover, a classic pasture legume, is the Vermont state flower.)

Darby has seen an increased environmental awareness on the part of farmers over the past ten years, and farmers are responding to consumer demand. But grass-milk often requires more acreage which may create pressure to clear land. And farm profits, or lack thereof, is still a big problem.

"When will we bear the true cost of having food and the environment?" Darby asked. "How will we pay for it?" Or as farming consultant, Ray Archuleta, has often said, "To go green, you have to be in the black."

Darby is not just an academic. With her husband she owns and operates Darby Farm, a seventh generation vegetable and fruit farm in Orwell, VT. Darby is also a hops expert and is currently experimenting with milkweed as a commercial crop. Her study of the reality of grass-fed farming nationwide is one ray of hope for the struggling dairy industry in the Northeast and for the environment.

*Sources:*

- *http://www.uvm.edu/faculty-darby.php*
- *www.darbyfarm.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.* ♻

# RESOURCES

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

## Renewable Energy Consortium

*Cont'd from p. 33*

Ithaca campus as well as other private universities. To reach its goal, the group will solicit new projects in the state to supply new renewable energy resources and promote the development of a "green economy," keeping jobs and economic benefit within the state. The New York Higher Education LSRE Project members expect their efforts to lower costs for renewable energy procurement, protect the institutions they represent from volatile gas prices, and provide new research opportunities for faculty, students, and others.

Sarah Zemanick, director of the campus sustainability office at Cornell, says, "As the land grant university to New York state, our commitment to sustainability begins on campus and extends beyond our boundaries. We are pleased to be a founding member of the New York Higher Education Large Scale Renewable Energy Project. Purchasing net-zero electricity brings our campus one step closer to meeting our carbon neutrality goals." The consortium's activities will also assist the state of New York in meeting its own goal of obtaining 50% of the state's energy needs from renewable sources by 2030. The consortium will focus its efforts on projects that will be ready for operation no later than 2020.

*Steve Hanley writes about the interface between technology and sustainability from his home in Rhode Island and anywhere else the Singularity may lead him. His motto is, "Life is not measured by how many breaths we take but by the number of moments that take our breath away!"*

*This article originally appeared in CleanTechnica, February 18th, 2019. Reprinted with permission of the author.* ♻





## GUIDE TO ADVERTISERS

*Larry Plesent*

# Ingredient of the Month

# ORGANIC WIPES?

Flushable damp wipes for keeping you extra clean are already very popular and becoming more so every day. But how flushable are those polyester wipes? And what happens to them after you flush them out of sight and mind?

Polyester is PET 1 plastic, and, while it may be flushable, it does not simply fall apart. They are not biodegradable. After all, this is plastic we are talking about, not paper. Even worse, these plastic single-use wipes are wreaking havoc in sewer systems across the country and around the world.

According to Candice Miller, Michigan's Macomb County Public Health Commissioner, these wipes are, "Probably causing 90% of the sewer problems we are having now. They sort of get together, and they almost act like a rope…choking sanitary sewer pumps and causing huge backups."

Another great idea ruined by plastic! So what's a conscious consumer to do?

DIY-ers can find themselves a clean small fine mist sprayer and fill it with unflavored vodka. Your choice. Add a couple of drops of peppermint oil, shake lightly and voila! You have just made yourself several months' worth of spray and wipe.

If this is for an especially delicate skin, skip the essential oils and dilute the vodka 50% with distilled water.

Keep away from flames and out of faces when you spray it.

For an off-the-shelf solution, try Izaroma. This product is just starting to appear in stores and is marketed to "Keep your toilet fresh between cleanings." I tested Izaroma extensively as a toilet freshener and cleaner and for everything else I could think of and was duly impressed overall. It worked great on my hands without drying them out. The ingredients are simple (non-GMO alcohol, essential oils and water), and I liked the handy six ounce clear spray bottle. Give it a try if you are not into experimenting and making your own wiping, cleansing, people and toilet freshening spray juice.

Make a disposable applicator by wrapping your favorite unscented toilet paper three times around your fingers. After dry wiping (yes, we can be talking butts here), spray your alcohol and essential oil blend onto the paper twice quickly and wipe once to finish. Dispose of in the usual fashion.

This home-made system is great as a cleansing wipe for yourself. Some people even claim that alcohol and essential oils helps to shrink hemorrhoids. I like to use it on my reading glasses as it cuts through greasy film easily.

Here is a terrific recipe for an all-purpose spray cleaner or wipe:

Fill an eight-ounce spray bottle with the following:

Seven ounces of distilled water (put this into the bottle first)

1/2 tsp Vermont Soap's Liquid Castile (your favorite scent!)

Optional: Add a couple of drops of essential oils to the blend.

Shake it once, and your nontoxic cleaner is ready to use. Great for all washable surfaces including glass, tile, and finished woodwork. Ball up newsprint and use it with the spray to make your windows shine!

You can upcycle an old flannel sheet or towel and cut it up into small squares. Keep a basket handy with these clean scraps and a pail in your laundry room for used wipes. When they are dirty, simply wash them out with Liquid Sunshine or Castile Liquid Soap and return them to the basket!

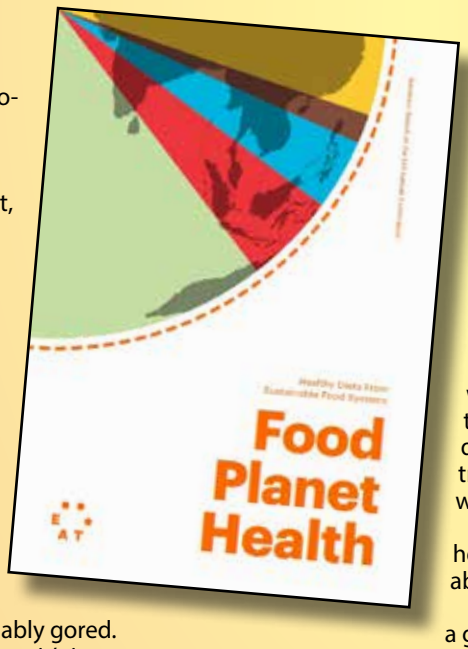
*Flushable wipes cause sewer clogs. Image: www.foxmetro.org*

*Larry Plesent is a writer, blogger and natural products formulator who lives off-grid in a hand built solar-powered cabin in the Vermont mountains. He is also the founder of Vermont Soap, a pioneering personal care products company dedicated to replacing yucky stuff with yummsuny stuff. Learn more at vermontsoap.com.*

*Please Note:* Green Energy Times *advocates exercise of caution in the use of potable alcohol as a disinfectant. While it can be very effective and can be used safely by anyone who could safely ingest it, some people can be negatively affected by it.* ♻

# EAT-Lancet with a Grain of Salt

*Jessie Haas*




The EAT-Lancet commission's report, "Food in the Anthropocene," which recommends a near-vegan diet for the health of people and the planet, dropped with major fanfare and a large PR budget, in five cities world-wide. It was widely and uncritically reported in the mainstream press. Critiques of the report were also published, but received far less press, and have been largely dismissed as the howlings of the meat industry, whose ox was undeniably gored.

What's the truth? First, it's important to recognize that "Food in the Anthropocene" is more of a campaign than a scientific report. EAT was founded by billionaire vegan and animal rights activist, Gunhild Stordalen. Corporate funders include Bayer (owner of Monsanto), Cargill, PepsiCo, Syngenta, and Unilever—Big Food, Big Pharma, and Big Ag. Another backer, The Wellcome Trust, is based on the pharmaceutical fortune of the Wellcome family, who have been Seventh Day Adventists for three generations. Seventh Day Adventists are committed vegetarians. 80% of the authors of the report have publicly supported a vegan or vegetarian diet.

EAT-Lancet's vegan-vegetarian diet, heavy on grains, extremely light on animal products (1.5 eggs per week, for instance, but eight teaspoons of sugar a day are allowable) is based on epidemiological studies. According to Psychology Today, 80% of nutritional epidemiological studies are proved wrong in clinical trials. The authors admit that the diet is inadequate for children, adolescents, pregnant women, and the elderly; it would also appear to be dangerous for diabetics and people trying to control their weight.

So much for the health of people. How about the planet?

The report talks a great deal about agricultural systems, yet seems to miss perhaps the major point. Grains are grown in a system of tillage which destroys soil microorganisms, which releases stored soil carbon into the atmosphere, and is largely responsible for the imbalance we are working to correct today.

Many farmers are now converting to no-till practices, in which seeds are drilled into the ground with minimal disturbance. However, most no-till systems use herbicide to control weeds. Glyphosate, the active ingredient in Round-Up, is the most widely applied agricultural chemical in the world. Though supposedly short-lived and 'harmless,' glyphosate appears to damage the soil bacteria and fungi that collaborate with plants in sequestering carbon and building humus. Worse, glyphosate is currently sprayed on many grain crops just before harvest to desiccate them. Glyphosate residue is found in most nonorganic grain products. Increasingly, glyphosate is being recognized as a carcinogen, with a particular connection to non-Hodgkins lymphoma.

Eating grains and animals which eat grain (pigs and chickens) multiplies the ill-effects of tillage. Beef and lamb, in contrast, can be raised exclusively on grass; on lands that would be marginal to impossible for growing crops; in cleanliness and a freedom that approaches natural life; and while sequestering large amounts of carbon, and building soil fertility.

Thus, the agricultural science on which the EAT-Lancet report is based seems as suspect as the nutritional science. Current soil science is discovering the astonishing capacity of microbes to build soil rapidly, when well-fed by a continuous cover of diverse living plants. That's the only thing that ever has built soil, and our entire food economy—and the climate--rests on ancient reserves from that work.

Plants feed microbes. Microbes build gorgeous, healthy soil, and feed the plants. We—humans and animals—eat the plants, return the nutrients, seed in more plants, and the soil gets better, deeper, more capable of nourishing the plants. A healthy, diverse community of plants becomes more capable of photosynthesizing by taking carbon out of the air, and the microbes build more carbon into soil glues and aggregates. Good soil becomes more capable of absorbing rainfall, and releasing moisture in dry times. The earth becomes fruitful and multiplies.

In contrast, the EAT-Lancet report offers a scarcity model of the world and reading it makes one feel hungry and peevish. The new science of soil shows that the world can be, and is, more abundant and fruitful than we have ever understood.

*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.*

*Sources:*
*https://www.thelancet.com/comm/EAT*
*https://regen-intl.org/why-regen-ag/*
*https://livelovefruit.com/glyphosate-food.* ♻

*Image: Sustainable Dish, EAT-Lancet, http://bit.ly/sustainabledish_EAT-Lancet_Opinion.*

# Are You Drinking Roundup?

## Popular Weed Killer Found in Top Beer and Wine Brands

A new report shows that numerous beers and wines, including organic, inadvertently contain toxic glyphosate from Roundup.

Many beers and wines sold in the U.S. contain the weed killer glyphosate, the main ingredient in Roundup, according to a new report by U.S. Public Interest Research Group (PIRG) Education Fund. U.S. PIRG tested twenty beers, wines and hard cider, including several organic brands, for glyphosate and found that all but one contained the harmful chemical.

This revelation came on the same day a San Francisco court began hearing arguments in the first federal civil case over whether Monsanto's Roundup weed killer causes cancer.

"When you're having a beer or a glass of wine, the last thing you want to think about is that it includes a potentially dangerous pesticide," said U.S. PIRG Education Fund's Kara Cook-Schultz, who authored the study. "No matter the efforts of brewers and vintners, we found that it is incredibly difficult to avoid the troubling reality that consumers will likely drink glyphosate at every happy hour and backyard barbeque around the country."

U.S. PIRG tested five wines, fourteen beers and one hard cider for the study. The wine brands were Barefoot, Beringer, Frey (organic), Inkarri Estates (organic), and Sutter Home. The beers examined were from Budweiser, Coors, Corona, Guinness, Heineken, Miller, Peak (organic), Sam Adams, Samuel Smith (organic), Sierra Nevada, Stella Artois, Tsingtao and New Belgium. Ace Perry Hard Cider was also tested. The study results confirm past results of several other groups, including Moms Across America.


*This popular weed killer is a known carcinogen. Practices of using it is toxic to the environment and people, as well as wildlife. It is banned in many states. Image: dewereldmorgen.be*

*Flickr/Steve Garfield*

Of particular note, the study found that, despite weed killer products like Roundup being prohibited in the making of organic beers and wines, glyphosate was discovered in three of the four organic alcoholic beverages tested.

The Brewers Association, which represents more than 4,900 small and independent craft brewers, said in a statement, "Brewers do not want glyphosate used on barley or any raw brewing material, and the barley grower organizations have also come out strongly against glyphosate."

The amount of glyphosate discovered in the samples ranged as high as 51 parts per billion (ppb) in Sutter Home wine and more than 25 ppb in non-organic beers from Budweiser, Coors, Corona, Miller and Tsingtao. The organic drinks were found to have totals as high as 5.2 ppb. While these numbers are below the EPA's risk tolerances for beverages, at least one previous scientific study found that as little as one part per trillion of glyphosate can stimulate the growth of breast cancer cells and disrupt the endocrine system.

"Craft brewers pride ourselves on producing the highest quality products for our patrons, and that necessitates the use of the highest quality, safest ingredients," said Elan Walsky, who is co-owner of Coalition Brewing in Portland, Oregon. "Maintaining this high standard of excellence is not only important for our beer and our health, but also for the local community from the farmers who grow our hops and barley, all the way down to the people enjoying our beer."

With the findings indicating glyphosate contamination is common in over-the-counter beers and wine, the report recommends that, unless it can be proved otherwise, the pesticide should be banned in the U.S. due to its many potential health risks and ubiquitous presence in food, water and alcohol.

"With a federal court looking at the connection between Roundup and cancer, we believe this is the perfect time to shine a spotlight on glyphosate," Cook-Schultz said. "This chemical could prove a true risk to so many Americans' health, and they should know that it is everywhere -- including in many of their favorite drinks."

U.S. PIRG Education Fund is an independent, non-partisan group that works for consumers and the public interest through research, public education and outreach, serving as counterweights to the influence of powerful special interests that threaten our health, safety or well-being. Learn more at uspirg.org.

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*Links are available on our website at http://www.greenenergytimes.org/2019/02/25/are-you-drinking-roundup/.* ♻

# Another Ban on Single-Use Plastics

*George Harvey*

*Image: asiapacificreport.nz*

Single-use plastics include such things as bags we get in stores, plastic table wear, and drinking straws. They include the plastic-based wipes Larry Plesent objects to in his "Ingredient of the Month" article in this issue of Green Energy Times (G.E.T.). In cases like plastic bags, they need not be thrown out but are anyway. In such cases as the wipes, they really should be thrown out but need not be made of plastic. But they are always a problem.

The issue is not whether they can be recycled. Jenna Evans, Ben & Jerry's Global Sustainability Manager, made this clear. She said, "We're not going to recycle our way out of this problem. We, and the rest of the world, need to get out of single-use plastic."

Plastics get into the environment and making their way in winds and river waters to the ocean, where they accumulate in slowly swirling systems called gyres. Some of the areas where plastics accumulate are hundreds of miles across. For more about this, see the article, "Garbage Patches in our Ocean," which was in the August, 2015 issue of G.E.T. (http://bit.ly/GET-gyres).

Single-use plastics kill all manner of life in the oceans, from the smallest to the largest. They often kill by clogging digestive systems. Last June, when the UN World Environment Day had the theme, "Beat Plastic Pollution," G.E.T. ran an article of the same name; it mentioned a whale that was killed by plastic bags (http://bit.ly/beat-plastic).

The move to stop plastic pollution has been gaining momentum over the last few years. Some Vermont towns have banned single-use plastic bags. Last year, Brattleboro was first to ban the bags outright, while Manchester called on the state to implement a state-wide ban. This year, Manchester, Middlebury, and Burlington residents voted overwhelmingly in favor of bans on plastic bags.

Vermont is not the only state moving on the bans. New Hampshire, Maine, Massachusetts, and others have efforts under way for state-wide bans on single use bans, with bills coming before the legislatures. As voters understand the issue better, support for the bans is growing, and we are increasingly likely to see bills passed into law.

Some businesses have taken leadership roles in reducing single-use plastic use. A notable example is Ben & Jerry's, which started reducing use of plastics in 2009, with a switch away from plastic containers for their ice cream. Now the company is eliminating use of plastic spoons and straws. The changeover to wood and paper for these items is set to be complete by the end of 2020.

Ben & Jerry's is not alone. Businesses large and small are working on eliminating single-use plastic. One example is the Common Man, which runs fifteen restaurants and a movie theater in New Hampshire. The Common Man is actually going a little beyond a simple switch to paper straws by making sure that all straws are made from Forest Stewardship Council certified paper. The switch is costing the chain $24,000, which does not seem excessive, considering there are sixteen sites involved.

For the time being, paper and wood cost a little more than plastic, but pressure can be brought on hesitant businesses to take steps to protect the environment. Trader Joe's has announced it will eliminate use of a million pounds of single-use plastic from its stores in 2019. It will replace all single-use plastic bags, offering biodegradable and compostable bags instead. It will eliminate the polystyrene foam used for packaging, and it will sell more produce loose, instead of wrapped in plastic. Nevertheless, according to Greenpeace, Trader Joe's could do much better, and customers should hold it to a higher standard. The plan Trader Joe's announced did not address well over a million pounds of plastic it will still be using.

This is an issue that we should all keep in mind as we shop. And if we see stores continue to offer single-use plastic to its customers, we might ask the management to stop. One alternative is to shop instead at a store that does better on plastic. ♻